SCHEME & SYLLABUS OF

UNDERGRADUATE DEGREE COURSE

Electrical & Electronic Engineering

VII & VIII Semester

Effective for the students admitted in year 2021-22 and onwards.

Teaching and Examination Scheme

4th Year – VII Semester

S. No.	Category	Code	Course Title	Contact hrs./week			Marks				Cr
				L	T	P	Exam Hrs.	IA	ETE	Total	
THEORY											
1	DC	7EX4-01	Embedded System	3	0	0	3	30	70	100	3
2	DE-4	7EX5-11	Digital Image Processing	2	0	0	3	30	70	100	2
		7EX5-12	Digital Signal Processing								
		7EX5-13	Embedded C								
3	UE-1		Elective Group-I	3	0	0	3	30	70	100	3
			Sub Total	**8**	**0**	**0**		**90**	**210**	**300**	**8**
PRACTICAL & SESSIONAL											
4	DC	7EX4-20	Embedded System Lab	0	0	2		60	40	100	1
5	UI	7EX7-30	Industrial Training (45 days)	0	0	1		60	40	100	3
6	UI	7EX7-50	Minor Project	0	0	3		60	40	100	2
7	UGE	7EX8-00	*Co-Curricular Activities*	0	0	2		60	40	100	1
			Sub- Total	**0**	**0**	**14**		**240**	**160**	**400**	**7**
			TOTAL OF VII SEMESTER	**8**	**0**	**14**		**330**	**370**	**700**	**15**

L: Lecture, **T**: Tutorial, **P**: Practical, **C**r: Credits
ETE: End Term Exam, **IA**: Internal Assessment

Teaching and Examination Scheme

4th Year – VIII Semester

S. No.	Category	Code	Course Title	Contact hrs./week			Marks				Cr
				L	T	P	Exam Hrs.	IA	ETE	Total	
THEORY											
1	UE-2		Elective Group-II	3	0	0	3	30	70	100	3
			Sub Total	**3**	**0**	**0**		**30**	**70**	**100**	**3**
PRACTICAL & SESSIONAL											
2	UI	8EX7-40	Seminar	0	0	2		60	40	100	2
3	UI	8EX7-50	Major Project	0	0	3		60	40	100	4
4	UGE	8EX8-00	*Co-Curricular Activities*	0	0	4		60	40	100	2
			Sub- Total	**0**	**0**	**16**		**180**	**120**	**300**	**8**
			TOTAL OF VIII SEMESTER	**3**	**0**	**16**		**210**	**190**	**400**	**11**

L: Lecture, **T**: Tutorial, **P**: Practical, **C**r: Credits
ETE: End Term Exam, **IA**: Internal Assessment

Syllabus

B.Tech. (Electrical & Electronic Engineering)

IV Year VII Semester

7EX4-01: Embedded System	
Credit: 3	**Max Marks: 100 (IA: 30, ETE: 70)**
3L+0T+ 0P	**End Term Exams: 3 hrs.**

Course Outcomes:

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

CO-1: Learn the architecture and functioning of advanced processors.

CO-2: Learn the Programming concepts of embedded systems.

CO-3: Understand the real time operating systems.

CO-4: Explain embedded system design and co-design issues and software tools for development of an embedded system.

S.No.	Contents	Hours
1.	**Introduction:** Objective, scope and outcome of the course	**1**
2.	**INTRODUCTION TO EMBEDDED SYSTEMS:** Embedded system, processor in the system, Hardware and software components, System-on chip.	**4**
3.	**REVIEW OF PROCESSOR AND MEMORY:** General-purpose processors, Single-purpose processors, Application specific processors, CISC and RISC processor architecture, ARM processors, Memory devices, Processor and memory selection for an embedded system, Interfacing processor, Memory and I/O devices, 8/16 bit microcontrollers.	**9**
4.	**DEVICES AND BUSES:** Review of I/O and timer devices, Parallel communications using ISA, PCI and other buses, Serial communication using I2C, CAN, USB and advanced buses, Interrupt serving mechanism, Device drivers.	**8**
5.	**EMBEDDED PROGRAMMING:** Review of programming in ALP and in C, Embedded programming in C++, Memory organization, Compiler and cross compiler.	**7**
6.	**REAL TIME OPERATING SYSTEMS:** Operating system services, I/O subsystems, Network operating systems, Embedded system operating systems, Interrupt routines in RTOS environment.	**6**
7.	**HARDWARE-SOFTWARE CO-DESIGN:** Embedded system design and co-design issues, Software tools for development of an embedded system.	**5**

Total	**40**

Suggested Books:

1. Kamal R., "Embedded Systems – Architecture, Programming and Design", Tata McGraw-Hill Publishing Company Limited.
2. Vahid F. and Givargis T., "Embedded System Design – A Unified Hardware/Software Introduction", Wiley India.
3. Maxfield C. M., "The Design Warrior's Guide to FPGAs – Devices, Tools and Flows", Newnes.
4. Berger A. S., "Embedded System Design – An Introduction to Processes, Tools and Techniques", CMP Books.
5. Labrosse J. J., "Embedded Systems Building Blocks", 2nd Ed., CMP Books.
6. Barr M., "Programming Embedded Systems in C and C++", O'Reilly.

