MINOR DEGREE

Semester-III							
S.No.	**Sub Code**	**Subject Name**	**L**	**T**	**P**	**Hrs.**	**Credits**
1.	MDEC-511	Digital Circuits and Logic Design	3	1	0	4	4
		Total	3	1	0	4	4
Semester-IV							
S.No.	**Sub Code**	**Subject Name**	**L**	**T**	**P**	**Hrs.**	**Credits**
1.	MDEC-521	Microcontroller	3	0	2	4	4
		Total	3	0	2	4	4
Semester-V							
S.No.	**Sub Code**	**Subject Name**	**L**	**T**	**P**	**Hrs.**	**Credits**
1.	MDEC-611	Communication System	3	1	0	4	4
		Total	3	1	0	4	4
Semester-VI							
S.No.	**Sub Code**	**Subject Name**	**L**	**T**	**P**	**Hrs.**	**Credits**
1.	MDEC-621	Fiber Optics	3	0	2	4	4
		Total	3	0	2	4	4
Semester-VII							
S.No.	**Sub Code**	**Subject Name**	**L**	**T**	**P**	**Hrs.**	**Credits**
1.	MDEC-711	Signal Processing	3	1	0	4	4
		Total	3	1	0	4	4

Vivek Harshey Sarbjeet Singh Dilip Kumar J.S. Ubhi Surinder Singh

MDEC-511
Digital Circuits and Logic Design

	L	T	P	Credits
	3	1	0	4
	Sessional Marks			50
	End Semester Examination Marks			50

Course Objectives

The main objective of this course to acquire knowledge and become familiar with digital circuits and logic design. The students will be able to implement various functions using combinational and sequential circuits. It enables students to design and analyze synchronous and asynchronous finite state machines. The course also deals with programmable logic devices such as PROM, PLA, PAL, FPGA, etc. Further, hardware description language will be used for designing combinational and sequential circuits.

Course Outcomes

1. Design and analysis of various logic functions using different combinational circuits.
2. Able to design and implement simple and complex synchronous and asynchronous sequential systems using state machines.
3. An ability to analyze and implement different functions using programmable logic devices.
4. Able to design and implement the digital system using a hardware description language.

Mapping of Course Outcomes with Program Outcomes

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	3	3	3	1	2	0	1	1	0	0	2	3	2
CO2	3	3	3	3	2	2	0	1	1	0	1	2	3	2
CO3	3	3	2	2	2	2	0	1	2	0	1	2	3	2
CO4	3	3	3	2	3	2	0	1	1	0	0	2	3	2

Unit-I — **10 hrs**

Introduction to Digital Design: Review of digital design fundamentals, design, and minimization of combinational circuits and their implementation using multiplexers, decoders, PROM, PLA, PAL, etc.

Unit-II — **14 hrs**

Finite State Machines: Sequential machine fundamentals, state diagram, analysis of synchronous circuits, state graphs and tables, reduction of state tables, state assignment, design of sequence detectors, concept of overlapping in sequence detectors, Moore and Mealy state machines, design of synchronous sequential state machine, design of counters and shift registers, introduction of asynchronous sequential state machines.

Unit-III — **12 hrs**

Programmable Logic Devices: Introduction to programmable logic devices, types of PLD's, its applications, implementation of digital logic using PROM, PAL, PLA, CPLD's and FPGA's.

Unit-IV — **12 hrs**

Vivek Harshey Sarbjeet Singh Dilip Kumar J.S. Ubhi Surinder Singh

Hardware Description Language: Introduction to HDL and its types, Overview of digital system design with VHDL, basic language terminology, VHDL representation of digital design entity and architectural declarations, basic language elements, introduction to behavioural, dataflow and structural models, model simulation and test bench, applications of VHDL to design.

RECOMMENDED BOOKS		
Title	**Author**	**Publisher**
1. An Engineering Approach to Digital Design	William I Fletcher	Pearson Education
2. Digital Design	M. Morris Mano R.	Pearson Education
3. Digital System Design using VHDL	Charles H. Roth Jr.	Cengage Learning
1. A VHDL Primer	J. Bhaskar	Pearson Education
2. Circuit Design using VHDL	V. A. Pedroni	MIT Press

Vivek Harshey Sarbjeet Singh Dilip Kumar J.S. Ubhi Surinder Singh

MDEC-521
Microcontroller

	L	T	P	Credits
	3	**1**	**0**	**4**
	Sessional Marks			**50**
	End Semester Examination Marks			**50**

Course Objectives

The objective of the course is to develop an in-depth understanding of the operation of microcontrollers, machine language programming & interfacing techniques. Students will be able to interface the microcontroller with the I/O devices to develop simple applications on microcontroller-based systems

Course Outcomes

1. To understand the internal architecture and pin configuration of 8051 Microcontrollers.
2. To understand and acquire knowledge in programming 8051.
3. Acquire the knowledge of instruction set and addressing modes of 8051.
4. Analyze the concept of serial communication and interfacing the external devices with the 8051.

