Bachelor of Technology (Electronics & Communication Engineering)

Scheme of Studies/Examination

Semester VII

S. No.	Course No.	Subject	L:T:P	Hours/Week	Examination Schedule (Marks)				Duration of Exam (Hrs)
					Theory	Sessionals	Practical	Total	
1	ECE-401N	Microcontroller & Embedded Systems Design	3:0:0	3	75	25	0	100	3
2	ECE-403N	Digital Image Processing	4:0:0	4	75	25	0	100	3
3	ECE-405N	Power Electronics	3:0:0	3	75	25	0	100	3
4	ECE-419N	Optical Communications	3:0:0	3	75	25	0	100	3
5	ECE-433N	Non Conventional Energy Resources	3:0:0	3	75	25	0	100	3
6	ECE-407N	Microcontroller & Embedded Systems Design Lab	0:0:3	3	0	40	60	100	3
7	ECE-409N	Digital Image Processing Lab	0:0:3	3	0	40	60	100	3
8	ECE-411N***	Project-1	0:0:10	10	0	100	100	200	3
9	ECE-413N*	Industrial Training Viva	2:0:0	2	0	100	0	100	
		Total		**34**	**375**	**405**	**220**	**1000**	

** The performance of the student will be evaluated by the technical training (undertaken after 6th semester) seminar and the report submitted by the student which should also include the Industrial/Research problems faced & suggested solutions.*

*** The students should select two departmental electives subjects from the list of core elective subjects.*

****The project should be initiated by the student in the 7th semester beginning and will be evaluated in the end of the semester on the basis of a presentation and report submitted to the department.*

Vision of the Department:

The Electronics and communication Engineering Department is looking forward to cater the latest industrial needs to produce skilful engineers who are innovative, entrepreneurial and result oriented.

Mission of the Department:

To provide the students with lifelong learning needed for a productive career on the grounds of ethics, good governance, and quality and to disseminate knowledge by upholding innovative services to provide collective environment that inspires every stakeholder.

Program Specific Outcomes (PSO):

PSO1	Study and implementing the fundamental concepts of electronics and communication systems.
PSO2	Design, develop and analyze advance model of electronics and communication system

Program Outcomes

1. Apply knowledge of mathematics, science, engineering fundamentals and electronics communication and engineering for the solution of engineering problems.

2. Problem analysis- Identify, analyze complex engineering problems reaching substantiated conclusions using basic of electronics engineering & mathematics.

3. Conduct Investigations of complex problems:- Developing presumed concept & providing valid facts behind using experiments, analysis and interpretation of data and synthesis of information.

4. Design and construct a electronic system or process to meet industry, domestic society needs, safety and sustainability.

5. Modeling &implementing complex engineering activities using modern tools & techniques.

6. The engineer and society:- Apply acquired knowledge to address the societal issue in relevance to professional engineering practices.

7. Environment & sustainability:- Understand the impact of professional engineering solutions in environmental contexts and demonstrate knowledge of and need for visible sustainability.

8. Work as professionals in accordance with the norms of electronics practices and commit to social, ethical and professional responsibilities.

9. Individual & Team work:- To inculcate an effective behavior in leader in diverse team and in multidisciplinary settings.

10. To converse effectively various engineering activity to various modes to all levels of society.

11. Understand and implement project management techniques, tools and methods to finalize.

12. Recognize the need for, and have the preparation and ability to engage in independent and life-long learning. Imparting the ability individual for lifelong learning and working independently in changing technological environment.

3. **PEO”s**

1. To prepare ECE graduates for supporting and leadership roles in multi deplaning domain with ethical values.

2. To prepare ECE graduates with a zeal for continuing, high degrees research and other professional developments.

3. To prepare ECE graduate with entrepreneurial skills and to encourage implementation and services via technical & communicational attributes.

ECE-401N	MICROCONTROLLER AND EMBEDDED SYSTEM DESIGN					
Lecture	**Tutorial**	**Practical**	**Theory**	**Sessionals**	**Total**	**Time**
3	**0**	**0**	**75**	**25**	**100**	**3 Hr.**
Pre-requisites: Microprocessor						
Course Outcomes						
CO1	***Acquired knowledge about the architecture of microcontrollers.***					
CO2	***Acquired knowledge about instruction set and programming concepts in C and assembly language.***					
CO3	***Students can understand the concepts of timers, counters and their applications***					
CO4	***Students can understand the interfacing of basic sensors to microcontrollers***					
CO5	***Students can understand the interfacing of different types of motors and may develop automated machines using microcontrollers***					
CO6	***Students can understand the microprocessor based models including sensors, actuators and display devices***					

Unit- I

INTRODUTION: Microprocessor and Microcontroller, Different types of Microcontrollers, 4 bit, 8 bit, 16 bit, and 32 bit Microcontrollers, Processor Architectures: Harvard & Princeton, CISC & RISC, Microcontrollers memory types, Microcontrollers features, Criteria for choosing a microcontroller, Applications of microcontrollers.

Embedded System, Embedded Processors, Hardware units, Devices and Software in a system, Embedded system on chip, Complex Systems design and processors, Design examples.

Unit- II

8051 ARCHITECTURE: 8051 Architecture, On-chip memory organization – general purpose registers, SFR registers, Internal RAM and ROM, Oscillator and Clock circuits. Pin Diagram of 8051, I/O Pins, Port, Connecting external memory, Counters and Timers, Purpose of TCON & TMOD registers, Serial data transmission/reception and transmission modes, Purpose of SCON & PCON registers, Different Types of Interrupts, Purpose of Time Delays.

Unit- III

8051 INSTRUCTION SET AND PROGRAMMING : Instruction syntax, Assembler directives, Addressing modes, Data transfer instructions, arithmetic and logical instructions, Jump and Call instructions, I/O port, Timer and Counter programming, Serial port and Interrupt programming.

