	Scheme for Second Year Four Year Undergraduate Engineering Degree Programme B.E. in ELECTRONICS AND TELECOMMUNICATION ENGINEERING (Semester -V)												
Sr No.	**Course Name**	**Code**	**Course Plan per Week (Hrs.)**				**Credits**	**Theory Evaluation**		**Practical Evaluation**		**Total**	**ESE Time Hrs.)**
			L	**P**	**T**	**Hrs.**		**IE**	**ESE**	**INT**	**EXT**		
	Core Courses												
1	Microcontroller (PCC-I)	5ET220PC	3	0	0	3	3	40	60			100	3.00 Hrs.
2	Digital Signal Processing (PCC-II)	5ET221PC	3	0	0	3	3	40	60			100	3.00 Hrs.
3	Communication Network (PCC-III)	5ET222PC	3	0	0	3	3	40	60			100	3.00 Hrs.
4	Programme Elective Course -I: Power Electronics/Wireless Sensor Networks/Electric Vehicles	5ET223PE	3	0	0	3	3	40	60			100	3.00 Hrs.
	Laboratory Courses												
5	Microcontroller Lab (PCC-I)	5ET224PC	0	2	0	2	1			25	25	50	
6	Digital Signal Processing Lab (PCC-II)	5ET225PC	0	2	0	2	1			25	25	50	
7	Communication Network Lab (PCC-III)	5ET226PC	0	2	0	2	1			25	25	50	
	Multidisciplinary Minor												
8	Multidisciplinary Minor –III*	5ET227MD	2	0	0	2	2	20	30			50	2.00 Hrs.
9	Multidisciplinary Minor –IV*	5ET228MD	2	0	0	2	2	20	30			50	2.00 Hrs.
10	Multidisciplinary Minor Lab. –I*	5ET229ML	0	2	0	2	1			25	25	50	
	Open Elective other than a particular Program												
11	Open Elective- III	5ET230OE	2	0	0	2	2	20	30			50	2.00 Hrs.
	TOTAL		19	08	0	26	**22**					**750**	

L: Lecture P: Practical T: Tutorial MSE: Mid Semester Exam ESE: End Semester Exam IE: Internal Evaluation INT: Internal EXT: External

Note: Six hours per week are allotted for continuous evaluation process for the above subjects. (Total contact hours per week = 34 Hours

Open Elective –III: 1) Introduction to Wireless Communication 2) Introduction to 5G-6G
***Please refer list of Multidisciplinary Minor courses attached separately.**

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B. E. ELECTRONICS AND TELECOMMUNICATION ENGINEERING

Multi -Disciplinary Minor Courses (14 Credits)

SEM	Course Code	Course Type	Credit		Course Title
			T	P	
Sem III	3ET205MD	MDM –I	2	0	Fundamentals of Digital Electronics
Sem IV	4ET214MD	MDM -II	2	0	Digital ICs and applications
Sem V	5ET227MD	MDM -III	2	0	Introduction to Microprocessors
	5ET228MD	MDM -IV	2	0	Microcontroller Applications
	5ET229ML	MDM Lab. -I	0	1	Microprocessor and Microcontroller Lab
Sem VI	6ET239MD	MDM -V	2	0	IoT and Applications
Sem VII	7ET307MD	MDM -VI	2	0	Introduction to Embedded Systems
	7ET308ML	MDM Lab. -II	0	1	Embedded Systems Lab
		Total	**12**	**02**	

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B.E. in Electronics and Telecommunication Engineering Syllabus
(Semester –V)

PROGRAM CORE COURSE-I (PCC-I)
5ET220PC Microcontroller

Course Requisite:

Introduction to Digital Electronics

Course Objectives:

1. To understand the fundamentals of microprocessor Intel 8085.
2. To deal interfacing and assembly language programming of Intel 8085 with Intel 8255.
3. To study microcontroller 8051 and its architecture.
4. To perform C programming with Intel 8051.
5. To interface and program ADC 0809 with microcontroller 8051
6. To equipped with measurement of physical quantities using microcontroller 8051

Course Outcomes:

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

1. Describe the internal architecture, addressing modes and functioning of 8085 microprocessors.
2. Understand PPI 8255 with its interfacing and programming with 8085
3. Illustrate the architecture & Memory interfacing for 8051 microcontrollers.
4. Implement programs for the 8051 microcontroller using the C programming.
5. Discuss with timers, counters, and interrupts of 8051.
6. Design and development of microcontroller based system using ADC and LCD.

