Rashtrasant Tukadoji Maharaj Nagpur University, Nagpur

Electronics and Communication/ Electronics & Telecommunication Engineering/Electronics Engineering

B.Tech.5 th Semester

Subject : Embedded System Design [L: 2 T:1 P:0]

Subject Code : BEETC-501T

Course Objectives:

1. To Understand the Requirements & Design issues of embedded systems design.
2. To study the architecture and Programming of ARM processor using Assembly & Embedded C language
3. To understand interfacing of various peripherals with ARM Processor.
4. To study the concept of Real Time Operating System for embedded system design.

Course Outcome: By the end of the course, the students shall be able to

1. To Describe and analyse the Requirements & Design issues of embedded systems design.
2. To apply the knowledge of architecture and Programming of for development of simple applications.
3. To Describe and Demonstrate the interfacing of various peripherals with ARM Processor.
4. To explain the concept of Real Time Operating System for embedded system design.

UNIT-I

The concept of embedded systems design:-

History, Definition, and Classification of Embedded System, Design Metric & Its optimization, Embedded System Design Challenges, Processor selection Criteria, Building blocks of typical Embedded System – Core Types, Memory Architecture , Memory & Its Types, Sensors & Actuators, Communication Interfaces and Other system components and software architecture, Design tradeoffs due to process compatibility, thermal considerations, recent trends in embedded systems.

UNIT-II

Technological aspects of embedded systems, Embedded microcontroller cores:-

Interrupt Service Mechanism, Context Switching, Device Drivers, Pin Configuration and Block Diagram of ARM7TDMI Microcontroller, Core of ARM7TDMI and Interrupt structure, Programming Model, Operating Modes, Exceptions and Interrupt Mechanism

UNIT-III

Interfacing with external systems:-

Instruction set and Programming of ARM7TDMI Microcontroller using Assembly & Embedded C, Interfacing of external devices like LED's, 7--segment display, Switches, Multiplexed Keyboard, Stepper motor, concept of Timers and Counters ARM7TDMI Microcontroller.

UNIT-IV

Interfacing of analog and digital blocks, Signal conditioning, digital signal processing. Sub-system interfacing:-

Analyzing Inbuilt of ADC and DAC of ARM7TDMI Microcontroller, Applications based on PWM, Interfacing of Temperature Sensor, USART, Bluetooth, USB Drive, I2C, LCD and GLCD display, GSM and GPS Module, SD Card using SPI, on-chip DAC for waveform generation

UNIT-V

Software aspects of embedded systems-I

Real time programming languages and operating systems for embedded systems:-

Kernel and its types, Architecture of the kernel, Functions of Kernel, introduction to RTOS and its features in details, ISR, Context Switching, Threads, Task scheduler, Types of Scheduling Algorithms with examples, Real time algorithms like Rate Monotonic Algorithm and earliest deadline first Algorithm.

Software aspects of embedded systems-II

Real time programming languages and operating systems for embedded systems:-

Resource Management and concepts of Semaphore, Mailbox, Message queues, Pipes, Events, Timers, Memory Management and Introduction to real time operating System µCos

Text/Reference Books:

1. Raj Kamal, "Embedded Systems ", TMH Publications.
2. Frank Vahid, "Embedded System Design", Wiley Publications, New edition 2001.
3. Sloss endrew & Dominic Symes, "ARM system Developers Guide", Morgan Kaufmann , 2004
4. Dr. K.V.K.K. Prasad , "Embedded / Real Time Systems", Dreamtech Publications
5. Steve Heath, "Embedded System Design", Neuwans Publications

Rashtrasant Tukadoji Maharaj Nagpur University, Nagpur

Electronics and Communication/ Electronics & Telecommunication Engineering/Electronics Engineering

B.Tech.5 th Semester

Subject : Embedded System Design Lab [L: 0 T:0 P:2]

Subject code : BEETC-501P

Course Objectives:

1. To familiar with RARM7 software & KITS.
2. To enhance the ability of logical thinking so that student will be design an algorithm and program

Course Outcome: By the end of the course, the students shall be able to

1. Apply the knowledge of Instruction skill for the Development of Simple and Complex Programs.
2. Apply the programming skill for the Development of Simple application.
3. Apply and Demonstrate the Concept of Interfacing for the Development of Embedded System.