PIC MICROCONTROLLER ARCHITECTURE: Introduction to PIC Microcontroller families, Different features of PIC16 Microcontrollers, PIC16 Architecture and Pipelining, Pin Configuration of PIC16, Program memory considerations, Register file structure, Addressing modes, Instruction set.

Unit-IV

APPLICATION DESIGN & HARDWARE INTERFACING WITH 8051: Interfacing Matrix Keyboards, LCD, ADC, DAC, Temperature Sensor, Stepper and DC motor, Relay and PWM.

Introduction of Advanced Microcontrollers: AVR and ARM microcontrollers.

Text Books:

1. Kenneth Ayala," The 8051 Microcontroller" 3rd ed. CENGAGE Learning.
2. M.A. Mazidi, J.G. Mazidi, R. D. McKinlay," The 8051 Microcontroller and Embedded systems using assembly and C" -2nd Ed, Pearson Education.
3. John. B. Peatman, "Design with PIC Microcontroller", Pearson Education, 2003.

References Books:

1. Myke Predko, “Programming and Customizing the 8051 Microcontroller”, TMH.
2. Manish K Patel,”Microcontroller based embedded system”, McGraw Hill Education.
3. Raj Kamal, “Embedded systems architecture, programming and design”-2nd nd. McGraw-Hill Companies.

4. Intel's manual on "Embedded Microcontrollers".
5. Myke Predko, "Programming and customizing PIC microcontroller" Mc- Graw Hill.

6. M.A. Mazidi, R. D. McKinlay,Causey," The PIC microcontroller and Embedded Systems using assembly and C for PIC18" -2nd Ed, Pearson.
7. M.A. Mazidi,Naimi" The AVR microcontroller and Embedded Systems using assembly and C" -2nd Ed, Pearson.

Lecture Plan

Lecture No.	Topic
	Unit- I: INTRODUCTION
L1	Introduction to Embedded Systems and difference between Microprocessor and Microcontroller
L2	Different types of Microcontrollers: 4 bit, 8 bit, 16 bit, and 32 bit Microcontrollers
L3	Processor Architectures: Harvard & Princeton, CISC & RISC, Microcontrollers memory types
L4	Microcontrollers features, Criteria for choosing a microcontroller, Applications of microcontrollers.
L5	Embedded System, Embedded Processors, Hardware units
L6	Devices and Software in a system, Embedded system on chip
L7	Complex Systems design and processors, Design examples.
	Unit- II: 8051 ARCHITECTURE
L8	8051 Architecture (Block Diagram) and Pin Diagram of 8051
L9	On-chip memory organization – general purpose registers, SFR registers
L10	Internal RAM and ROM, Oscillator and Clock circuits
L11	I/O Pins, Port
L12	Connecting external memory
L13	Counters and Timers Purpose of Time Delays.
L14	Purpose of TCON & TMOD registers
L15	Serial data transmission/reception and transmission modes
L16	Purpose of SCON & PCON registers, Different Types of Interrupts
	Unit- III: 8051 INSTRUCTION SET AND PROGRAMMING
L17	Instruction syntax, Assembler directives and Addressing modes
L18	Data transfer instructions
L19	Arithmetic and logical instructions
L20	Jump and Call instructions
L21	I/O port
L22	Timer and Counter programming
L23	Serial port Programming
L24	Interrupt programming
	PIC MICROCONTROLLER ARCHITECTURE:
L25	Introduction to PIC Microcontroller families, Different features of PIC16 Microcontrollers
L26	PIC16 Architecture and Pipelining, Pin Configuration of PIC16
L27	Program memory considerations, Register file structure
L28	Addressing modes, Instruction set
	Unit-IV: APPLICATION DESIGN & HARDWARE INTERFACING WITH 8051:
L29	Interfacing Matrix Keyboards
L30	Interfacing LCD
L31	Interfacing ADC
L32	Interfacing DAC
L33	Interfacing Temperature Sensor
L34	Interfacing Stepper and DC motor
L35	Interfacing Relay and PWM

Tutorial Sheet 1

1. Define an embedded system and describe its important features. List Few applications of embedded systems.
2. What are different ways of classifying the microcontrollers? Explain the classification of microcontrollers based on their data lines.
3. With the help of a diagram, explain why hardware architecture is preferred over prineton architecture.
4. Differentiate between following
   i) Harvarol vs Princeton architecture
   ii) CISC vs RISC
   iii) Microprocessors Vs Microcontrollers
   iv) OTP and Flash Memory
5. Compare and contrast 8051, 8031 and 8751 microcontrollers. Discuss the criteria for choosing these microcontrollers for particular application.
6. Explain a design example of embedded system on chip.

Tutorial Sheet 2

1. Draw the block diagram of 8051 microcontroller and describe functions of DPTR and PC registers of 8051.
2. Find the THL needed to have the band rate of 2400 with the crystal frequency of 11.0592 MHz.
3. What is the difference between external and software generated interrupts? Discuss the applications of interrupts.
4. Draw pin diagram of 8051 microcontrollers and explain function of each pin.Also discuss the difference between Part 0, Part 1, Part 2 and Part 3 functions.
5. Describe all times modes of 8051 microcontroller.

Tutorial Sheet 3

1. Explain the addressing modes of 8051 microcontroller.
2. What are assembler directives. Give example of assembler directive used in 8051 microcontroller.
3. Explain the function of following instructions with the help of an example of each.
   1) CJNE 2) MOVC 3)DJN
4. Write an assembly language program to find maximum number among array of N numbers.
5. Write an assembly language program to produce a software delay of 1 minute.

Tutorial Sheet 4

1. Explain the interface of a matrix keypad with 8051 microcontroller.
2. Draw interfacing diagram of DAC with 8051 microcontroller and write ALP to generate saw tooth waveform at the output of DAC.
3. Discuss the interfacing of LCD display and write a program to display ‘CONTROLLER

8051’.