Unit No.	Contents	No. of lectures
1	**Introduction to Microprocessors**: Intel 8085 Pin Diagram & Architecture, Addressing modes and overview of instruction set, Program control and Stack related instructions, Interrupt system.	06
2	**I/O Interfacing & Programming of Intel 8085:** Address space partitioning schemes with its related instructions. Architecture, interfacing and programming of Intel 8085 with Intel 8255 PPI.	06
3	**Introduction to Microcontrollers 8051 Architecture:** Difference between Microprocessor and Microcontroller, Intel 8051 signal description and architecture, Register set, Memory organization.	06
4	**8051 programming in C :** Data types and time delay in 8051 C, IO programming in 8051 C, Logic operations in 8051 C, Data conversion programs in 8051 C, Accessing code ROM space in 8051 C, Data serialization using 8051 C.	06

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5	**Timers, Counters, and Interrupts in 8051:** Timer and Counter structure, Modes of operation, Serial communication registers and modes in 8051, Interrupt structure of Intel 8051.	**06**
6	**Interfacing Applications:** Architecture, Interfacing and programming of ADC 0808/09 with 8051, Measurement of physical quantities using microcontroller, LCD Interfacing.	**06**

Text Books:

1. Ramesh S. Gaonkar, Microprocessor Architecture, Programming and Applications with 8085, Penram International.
2. Muhammad Ali Mazidi & Janice Gillispie Mazidi, The 8051 Microcontroller and Embedded Systems, Pearson Education.
3. Ajay Deshmukh, Microcontrollers: Theory and Applications, Tata McGraw-Hill.

Reference Books:

1. Kenneth J. Ayala, The 8051 Microcontroller: Architecture, Programming and Applications, Penram International.
2. Han-Way Huang, The 8051 Microcontroller and Embedded Systems Using Assembly and C, Cengage Learning.
3. Raj Kamal, Embedded Systems: Architecture, Programming and Design, McGraw-Hill Education.
4. Steve Furber, ARM System-on-Chip Architecture, Addison-Wesley.

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PROGRAM CORE COURSE-II (PCC-II)
5ET221PC Digital Signal Processing

Course Requisite:

1. Applied Mathematics-II
2. Signals and Systems

Course Objectives:

1. To understand discrete signal and system fundamentals.
2. To analyse the discrete-time signals in the frequency domain, using Z-transform and DFT.
3. To design FIR and IIR filters and to understand the architecture of DSP processor, filter bank and some applications of multi-rate DSP.

Course Outcomes:

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

1. Understand the discrete time signals and systems mathematically and their classification along with the mathematical operations.
2. Evaluate the Z-transform of a sequence, identify its region of convergence and compute the inverse Z-transform.
3. Analyse the digital signals using various digital transforms DFT, FFT.
4. Design FIR filters using different windowing techniques.
5. Design IIR filter and realise it using several filter structures.
6. Explain the concepts of Multi-rate Digital Signal Processing, need of Filter banks and the application of Digital Signal Processing.

Unit No.	Contents	No. of lectures
1	Discrete Time Signals and systems: Discrete time Signals, Basic Operations on signals, Convolution, correlation.	06
2	Z-Transform: Definition and Properties of Z-Transform, Concept of Region of Convergence, Inverse Z- transform using long division, Power Factor Expansion and residue method	06
3	Discrete and Fast Fourier Transform: Discrete Fourier Transform (DFT), Definition and Properties of DFT and IDFT, Circular convolution. Fast Fourier Transforms (FFT), Radix-2 decimation in time and decimation in frequency FFT algorithms.	06
4	Finite Impulse Response (FIR) filters: Linear phase filter, FIR filter design by Rectangular, Hanning, Hamming and Blackman window, FIR filter realization	06
5	Infinite Impulse Response (IIR) filters: IIR Filter Design by Approximation of derivatives, Impulse Invariance method, Bilinear Transformation method, Realization of IIR filter structures: Direct form-I, Direct Form-II, Cascade and Parallel form.	06

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6	Multi-rate Digital Signal Processing: Sampling, Sampling rate conversion, multi-level filter bank. Overview and architecture of DSP processor TMS320C54XX. Applications of DSP: Block diagram of Speech Signal, RADAR & SONAR.	06

Text Books:

1. S. Salivahanan, A. Vallavaraj, "Digital Signal Processing", Tata McGraw-Hill Education, 2001.
2. Nagoorkani, "Digital Signal Processing", Tata McGraw-Hill Education, Second Edition.
3. Oppenheim A V and Schafer R W, "Discrete Time Signal Processing", Prentice Hall

Reference Books:

1. Mitra S. K., "Digital Signal Processing", TMH.
2. Ifeacher E. C., Jervis B. W., "Digital Signal Processing", Addison Wesley.
3. Proakis & Manolakis D. G., "Digital Signal Processing", PHI.