Use Assembly & Embedded C Language for following Programs.

1. To study the ARM Development Board.
2. To Write & Demonstrate the program for addition, subtraction Multiplication & Division of 16 / 32 bit number.
3. To Write & Demonstrate the program to find largest / Smallest of a Ten data Words.
4. To Write & Demonstrate the program for arranging the multiple data in Ascending / Descending Order.
5. To Write & Demonstrate the program for the swapping of 16 / 32 bit data.
6. To Write & Demonstrate the program for factorial of a given number
7. To Write & Demonstrate the program for display of number from 11 to 99 on seven segment display.
8. To Write & Demonstrate the program for Binary to Gray & Gray to Binary Number Conversion.

Use Embedded C Language for following Programs

9. To Write and demonstrate the program for flashing of LEDS Using ARM DEVELOPMENT BOARD.
10. To Write and demonstrate the program for interfacing ADC and DAC Using ARM DEVELOPMENT BOARD.
11. To Write and demonstrate the program for interfacing of a stepper motor and Rotate it in clockwise & anti-clock wise direction with equal delay Using ARM DEVELOPMENT BOARD.
12. To Write and demonstrate the program for interfacing of real time clock and serial port Using ARM DEVELOPMENT BOARD.
13. To Write and demonstrate the program for interfacing LED and PWM Using ARM DEVELOPMENT BOARD.
14. To Write and demonstrate the program for sending SMS to any mobile number Using ARM DEVELOPMENT BOARD.
15. To Write and demonstrate the program for Interfacing of pen drive for writing the predefined file Using ARM DEVELOPMENT BOARD

Rashtrasant Tukadoji Maharaj Nagpur University, Nagpur

Electronics and Communication/ Electronics & Telecommunication Engineering/Electronics Engineering

B.Tech.5 th Semester

Subject : Electromagnetic Waves [L: 3 T:1 P:0]

Subject Code : BEETC-502T

Course Outcomes:

At the end of this course students will demonstrate the ability to :

1. Understand the different coordinate system & analyze theorem's of electric Field.
2. Understand magnetic fields, Apply the Maxwell's equations to solve problems in electromagnetic field theory.
3. Analyze the propagation of wave in different transmission media.
4. Understand and analyze various parameters and characteristics of the rectangular waveguide.
5. Understand principle of radiation and radiation characteristics of an antenna.

Unit I : Electric Field

Basics of Vectors, Coordinate system and concepts of differential surface and differential volume, Basics of Coulombs Law, Gauss Law, Divergence Theorem, Gradient, Curl,

Unit II : Magnetic Field & Maxwell's equations

Basics of Magnetic Field, Biot-Savart's Law, Amperes Circuital Law, Stokes Theorem, Maxwell's equations for Time constant fields and Time Varying fields.

Unit III : Electromagnetic Waves

Electromagnetic wave equation, Wave propagation in free space, perfect dielectric and perfect conductor, Skin effect, Poynting vector and Poynting theorem, Snell's Law, Brewster Angle,Total Internal Reflection.

Unit IV : Rectangular Waveguide

Basics of Waveguide and its types, Comparison of Rectangular waveguide with Transmission Lines, TE, TM and TEM Waves, Field equations for TE and TM waves through rectangular waveguide, Modes in rectangular waveguide, Various losses, Cut-off frequency and wavelength, Phase and Group velocities, Guide Wavelength, Wave impedances in waveguide.

Unit V : Radiation

Retarded potential, Radiation from the Hertz dipole and its field equations, Induction field, Radiation Field, Total power Radiated and equation of Radiation Resistance, Basics of antenna and antenna terminologies, Fundamentals of antenna arrays.