4. Write an assembly language program to measure width of pulse.
5. Explain speed control of DC motor using PWM.

Roll No. .....

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MICROCONTROLLERS AND EMBEDDED SYSTEM DESIGN

ECE-401N

Time : Three Hours] [Maximum Marks : 75

Note : Attempt *Five* questions in all, selecting at least *one* question from each Unit. All questions carry equal marks.

Unit I

1. Describe features, applications and examples of 4 bit, 8 bit, 16 bit and 32 bit microcontrollers. 15

2. (a) Explain, what are the different types of semiconductor memories used for program storage in embedded system design ? 7

   (b) Explain in detail the significance of the following terms :

   (i) RTOS

   (ii) Simulator

   (iii) Power-up-timer

   (iv) IP core. 8

Unit II

3. (a) Discuss the on-chip ROM and RAM memory organization in the 8051. **8**

   (b) Explain the function of each flag in PSW. What are the applications of carry and overflow flags ? **7**

4. Describe the need and features of UART. Also explain its various operating modes and associated registers. **15**

Unit III

5. (a) Describe the architecture diagram of PIC16C7X microcontroller. **10**

   (b) Write a program to read port P0 and send its value on port P2 five hundred times. **5**

6. (a) Write a program to generate a square wave of 1 kHz frequency on P2.0. Assume crystal frequency is 11.0592 MHz. **5**

   (b) Explain, how to access direct and indirect addressing modes in PIC16C7X microcontrollers ? **10**

Unit IV

7. Describe the operation, programming and interfacing of stepper motor with 8051. **15**

8. Describe the interfacing of a ADC chip with the 8051 and write a program to take 10 samples of analog signal connected at input of the ADC. Take the sample every 1 second and store them at internal RAM addresses. **15**

ECE-403N	DIGITAL IMAGE PROCESSING					
Lecture	**Tutorial**	**Practical**	**Theory**	**Sessionals**	**Total**	**Time**
4	**0**	**0**	**75**	**25**	**100**	**3 Hr.**
Course Outcomes						
CO1	***Students will understand the need of Digital Image processing***					
CO2	***Students will be able to explain the basics of Digital Image processing***					
CO3	***Student will be able to explain sampling and quantization of digital image***					
CO4	***Students will understand the concepts of color images***					
CO5	***Student will be able to analyze the image enhancement operations on digital image***					
CO6	***Students will be able to analyze the various image analysis and computer vision algorithm***					

Unit-I

Introduction: Processing and applications, Image representation and modeling, Image Enhancement, Restoration, analysis, reconstruction from Projections, Image Data Compression. Image Perception: Light, Luminance, Brightness, Contrast, MFT of visual System, Visibility Function, Image fidelity, Color representation, color matching and reproduction, color vision Model

Unit-II

Image sampling and Quantization: Introduction, Two dimensional sampling theory, practical limitations in sampling and reconstruction, Image quantization, Optimum mean square or Lloyd-Max quantizer.

Unit-III

Image Enhancement: Introduction, Point Operation, Histogram Modeling, Spatial Operations, Transform Operations, Multispectral Image enhancement, Color Image enhancement.

Unit-IV

Image Analysis and Computer Vision: Introduction, Spatial Feature Extraction, Transform features, Edge Detection, Boundary Extraction, Shape features, Image segmentation.

Text Books:

1. Digital Image Processing, third edition by Rafael C. Gonzalez and Richard E Woods. Publisher: Pearson Education.
2. Digital Image Processing by S. Sridhar , Publisher: Oxford

Reference Books:

1. Fundamentals of Digital Image Processing by Anil K Jain, Publisher: Prentice Hall

Digital Image Processing

Lecture Plan

L-1: Introduction to images and processing.

L-2: Image Representation and modeling.

L-3: Familiarization with image Enhancement, Restoration, Analysis.

L-4: Familiarization with image reconstruction from Projections, Compression.

L-5: Image Perception: Light, Luminance, Brightness and Contrast.

L-6: MFT of visual system, Visibility function.

L-7: Visibility function, Image fidelity.

L-8: Color Representation,

L-9: Color matching and Reproduction.

L-10: Color vision model.

L-11: Two-dimensional sampling theory.

L-12: Practical limitation in sampling and quantization.

L-13: Image quantization.

L-14: Optimum mean square quantizer.

L-15: Optimum mean square quantizer continues.

L-16: Introduction to image enhancement.

L-17: Point operations.

L-18: Histogram Modeling.

L-19: Spatial operations.

L-20: Transform operations.

L-21: Multi-spectral image enhancement.

L-22: Color image enhancement.

L-23: Color image enhancement continues.

L-24: Introduction to computer vision.

L-25: Spatial feature extraction.

L-26: Spatial feature extraction continues.

L-27: Transform features.

L-28: Transform features continue.

L-29: Edge detection.

L-30: Edge detection continues.

L-31: Boundary extraction.

L-32: Boundary extraction continues.

L-33: Shape features.

L-34: Shape features continue.

L-35: Image Segmentation.

L-36: Image Segmentation continues.

Tutorial Sheets

Tutorial No 1

Q1. Draw and explain image capturing mechanism.

Q2. Draw and explain MFT of a visual system.

Q3. Explain image fidelity.

Q4. Explain color vision model.

Q5. What is a difference between luminance, brightness and contrast.

Tutorial No 2

Q1. Explain two dimensional sampling with suitable example.

Q2. What is quantization and its impact on quality.

Q3. Explain Lloyd-Max quantizer.

Q4. Capture an image with different sampling rate and compare.

Tutorial No 3

Q1. What are various point operations?

Q2. What are various Transform operations?

Q3. What is Multi-spectral image enhancement?

Q4. What is color image enhancement?