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PROGRAM CORE COURSE-III (PCC-III)
5ET222PC Communication Network

Course Requisite:

1. Analog and Digital Communications
2. Signal and Systems

Course Objectives:

1. To provide fundamental knowledge of Data Communication concepts and Network Architecture.
2. To develop understanding of Data Link Layer protocols and error/flow control mechanisms.
3. To enable students to analyze Medium Access and Multiple Access techniques used in networks.
4. To equip students with the ability to apply Network Layer concepts such as IP addressing and routing algorithms.
5. To explain Transport Layer services and congestion control mechanisms.
6. To describe Application Layer protocols and Internet services.

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

1. Explain the fundamentals of data communication networks, including the history of the Internet, protocols and standards, OSI and TCP/IP reference models, IP addressing, network types, interconnecting devices, and network topologies.
2. Discuss flow control and error control mechanisms used in data link layer protocols, including ARQ schemes.
3. Describe the multiple access techniques and medium access control protocols used for efficient channel sharing in networks.
4. Apply network layer concepts such as IP addressing, routing algorithms, and traffic control mechanisms to solve networking problems.
5. Describe transport layer services, congestion control mechanisms, and Quality of Service concepts in networking.
6. Explain the functions and working of application layer protocols used in Internet services such as DNS, HTTP, FTP, and Email.

Unit No.	Contents	No. of lectures
1	**Data Communication Network:** A brief history of Internet, Protocols and Standards, Standard Organizations, Need for Protocol Architecture, OSI Reference Model,Overview of TCP/IP architecture, Addresses in TCP/IP. **Types of Network:** LAN, MAN, WAN. **Network connecting Devices:** Hubs, Repeater, Bridges, Switches, Routers, Gateways. **Network Topology:** Mesh, Bus, Tree, Ring, Star.	06

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2	**Data Link Control Protocols:** Need for Flow control, Stop and Wait Flow Control, Sliding Window Flow Control, Stop and wait ARQ, Go-Back-N ARQ, Selective Repeat ARQ, Transmission efficiency of ARQ protocols.	06
3	**Multiple Access Control Protocols:** Random Access Techniques: ALOHA, Slotted ALOHA, Contention Techniques: CSMA, CSMA/ CD (IEEE 802.3), CSMA/CA. Controlled Access Techniques: Polling, Token Passing. **Medium Access Control Protocols:** Token Bus (IEEE 802.4), Token Ring (IEEE 802.5).	06
4	**Network layer:** TCP IP Reference Model, IPv4-Classful and Classless Addressing, Virtual circuit and Datagram networks, Router, Routing algorithms, Dijkstra's Algorithm (Problems expected), Bellman Ford Algorithm (Problems expected). Traffic Control: Leaky bucket algorithm, Token bucket algorithm.	06
5	**Transport layer:** Connectionless transport - UDP, Connection-oriented transport – TCP, Remote Procedure Call. **Congestion Control and Resource Allocation:** Issues in Resource Allocation, Queuing Disciplines, TCP congestion Control, Congestion Avoidance Mechanisms and Quality of Service.	06
6	**Application Layer:** Domain Name Space (DNS), TELNET, EMAIL, File Transfer Protocol (FTP), WWW, HTTP, SNMP.	06

Text Books:

1 B. Forouzan , "Data Communications and Networking", McGraw-Hill, 4th Edition.

2 Andrew S. Tanenbaum and David J. Wetherall,"Computer Networks", Pearson Education, Inc., 5th Edition.

3 William Stallings , "Data and Computer Communication", Pearson Education, Inc., 8th Edition

References:

1 James F. Kuross, Keith W. Ross, "Computer Networking A Top-Down Approach Featuring the Internet", Addison Wesley, 3rd Edition.

2 Nader F. Mir , "Computer and Communication Networks", Pearson Education, 2007.

3 Comer "Computer Networks and Internets with Internet Applications", Pearson Education, 2003, 4th Edition.

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PROGRAMME ELECTIVE COURSE –I (PEC-I)
5ET223PE (i) Power Electronics

Course Requisite:

1. Physics
2. Electronics Devices and Circuits

Course Objectives:

1. To introduce power electronics devices; SCR, TRIAC, IGBT, MOSFET and to learn their characteristics.
2. To study AC-DC converters and effect of freewheeling diode.
3. To study AC-AC, DC-AC, DC-DC converters.
4. To study applications of power electronics.

Course Outcomes:

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

1. Illustrate the working of SCR.
2. Sketch & explain the characteristics of power electronics devices.
3. Demonstrate the working of Phase Controlled Rectifiers.
4. Illustrate the working of Inverters.
5. Demonstrate the working of Choppers.
6. Explain the working of cyclo-converter and applications of power converters in DC drives.

