SEMESTER I

PEPHA20 - ELECTIVE IA: ELECTRONIC DEVICES AND APPLICATIONS

Year: I **Sem:** I	**Course Code:** PEPHA20	**Title of the Course:** Electronic Devices and applications	**Course Type:** Theory	**Course Category:** Major Elective	**H/W** 5	**Credits** 4	**Marks** 100

Course Objectives

1. To teach the students the methods of the fabrication of digital circuits and the devices used in the design of digital systems.
2. To understand the principles of operational amplifier and its applications and digital communication.

Course Outcomes (CO)

The learners will be able to

1. Analyze about the fabrication of various Integrated circuits and semiconductor devices (construction, working, principles and V-I characteristics) and their applications.
2. Ability to understand about the basic principles and operations of opto electronic devices and their features and applications.
3. To study the Timer IC and its applications.
4. To know the principles, configuration, linear and non-linear applications of Op-amp used to design various digital circuits.
5. To understand the concepts of combinational circuits and sequential circuits and A/D – D/A converters used to design advanced digital system.

CO	**PSO**					
	1	**2**	**3**	**4**	**5**	**6**
CO1	H	H	M	H	H	H
CO2	H	H	L	H	M	M
CO3	M	H	M	H	M	M
CO4	M	H	H	H	M	H
CO5	H	M	M	H	H	H

CO	**PO**					
	1	**2**	**3**	**4**	**5**	**6**
CO1	H	H	H	H	M	H
CO2	H	H	H	H	M	H
CO3	H	H	H	H	M	H
CO4	H	M	H	H	H	H
CO5	M	M	M	M	M	H

(Low -L, Medium– M, High-H)

Course Syllabus

Unit I: FinFET and SET **(16 Hours)**

1.1 Multi gate transistors - Need of FinFET- Structure of FinFET - Fabrication - Mechanism of FinFET Technology-Bulk FinFET- SOI FinFET(K1, K2, K3)
1.2 FinFET Classifications: Gate shorted (SG), Insulated Gate (IG) and Low Power (LP) - n-FinFET and p-FinFET - Working of FinFET- I-V characteristics of FinFET(K2, K3, K4)
1.3 Applications of FinFET - Design of Switches, logic gates, flip-flops and Schmidt trigger using FinFET(K3, K4, K5)
1.4 Single Electron Transistor: Principle - Quantum dots - Coulomb blockade and electron tunneling –Construction and operation of SET (K3, K4)
1.5 Single island RC equivalent circuit of SET- Operation Temperature - Different ways to increase Coulomb energy E_c- I-V characteristics of symmetric and asymmetric junction (Coulomb Stair-Case) SET (K3, K4, K5)
1.6 Design of logic gates using SET - Realization of AND, OR and NOT gates using SET - Advantages and disadvantages of SET- Difference between SET and FET - Applications of SET (K4, K5, K6)

Unit II: Opto Electronic Devices **(12 Hours)**

2.1 Light units - Light emitting diodes - Operation and construction - Characteristics and parameters (K1, K2)
2.2 Seven-segment displays - LED seven-segment display - liquid crystal cells - LCD seven-segment displays(K1, K2, K3)
2.3 Photoconductive cells - Construction - Characteristics and Parameters - Applications(K2, K3, K4)
2.4 Photodiodes and Solar cells - Photodiode operation - characteristics - specification - construction- Applications - Solar cells (K2, K4, K5, K6)
2.5 Phototransistors (BJT) - Characteristics and specifications - Applications - Photo-Darlingtons- Photo-FET-Optocouplers- Operation and constructions - specification - Applications (K2, K3, K4)
2.6 Laser diode - Operation - Characteristics and parameters- Drive circuits - Modulation (K3, K4, K5, K6)

Unit III: 555 Timer and Applications **(13 Hours)**

3.1 555 Timer - Description (K1, K2)
3.2 Monostable operation - Frequency divider(K1, K2, K3)
3.3 Astable operation - Schimitt trigger (K2, K3)
3.4 Phase Locked Loops - Basic principles (K2, K3, K4, K6)
3.5 Analog phase detector(K2, K3)
3.6 Voltage Controlled Oscillator - Voltage to Frequency conversion (K2, K3)