Tutorial No 4

Q1. Explain different spatial feature extraction technique.

Q2. Explain edge detection with example.

Q3. What is boundary extraction?

Q4. What are various techniques of image segmentation?

Roll No. ..... Total Pages : 02

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DIGITAL IMAGE PROCESSING
ECE-403-N

Time : Three Hours] [Maximum Marks : 75

Note : Attempt *Five* questions in all, selecting at least *one* question from each Unit.

Unit I

1. (a) What is Image Processing ? List some major applications of image processing. 7.5

   (b) Discuss luminance, brightness and contrast in digital imaging system. 7.5

2. (a) Explain color vision model in detail. 7.5

   (b) How an image is reconstructed from projections ? Discuss. 7.5

Unit II

3. Discuss the Lloyd-Max quantizer in detail with its prominent properties. 15

4. (a) What is Image Interpolation ? Discuss bilinear and bicubic interpolation with proper examples. 7.5

(b) How a digital image is generated from its samples ? Also, discuss how a digital image is represented ? 7.5

Unit III

5. What is Histogram Modelling ? Discuss histogram equalization and local histogram processing in Context to Histogram Modelling. 15

6. (a) Discuss the point operation in relation to image enhancement. 7.5

(b) Briefly discuss the transform operations in image enhancement process. 7.5

Unit IV

7. What is Image Segmentation ? Discuss region splitting and region merging in relation to image segmentation. 15

8. How computer vision is associated with image analysis ? Discuss the concept and also draw the block diagram to explain the above procedure. 15

ECE-405N	POWER ELECTRONICS					
Lecture	**Tutorial**	**Practical**	**Theory**	**Sessionals**	**Total**	**Time**
3	**0**	**0**	**75**	**25**	**100**	**3 Hr.**
Purpose	***To understand and acquire knowledge about various power semiconductor devices. To prepare the students to analyze and design different power converter circuits.***					
Course Outcomes						
CO1	***Acquire knowledge about fundamental concepts and techniques used in power electronics.***					
CO2	***Ability to analyze various single phase and three phase power converter circuits and understand their applications.***					
CO3	***Foster ability to identify basic requirements for power electronics based design application.***					
CO4	***To develop skills to build, and troubleshoot power electronics circuits.***					
CO5	***Identify the critical areas in application levels and derive typical alternative solutions, select suitable power converters to control Electrical Motors and other industry grade apparatus***					
CO6	***Recognize the role power electronics play in the improvement of energy usage efficiency and the applications of power electronics in emerging areas***					

Unit-1

Introduction: Concept of Power Electronics, Applications of power electronics, Advantages and disadvantages of power-electronic converters, Power electronic systems, Power semiconductor devices, Types of power electronic converters. Power semiconductors: The p-n junction, Basic structure of power diodes, Characteristics of power diodes, Power transistors, Power MOSFETS, Insulated gate bipolar transistor, Static induction transistor.

Unit-II

Thyristors :Terminal characteristics of thyristors, thyristor turn on methods, Switching characteristics of thyristors, Thyristor gate characteristics, Two-transistor model of a thyristor, Thyristor ratings, Thyristor protection, Improvement of thyristor characteristics, Series and parallel operation of thyristors, Gate turn off thyristor, Firing circuits for thyristors.

Thyristor Commutation: Class A commutation: Load commutation, Class B commutation: Resonant commutation, Class C commutation: Complementary commutation, Class D commutation: Impulse commutation, Class E&F commutation.

Unit–III

Phase Controlled Rectifiers: Principle of phase control, Full wave controlled converters, Single phase full wave converters, Single phase symmetrical and asymmetrical semi converters, three phase rectifiers and thyristor converters, Performance parameters of three phase full converters, Effect of source impedance on the performance of converters. Principle of chopper operation, Control strategies, Step up choppers, Types of chopper circuits, Single phase voltage source inverters: Operating principle, Force commutated thyristor inverters, Voltage control in single phase inverters.

Unit-IV

AC Voltage Controllers: Principle of phase control, Principle of integral cycle control, single phase ac voltage controller with R load and RL load.

Cycloconverters: Principle of cycloconverter operation, step up and step down cycloconverters, Three phase half wave converters, Output voltage equation for a cycloconverter, Load commutated cycloconverter.

Text Books

1. P S Bimbhra: Power Electronics, Khanna Publishers.

Reference Books

1. M. H. Rashid. : Power Electronics – circuits, devices & applications, Pearson Education

POWER ELECTRONICS
(ECE-405N)

LECTURE PLAN

LECTURES	TOPICS
L1	Concept of Power Electronics, Applications of Power Electronics
L2	Advantages & Disadvantages of Power electronic converters, Power Electronic systems
L3	Power semiconductor devices, Types of power electronic Converters
L4	Power semiconductors: The p-n junction, Basic structure of power diodes
L5	Characteristics of power diodes
L6	Power transistors
L7	Power MOSFETS
L8	Insulated gate bipolar transistor & static gate induction Transistor
L9	Terminal characteristics of thyristors, Thyristor turn on methods
L10	Switching characteristics of thyristors, Thyristor gate Characteristics
L11	Two-transistor model of a thyristor, Thyristor ratings
L12	Thyristor protection, Improvement of thyristor characteristics
L13	Series & Parallel operation of thyristors, Gate turn off thyristor
L14	Firing circuits for thyristors
L15	Thyristor Commutation: Class A commutation: Load commutation
L16	Class B commutation: Resonant commutation
L17	Class C commutation: Complementary commutation, Class D Commutation: Impulse commutation
L18	Class E&F commutation
L19	Principle of phase control, Full wave controlled converters
L20	Single Phase full wave converters
L21	Single phase symmetrical & asymmetrical semi converters
L22	Three phase rectifiers & thyristor converters
L23	Performance parameters of three phase full converters
L24	Effect of source impedance on the performance of converters
L25	Principle of chopper operation, Control strategies
L26	Step up choppers
L27	Types of Chopper circuits
L28	Single phase voltage source inverters: Operating Principle
L29	Force commutated thyristor inverters
L30	Voltage control in single phase inverters
L31	AC Voltage Controllers: Principle of phase control
L32	Principle of integral cycle control
L33	Single phase ac voltage controller with R load & RL Load
L34	Principle of cycloconverter operation
L35	Step up & Step down cycloconverters
L36	Three phase half wave converters
L37	Output voltage equation for a cycloconverter
L38	Load commutated cycloconverter