Unit No.	Content	No. of Lect.
1	**SCR:** SCR -construction, characteristics, two transistor analogy for turning ON-OFF a SCR, different methods of turning ON of a SCR, turn OFF mechanism, Thyristor firing circuit using UJT, Protection of SCR (snubber circuit)	6
2	**Construction and characteristics of Power Electronics Devices:** Triac, Diac-construction, characteristics. power transistor, power MOSFET, IGBT – their construction & characteristics, Introduction to GTO, Classification of circuit for forced commutation.	6
3	**Phase Controlled Rectifiers:** Principle of phase control, single phase half wave controlled rectifier, half controlled bridge & fully controlled bridge rectifier for resistive and RL load, derivation for output voltage and current, effect of freewheeling diode, single phase dual converters.	6
4	**Inverter:** Series inverter, improved series inverter, parallel inverter, principle of operation for three phase bridge inverter in 120 deg. and 180 deg. mode, single phase transistorized bridge inverter.	6

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5	**Chopper:** Basic principles of chopper, time ratio control and current limit control techniques, voltage commutated chopper circuit, Jones chopper, step-up chopper, step up/down chopper and AC chopper.	6
6	**Cycloconverter and Applications:** Basic principle of cyclo-converter, single phase to single phase cyclo-converter. Speed control of DC series motors speed control of DC shunt motor using phase controlled rectifiers UPS, fan speed regulator.	6

Text Books:

1 M.D.Singh, K.B. Khanchandani, "Power Electronics",Tata McGraw-Hill.

2 Muhammad H. Rashid, "Power Electronics", Prentice Hall of India.

References:

1 Ned Mohan, Robbins, "Power Electronics", John Wiley and sons edition III

2 P.C. Sen, "Modern Power Electronics",Chand& Co. edition II

3 V. R. Moorthi, "Power Electronics",Oxford University Press.

4 Cyril W., Lander, "Power Electronics",McGraw Hill edition III

5 G K Dubey, S R Doradla, "Thyristorised Power Controllers",New Age International

6 SCR manual, GE, USA.

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PROGRAMME ELECTIVE COURSE –I (PEC-I)
5ET223PE (ii) Wireless Sensor Networks

Course Requisite:

1. Engineering Mathematics
2. Network Analysis / Basic Electrical Engineering
3. Analog and Digital Communication

Course Objectives:

1. To understand the general principles of network design and compare the different network Topologies.
2. To understand the general principles of switching and various routing algorithms.
3. To acquire the knowledge of functions and protocols of OSI and TCP/IP models.
4. To understand Application layer Protocols.

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

1. Identify different types of network devices and their functions within a network.
2. Understand the basic functions of data logical link control and media access control and protocol used in this layers.
3. Distinguish between the layers of the OSI and TCP/IP model.
4. Analyze, specify and design routing strategies for an IP based networking infrastructure
5. Understand the concept of reliable and unreliable transfer protocol of data and how TCP and UDP implement these concepts.
6. Understand various Application layer Protocols.

Unit No.	Contents	No. of lectures
1	Introduction to wireless sensor Networks – Advantages of ad-hoc/sensor networks, Unique constraints and challenges-. Applications Platforms for WSN: Sensor node hardware: mica2, micaZ, telosB, cricket, Imote2, tmote, btnode . Sensor node software introduction (Operating System): tiny0S, MANTIS, Contiki, and Ret0S.	07
2	Single-Node Architecture. WSN coverage and placement: Coverage problems in WSN – Type of coverage – OGDC coverage Algorithm- Placement Problem.	06
3	Topology management in wireless sensor Networks-: Different classification of topology management Algorithms- topology discovery-sleep cycle management. Medium access control in wireless networks.	06
4	Routing in sensor networks: Data centric- position based routing- data aggregation- Clustered based routing Algorithms.	05

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5	Congestion and flow control: Source of congestion- congestion control scenarios- Protocols for congestion and flow control in sensor networks: ESRT-CODA-PSFQ-RCRT-RMST-Fusion.	06
6	Hard ware design of sensor Networks : Characteristics – Design challenges- Design of Architecture- Functional components- Energy supply- operating system. Application: Home Control, Highway Monitoring, Environmental Engineering Applications.–	06

Test Books:

1. Holger Karl and Andreas Willig, "Protocols and Architectures for Wireless Sensor Networks", John Wiley & Sons, 2005.
2. Zhao and L. Guibas, "Wireless Sensor Networks", Morgan Kaufmann, San Francisco, 2004
3. C. S. Raghavendra, K.M.Shivalingam and T.Znati, "Wireless Sensor Networks", Springer, New York, 2004

Reference Books

1. Anna Hac, "Wireless Sensor Network Designs", John Wiley & Sons, 2004.
2. KazemSohraby, Daniel Minoli and TaiebZnati, "Wireless Sensor Networks: Technology, Protocols, and Applications", Wiley Inter Science, 2007.