IV Year VII Semester

7EX5-11: Digital Image Processing	
Credit: 2	**Max Marks: 100 (IA: 30, ETE: 70)**
2L+0T+ 0P	**End Term Exams: 3 hrs.**

Course Outcomes:

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

CO-1: Understand fundamentals of image processing.

CO-2: Learn the concepts of image restoration and compression.

CO-3: Explore the concepts of image segmentation.

S. No.	Contents	Hours
1.	**Introduction:** Objective, scope and outcome of the course.	**1**
2.	**BASICS CONCEPTS OF IMAGE PROCESSING:** Digital Image representation, Sampling & Quantization, Steps in image Processing, Image acquisition, Color image representation.	**5**
3.	**IMAGE TRANSFORMATION & FILTERING:** Intensity transform functions, Histogram processing, Spatial filtering, Fourier transforms and its properties, Frequency domain filters, Colour models, Pseudo colouring, Colour transforms, Basics of wavelet transforms.	**6**
4.	**IMAGE RESTORATION:** Image degradation and restoration process, Noise models, Noise filters, Degradation function, Inverse filtering, Homomorphism filtering.	**6**
5.	**IMAGE COMPRESSION:** Coding redundancy, Inter pixel redundancy, Psycho visual redundancy, Huffman coding, Arithmetic coding, Lossy compression techniques, JPEG compression.	**6**
6.	**IMAGE SEGMENTATION & REPRESENTATION:** Point, Line and Edge Detection, Thresholding, Edge and Boundary linking, Hough transforms, Region based segmentation, Boundary representation, Boundary descriptors.	**6**
	Total	**30**

Suggested Books:

1. Gonzalez & Woods, Digital Image Processing, Pearson education, 3rd Edition, 2008.
2. Jain Anil K., Fundamentals Digital Image Processing, Prentice Hall India, 2010.
3. Milan Sonka, Vaclav Hlavav, Roger Boyle, Image Processing, Analysis and Machine Vision, Thomson Learning, 2nd Edition, 2001.
4. Pratt W.K, Digital Image Processing, John Wiley & Sons, 3rd Edition, 2007.

IV Year VII Semester

7EX5-12: Digital Signal Processing	
Credit: 2	**Max Marks: 100 (IA: 30, ETE: 70)**
2L+0T+ 0P	**End Term Exams: 3 hrs.**

Course Outcomes:

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

CO-1: Ability to compute Z transforms analysis of LTI System.

CO-2: Analyze the DFT for discrete time signals.

CO-3: Analyze the Fast Fourier transform for discrete time signals.

CO-4: Structure realization of FIR and IIR systems.

CO-5: Understand designing of FIR and IIR filters.

S. No.	Contents	Hours
1.	**Introduction:** Objective, scope and outcome of the course.	**1**
2.	**Basic elements of digital signal Processing:** Z-Transform, Inverse Z-Transform, and Properties of the Z-Transform, Inversion of the Z-Transforms (by Power Series Expansion, by Partial-Fraction Expansion), Analysis of Linear Time-Invariant Systems in the Z-Domain, Response of Systems with rational System Functions, Transient and Steady-State Responses, Causality and Stability.	**6**
3.	**Introduction to DFT:** Frequency-Domain Sampling and Reconstruction of Discrete-Time Signals, The Discrete Fourier Transform, The DFT as a Linear Transformation, Relationship of the DFT to other Transforms, Properties of the DFT: Periodicity, Linearity, and Symmetry Properties, Multiplication of Two DFTs and Circular Convolution, Additional DFT Properties, Linear Filtering Based on DFT.	**6**
4.	**Fast Fourier Transform:** FFT Algorithms, Direct Computation of the DFT, Radix-2 FFT Algorithms: Decimation-In-Time (DIT), Decimation-InTime (DIF); Applications of FFT Algorithms: Use of the FFT Algorithm in Linear Filtering and Correlation.	**6**
5.	**Structure of FIR and IIR:** Structure for FIR Systems: Direct-Form Structure, Cascade-Form Structures, Structure for IIR Systems: Direct-Form Structures, Signal Flow Graphs and Transposed Structures, Cascade-Form Structures, Parallel-Form Structures.	**6**

6.	**Design of Filters:** Symmetric and Anti-symmetric FIR Filters, Design of Linear-Phase FIR Filters by using Windows, Design of Linear-Phase FIR Filters by the Frequency-Sampling Method; Design of IIR Filters from Analog Filters: IIR Filter Design by Impulse Invariance, IIR Filter Design by the Bilinear Transformation.	**6**
	Total	**31**

Suggested Books:

1. Digital Signal Processing – Principles, Algorithms and Applications by J. G. Proakis and D. G. Manolakis, 4th Edition, Pearson.
2. Digital Signal Processing by A. V. Oppenheim and R. W. Schafer, PHI.
3. Principles of Signal Processing and Linear Systems by B.P. Lathi, Oxford.
4. Digital Signal Processing: A MATLAB-Based Approach by Vinay K. Ingle and John G. Proakis, Cengage Learning.
5. Fundamentals of Digital Signal Processing using MATLAB by Robert J. Schilling and Sandra L. Harris, Cengage Learning.
6. Sanjit K Mitra “Digital Signal Processing” TMH.