TUTORIAL SHEET-1

1. Explain the concept of Power Electronics

2. What are the advantages & disadvantages of Power Electronic converters.

3. Explain different types of Power Electronic converters.

4. Describe the basic structure of power diodes.

5. Explain the concept of Power transistors.

TUTORIAL SHEET-2

1. Explain terminal characteristics of thyristors.

2. Explain thyristor gate characteristics.

3. Explain the Two-transistor model of a thyristor.

4. Explain the Series & Parallel operation of thyristors.

5. Explain the concept of Thyristor Commutation.

TUTORIAL SHEET-3

1. Explain the working of full wave controlled converters.

2. Explain three phase rectifiers & thyristor converters.

3. Explain the effect of source impedance on performance of converters.

4. Explain principle of chopper operation.

5. Explain the operating principle of single phase voltage source inverters.

TUTORIAL SHEET-4

1. Explain the principle of phase control for AC Voltage Controllers.

2. Explain the principle of integral cycle control.

3. Describe single phase ac voltage controller with R load & RL load.

4. Explain thr principle of operation of cycloconverters.

5. Explain the working of step up & step down cycloconverters.

TUTORIAL SHEET-5

1. Explain the working of Power MOSFETS.

2. Explain firing circuits for thyristors.

3. Explain various performance parameters of three phase full converters.

4. Explain different types of chopper circuits.

5. Explain Class A, Class B & Class C thyristor commutation.

Roll No. ..... Total Pages : 03

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POWER ELECTRONICS

ECE-405N (Option I)

Time : Three Hours] [Maximum Marks : 75

Note : Attempt exactly *Five* questions by selecting at least *one* question from each of the four Sections A, B, C and D.

Section A

1. Explain the static and switching characteristics of IGBT & MOSFET and critically compare the two. **15**

2. (a) What do you mean by the following terms and write down the purpose of each ?
   (i) Converter
   (ii) Inverter
   (iii) Chopper
   (iv) Cycloconverter
   (v) AC Controller **2×5=10**

   (b) Define the following :
   (i) firing angle
   (ii) commutation **5**

Section B

3. (a) Draw the cross sectional structure of general purpose Thyristor. Explain the latching and holding currents of SCR. **10**

   (b) Comment on the statement : 'When subjected to standby increasing over voltages, the thyristor needs over current protection but not overvoltage protection.' **5**

4. (a) Discuss briefly the voltage commutation and current commutation techniques used for the commutation of thyristors. **10**

   (b) Compare GTO and general purpose thyristor. Give typical applications of GTO. **5**

Section C

5. (a) How are choppers classified ? Briefly explain the operation of a type-C chopper. **10**

   (b) Explain voltage control in single phase inverters. **5**

6. (a) Explain time ratio control (TRC) and current limit control strategies employed for d.c. choppers. Also, enumerate applications and limitations of individual strategies. **10**

   (b) Explain, with a diagram, how a step-up chopper works. **5**

Section D

7. (a) Explain the principle of load commuted Cycloconverter and discuss its advantages and disadvantages over line commuted converters. **10**

   (b) Briefly explain the operation of a single-phase Cycloconverter which accepts 230 V/50 Hz a. c. and provides output voltage at 16.6 Hz. **5**

8. (a) Explain the operation of a single-phase to single phase step-down Cycloconverter with suitable sketches. Assume resistive load.. **12**

   (b) What are the applications of Cycloconverter ? **3**

ECE - 419N	OPTICAL COMMUNICATION					
Lecture	**Tutorial**	**Practical**	**Theory**	**Sessionals**	**Total**	**Time**
3	**0**	**0**	**75**	**25**	**100**	**3 Hr.**
Purpose	*To familiarize the students with the concepts of Optical communication covering the contents of optical fibers, losses in fibers, optical sources, detectors etc.*					
Course Outcomes						
CO1	***Students will be able to understand the structure of fiber and the mechanism of light travelling in the fiber.***					
CO2	***Students will be able to understand different types of fibers & power launching-coupling methods***					
CO3	***Students will be able to analyze various losses associated with fibers.***					
CO4	***Students will learn about the optical sources and optical detecters.***					
CO5	***Students will become familiar with design considerations of fiber optic systems***					
CO6	***Students will be able to understand the various components needed in optical networks***					

Unit – I

INTRODUCTION : Optical Fibers: Structure, Propagation within the fiber, Numerical aperture of fiber, step index and graded index fiber, Modes of propagation in the fiber, Single mode and multi mode fibers. Splices and connectors. Optical Power Launching and Coupling. Fiber-to-fiber joints.

Unit–II

LOSSES IN OPTICAL FIBER : Rayleigh Scattering Losses, Absorption Losses, Leaky modes, Mode coupling losses, Bending Losses, Combined Losses in the fiber.

DISPERSION EFFECT: Effect of dispersion on the pulse transmission Intermodal dispersion, Material dispersion, Wave guide dispersion, Polarization Mode Dispersion Total dispersion, Transmission rate. Dispersion Shifted Fibers, Dispersion Compensating Fibers.

Unit – III

LIGHT SOURCES : LEDS, Laser Action in semiconductor Lasers, Semiconductor Lasers for optical communication – Laser modes, Spectral Characteristics, Power Voltage Characteristics, Frequency response.