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PROGRAMME ELECTIVE COURSE –I (PEC-I)
5ET223PE (iii) Electric Vehicles

Course Requisite:

1. Engineering Mathematics
2. Basic Electrical Engineering
3. Electronic Devices and Circuits

Course Objectives:

1. Provide fundamental knowledge of electric vehicles, including their evolution, classification, architecture, and environmental impact.
2. Develop understanding of EV powertrain systems and their key components such as motors, transmission, and regenerative braking.
3. Introduce various battery technologies and energy storage systems used in electric vehicles along with their characteristics and safety aspects.
4. Familiarize students with power electronics applications in EVs, including converters, inverters, and motor control techniques.
5. Explain the concept and importance of Battery Management Systems (BMS) for efficient and safe battery operation.
6. Create awareness about EV charging infrastructure, charging methods, standards, and emerging trends in electric mobility.

Course Outcomes:

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

1. Explain the evolution, classification and basic architecture of electric vehicles
2. Describe the components and working of EV powertrain systems
3. Analyze different battery technologies used in EVs
4. Explain the role of power electronics in EVs, including DC-DC converters, Inverters.
5. Describe the architecture and functions of Battery Management Systems (BMS).
6. Explain EV charging methods and types of charging stations

Unit No.	Contents	No. of lectures
1	**Introduction to Electric Vehicles:** Evolution of electric vehicles and history of EV development, Classification of electric vehicles: BEV, HEV, PHEV and FCEV, Global EV market trends and policies Environmental impact and sustainability, Basic architecture of electric vehicles.	6
2	**Electric Vehicle Powertrain Architecture:** Components of EV powertrain, Traction motors: DC, Induction, PMS and BLDC motor. Motor characteristics and performance parameters, Transmission systems, Regenerative braking concept and working, Power flow control in EVs	6
3	**Battery Technology and Energy Storage Systems**: Energy storage requirements in EVs. Types of batteries used in EVs: Lead Acid, Nickel Metal Hydride, Lithium-ion batteries. Battery parameters: Energy density, Power density, State of Charge (SOC), State of Health (SOH). Battery charging methods, Battery safety considerations.	6

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4	**Power Electronics in Electric Vehicles:** Role of power electronics in EVs, DC-DC converters in EV applications, Inverters for motor drive, Motor control techniques, Power electronic devices used in EVs (MOSFET, IGBT, SiC devices), Thermal management in power electronics.	6
5	**Battery Management System and Control:** Battery Management System (BMS) architecture. Functions of BMS: Cell monitoring, SOC estimation, Thermal management, Cell balancing. Sensors used in EV systems, Embedded controllers used in EVs, Fault detection and safety systems	6
6	**Charging Infrastructure:** EV charging methods, Charging standards and connectors, Types of charging stations: Level 1, Level 2, DC fast charging. Future trends in EV technology	6

Text Book:

1. C.C Chan, K.TChau: "Modern Electric Vehicle Technology", Oxford University Press Inc.,New York 2001.
2. Rashid M. H., "Power Electronics Circuits, Devices and Applications", Prentice Hall.
3. L.Guzzellaand, A.Sciarretta, Vehicle Propulsion Systems: Introduction to modeling and Optimization, Springer2007, Third Edition.

Reference Book:

1. Iqbal Hussein, "Electric and Hybrid Vehicles: Design Fundamentals", CRC Press, 2003.
2. JamesLarminie, JohnLowry, "Electric Vehicle Technology Explained" ,Wiley, 2003.
3. Austin Hughes and Bill Drury,"Electric Motors and Drives Fundamentals Types and Applications",Elsevier,2019.
4. Mehrdad Ehsani, Yimin Gao, Sebastian E.Gsay, Ali Emadi, "Modern Electric, Hybrid Electric and Fuel Cell vehicles-Fundamentals-Theory and Design", CRC Press

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PROGRAM CORE COURSE-I (PCC-I)
5ET224PC Microcontroller Lab

Course Requisite:

1. Introduction to Digital Electronics.

Course Objectives:

1. To understand the fundamentals of various arithmetic operations.
2. To perform assembly language programming using looping instructions.
3. To develop skills for sorting of numbers using assembly language programming.
4. To implement interfacing and assembly language programming of peripherals with Intel 8085.
5. To interface and program ADC 0809 with microcontroller 8051
6. To achieve an experience for measurement of physical quantities using microcontroller 8051

Course Outcomes:

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

1. Build the assembly language program for various arithmetic operations.
2. Execute assembly language program using looing instruction
3. Acquire skills for sorting of numbers using assembly language
4. Organizing Interfacing of peripherals with assembly language programming
5. Integrating Interfacing and programming of microcontroller 8051 with ADC 0809
6. Design for measurement of physical quantities using microcontroller 8051.