Text/Reference Books:

1. R.K. Shevgaonkar, Electromagnetic Waves, Tata McGraw Hill India, 2005

2. E.C. Jordan & K.G. Balmain, Electromagnetic waves & Radiating Systems, Prentice Hall, India.

3. NarayanaRao, N: Engineering Electromagnetics, 3rd ed., Prentice Hall, 1997.

4. David Cheng, Electromagnetics, Prentice Hall.

5. William H. Hayt Jr.&John A. Buck, Engineering Electromagnetics,McGraw-Hill.

Rashtrasant Tukadoji Maharaj Nagpur University, Nagpur

Electronics and Communication/ Electronics & Telecommunication Engineering/Electronics Engineering

B.Tech.5 th Semester

Subject : Digital Signal Processing [L: 3 T:0 P:0]

Subject Code : BEETC-503T

Course Objectives:

The objective of this course is to:-

1. Apply the principles of discrete-time signal analysis to perform various signal operations
2. Learn the Discrete time signal processing in z domain &Its relationship with other domain and it's analysis.
3. Learn Fourier Transform and Concepts of frequency domain analysis using different FFT architectures.
4. Learn design aspects of FIR digital filters.
5. Learn design aspects of IIR digital filters.

Course Outcomes:

Upon the completion of this course, students will demonstrate the ability to:

1. Analyze discrete time signals and system.

2.Process the signal in z domain for various discrete time systems.

3. Draw the structures of various discrete time systems in DFI, DFII, cascade and parallel form.
4. Apply discrete Fourier transform, its properties &Analyze the discrete time systems in frequency domain.
5. Understand the filter design techniques for IIR and FIR digital filters and will be able to determine parameters affecting its response.

Unit I: Introduction (10)

Sampling theorem, sampling process and reconstruction of sampling data.

Discrete time signals &systems : classification of discrete time signals and systems, LTI systems, linear convolution, Correlation

Multirate Digital Signal Processing-Down sampling, Up sampling, Sampling Rate Conversion

Unit II: Discrete Fourier Transforms

(09)

Frequency domain sampling: DFT/IDFT, Computation of DFT, Properties of DFT, Circular convolution, Computation of DFT using FFT algorithm – Decimation in time, Decimation in Frequency using radix 2 FFT – Butterfly structure.

Unit III:Realization of Digital Filters

(09)

Z-transform and its properties, inverse z-transforms; difference equation – Solution by z-transform, Realization of digital filters - Direct, Canonic, Cascade and Parallel forms

Unit IV: IIR Filter Design (09)

Bilinear transformation, Impulse invariant transformation, Lowpass IIR digital filters, Butterworth and Chebyshev filter, Spectral transformations.

Unit V: FIR Filter Design (08)

FIR filter design using windowing techniques (Rectangular, Hann, Hamm, Blackmann, Bartlett and Kaiser), Frequency sampling technique

Text Books:

1. J.G. Proakis, D.G. Manolakis "Digital Signal Processing: Principles, algorithms and applications, PHI.
2. A.V. Oppenheim, R.W. Schafer, "Discrete Time Signal Processing", PHI.
3. Rabiner Gold "Theory and Application of DSP", PHI
4. Texas Instruments and Analog Devices DSP Chip Manuals.

Reference books:

1. Digital signal processing- A practical approach Second Edition, 2002. **.E**. C. Ifeachar, B. W. Jarvis Pearson Education
2.Sanjit K. Mitra , 'Digital Signal Processing – A Computer based approach'
3. S. salivahanan, A Vallavaraj, C. Gnanapriya , 'Digital Signal Processing', 2nd Edition McGraw Hill.
4. A. NagoorKani, 'Digital Signal Processing', 2nd Edition McGraw Hill.
5.P. Ramesh Babu, 'Digital Signal Processing' Scitech

Rashtrasant Tukadoji Maharaj Nagpur University, Nagpur

Electronics and Communication/ Electronics & Telecommunication Engineering/Electronics Engineering