DETECTORS : P-I-N Photodiode, APD, Noise Analysis in detectors, Coherent and non-coherent detection, Infrared sensors. Bit error rate.

Unit– IV

THE FIBER-OPTIC COMMUNICATION SYSTEM: Design considerations of fiber optic systems: Analog and digital modulation. Optical Devices: Optical coupler, space switches, linear divider-combiners, wavelength division multiplexer and demultiplexer, optical amplifier

OPTICAL NETWORKS: Elements and Architecture of Fiber-Optic Network, Optical link network-single hop , multihop, hybrid and photonic networks.

Suggested Books:

1. John Power, An Introduction to Fiber optic systems, McGraw Hill International.

2. John Gowar , Optical communication Systems.

3. R. Ramaswamy, Optical Networks, Narosa Publication

4. John M. Senior,Optical Fiber Communication

5. Gerd Keiser, Optical Fiber Communication

OPTICAL COMMUNICATION
(ECE-419N)

LECTURE PLAN

LECTURES	TOPICS
L1	Optical Fibers: Structure, Propagation within the fiber
L2	Numerical aperture of fiber
L3	step index and graded index fiber
L4	Modes of propagation in the fiber
L5	Single mode and multi mode fibers
L6	Splices and connectors
L7	Optical Power Launching and Coupling
L8	Fiber-to-fiber joints
L9	Rayleigh Scattering Losses
L10	Absorption Losses, Leaky modes
L11	Mode coupling losses, Bending Losses
L12	Combined Losses in the fiber
L13	Effect of dispersion on the pulse transmission
L14	Intermodal dispersion, Material dispersion
L15	Wave guide dispersion, Polarization Mode Dispersion
L16	Total dispersion
L17	Transmission rate
L18	Dispersion Shifted Fibers
L19	Dispersion Compensating Fibers
L20	LEDS, Laser Action in semiconductor Lasers
L21	Semiconductor Lasers for optical communication
L22	Laser modes, Spectral Characteristics
L23	Power Voltage Characteristics
L24	Frequency Response
L25	P-I-N Photodiode
L26	APD, Noise Analysis in detectors
L27	Coherent and non-coherent detection
L28	Infrared Sensors, Bit error rate
L29	Design considerations of fiber optic systems: Analog and digital modulation
L30	Optical Devices: Optical coupler
L31	Space switches, linear divider-combiners
L32	Wavelenth Divison Multiplexer & Demultiplexer
L33	Optical Amplifier
L34	Elements and Architecture of Fiber-Optic Network
L35	Optical link network-single hop , multihop
L36	Hybrid and photonic networks

TUTORIAL SHEET -1

1. What are the advantages of Optical Fiber Communication?
2. Explain different modes of propagation in optical fiber.
3. State differences between step index & graded index fiber.
4. Explain splices & connectors used in optical fiber communication..
5. Explain the concept of Optical Power Launching & Coupling.

TUTORIAL SHEET -2

1. What are different losses in a fiber.
2. Explain difference between single mode & multi mode fiber.
3. An optical signal has lost 55 percent of its power after traversing 3.5 km of fiber. What is the loss in db/Km in this fiber.
4. Explain Polarization mode dispersion.
5. Explain dispersion shifted & dispersion compensating fibers.

TUTORIAL SHEET -3

1. Explain the effect of dispersion on pulse transmission.
2. Explain pulse broadening in graded index fiber.
3. Explain inter model & intra model dispersion.
4. What is the difference between material dispersion & waveguide dispersion?
5. Write short note on APD noise.

TUTORIAL SHEET -4

1. Explain different types of LEDs.
2. Plot spectral characteristics & power voltage characteristics of semiconductor laser.
3. Explain the operation of p-i-n photodiode.
4. Explain fiber optic communication system.
5. Explain power characteristics of laser.

TUTORIAL SHEET -5

1. Explain Optical couplers & space switches.
2. Explain wavelength division multiplexer & de-multiplexer.
3. Explain optical amplifier.
4. Explain single hop & multi hop network.
5. Explain hybrid & photonic networks.

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OPTICAL COMMUNICATION

ECE-419-N

Time : Three Hours] [Maximum Marks : 75

Note : Attempt *Five* questions in all, selecting at least *one* question from each Unit.

Unit I

1. What do you mean by acceptance angle and numerical aperture of an optical fiber, show how it is related to refractive index of core and cladding of fiber ? Differentiate between the numerical aperture of meridional and skew rays. An optical fiber in air has NA 0.4; compare the acceptance angle for skew rays which changes direction by 100° at each reflection. **15**

2. (a) What is the structure of optical fiber ? Differentiate between step index and Graded index fiber. How the rays do propagates in graded index fiber ? **8**

   (b) What do you mean by fiber splices ? Explain electric arc fusion in detail. **7**

Unit II

3. (a) Mention the reasons responsible for absorption in optical fibers. A continuous 12 km long optical fiber link has a loss of 1.5 dB/km. What is the minimum optical power level that must be launched into the fiber to maintain an optical power level of 0.3 μm at the receiving end ? **7**

(b) Discuss in detail the linear scattering losses in optical fibers. **8**

4. Explain the different dispersion mechanisms in optical fibers along with the reasons responsible for them. What do you understand by Inter Symbol Interference (ISI) ? How does dispersion effect the data rate that can be transmitted through fiber. A multimode graded index fiber exhibits total pulse broadening of 0.1 μs over a distance of 15 km. Estimate : (i) The maximum possible bandwidth without ISI. (ii) Pulse dispersion per unit length. **15**

Unit III

5. (a) What is the Population Inversion ? Explain the mechanism of Population inversion for semiconductor LASER.