Expt. No	Experiment
1	Write and execute 8085 ALP for addition and subtraction of two 8 bit numbers from memory & store Result at next location of memory.
2	Write and execute 8085 ALP for multiplication of two 8 bit numbers from memory and store the result in memory.
3	Write and execute8085 ALP for addition of series of 8 bit numbers from memory and store the result in memory.
4	Write and execute 8085 ALP for smallest/largest numbers from an array of memory.
5	Interfacing and programming of Intel 8085 with Intel 8255 PPI for I/O Mode
6	Interfacing and programming of Intel 8085 with Intel 8255 PPI for BSR Mode
7	Write & execute 8051 embedded C- program to blink 8 LEDs to any PORT
8	Interface 7-segment display with 8051 microcontroller and write embedded C code to display 0-9 numbers
9	Interface LCD display with 8051 microcontroller and write embedded C code which will display your name and roll number on the LCD
10	Interface stepper motor with 8051 microcontroller and write embedded C code which will rotate stepper motor continuously
11	Interfacing and Programming of Intel 8051 microcontroller with ADC 0808/09.
12	Measurement of physical quantities using microcontroller 8051.

Minimum 08 experiments should be conducted out of above enlisted.

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PROGRAM CORE COURSE-II (PCC-II)
5ET225PC Digital Signal Processing Lab

Course Requisite:

Digital Signal Processing

Course Objectives:

1. To understand and analyze discrete-time signals and systems through mathematical operations such as convolution, correlation, and transformations.
2. To develop practical skills in frequency-domain analysis techniques including DFT, IDFT, and FFT for signal processing applications.
3. To design and implement digital filters (FIR and IIR) and perform sampling rate conversion for real-world DSP applications.

Course Outcomes:

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

1. Generate and manipulate discrete-time signals and apply operations like convolution and correlation effectively.
2. Analyze signals in both time and frequency domains using DFT, FFT, and Z-transform techniques.
3. Design and implement FIR and IIR filters and apply multi-rate signal processing techniques such as interpolation and decimation.

Expt. No	Experiment
1.	To generate and plot basic discrete-time signals such as unit impulse, unit step, ramp, and sinusoidal sequences.
2.	To perform basic operations on discrete-time signals including time shifting, time scaling, and folding.
3.	To compute the linear convolution of two discrete-time sequences.
4.	To determine the auto-correlation and cross-correlation of given discrete-time signals.
5.	To find the Z-transform and Inverse Z-Transform.
6.	To compute the Discrete Fourier Transform (DFT) and Inverse DFT (IDFT) of a given sequence.
7.	To perform circular convolution using DFT.
8.	To implement Fast Fourier Transform (FFT).
9.	To design FIR filters using window techniques such as Rectangular, Hanning, Hamming, and Blackman windows.
10.	To design IIR filters using the bilinear transformation method.
11.	To design IIR filters using the impulse invariance method.
12.	To perform sampling rate conversion using interpolation and decimation techniques.

Minimum 08 experiments should be conducted out of above enlisted.

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PROGRAM CORE COURSE-III (PCC-III)
5ET226PC Communication Network Lab

Course Requisite:

Communication Network

Course Objectives:

1. To develop practical skills in computer networking setup and configuration, including LAN creation, device configuration, and resource sharing between computers.
2. To understand the working of network hardware and communication media, such as NICs, cables, switches, and network topologies through hands-on implementation.
3. To gain proficiency in network simulation and troubleshooting using tools like Cisco Packet Tracer.

Course Outcomes:

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

1. Configure and manage basic computer networks, including file sharing, remote access, VLAN configuration, and LAN setup.
2. Identify and use networking components effectively, such as MAC addressing, network cables, and network devices.
3. Design, simulate, and troubleshoot networks using industry-relevant tools like Cisco Packet Tracer.

Expt. No.	EXPERIMENT DESCRIPTION
1	Sharing file/ folder with various security levels between two PC's
2	Installation and accessing remote computer desktop and share printer between PC on local area network.
3	Format and partition the hard disk of Personal Computer (PC). Install network driver.
4	Check Network Interface Card identify its MAC address.
5	Create a simple LAN with multiple PCs using an Ethernet switch/hub and a straight-through cable to connect each PC. Check the network connection with the Ping command.
6	Study of different Network Devices in detail.
7	Study of Different types of Network cables and practically implement the cross-wired cable and straight through cable using crimping tool.
8	To Configure various network topology using Packet Tracer Software. a)Bus b) Ring c) Mesh d) Star
9	Configure network with Cisco Packet Tracer.
10	Building a VLAN Configuration using Cisco Packet Tracer.
11	Network Troubleshooting

Minimum 08 experiments should be conducted out of above enlisted.