Unit IV: Op-Amp Applications **(18 Hours)**

4.1 Instrumentation amplifier - V to I and I to V converter - Op-amp circuits using diodes - Sample and Hold circuits (K1, K2)
4.2 Log and Antilog amplifiers –Multiplier and Divider - Electronic analog Computation (K2, K3, K4)
4.3 Phase shift and Wein bridge sine wave oscillators (K1, K2, K3)
4.4 Solution to simultaneous equations and differential equations - Schimitt Trigger - Astable, Monostable Multivibrator (K2, K3, K4, K6)
4.5 Square, Triangular and Saw tooth wave generators (K2, K3, K4, K6)
4.6 RC Active filters - Low pass, High pass and Band pass filter (K2, K3, K4)

Unit V: Digital Electronic Devices **(13 Hours)**

5.1 4bit Binary adder/subtractor IC 7483 (K1, K2, K3, K4)
5.2 Multiplexer IC 74150 and Demultiplexer IC 74154 (K1, K2)
5.3 Counters: Binary Counter - BCD Counter - Parallel Counters (K1, K2)
5.4 D/A Converters: Binary Weighted Resistor method - R-2R Ladder method (K1, K2, K3)
5.5 A/D Converters: Counter type, Successive Approximation (K2, K3, K4)
5.6 Dual Slope method - Parallel comparator A/D converter (K2, K3, K4)

Books for Study:

1. D. Roy Choudhury - Linear Integrated Circuits - Wiley Eastern, New Delhi, 1991.
2. V.Vijayendran - Introduction to Integrated Electronics, S.Viswanathan (Printers &
3. Publishers), Pvt. Ltd., 2007.
4. Amar K.Ganguly - Optoelectronic Devices and Circuits - Narosa Publishing House, 2007.
5. R.A. Gaekwad - Op-Amps and Integrated Circuits EEE, 1994.
6. CMOS VLSI Design: A circuit and systems perspective, by Neil H.E. Weste, David Harris and Ayan Banerjee Third edition , Pearson
7. Physics of Semiconductor Devices by J.P. Colinge, C.A. Colinge
8. FinFETs and Other Multi-Gate Transistors by J.-P. Colinge
9. Hybrid CMOS Single-Electron-Transistor Device And Circuit Design by Santanu Mahapatra, Adrian Mihai Ionescu
10. Nanoscale Transistors: Device Physics, Modeling and Simulation Mark Lundstrom, Jing Guo

Book for Reference:

1. R.F. Coughlin and F.F, Driscol - Op-Amp and Linear Integrated Circuits, Prentice Hall of India, New Delhi, 1996.
2. M.S.Tyagi - Introduction to Semiconductor Devices - Wiley, New York, 2014.
3. Deboo/ Burrous - Integrated circuits and Semiconductor Devices - Theory and Application, McGraw Hill, New Delhi, 1985.
4. Ramakant Gaekwad - Operational Amplifiers - Wiley Eastern, New Delhi, 1981.
5. S.M. Sze - Semiconductor Devices - Physics and Technology, Wiley, New York, 1985.
6. Millman and Halkias - Integrated Electronics - McGraw Hill, New Delhi.
7. Quantum Transport: Atom to Transistor by SupriyoDattaOrganic field-effect transistors by Bao Z., Locklin J. (eds.)

SEMESTER III

PCPHK20 – MICROPROCESSORAND MICRO-CONTROLLER

Year: II **Sem:** III	**Course Code:** PCPHK20	**Title of the Course:** Microprocessor and Microcontroller	**Course Type:** Theory	**Course Category:** Core	**H/W** 5	**Credits** 4	**Marks** 100

Course Objectives

1. To make the students understand the concepts that are involved in the Microprocessor 8085 and Microcontroller 8051.
2. To make the students understand instruction sets, addressing modes, timings, memory and I/O interfaces.

Course Outcomes (CO)

The learners will be able to

1. Describe Hardware, different bus cycles and memory interface to 8085 Microprocessor.
2. Develop programs using 8085 Microprocessor Instruction set and addressing modes.
3. Describe and perform different types of peripheral interfaces to 8085 Microprocessor.
4. Explain hardware, instruction set and addressing modes of Microcontroller 8051 and develop programming for basic operations.
5. Describe and perform different types of external interfaces to 8051 Microcontroller.