B.Tech.5 th Semester

Subject : Digital Signal Processing Lab [L: 0 T:0 P:2]

Subject Code : BEETC-503P

Objectives:

1. To understand the concept of Sampling and Aliasing effect & generation of different discrete time signal
2. To Learn to generate discrete time signals and to perform signal operations.
3.To understand the Z transform and discrete time Fourier transform for the analysis of digital signals and systems.
4. To Understand discrete Fourier transform and its properties.
5. To design and implement FIR & IIR filter and analysis of their frequency response
6. To understand the principle & working of digital signal processing for various applications.

Outcome:

At the end of the course the students shall be able to:

1. Demonstrate the sampling and reconstruction of discrete time signal & perform different signal operation in developing discrete time system.
2. Analyze different properties of Z-transform.
3. Analyze different properties of discrete Time Fourier transform.
4. Analyze and process the signals in the discrete domain.
5. Design the filters to suit requirements of specific applications.
6. Apply the techniques, skills, and modern engineering tools like MATLAB

Any TEN practicals are to be conducted

LIST OF EXPERIMENTS

1. To plot and represent following basic discrete time signals using MATLAB functions. : Unit impulse, unit step, ramp, real and complex exponential and its representations.

2. Sampling of Continuous time Signal. Reconstruction of Discrete time Signal and Illustration of Aliasing

3. To plot linear convolution of discrete signals using MATLAB functions.

4. Write a program to test stability of given discrete- time system.

5. To find Z transform of discrete time signal and its ROC with corresponding plot.

6. To find inverse Z transform of given discrete time signal.

7. Write a program to find frequency response of given system. (Transfer Function/ Differential equation form).

8. To compute DFT and IDFT of discrete time signals.

9. Write a program to find FFT and IFFT of given sequences.

10. Compute linear and circular convolution using DFT / IDFT method.

11. Designing of Digital IIR filter using MATLAB functions

12. Designing of Digital FIR filter using MATLAB functions

13. Designing of Digital FIR filter using GUI tool box.

14.Genefration of sinusoidal signal through filtering

15.Implementation of Decimation ,interpolation Process

Contents beyond syllabus

1. To Study DSP Processor using TMS 5416 and TMS 6713 starter kits.

2. To perform linear convolution and circular convolution on Processor kit.

3. Designing and implementation of High pass filter on DSP processor.

4. Generation of DTMF signals

Rashtrasant Tukadoji Maharaj Nagpur University, Nagpur

Electronics and Communication/ Electronics & Telecommunication Engineering/Electronics Engineering
B.Tech.5 th Semester

Subject: INDUSTRIAL ECONOMICS AND ENTREPRENEURSHIP DEVELOPMENT.

Examination Scheme:

Units: 05.

Marks: Internal - 30
External - 70

Objective
Study of this subject provides an understanding of the scope of an industrial economics and entrepreneurship development, key areas of business development, sources of finance, project preparation, methods of taxation and tax benefits, significance of entrepreneurship and economic growth, application of engineering skills in entrepreneurial activities etc.

Course Outcomes:After completing the course, students will be able to:

CO1. Understand different types of business structure.

CO2. Acquire the knowledge of different market structures and New economic policy

CO3. Grasp the functions of banks, taxations system and implications of Inflation.

CO4. Identify various sources of finance

CO5. Analyse the problems of Small Scall Industries and government's policies for them.

1. Industrial economics, Types of Business structures, top and bottom line of the organization, economic analysis of business, economics of operations, economic prudence in business.

2. Market structures- Monopoly, Oligopoly, and Monopolistic competition. Pricing strategies, business integration- forward backward integration, economies of scale, diseconomies of scale, liberalization, privatization and globalization, Business cycles, optimum size of firm.

3. The functions of central bank and commercial banks, Foreign Direct Investment, Free trade vs. Protectionism, Inflation, Recession, Inclusive growth, Public-Private partnership for development

4. Need – Sources of Finance, Term Loans, Capital Structure, venture capital. Angel funding, Financial Institution, management of working Capital, Break Even Analysis, Taxation – Direct, Indirect Taxes.