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MULTIDISCIPLINARY MINOR –III (MDM- III)

5ET227MD Introduction to Microprocessors

Course Requisite:

1. Digital Electronics

Course Objectives:

1. To understand the architecture and operation of the 8085 microprocessor.
2. To learn 8085 instruction set and assembly language programming.
3. To study I/O interfacing and programming with peripheral devices like 8255.

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

1. Explain the architecture and interrupts of the 8085 microprocessor.
2. Develop 8085 assembly language programs using instruction sets and addressing modes.
3. Implement I/O interfacing of 8085 with 8255 PPI.

Unit No.	Contents	No. of lectures
1	**Introduction to Microprocessor:** History and evolution of microprocessor and their classification, Introduction to microprocessors and microcomputers, Study of 8 bit Microprocessor, 8085 pin configuration, Internal Architecture and operations, Interrupts and interrupt service routine.	8
2	**8085 Assembly Language Programming:** Addressing modes, 8085 instruction set, 8085 assembly language programming,	8
3	**I/O Interfacing & Programming of Intel 8085:** Address space partitioning schemes with its related instructions. Architecture, interfacing and programming of Intel 8085 with Intel 8255 PPI	8

Text Books:

1. Gaonkar R.S: "Microprocessor Architecture Programming and Applications with the 8085", Penram International Pub.
2. B.Ram: "Introduction of Microprocessors & Microcomputers" Dhanpatrai & Sons Publications

References:

1. Data Sheet Manual by INTEL

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MULTIDISCIPLINARY MINOR –IV (MDM- IV)

5ET228MD Microcontroller Applications

Course Requisite:

1. Digital Electronics

Course Objectives:

1. To understand the architecture and memory organization of 8051 microcontroller.
2. To learn 8051 programming using C language.
3. To study interfacing of peripherals with 8051 microcontroller.

Course Outcomes:

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

1. Explain the architecture and features of the 8051 microcontroller.
2. Develop embedded programs in C for 8051.
3. Implement interfacing of devices with 8051.

Unit No.	Contents	No. of lectures
1	**Introduction to Microcontrollers 8051 Architecture:** Difference between Microprocessor and Microcontroller, Intel 8051 signal description and architecture, Register set, Memory organization	08
2	**8051 programming in C :** Data types and time delay in 8051 C, IO programming in 8051 C, Logic operations in 8051 C, Data conversion programs in 8051 C, Accessing code ROM space in 8051 C, Data serialization using 8051 C.	08
3	**Interfacing with 8051 Microcontrollers:** Interfacing and programming of: LED, Switches, Seven Segment, Stepper Motor, DC Motor, LCD.	08

Text Books:

1. Gaonkar R.S: "Microprocessor Architecture Programming and Applications with the 8085", Penram International Pub.
2. M. A. Mazidi, J. G. Mazidi and R. D. McKinley: "The 8051 Microcontroller and Embedded Systems using Assembly and C", Pearson Education (2nd Ed.)

References:

1. K. J. Ayala : "The 8051 Microcontroller", Penram Int. Pubs., 1996
2. Phillips NXP LPC 2148 User Manual.
3. Data Sheet Manual by INTEL

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MULTIDISCIPLINARY MINOR LAB –I (MDM LAB -I)
5ET229ML Microprocessor and Microcontroller Lab

Course Requisite:

1. Introduction to Microprocessors
2. Microcontroller Applications

Course Objectives:

1. To understand the architecture and working of microprocessors and microcontrollers, specifically the Intel 8085 and Intel 8051.
2. To develop programming skills in assembly language and embedded C, for solving computational and control-based problems.
3. To gain hands-on experience in interfacing external devices such as LEDs, displays, and motors with microprocessors and microcontrollers.

Course Outcomes:

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

1. Write and execute programs using 8085 assembly language and 8051 embedded C.
2. Interface peripheral devices like Intel 8255, LEDs, LCDs, and motors with microcontroller systems.
3. Design and implement basic embedded systems, integrating hardware and software for real-time applications.