Mapping of Course Outcomes with Program Outcomes

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	3	3	3	1	2	0	1	1	0	0	2	3	2
CO2	3	3	3	3	2	2	0	1	1	0	1	2	3	2
CO3	3	3	2	2	2	2	0	1	2	0	1	2	3	2
CO4	3	3	3	2	3	2	0	1	1	0	0	2	3	2

Unit-I — 10 hrs

Microcontroller 8051: Introduction and history of microcontrollers. Features of 8051microcontroller. Block diagram of 8051- Flags and program status word (PSW), accumulator and B register, program counter and Data Pointer.

Memory organization : RAM & ROM, register banks, stack and stack pointer, Pin out diagram-description of pins, special function registers (SFRs), I/O port organization, Interrupts, Counters and Timers

Unit-II — 14 hrs

Instruction Set of 8051: Classification of instruction set - Data transfer group, arithmetic group, logical group, single bit, branching group, CALL and RET instructions and their usage. **Addressing modes :** Immediate, register, direct, register indirect and indexed addressing modes. Accessing the data from internal and external memory. Signed number concepts, generating relative address for loops.

Unit-III — 12 hrs

Programming 8051 Using Assembly Language: Introduction to 8051 assembly language programming-

Data types & directives. Programs - addition, subtraction, multiplication (with & without MUL),

division (with & without DIV), sum of natural numbers., block transfer, finding smallest and biggest number from a set of numbers. Concept of subroutine & time delay programming.	
Unit-IV	**12 hrs**
Timer programming : Timer / Counter in 8051: Timer registers - Timer0, Timer1. Configuration of TMOD (Timer Mode), TCON (Timer Control) registers. Timer modes- Mode1, Mode2 programming. Counter mode. **Serial communication:** modes and protocols, RS-232 pin configuration and connection. Serial port programming (Transmitting a character, and receiving a character using serial communication). **Interfacing Data Converters with 8051:** Digital to Analog converters and Analog to Digital converters.	

RECOMMENDED BOOKS

Title	Author	Publisher
1. The 8051 Microcontroller and Embedded Systems	M.Mazidi, JG Maizidi	Pearson Education
2. The 8051 Microcontroller	Kenneth J. Ayala	Pearson Education
3. Microprocessors and Microcontrollers	N Senthil Kumar, M Saravanan, S Jeevananthan	Oxford University Press
4. An introduction to Intel family of Microprocessors	James L Antonakes	3rd Edition, Pearson Education

MDEC-521 **Microcontroller Lab**				
	L	T	P	Credits
	0	0	2	1
	Internal Assessment marks			50
	End Semester Marks			50
Course Objectives	The aim of this course is to study and understand the practical aspects of the microcontroller applications. It also gives the insight into the interfacing of microcontrollers with external devices.			
Course Outcomes	1.Students will be able to understand fundamental programming concepts of microcontrollers. 2.Students will be able to have an in-depth knowledge on interfacing the external devices to the controllers. 3.Students will be able to have an in-depth knowledge of applying the concepts on real-time applications.			

Mapping of Course Outcomes with Program Outcomes

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	**3**	**0**	**0**	**0**	**0**	**1**	**0**	**1**	**0**	**3**	**1**	**0**
CO2	**2**	**2**	**0**	**3**	**0**	**2**	**0**	**2**	**0**	**3**	**2**	**0**
CO3	**0**	**0**	**3**	**0**	**0**	**3**	**2**	**0**	**0**	**3**	**3**	**2**

List of Experiments

PART –A(At least 6 experiments are mandatory)

Assembly Language Programming experiments using 8051 Trainer kit.

1. Data transfer/exchange between specified memory locations.
2. Largest/smallest from a series.
3. Sorting (Ascending/Descending) of data.
4. Addition / subtraction / multiplication / division of 8/16 bit data.
5. Sum of a series of 8 bit data.
6. Multiplication by shift and add method.
7. Square / cube / square root of 8 bit data.
8. Matrix addition.
9. LCM and HCF of two 8 bit numbers.
10. Code conversion – Hex to Decimal/ASCII to Decimal and vice versa.