5. Sickness in small Business, Major problems faced by SSIs, Foreign Direct Investments and threat to SSI, Technical consultancy organizations, Government Policy for Small Scale Enterprises, tax holidays, and incentives to SSIs.

TEXT BOOKS

Industrial Economics. By, Ranjana Seth, Ane Book Pvt Ltd.

Modern Economic Theory By, K.K. Dewett. S.Chand.

Industrial Economics. By, Jagdish Sheth, Pearson Publication.

"Entrepreneurial Development" By, S.S.KhankaS.Chand& Co. Ltd. Ram Nagar New Delhi, 1999.

Hisrich R D and Peters M P, "Entrepreneurship" 5th Edition Tata McGraw-Hill, 2002.

Management of Entrepreneurship. By, N.V.R. Naidu, I.K. International Pvt Ltd.

Entrepreneurial Development. By, S.Anil Kumar. New Age International.

Small- Scale Industries and Entrepreneurship, By, Dr. Vasant Desai, Himalaya Publication.

REFERENCE BOOKS:

Business Economics. By, K.Rajgopalchar. Atalantic Publishers.

Microeconomics. By, Robert Pindyk

Business Economics.By, H.L. Ahuja,H. L. Ahuja,Louis Prof. De Broglie. S.Chand.

Rabindra N. Kanungo "Entrepreneurship and innovation", Sage Publications, New Delhi, 1998.

Financing Small Scale Industries in India, By, K.C.Reddy.Himalaya Publication.

Rashtrasant Tukadoji Maharaj Nagpur University, Nagpur

Electronics and Communication/ Electronics & Telecommunication Engineering/Electronics Engineering

B.Tech.5 th Semester

Subject : Operating system (Elective) [L: 2 T:1 P:0]

Subject Code : BEETC-505PE

Course Objectives :

1. To make computer system convenient to use in an efficient manner.
2. To provide users a continent interface to use the computer system .
3. Course description covers the classical internal algorithms and structures of operating systems, including CPU scheduling, memory management, device management and deadlocks
4. To keep track of who is using which resource, to provide efficient and fair sharing of resources among users and programs

Course Outcomes :

At the end of the course, a student will be able to:

1. Explain basic concepts of operating system
2. Understand the process management policies and scheduling algorithms
3. Design various memory management techniques
4. Analyze process synchronization techniques.
5. Evaluate deadlock detection and prevention mechanism

Unit 1 : **Introduction:**
(09)

Evolution of OS, Types of OS, Basic hardware support necessary for modern operating systems, services provided by OS, system programs and system calls, OS structures : Layered, Monolithic, Microkernel, disk space management, and space allocation strategies, disk arm scheduling algorithms

Unit 2 : **Process Scheduling:** **(06)**

Process Concepts, Process control block, types of schedulers, context switch, threads, multithreading model, goals of scheduling, and different scheduling algorithms, examples from Windows 2000 and Linux

Unit 3 : **Memory Management:** **(06)**

Contiguous allocation, Relocation, Paging, Segmentation, Segmentation with paging, demand paging, paging faults and instruction restart, page replacement algorithms, working sets, Locality, Thrashing, Garbage collection

Unit 4 : **Process cooperation and synchronization:** **(06)**

Concurrency Conditions, Critical section problem, software and hardware solutions, Semaphores, conditional critical regions and monitors, classical inter process communication problems

Unit 5 : **File system:** **(09)**

File concepts , Access methods, directory structures, Recovery, Log-structured file systems. **Deadlock and Protection** : Deadlock characteristics, Prevention, Avoidance, Detection and Recovery, Goals of protection, access matrix, implementation, security problem

Suggested Books:

Text Books :