Expt. No	Experiment
1	Study of pin configuration and internal architecture of the Intel 8085
2	Study of interrupt structure of the Intel 8085
3	8085 ALP for addition and subtraction of 8-bit numbers
4	8085 ALP for multiplication of two numbers
5	8085 ALP for division of two numbers
6	8085 ALP to find largest/smallest number in an array
7	8085 ALP for sorting numbers (ascending/descending)
8	Interfacing of Intel 8255 with 8085
9	Study of architecture and memory organization of the Intel 8051
10	8051 C program for input/output port operations
11	8051 C program for time delay generation
12	8051 C program for logical operations and data conversion
13	Interfacing LEDs and switches with 8051
14	Interfacing seven-segment display / LCD with 8051
15	Interfacing stepper motor / DC motor with 8051

Minimum 08 experiments should be conducted based on MDM III and MDM IV.

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OPEN ELECTIVE- III (OE- III)

5ET230OE (i) Introduction to Wireless Communication

Course Requisite:

Course Objectives:

1. To understand the fundamental principles and evolution of wireless communication systems.
2. To analyze the basic structure of cellular systems.
3. To understand basic radio propagation mechanism and Multiple access techniques.

Course Outcomes:

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

1. Understand the fundamental principles and evolution of wireless communication systems.
2. Analyze the basic structure of cellular systems.
3. Understand basic radio propagation mechanism and Multiple access techniques

Unit No.	Contents	No. of lectures
1	**Fundamentals of Wireless Communication:** Evolution of wireless systems (1G to 5G & beyond), Wireless communication advantages, limitationsand applications,Basic Cell Fundamentals, Cellular Telephone System, Wireless Cellular Networks and Standards	08
2	**Cellular System Fundamentals:** Frequency Reuse, Channel assignment Strategies, Co-channel and Adjacent channel Interference, Hand off strategies, Types of Hand off, Cell improvement techniques: Cell Sectoring, Cell Splitting.	08
3	**Basic Radio Propagation and Multiple Access Techniques:** Basic propagation techniques: Reflection, Diffraction and Scattering, Comparison, Multipath propagation and Large scale and Small-scale fading (numerical not expected), Types of Small-Scale Fading, Doppler effect and coherence bandwidth/time, Introduction to FDMA, TDMA and CDMA, Comparison.	08

Text Books:

1. Theodore S. Rappaport, "Wireless Communications: Principles & Practice", Second edn., Pearson Edn.(2002).
2. T. L. Singal, "Wireless Communication". McGraw Hill Education.

Reference Books:

1. A. F. Molisch, "Wireless Communications", Second Edition, Wiley Publication.
2. K. Shammugham,"Digital and Analog Communication.

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OPEN ELECTIVE- III (OE- III)
5ET230OE (ii) Introduction to 5G-6G

Course Requisite:

Analog & Digital Communication

Course Objectives:

1. To describe and explain the evolution of wireless communication systems from 1G to 5G, including fundamental radio propagation mechanisms used in wireless networks.
2. To analyze the cellular network design principles including cellular concept, frequency reuse, channel allocation techniques, capacity enhancement methods, and handoff mechanisms.
3. To evaluate the architecture, performance requirements, applications, and future vision of 5G and emerging 6G communication systems, including the Bharat 6G Mission.

Course Outcomes:

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

1. Explain the evolution of wireless communication systems and the basic radio propagation mechanisms used in wireless networks.
2. Analyze the cellular network concepts such as frequency reuse, channel allocation, and handoff techniques used in mobile communication.
3. Evaluate the architecture, key technologies, applications, and future scope of 5G and emerging 6G communication systems.

Unit No.	Contents	No. of lectures
1	**Overview of Wireless Networks:** Evolution of voice oriented and data oriented wireless networks, different generations of wireless networks (1G → 5G), and comparison of wired and wireless media, radio propagation mechanism.	08
2	**Cellular Fundamentals:** Cellular concept, cellular hierarchy, cell fundamentals, Frequency Reuse Concept, Capacity Expansion: cell splitting and cell sectoring, Channel allocation techniques: Fixed, Dynamic & Hybrid channel allocation, channel borrowing technique. Handoff concept, types of handoffs.	08
3	**5G & 6G System:** 5G standards, Key performance indicators of 5G, 5G use cases, 5G Applications & Services, 5G architecture: gNB, RAN, Core Network (5GC), 5G Frequency spectrum, introduction of 6G and its vision Bharat 6G Vision (India 2030 roadmap)	08

Reference Books:

1. G. S. Rao, "Mobile Cellular Communication", Pearson Education
2. Theodore S. Rappaport, "Wireless Communications: Principles &Practice", Second edition, Pearson Education (2002)
3. Saad Z. (Springer, 2019) - "5G Mobile Communications"
4. Jonathan Rodriguez (Wiley, 2015) - "Fundamentals of 5G Mobile Networks"
5. Erik Dahlman, Stefan Parkvall, and Johan Skold (Academic Press, 2020) - "5G NR: The Next Generation Wireless Access Technology"

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