(b) Explain the working principle of LED. How the quantum efficiency of a LED is defined ? Derive expression for quantum efficiency of LED. 8

6. What do you understand by optical detector ? Explain the detection process in photodetectors. Also define absorption coeffcient, responsivity and quantum efficiency of photodetector. 15

Unit IV

7. (a) Explain the working of 2×2 star coupler. 8

(b) What is WDM ? Define. 7

8. Write short notes on the following :

(a) Single Hop and Multihop Networks 8

(b) Photonic networks. 7

CE-433N	NON-CONVENTIONAL ENERGY RESOURCES					
Lecture	**Tutorial**	**Practical**	**Theory**	**Sessionals**	**Total**	**Time**
Lecture	**-**	**-**	**75**	**25**	**100**	**3 Hour**
Course Outcomes						
CO 1	***To understand the energy demand of world, nation and available resources to fulfill the demand***					
CO 2	***To know about Distributed energy systems and dispersed generation***					
CO 3	***To know about the conventional energy resources and their effective utilization***					
CO 4	***To acquire the knowledge of modern energy conversion technologies***					
CO 5	***To be able to understand and perform the various characterization techniques of fuels***					
CO 6	***To be able to identify available nonconventional (renewable) energy resources and techniques to utilize them effectively.***					

Unit-I

Introduction: Energy demand of world and country and gap analysis, Fossil fuel based systems, Impact of fossil fuel based systems, Non conventional energy – seasonal variations and availability, Renewable energy – sources and features, Hybrid energy systems. Distributed energy systems and dispersed generation (DG).

Unit-II

Solar thermal systems: Solar radiation spectrum, Radiation measurement , Technologies, Applications, Heating, Cooling, Drying, Distillation, Power generation; Costing : Life cycle costing (LCC),Solar thermal system
Solar Photovoltaic systems ,Operating principle, Photovoltaic cell concepts ,Cell, module, array, Series and parallel connections, Maximum power point tracking, Applications ,Battery charging, Pumping , Lighting,Peltier cooling , Costing: Life cycle costing ,Solar PV system

Unit-III

Microhydel: Operating principle, Components of a microhydel power plant, Types and characteristics of turbines, Selection and modification, Load balancing, Costing: Life cycle costing -Microhydel
Wind ; Wind patterns and wind data, Site selection, Types of wind mills , Characteristics of wind generators, Load matching, Life cycle costing - Wind system LCC

Unit-IV

Biomass: Learning objectives, Operating principle, Combustion and fermentation, Anaerobic digester, Wood gassifier, Pyrolysis, Applications, Bio gas, Wood stoves, Bio diesel, Combustion engine, Life cycle costing - Biomass system LCC
Hybrid Systems, Need for Hybrid Systems, Range and type of Hybrid systems, Case studies of Diesel-PV, Wind-PV, Microhydel-PV, Biomass-Diesel systems, electric and hybrid electric vehicles

Suggested Books:

1. Ashok V Desai, Non-Conventional Energy, Wiley Eastern Ltd, New Delhi, 2003
2. Mittal K M, Non-Conventional Energy Systems, Wheeler Publishing Co. Ltd, New Delhi,2003 3.Ramesh R & Kumar K U, Renewable Energy Technologies, Narosa Publishing House, New Delhi, 2004
4.Wakil MM, Power Plant Technology, Mc Graw Hill Book Co, New Delhi, 2004.

Lecture	Topics
L1	Energy demand of world and country and gap analysis
L2	Fossil fuel based systems, Impact of fossil fuel based systems
L3	Non conventional energy :seasonal variations and availability
L4	Renewable energy sources and Features
L5	Hybrid energy systems, Distributed Energy Systems, Dispersed generation(DG)
L6	Solar radiation spectrum, Radiation measurement
L7	Technologies, Applications
L8	Heating, Cooling, Drying
L9	Distillation, Power generation
L10	Costing :Life cycle costing (LCC), Solar thermal system
L11	Solar Photovoltaic systems
L12	Operating principle
L13	Photovoltaic cell concepts
L14	Cell module, array
L15	Series and parallel connections
L16	Maximum power point tracking
L17	Applications ,Battery charging,
L18	Pumping ,Lighting, Peltier cooling
L19	Costing: Life cycle costing ,Solar PV system
L20	Operating principle, Components of a microhydel power plant,
L21	Types and characteristics of Turbines
L22	Selection and modification, Load balancing
L23	Costing: Life cycle costing –Microhydel
L24	Wind ; Wind patterns and wind data
L25	Site selection, Types of wind mills
L26	Characteristics of wind Generators
L27	Load matching, Life cycle costing - Wind system LCC
L28	Biomass: Learning objectives, Operating principle
L29	Combustion and fermentation, Anaerobic digester
L30	Wood gassifier, Pyrolysis,
L31	Applications, Bio gas, Wood stoves
L32	Bio diesel, Combustion engine
L33	Life cycle costing - Biomass system LCC
L34	Hybrid Systems, Need for Hybrid Systems
L35	Range and type of Hybrid systems, Case studies of Diesel-PV
L36	Wind-PV, Microhydel-PV,
L37	Biomass-Diesel systems, electric and hybrid electric vehicles

TUTORIAL SHEET-I

1. Explain Energy demand of world and country and gap analysis.

2. Explain different Fossil fuel based systems and its Impact.

3. Explain Renewable energy – sources and features.

4. Explain Distributed energy systems and dispersed generation (DG).

TUTORIAL SHEET-II

1. Explain solar radiation spectrum and radiation measurement.

2. Discuss solar thermal systems and its applications.

3. Explain Operating principle of Solar Photovoltaic systems.

4. Explain in brief Solar PV system.

TUTORIAL SHEET-III

1. Discuss different components of a microhydel power plant.

2. Explain Types and characteristics of turbines.

3. What are various parameters for site selection?

4. Explain types of wind mills in detail.

TUTORIAL SHEET-IV

1. Explain Operating principle and objectives of biomass.

2. Discuss the concept of Combustion and fermentation.

3. Explain need for Hybrid Systems and its types.

4. Explain electric and hybrid electric vehicles in detail.

NON-CONVENTIONAL ENERGY RESOURCE

ECE-433N

Time : Three Hours] [Maximum Marks : 75

Note : Attempt *Five* questions in all, selecting at least *one* question from each Unit.