1. Operating system Concepts (8th edition) by Silberschatz, Peter B Galvin, and Greg Gagne, Willey Indian Edition 2010.
2. Modern Operating system (third edition) by Andrew s Tanenbaum, Prentice Hall of India (2008)
3. Operating systems by D. M. Dhamdhere, Tata McGraw Hill, 2nd Edition
4. Operating systems, 3rd edition by A. Godbole, TMH publications

Reference Books :

1. Operating systems (5th Edition), Internal and Design principles by Williams stallings, Prenctice Hall India, 2000
2. Operating systems: Concepts and Design by Milan Milenkovik, McGraw Hill Higher Education
3. Operating System (3rd Edition) b Garry Nut, Pearson Education
4. Operating system, 3rd edition by P Balkrishna Prasad, SciTech Publication

Rashtrasant Tukadoji Maharaj Nagpur University, Nagpur

Electronics and Communication/ Electronics & Telecommunication Engineering/Electronics Engineering

B.Tech.5 th Semester

Subject : Sensors and Systems (Elective) [L: 2 T:1 P:0]

Subject Code : BEETC-505PE

Course Objectives :

1. To understand basic working principle of various types of sensors.
2. To understand the sensors used in automobile applications.
3. To understand the sensors used in industries
4. To understand the various sensors used in IoT smart city project.
5. To illustrate various actuators and motors used in robotics field.

Course Outcomes :

At the end of the course, a student will be able to:

1. Explain fundamental physical and technical base of sensors and actuators.
2. Describe basic laws and phenomena that define behavior of sensors and actuators.
3. Analyze various approaches, procedures and results related to sensors and actuators.
4. Create analytical design and development solutions for sensors and actuators.
5. Interpret the acquired data and measured results.

Describe application and development of sensors and actuators

Unit 1 : **Basics of Sensors:** **(08)**

Sensors / Transducers: Principles, Classification, Parameters, Characteristics, Environmental Parameters (EP), Characterization, Design procedure while choosing the sensors for various application. Types of sensors: Inductive, capacitive and resistive sensors.

Unit 2: **Sensors used in Automobile Industries:** **(08)**

Camshaft Position Sensor ,Throttle Position Sensor ,Vehicle Speed Sensor, Voltage sensor, Fuel Temperature Sensor, Manifold Absolute Pressure (MAF) Sensor, Coolant Sensor, Spark Knock Sensor, Oxygen Sensor, Engine Speed Sensor, Mass airflow sensor. Selection of appropriate model & types of sensors, their Interfacing with microcontroller, calibration, characterization.

Unit 3: **Sensors used in Automation Industries:** **(08)**

Rotary transformer, torque transducer, passive seed sensors, smart position sensor, non-contact hall effect rotary position sensors, current and voltage sensors, hot metal detector,

proximity and displacement sensor. Selection of appropriate model & types of sensors, their Interfacing with microcontroller, calibration, characterization.

Unit 4 : **Sensors used in IoT Smart City Applications:** **(08)**

Temperature Sensor, Pressure Sensor, Accelerometer and Gyroscope Sensor, IR Sensor, Optical Sensor, Gas Sensor, Smoke Sensor, rain sensor, motion sensor, RFID. Selection of appropriate model & types of sensors, their Interfacing with microcontroller, calibration, characterization.

Case Study: Designing sensors interface for :

1. Smart traffic light system.
2. Waste management system.

Unit 5: **Actuators and motors used in Robotics:** **(10)**

Pneumatic and Hydraulic Actuation Systems- Actuation systems, Pneumatic and hydraulic systems, Directional Control valves, Pressure control valves, Cylinders, Servo and proportional control valves, Process control valves, Rotary actuators, Mechanical Actuation Systems Types of motion, Kinematic chains, Cams, Gears, Ratchet and pawl, Belt and chain drives, Bearings, Mechanical aspects of motor selection, Electrical Actuation Systems, Electrical systems, Mechanical switches, Solid-state switches, Solenoids, D.C. Motors, A.C. Motors, Stepper motors.

