SCHEME OF EXAMINATION FOR
B.Tech. ELECTRONICS & TELECOMMUNICATION / ELECTRONICS & COMMUNICATION ENGINEERING
(SEMESTER – V)

Code	Subject	Teaching Scheme				Credits				MARKS				
										Theory		Practical		Total Marks
		L	P	T/A	Total	L	P	T/A	Total	Internal	Univ.	Internal	Univ.	
BEETC-501T	Embedded System Design	2	-	1T	3	2	-	1	3	30	70	-	-	100
BEETC-501P	Embedded System Design Lab	-	2	-	2	-	1	-	1	-	-	25	25	50
BEETC-502T	Electromagnetic Waves	3	-	1T	4	3	-	1	4	30	70	-	-	100
BEETC-503T	Digital Signal Processing	3	-	-	3	3	-		3	30	70	-	-	100
BEETC-503P	Digital Signal Processing Lab	-	2	-	2	-	1	-	1	-	-	25	25	50
BEETC-504OT	HSC: IEED(Economics)	2	-	1A	3	2	-	1	3	30	70			100
BEETC-505PE	PEC-I	2	-	1T	3	2	-	1	3	30	70	-	-	100
BEETC-506P	Electronic Workshop II	-	2	-	2		1	-	1	-	-	25	25	50
BEETC-507A	Audit Course													AUDIT
	Total	**12**	**6**	**3T+1A**	**22**	**12**	**3**	**4**	**19**	**150**	**350**	**75**	**75**	**650**

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.

SCHEME OF EXAMINATION FOR
B.Tech. ELECTRONICS & TELECOMMUNICATION / ELECTRONICS & COMMUNICATION ENGINEERING
(SEMESTER VI)

Code	Subject	Teaching Scheme				Credit				MARKS					MIN PASSING	
										Theory		Practical		Total Marks		
		L	P	T/A	Total	L	P	T/A	Total	Internal	Univ.	Internal	Univ.		Theory	Practical
BEETC-601T	Computer Communication Network	2	-	-	2	2	-	-	2	30	70	-	-	100	45	
BEETC-601P	Computer Communication Network Lab	-	2	-	2	-	1	-	1	-	-	25	25	50		25
BEETC-602T	Internet of Things (IOT)	2	-	-	2	2	-	-	2	30	70	-	-	100	45	
BEETC-602P	IOT Lab	-	2	-	2	-	1	-	1	-	-	25	25	50		25
BEETC-603T	Wireless Sensor Network	2	-	-	2	2	-	-	2	30	70	-	-	100	45	
603P	BEETC-Wireless Sensor Network Lab	-	2	-	2		1	-	1	-	-	25	25	50		25
BEETC-604PE	PEC-II	2	-	1T	3	2	-	1	3	30	70	-	-	100	45	
BEETC-605OE	OE-I	2	-	1A	3	2	-	1	3	30	70	-	-	100	45	
BEETC-606T	HSC: Effective Technical Communication	2		-	2	-	-	2	2	15	35	-	-	50	23	
BEETC-607I	Mini Project(Internship)	-		3A	3	--	-	3	3	-	-	25	25	50		25
BEETC-608A	Audit Course	2	0	0	2	0	0	0	0	-	-			AUDIT		
Total		**12**	**6**	**1T+4A**	**23**	**10**	**3**	**7**	**20**	**165**	**385**	**100**	**100**	**750**		

(Dr. V. K. Takesande) 3/8/23

(Dr. P. D. Khandait) 03/08/23

N. G. Bawane

Rashtrasant Tukadoji Maharaj Nagpur University, Nagpur

Electronics and Communication/ Electronics & Telecommunication Engineering/Electronics Engineering

B.Tech. 6th Semester

Subject : Computer Communication Networks [L: 3 T:0 P:2]

Course Objectives:

The objective of this course is to provide students with understanding of

1. Build an understanding of the fundamental concepts of computer networking and its topologies.
2. Learn about the transmission media used for wired and wireless network and learn the concept of switching techniques.
3. Learn the concept of network services and various protocols of Data Link Layer and MAC sub-layer.
4. Introduce the concept Network Layer and IP Addressing techniques.
5. Introduce transport layer services and its protocol Headers.
6. Introduce the function of Application Layer and Presentation layer paradigm and protocols.

Course Outcome:

At the end of this course, the students shall be able to

1. Describe the basics of Computer Network, Data Communication, Network topologies, transmission media and switching techniques.
2. Analyze the services and features of various protocols of Data Link Layer and MAC sub-layer.
3. Apply the concept of IP Addressing techniques and its various protocols of Network Layer.
4. Describe the transport layer, Application Layer services and its protocol Headers and analyze the congestion control protocols.
5. Explain the function of Application Layer and Presentation layer paradigm and protocols.