IV Year VII Semester

7EX5-13: Embedded C	
Credit: 2	**Max Marks: 100 (IA: 30, ETE: 70)**
2L+0T+ 0P	**End Term Exams: 3 hrs.**

Course Outcomes:

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

CO-1: Understand the embedded system, 8051 microcontroller and its programming.
CO-2: Explain about the reading switches and its bits.
CO-3: Know the Object-oriented programming with C and its examples.
CO-4: Analyze the real-time constraints and compilation and linking.

S. No.	Contents	Hours
1.	**Unit I:** Objective, scope and outcome of the course	**1**
2.	**Unit II: Programming Embedded Systems in C**: Introduction, What is an embedded system, Which processor should you use, Which programming language should you use, Which operating system should you use, How do you develop embedded software, Conclusions Introducing the 8051 Microcontroller Family Introduction, What's in a name, The external interface of the Standard 8051, Reset requirements, Clock frequency and performance, Memory issues, I/O pins, Timers, Interrupts, Serial interface, Power consumption ,Conclusions.	**5**
3.	**Unit III: Reading Switches**: Introduction, Basic techniques for reading from port pins, Example: Reading and writing bytes, Example: Reading and writing bits (simple version), Example: Reading and writing bits (generic version), the need for pull-up resistors, Dealing with switch bounce, Example: Reading switch inputs (basic code), Example: Counting goats, Conclusions.	**6**
4.	**Unit IV: Adding Structure to the Code**: Introduction, Object-oriented programming with C, The Project Header (MAIN.H), The Port Header (PORT.H), Example: Restructuring the 'Hello Embedded World' example, Example: Restructuring the goat-counting example, Further examples, Conclusions.	**5**
5.	**Unit V: Meeting Real-Time Constraints**: Introduction, Creating 'hardware delays' using Timer 0 and Timer 1, Example: Generating a precise 50 ms delay, Example: Creating a portable hardware delay, Why not use Timer 2, The need for 'timeout' mechanisms, Creating loop timeouts, Example: Testing loop timeouts, Example: A more reliable switch interface, Creating hardware	**7**

	timeouts, Example: Testing a hardware timeout, Conclusions.	
6.	**Unit VI: Compilation and linking**: Compiling and Linking Multiple Source Files, Compiling Multi-file Programs, Linking Multi-file Programs, Using #include, External Variables Using an Object Library Manager Using MAKE Files. Case Study: Intruder Alarm System Introduction, The software architecture, Key software components used in this example, running the program, the software, Conclusions	**7**
	Total	**31**

Suggested Books:

1. Embedded C - Michael J. Pont,
2. 2nd Ed., Pearson Education, 2008 2.
3. Advanced C - Peter D. Hipson, Sams Publishing, USA, 1992
4. PIC micro MCU C-An introduction to programming, The Microchip PIC in CCS C - Nigel Gardner

IV Year VII Semester

7EX4-20: Embedded System Lab	
Credit: 1	**Max Marks: 100 (IA: 60, ETE: 40)**
0L+0T+2P	**End Term Exams: 2 hrs.**

Course Outcomes:

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

CO-1: Know the Embedded Systems and their working, data transfer and different addressing modes.

CO-2: Analyze the different arithmetic operation in binary and display their results.

CO-3: Solve different problems using sensors.

CO-4: Model a system for Master Slave Communication and observe the analysis using standard software as well as hardware.

S. No.	List of Experiments	Hours
1.	Introduction to Embedded Systems and their working.	**2**
2.	Data transfer instructions using different addressing modes and block transfer.	**2**
3.	Write a program for Arithmetic operations in binary and BCD-addition, subtraction, multiplication and division and display.	**2**
4.	Interfacing D/A converter & Write a program for generation of simple waveforms such as triangular, ramp, Square etc.	**2**
5.	Write a program to interfacing IR sensor to realize obstacle detector.	**2**
6.	Write a program to implement temperature measurement and displaying the same on an LCD display.	**2**
7.	Write a program for interfacing GAS sensor and perform GAS leakage detection.	**2**
8.	Write a program to design the Traffic Light System and implement the same using suitable hardware.	**2**
9.	Write a program for interfacing finger print sensor.	**2**
10.	Write a program for Master Slave Communication between using suitable hardware and using SPI.	**2**
11.	Write a program for variable frequency square wave generation using with suitable hardware.	**2**
12.	Write a program to implement a PWM based speed controller for 12 V/24V DC Motor incorporating a suitable potentiometer to provide the set point.	**2**
	Total	**24**