Suggested Books:

Text Books

1.Sensors and Signal Conditioning Wiley-Blackwell, 2008 Jacob Fraden, Handbook of
modern sensors, Springer, Stefan Johann Rupitsch.
2.Piezoelectric Sensors and Actuators: Fundamentals and Applications, Springer, 2018
Senturia S. D.

3. D. Patranabis, "Sensors and Transducers", PHI Learning Private Limited.

Reference Books :

1. W. Bolton, "Mechatronics", Pearson Education Limited.
2. Sensors and Signal Conditioning Wiley-Blackwell, 2008 Jacob Fraden, Handbook of modern sensors, Springer, Stefan Johann Rupitsch.
3. Piezoelectric Sensors and Actuators: Fundamentals and Applications, Springer, 2018 Senturia S. D.
4. D. Patranabis, "Sensors and Transducers", PHI Learning Private Limited.
5. W. Bolton, "Mechatronics", Pearson Education Limited.

Rashtrasant Tukadoji Maharaj Nagpur University, Nagpur

Electronics and Communication/ Electronics & Telecommunication Engineering/Electronics Engineering

B.Tech.5 th Semester

Subject : Information Theory and Error Correcting Codes(Elective) [L: 2 T:1 P:0]

Subject Code : BEETC-505PE

Objectives:

1. To study Introduction to Information Theory, Entropy, Mutual Information
2. To study Super Information, Channel Models.
3. To study error correcting codes
4. To study Hamming Codes, LDPC Codes, Introduction to Cyclic Codes,.
5. To study designing aspects of Antenna.

Course Outcomes:

At the end of the course, students will be able to -

1. Interpret and summarize the role of information theory and linear algebra in source coding and channel coding
2. Make use of various error control encoding and decoding techniques
3. Implement various error control techniques
4. Analyze the performance of error control codes.

	Hours per Week
UNIT I: Introduction to Information Theory, Entropy, Mutual Information, Conditional and Joint Entropy, Measures for Continuous Random Variable, Relative Entropy, Variable Length Codes, Prefix Codes, Source Coding Theorem, Various source coding techniques: Shannon-Fano, Huffman, Arithmetic, Lempel Ziv, Run Length, Optimum Quantizer, Practical Application of Source Coding: JPEG Compression	10
UNIT II Introduction to Super Information, Channel Models and Channel Capacity, Noisy Channel Coding Theorem, Gaussian Channel and Information Capacity Theorem, Capacity of MIMO channels	08

Unit III Introduction to Error Control Coding, Introduction to Galois Field, Generator Matrix and Parity Check Matrix, Systematic Codes, Error Detection and Correction, Erasure and Errors, Standard Array and Syndrome Decoding, Probability of Error, Coding Gain and Hamming Bound	10
Unit IV Hamming Codes, LDPC Codes, Introduction to Cyclic Codes, Generator Polynomial, Syndrome Polynomial and Matrix Representation, Golay Code, Introduction to BCH Codes: Generator Polynomials, Multiple Error Correcting BCH Codes, Decoding of BCH Codes	10
Unit V Introduction to Reed Solomon (RS) Codes, Introduction to Convolutional Codes, Trellis Codes: Generator Polynomial Matrix and Encoding using Trellis, Vitrebi Decoding, Introduction to Turbo Codes	10

TEXT BOOKS

1. K. Sam Shanmugam ,"Digital and analog communication systems", John Wiley, 1996.
2. Simon Haykin ,"Digital communication" , John Wiley, 2003.
3. Shu Lin, Daniel J.Costello, Jr, "Error Control Coding- Fundamentals and Applications" – Prentice Hall, Inc.
4. Error Correcting Coding Theory-Man Young Rhee- 1989, McGraw-Hill Publishing.
5. T.M. Cover and J. A. Thomas, Elements of information theory, John Wiley & Sons, 2012.
6. R. M. Roth, Introduction to Coding Theory, Cambridge University Press, 2006.
7. Information theory, coding and cryptography, Ranjan Bose, McGraw Hill, 3 rd Edition, 2016.