UNIT I: Computer Networks Overview and Introduction to Physical Layer

Introduction to Networks, Network Topology, Types of communication:-simplex, half duplex, full duplex, Network classification:- LAN,MAN,WAN, Network Architecture, Protocols, Services and primitives, OSI Reference Model, TCP/IP Reference Model.

Transmission Media:-Guided Media, Unguided, Structure of Switch, types of switches, Switching Techniques:-Circuit-switching, Message switching, packet switching,

UNIT II: Data Link Layer

Design Issues, Framing methods, Flow Control and Error Control, Stop-and-wait flow control, Sliding-window flow control, Stop-and-wait ARQ, Go-back-N ARQ, Selective-repeat ARQ, HDLC, MAC sub layer: ALOHA,CSMA-CD.

UNIT III: Network Layer:

Network layer duties, Routers, IP addressing and its classification, IPv4 address, IPv6 address, Mask and Subnet, Routing algorithms like Shortest path routing, Djkstra's algorithm, Bellman Ford Algorithm, Distance Vector Routing, Dynamic Routing.

UNIT IV: Transport Layer

Transport layer services, Connection oriented & Connectionless, Three-way handshaking, UDP model, TCP:- TCP header format, comparison between UDP and TCP, Need of Congestion control, Principal of congestion, Quality of Service (QoS), Token bucket and leaky bucket algorithm.

UNIT V: Application Layer

Application Layer: DNS, Electronic Mail, File Transfer (FTP), WWW, HTTP, SNMP, SMTP. Introduction to Cryptography, Secret key algorithm, public key algorithm, Digital Signature, Basics of Attacks and security.

TEXT BOOKS:

1. Data Communications and Networking, Fourth Edition by Behrouza A. Forouzan, TMH.

2. Computer Networks, A.S.Tanenbaum, 4th Edition, Pearson education.

Reference Books:

1. Data and Computer Communications, tenth Edition by William Stallings, Pearson Educations.

Rashtrasant Tukadoji Maharaj Nagpur University, Nagpur

Electronics and Communication/ Electronics & Telecommunication Engineering/Electronics Engineering

B.Tech. 6th Semester

Subject : Computer Communication Networks lab

LIST OF EXPERIMENTS

Course Outcomes:

CO1	To analyze and select various cables and Connectors used for networking with computer network security.
CO2	To verify the implementation results on software like NS2 and simulate different networking models and implement different networking protocols.
CO3	To understand different data transmission techniques using TCP and UDP Protocol for evaluating the different IP addresses for various systems.

Experiment No.1

To study Network Hardware components – Cables, NIC, Repeaters, Hubs, Bridges, Switches and Routers.

Experiment No.2

To demonstrate the formation of Local Area Network

Experiment No.3

To demonstrate data transmission using Ping protocol, tracert and IP configuration.

Experiment No.4

To study Network Simulator “ns-2”.

Experiment No.5

To perform the simulation of 2 Nodes in ns-2.

Experiment No.6

To create a Simple Network Topology in ns-2.

Experiment No.7

To understand TCP protocol using ns-2

Experiment No.8

To understand UDP protocol using ns-2.

Experiment No. 9

To perform PC to PC communication using RS-232 port.

Experiment No. 10

To configure Router.

Experiment No.11

To understand IP address of the system and Network Address Translation.

Experiment No.12

To study the Domain Name Server (DNS)

Rashtrasant Tukadoji Maharaj Nagpur University, Nagpur

Electronics and Communication/ Electronics & Telecommunication Engineering/Electronics Engineering

B.Tech. 6th Semester

Subject : Internet of Things L :2 T :0 P:0 Credit : 2

Objectives:

- To understand the fundamentals of Internet of Things
- To learn about the basics of IOT protocols
- To build a small low cost embedded system using Arduino/Raspberry Pi.
- To apply the concept of Internet of Things in the real world scenario.

Outcomes:
Upon completion of this course, the students should be able to:

- Analyze different design levels of IoT
- Analyse IOT Architecture
- Understand network and communication aspects
- Design a portable IoT using Rasperry Pi and Aurdino
- Analyze applications of IoT in real time scenario

Unit I : Introduction to IoT (**04)**

IoT definition & Characteristics, Advantages and disadvantages, IoT functional blocks, sensing , actuation , Physical design of IoT, Logical design of IoT, Constraints affecting design in IoT .

Unit II :IOT Architecture:- (05)

Introduction, Functional View, Information View, Deployment and Operational View, Other Relevant architectural views. Real-World Design Constraints- Introduction, Technical Design constraints , IoT reference model.