PART –B (At least 4 experiments are mandatory)

Interfacing experiments using 8051 Trainer kit and interfacing modules.

1. Time delay generation and relay interface.
2. Display (LED/Seven segments/LCD) and keyboard interface.
3. ADC interface.
4. DAC interface with wave form generation.
5. Stepper motor and DC motor interface.
6. Realization of Boolean expression through port.
7. Elevator interfacing.

PART –C (At least 2 experiments are mandatory)

Programming/interfacing experiments with IDE for 8051/PIC/MSP/Arduino/Raspberry Pi based interfacing boards/sensor modules (Direct downloading of the pre-written ALP/'C'/Python programs can be used).

1. Relay control
2. Distance measurement.
3. Temperature measurement / Digital Thermometer
4. Txr-Rxr interface.
5. Alphanumeric LCD display interface.

MDEC- 611 Communication System				
	L	T	P	Credits
	3	0	0	3
	Sessional Marks			50
	End Semester Examination Marks			50
Course Objectives	The main focus of the course is on understanding the importance and theories of communication systems. The students will study the various analog and digital communication techniques, generation, detection, transmission, and reception methods.			
Course Outcomes	1. Gain knowledge about the fundamental concepts of communication systems. 2. Analyse AM, SSB, FM, and PM transmission and reception circuits. 3. Understand various pulse communication schemes. 4. Acquire knowledge about the basic concepts of digital modulation and demodulation techniques.			

Mapping of course outcomes with program outcomes

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	2	2	2	2	2	0	1	0	2	1	2	3	3
CO2	3	3	3	3	2	2	1	1	2	2	1	2	3	3
CO3	1	1	1	0	1	2	0	1	1	1	3	2	3	3
CO4	2	1	1	2	0	2	0	1	1	0	1	2	3	3

Unit-I — **12 hrs**

Introduction: Communication, information, message and signals, electromagnetic spectrum, classification of signals, periodic and non-periodic signals, analog and digital signals, deterministic and random signals, elements of a communication system, modulation and its types, need for modulation.
Amplitude modulation: Definition, expression of AM wave, modulation index, frequency spectrum, bandwidth, power contents of sidebands, and carrier.

Unit-II — **12 hrs**

Angle modulation: Concepts of angle modulation, theory of frequency modulation, mathematical analysis of FM, spectra of FM signals, narrowband FM, wideband FM, phase modulation, phase modulation obtained from frequency modulation, comparison of AM, FM, and PM.
Generation of AM and FM waves: Basic principle of AM generation, basic principle of FM generation, varactor diode modulator. DSB-SC, SSB, their comparison and areas of applications.

Unit-III — **12 hrs**

Pulse modulation: Sampling process, sampling theorem, natural sampling, flat-top sampling, sampling rate, aliasing, a basic idea about PAM, PWM, and PPM and typical applications, reconstruction of message, pulse code modulation (PCM), block diagram of PCM system, quantization.

Unit-IV — **12 hrs**

Elements of digital communication: Block diagram of digital communication system, digital representation of analog signals, advantages, and disadvantages of digital communication system,
Digital carrier modulation techniques: Introduction, amplitude shift keying (ASK), ASK spectrum, ASK modulator, frequency shift keying (FSK), PSK.

Vivek Harshey Sarbjeet Singh Dilip Kumar J.S. Ubhi Surinder Singh

Digital carrier demodulation techniques: Coherent ASK detector, non-coherent ASK detector, non-coherent FSK detector, coherent FSK detector**.**		
RECOMMENDED BOOKS		
Title	**Author**	**Publisher**
1. Communication Systems (Analog and Digital)	Sanjay Sharma	S.K. Kataria & Sons
2. Electronic Communication Systems	J. Kennedy	Tata McGraw Hill
3. Electronic Communications	Roddy and Coolen	Prentice Hall of India
4. Principles of Communication Systems	Taub and Schilling	Tata McGraw Hill

Vivek Harshey Sarbjeet Singh Dilip Kumar J.S. Ubhi Surinder Singh

MDEC-621 Fiber Optics				
	L	**T**	**P**	**Credits**
	3	**1**	**0**	**4**
	Sessional Marks			**50**
	End Semester Examination Marks			**50**
Course Objectives	To be familiar with the operating principles of fiber optics characteristics and optical components for fiber communication systems. Analyzation of various nonlinear effects in optical fibre and performance of Optical sources and detector. Describe the hardware i.e. optical sources, detectors and amplifiers of fibre optic communication systems and familiar with the installation of fibre optics communication network for real time application.			
Course Outcomes	1. Learn basics of optical fiber and other components for optical communication system. 2. Analyze the various nonlinearities in optical communication system. 3. Appreciate the long-haul communication achieved by using optical amplifier. 4. Describe the various optical network topologies. 5. Use the appropriate state-of-the-art engineering references and resources needed to find the best solutions to optical system design problems.			