REFERENCES

1. Digital Communications-Fundamental and Application - Bernard Sklar, PE.
2. Digital Communications- John G. Proakis, 5th ed., 2008, TMH.
3. Introduction to Error Control Codes-Salvatore Gravano-oxford
4. Error Correction Coding – Mathematical Methods and Algorithms – Todd K.Moon, 2006, Wiley
5. Information Theory, Coding and Cryptography – Ranjan Bose, 2ndEdition, 2009, TMH.
6. S. Lin and D. J. Costello, Error Control Coding, 2 nd Edition, Prentice Hall, 2004.
7. R. E. Blahut, Algebraic Codes for Data Transmission, Cambridge University Press, 2002.

Rashtrasant Tukadoji Maharaj Nagpur University, Nagpur

Electronics and Communication/ Electronics & Telecommunication Engineering/Electronics Engineering

B.Tech.5 th Semester

Subject : Electronic Design Techniques with HDL(Elective-I) [L: 2 T:1 P:0]

Subject Code : BEETC-505PE

Learning Objective:

1) To enable the students to translate a functional system description into appropriate digital blocks coded in VHDL.
2) Perform synthesis, place, and route of a digital design into a target FPGA.

Prerequisite: Digital Design, C language.

Learning Outcomes:

At the end of the course, the students would be able to:

1) Design digital systems through HDL language
2) Simulate, synthesise, and implement HDL code
3) Implement code on FPGA/CPLD

Course Contents

Unit I : Introduction to VLSI and HDL:

History of IC Design, IC Technology, Moore's Law, IC Design Constraints, Feature Size, VLSI Family, Programmable Logic Devices, Designing with Programmable Logic- Design Entry, Simulation, Synthesis, Implementation, Device Programming, EDA Tools, IP Cores, Gjeski's Y Chart.

Digital system design process, Hardware simulation, Levels of abstraction, VHDL requirements, Elements of VHDL Top-down design, VHDL basic language Elements, VHDL operators, Timing, Concurrency, Objects, and classes.

Unit II : Behavioural Modeling:

Signal assignments, Concurrent and sequential assignments., Entity Declaration, Architecture Body, Behavioral Modeling, Process statement, Loop control statements, Multiple Processes, Delay Models, Signal Drivers.

Unit III : Dataflow and Structural Modeling Techniques:

Data flow Modeling, Concurrent Assignment statements, Block statements, Structural Modeling, Component declaration and Instantiation, Generate statements. Generics and Configuration, Subprogram, Overloading, Packages and Libraries, Design Libraries, Attributes.

Unit IV : FINITE STATE MACHINE: Overview of FSM, FSM representation, Moore machine versus Mealy machine, VHDL representation of an FSM, State assignment, Some FSM design examples – sequence detector, FSM based binary counter. Analysis of asynchronous sequential circuit – flow table reduction-races-state assignment-transition table and problems in transition table.

Unit V : Design for Synthesis:

Language directed view of synthesis, Inference from CSA statements, Inference from within Process, Inference using Signals v/s variables, Latch v/s Flip Flop Inference, Wait statements, Synthesis Hints, Synthesis for dataflow and structural models.

BOOKS RECOMMENDED:

[1]J. Bhasker, VHDL Primer, 3/e, Addison Wesley, 1999.

[2]Sudhakar Yalamanchili, Introductory VHDL-From Simulation to Synthesis, Pearson Education, 3/e Indian Reprint.

[3]Douglas Perry, VHDL, 3/e Edition, McGraw Hill 2001.

[4]Peter.J.Ashenden, The Designer's Guide to VHDL-AMS,

[5]Charles.H.Roth, Digital system Design using VHDL, Thompson Publishers, 2/e Edition, 2007.

[6]Ben Cohen, VHDL-Coding style and Methodologies, Kluwer academic Publishers, 1995.

[7].Volnei. A.Pedroni, Circuit Design with VHDL, MIT Press Cambridge, 2004.