Unit I

1. (a) Discuss the energy scenario in India and world. What is the gap between two ? Explain in breif. 8

(b) What do you mean by distributed energy resources. Explain in brief. 7

2. (a) What do you mean by conventional and non-conventional sources ? Explain the various components to promote the use of non-conventional sources. 8

(b) Write a brief note on generation capacity of energy various sources in India. 7

Unit II

3. (a) Write a brief note on liquid flat plate collector. 8

   (b) Briefly discuss the following :

   (i) Solar irradiance

   (ii) Solar constant

   (iii) Extra-terrestrial radiations

   (iv) Terrestrial radiations. 7

4. (a) Explain the following :

   (a) Solar pumping system

   (b) Solar cooker

   (c) Solar furnace. 8

   (b) List out various types of maximum power point techniques. Explain about perturb and observed method. 7

Unit III

5. (a) Define small, mini and micro hydro power. 8

   (b) What are the various types of turbine used in micro-hydel power plants ? explain them in brief. 7

6. (a) Derive an expression for power extracted from wind. Write a short note on Betz criterion. 8

   (b) Explain various characteristics of wind and variation with respect to height, pressure, temperatures and time. 7

Unit IV

7. (a) Draw and explain different biomass gasification plants in brief. 8

   (b) What do you mean by biodiesel ? Explain it various ways for its production. 7

8. (a) What do you mean by Hybrid generation system ? Name the various combinations and write a brief note on their need. 8

   (b) Discuss the Diesel-PV system in brief. 7

ECE-407N	MICROCONTROLLER AND EMBEDDED SYSTEM DESIGN LAB					
Lecture	**Tutorial**	**Practical**	**Sessionals**	**Practical**	**Total**	**Time(Hrs)**
0	**0**	**3**	**40**	**60**	**100**	**3**
Course Objectives	*1. To design of microcontroller based systems.* *2. To impart practical knowledge of 8051 and PIC Microcontrollers*					
Course Outcomes						
CO1	*To familiarization with 8051 and PIC Microcontrollers.*					
CO2	*Understand hardware and software design requirements of embedded systems*					
CO3	*Ability to write a C language and assembly language program for 8051 Microcontroller.*					
CO4	*Ability to interfacing the various Peripheral to 8051 Microcontrollers.*					
CO5	*Ability to design the embedded systems based on 8051 Microcontrollers.*					
CO6	*An in-depth knowledge of applying the concepts on real- time applications.*					

List of experiments to be performed using 8051 Microcontrollers

1. (a) To study different commands of 8051 trainer kit with their function.
   (b) To study architectural block and pin diagram of 8051 microcontroller and PIC16C74 microcontroller.
2. To write an ALP to perform addition, subtraction, multiplication and division of two unsigned numbers.
3. To write an ALP to perform logical operation i.e., AND, OR, XOR and Complement of two unsigned numbers.
4. To write an ALP to perform multi byte addition and subtraction of two unsigned number.
5. To write an ALP to perform rotate operations i.e., RL, RLC, RR, RRC.
6. To write an ALP for flashing message “WELCOME M51-02 KIT” on LCD screen.
7. To write an ALP for identifying pressed number is even or odd. If number is even, message displays on LCD “NUMBER IS EVEN” and if number is odd, message displays on LCD “NUMBER IS ODD”.
8. To write an ALP to perform data transfer between internal & external memory using all available addressing modes.
9. To write an embedded C program for interfacing LCD to port P0 and display message “LCD Display” on LCD screen.
10. To write an embedded C program for interfacing keypad to port P0 .Whenever a key is pressed; it should be displayed on LCD.
11. To write an embedded C program for interfacing a switch and a buzzer to two different pins of a Port such that the buzzer should sound as long as the switch is pressed.
12. To write an embedded C program for interfacing stepper motor to rotate clockwise and anticlockwise directions.
13. To write an embedded C program for interfacing relay and buzzer.
14. To write an embedded C program for interfacing PWM module to control speed of motor.
15. To write an embedded C program for interfacing LED to glow in different pattern i.e., even odd, rotate left, rotate right.
16. To write an embedded C program for interfacing temperature sensor.
17. Design an Obstacle Detector system through Ultra Sonic obstacle detection using ultrasonic transmitter receiver.

ECE-409N	DIGITAL IMAGE PROCESSING LAB					
Lecture	**Tutorial**	**Practical**	**Sessionals**	**Practical**	**Total**	**Time**
-	**-**	**3**	**40**	**60**	**100**	**3 Hr.**
Course Outcomes						
CO1	***Students should be able to explain the basics of Digital Image processing***					
CO2	***Student will be able to explain sampling and quantization of digital image***					
CO3	***Student will be able to analyze the image enhancement operations on digital image***					
CO4	***Students will be able to analyze the various image analysis and computer vision algorithm***					
CO5	***Students will be able to analyze the image segmentation and representation techniques***					
CO6	***Students will be able to learn different feature extraction techniques for image analysis and recognition***					

List of Experiments:

1. Study of Image processing toolbox of Matlab.
2. WAP to read and show various images of at least five different formats.
3. WAP to extract R, G, B component of Color Image.
4. WAP to convert a color image into gray scale and save it in new format.
5. WAP to invert a gray scale image.
6. WAP to implement Morphological operations on an image.
7. WAP to implement Histogram equalization.
8. WAP to implement various edge detection algorithms.
9. WAP to implement image segmentation
10. WAP to implement boundary extraction of basic structure.