Mapping of Course Outcomes with Program Outcomes

	PO 1	PO 2	PO 3	PO 4	PO 5	PO6	PO 7	PO8	PO9	PO1 0	PO11	PO1 2	PSO 1	PSO 2
CO1	2	2	3	3	3	0	2	1	0	0	1	3	2	3
CO2	3	3	3	3	3	2	0	1	2	0	2	3	2	2
CO3	3	3	2	2	3	0	1	1	2	0	0	3	2	2
CO4	3	3	3	3	2	1	2	1	2	0	3	3	1	1

Unit-I	**10 hrs**
Introduction to fiber optic: Historical of fiber optics, block diagram of fiber optical communication, key elements of optical fiber system, standard for optical communication. **Optical fibers**: Basic optical law and definitions, fiber characteristics and transmission, total internal reflection, critical angle, numerical aperture, modes, Types of fibers: single-mode and multimode fiber, step-index and graded-index fiber, numerical aperture.	
Unit-II	**14 hrs**
Attenuation and dispersion: Attenuation causes and measurement of attenuation, intrinsic absorption, extrinsic absorption, bending losses, Linear scattering losses: Rayleigh scattering and Mie scattering, Nonlinear scattering: Stimulated Brillouin scattering and Stimulated Raman Scattering dispersion (intermodal and intermodal).	
Unit-III	**12 hrs**
Optical source and detectors: Energy bands, intrinsic and extrinsic material, P-n junction, direct and indirect band gaps, LED, structure, material and quantum efficiency, LASER diodes, principle of operation, laser diode rate equations, quantum efficiency, PIN photo detector and avalanche photodiode, photo detector noise, detector response time.	
Unit-IV	**12 hrs**

Vivek Harshey Sarbjeet Singh Dilip Kumar J.S. Ubhi Surinder Singh

Optical amplification: Introduction to optical amplifier, characteristics of semiconductor optical amplifiers (SOAs) and Erbium doped fibre amplifiers (EDFAs).
Optical networking: Introduction to the signal sampling and sampling theorem, optical time division multiplexing, (OTDM), Introduction to the signal interference, constructive and destructive interference, wavelength division multiplexing.

RECOMMENDED BOOKS

Title	Author	Publisher
1. Fiber-Optic Communication Systems	G. P. Aggarwal	J. Wiley & Sons. 2nd Ed., 1997
2. Optic Communication Systems	Mynbaev	Pearson education, 2001,
3. Optical Fiber Communication	Gerd Keiser	McGraw Hill, 5th edition 2013
4. Optical Fiber Communication	Senior	PHI

Vivek Harshey Sarbjeet Singh Dilip Kumar J.S. Ubhi Surinder Singh

MDEC-621 Fiber Optics lab				
	L	**T**	**P**	**Credits**
	0	**0**	**2**	**1**
	Internal Assessment marks			**50**
	End Semester Marks			**50**
Course Objectives	The aim of this course is to study and understand the practical aspects of the fiber optics. It also gives the insight into characterization of multiple optical communication and their mitigation. Finally, it will provide platform for the student to design and evaluation of modern optical communication networks.			
Course Outcomes	1. Understand the basic operations in fiber optics communication. 2. Able to understand the various losses experienced by optical signal inside the optical fiber. 3. Able to establish the optical fiber communication link			

Mapping of Course Outcomes with Program Outcomes

	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**
CO1	**2**	**0**	**0**	**0**	**0**	**1**	**0**	**2**	**0**	**3**	**1**	**0**
CO2	**2**	**2**	**0**	**3**	**0**	**2**	**0**	**2**	**0**	**3**	**2**	**0**
CO3	**0**	**0**	**3**	**0**	**0**	**3**	**2**	**0**	**0**	**3**	**3**	**2**

List of Experiments:

1. To splice the single mode fiber using fusion splicer.
2. Evaluation of the effect of various fiber cutting methods on fiber splicing loss.
3. To detect the length of the fiber using optical time domain reflectometer method.
4. To study and monitor the propagation of laser signal in various optical mediums.
5. Characterization of the laser diode and photodetector.
6. Measurement of the optical fiber attenuation.
7. Measurement of the dispersion in optical fiber.
8. Design of the single point to point optical fiber communication link.
9. Evaluation of the power budget in optical fiber communication link.
10. To study the characterization of Erbium doped fiber amplifier.
11. Design of the wavelength multiplexed optical communication system.