CO	**PSO**					
	1	**2**	**3**	**4**	**5**	**6**
CO1	H	L	L	M	M	M
CO2	H	H	L	M	M	M
CO3	H	M	L	M	M	M
CO4	H	M	L	M	M	M
CO5	H	M	L	M	M	M

CO	**PO**					
	1	**2**	**3**	**4**	**5**	**6**
CO1	H	M	L	M	M	M
CO2	H	H	H	M	M	M
CO3	H	H	L	M	M	M
CO4	H	H	H	M	M	M
CO5	H	M	L	M	M	M

(Low - L, Medium – M, High - H)

Course Syllabus

Unit I: 8085 Microprocessor- Architecture, Instruction set and Programming (12 Hours)

1.1 Architecture- Functional pin diagram (K2)
1.2 Buses - Address bus, data bus, multiplexing address/data bus (K2)
1.3 Instruction format–instruction fetch and execution–Machine and instruction cycle- T state- (K2)
1.4 Addressing modes- Instruction set - data transfer group- arithmetic/logic group (K2)
1.5 Branch group - stack and I/O control instruction (K2)
1.6 Programming: Picking up Largest / smallest number - Arranging an array in ascending / descending order - Code conversion: Binary to BCD and BCD to Binary, Binary to ASCII, ASCII to Binary and ASCII to BCD and BCD to ASCII (K3, K6)

Unit II: 8085 Microprocessor- Memory and I/O interfacing (12 Hours)

2.1 ROM and RAM memory - Memory interface: 2K X 8, 4K x 8 ROM and RAM interface(K2)
2.2 8255 Programmable interface I/O –functional Pin configuration- Internal Architecture (K2)
2.3 Interfacing of 8255 (K2)
2.4 ADC interface - DAC interface - wave form generator (K2, K3, K6)
2.5 Hex keyboard interface - 4 step Stepper motor interface (K2, K3, K6)
2.6 Traffic regulation interface (K2, K3, K6)

Unit III: 8051 Microcontroller-Architecture, Instruction set and Programming (12 Hours)

3.1 Introduction to Microcontroller –8051 Functional pin diagram (K2)
3.2 Architecture - Internal registers (K2)
3.3 Special function registers -Memory organizations (K2)
3.4 Instruction set - Addressing modes (K2)
3.5 Programming - Addition and Subtraction -Multiplication and Division (K3, K6)
3.6 Arranging an array in ascending/ descending order -Sorting out the maxima and minima (K3, K6)

Unit IV: 8051 Microcontroller - Memory and I/O interfacing (12 Hours)

4.1 8051 Input/output Ports (K2, K3)
4.2 8051 Interrupts (K2, K3)
4.3 Interface 8051 to external memory and I/O devices using its I/O ports (K2, K3)
4.4 Counters and Timers –Serial communication using MAX232 (K2, K3)
4.5 Interfacing 8051 with ADC –DAC (K2, K3, K6)
4.6 LED Display - Hex Keyboard (K2, K3, K6)

Unit V: Sensor Based Embedded Controller &IoT Applications (12 Hours)

5.1 Working principle of Sensors/Transducers: Light sensor LDR, Heat sensor LM35, IR Transmitter/ Receiver module (K2)
5.2 Embedded system concept–Architecture & salient features of ATmega328 (K2)
5.3 Programming & compiling with IDE software - Motor driver IC LM339 (K2, K3)
5.4 Blue tooth controller HC05 for wireless communication (K2, K3)
5.5 IoT applications for automation : Light activated Morning alarm - Darkness activated Garden Lights - Heat activated Fire alarm (K3, K6)
5.6 Intruder alarm using IR - Android mobile touch key pad controlled Robot car (K3, K6)

Books for Study:

1. R.S. Gaonkar - Microprocessor Architecture, Programming and Application with the 8085, 3rd Edition - Penram International Publishing, Mumbai, 1997.
2. V.Vijayendran - Fundamentals of Microprocessor 8085 - Architecture, Programming and interfacing - Viswanathan Publication, Chennai, 2002.
3. N. NagoorKanni- Microprocessor and Microcontroller –2nd Edition - Tata McGraw Hill EducationPvt. Ltd., New Delhi, 2017.
4. Muhammed Ali Mazidi and Janice Gillespie Mazidi- The 8051 Microcontroller and Embedded Systems, Fourth Indian Reprint - Pearson Education, 2004.
5. Kenneth J. Ayala - The 8051 Micro Controller Architecture, Programming and Applications, 3rd Edition - West Publishing Company, 1991.

Books for Reference:

1. B. Ram - Fundamentals of Microprocessors and Microcomputers – DhanpatRaiPublications, New Delhi, 2005.
2. R. Thiagarajan, S. Dhanasekaran and S.Dhanapal - Microprocessor and its Applications, New Age International, New Delhi, 2010.
3. John B. Peatman - Design with PIC Microcontrollers, 7th Indian Reprint – Pearson Education, 2004.
4. Raj Kamal - Introduction to Embedded Systems - TMS, 2002.