Vivek Harshey Sarbjeet Singh Dilip Kumar J.S. Ubhi Surinder Singh

MDEC-711 Signal Processing				
	L	T	P	Credits
	3	0	0	3
	Sessional Marks			50
	End Semester Examination Marks			50
Course Objectives	This course covers the concepts and techniques of modern digital signal processing which are fundamental to all the signal/speech/image processing, applications. The course starts with a detailed overview of sampling and reconstruction of signals, representation of the systems by means of differential equations, and their analysis using Fourier and z-transforms. The methods for spectral analysis of discrete-time signals are discussed next and principal methods for design of FIR and IIR filters,			
Course Outcomes	1. Describe the process of sampling mathematically and articulate its benefits and limitations in modern engineering applications 2 Use and manipulate representations of discrete-time signals in both the time and frequency domains, apply various techniques such as z- and Fourier transforms for signal processing applications 3. Describe the characteristics of stochastic signals and processes using statistical measures, and apply them to model real-world systems 4. Write MATLAB code to perform signal processing functions, to produce a high-level program for real-world use			

Mapping of Course Outcomes with Program Outcomes

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	3	2	1	2	1	1	1	1	0	2	2	3	2
CO2	3	3	3	2	1	1	2	1	1	0	1	2	3	2
CO3	3	3	3	2	2	2	2	1	1	0	2	2	3	3
CO4	3	3	3	3	3	2	2	1	1	0	3	3	2	3

Unit-I **12 hrs**

Sampling and Reconstruction: Sampling theorem, aliasing, quantization, sampled data systems, cardinal (Whitaker) reconstruction, zero-, first-, second-order hold reconstructors, interpolators, non-resetting reconstructors, matched filtering. Interpolation and decimation, basic components of dsp systems.

Discrete-Time Systems: Linearity and time invariance, impulse response, fir and iir filters, causality and stability, fir filtering and convolution: block processing methods, convolution, direct form, convolution table, lti form and matrix form, transient and steady-state behavior, convolution of infinite sequences, hardware realizations and circular buffers

Unit-II **12 hrs**

Discrete-Time Signal Processing: The z transform, difference equations, relationship between F(z) and F*(jw), mappings between s-domain and z-domain, inverse z transform. Discrete–time stability. Pole/Zero Designs, First-Order Filters, Parametric Resonators and Equalizers, Notch and Comb Filters, Deconvolution, Inverse Filters, and Stability, Digital Filter realization.

Unit-III	12 hrs
Discrete Spectral Analysis: The DFT and its relationship to the continuous FT, the FFT and implementations (decimation in time and frequency), radix-2 implementation, leakage, windowing. Uses of the DFT: convolution — (overlap and add, select savings), correlation. Random processes, power spectral density (PSD) estimation — methods of smoothing the periodogram (Welch's method, windowing the correlation function, etc). ARMA methods. **Statistical Signal Processing:** Linear prediction, adaptive filters (LMS), recursive least-squares.	
Unit-IV	**12 hrs**
Real-Time Simulation Methods Using Difference Equations: Impulse-, step-, ramp-invariant simulations. Tustin's method, matched poles/zeros, bilinear transform methods. Error analysis. **Filter Design — Continuous and Discrete:** Butterworth, elliptic, Chebyshev low-pass filters. Low-pass design methods based on continuous prototypes. Realizations. Conversion to high-pass, band-pass, band-stop filters. Discrete-time filters: IIR and FIR. Linear phase filters. Frequency sampling filters.	

RECOMMENDED BOOKS

Title	Author	Publisher
1. Digital Signal Processing	Proakis, John G., and Dmitris K. Manolakis	,Prentice Hall (2006), 4^{th} ed
2. Discrete-Time Signal Processing	Oppenheim, Alan V., Ronald W. Schafer, and John R. Buck.	Discrete-Time Signal Processing. 2nd ed.
3. Digital Signal Processing	Mitra, Sanjit K	McGraw-Hill

Vivek Harshey Sarbjeet Singh Dilip Kumar J.S. Ubhi Surinder Singh