Unit III: M2M to IOT (05)

Introduction, Basic Concepts, Difference between IoT and M2M, M2M Value Chains, IoT Value Chains, Machine to Machine Communication, M2M to IoT- Architecture, Design principles and capabilities.

Unit IV: Network and Communication Aspects (05)

Wireless medium access issues, MAC protocol, Survey routing protocols, Sensor deployment & Node discovery, Data aggregation & dissemination, service model, service management and security.

Unit V : Introduction to different IoT tools (05)

Introduction to different IoT tools, Introduction to Arduino and Raspberry Pi & Its Programming.

Case Study on Health care and Agriculture

References

1. Arshdeep Bahga, Vijay Madisetti, ―Internet of Things – A hands-on approach‖, Universities Press, 2015 .

2. From Machine-to-Machine to the Internet of Things: Introduction to a New Age of Intelligence: By Jan Holler, Vlasios Tsiatsis, Catherine Mulligan, Stefan Avesand, Stamatis Karnouskos, David Boyle, 1st Edition, Academic Press, 2014.

3. Dieter Uckelmann, Mark Harrison, Michahelles, Florian (Eds), ―Architecting the Internet of Things‖, Springer, 2011.

4. Honbo Zhou, ―The Internet of Things in the Cloud: A Middleware Perspective‖, CRC Press, 2012.

5. Olivier Hersent, David Boswarthick, Omar Elloumi , ―The Internet of Things – Key applications and Protocols‖, Wiley, 2012

6. Rethinking the Internet of Things: A Scalable Approach to Connecting Everything, by Francis daCosta, 1st Edition, Apress Publications, 2013

Internet of Things Lab [0 L:0T:2P credit:1]

Hands-on experiments related to the course contents

At least Ten practical's are suggested to be performed based on above syllabus

1. Study various types of Arduino and install Arduino IDE.
2. Study temperature/humidity sensor. and write a program to monitor temperature/humidity using Arduino.
3. Study and implement RFID using Arduino.
4. Implement MQTT protocol using Arduino.
5. To study and Configure Raspberry Pi.
6. Study and implement Zigbee protocol using Arduino/ Raspberry Pi.
7. To interface Bluetooth with Arduino/ Raspberry Pi and write a program to send the sensor data to smartphone using Bluetooth
8. To interface LED/Buzzer with Arduino/ Raspberry Pi and write a program to turn on LED for 1 seconds after every two seconds.
9. To interface OLED with Arduino/ Raspberry Pi and write a program to print temperature and humidity.
10. To interface motor using relay with Arduino/ Raspberry Pi and write a program to turn on the motor.
11. Interface Ultrasonic sensor and IR sensor with Raspberry Pi and write a program to detect an object.
12. To interface ultrasonic sensor with Raspberry Pi/ Arduino and write a program to calculate distance of object.
13. Study of implementation of Web server using Node MCU and ESP module.
14. To create a local server using Node MCU.
15. To fetch humidity and temperature using DHT 11 sensor and sent it to local server.
16. Write a program to continuously monitor sensor reading through internet.
17. To generate API and program Node MCU.
18. To create Web page and control Home Appliances through Wi-Fi.
19. To create Adafruit account and using Adafruit to read sensor values and send data to node MCU.

20. To create local host server.

Note : The practicals are not restricted to this list. Faculties can explore more advanced practicals based on syllabus of ‘Internet of Things’.

Rashtrasant Tukadoji Maharaj Nagpur University, Nagpur

Electronics and Communication/ Electronics & Telecommunication Engineering/Electronics Engineering

B.Tech. 6th Semester

Subject : Internet of Things L :0 T :0 P:2 Credit : 1

Internet of Things

Hands-on experiments related to the course contents

At least Ten practical's are suggested to be performed based on above syllabus

- Study various types of Arduino and install Arduino IDE.
- Study temperature/humidity sensor. and write a program to monitor temperature/humidity using Arduino.
- Study and implement RFID using Arduino.
- Implement MQTT protocol using Arduino.
- To study and Configure Raspberry Pi.
- Study and implement Zigbee protocol using Arduino/ Raspberry Pi.
- To interface Bluetooth with Arduino/ Raspberry Pi and write a program to send the sensor data to smartphone using Bluetooth
- To interface LED/Buzzer with Arduino/ Raspberry Pi and write a program to turn on LED for 1 seconds after every two seconds.
- To interface OLED with Arduino/ Raspberry Pi and write a program to print temperature and humidity.
- To interface motor using relay with Arduino/ Raspberry Pi and write a program to turn on the motor.
- Interface Ultrasonic sensor and IR sensor with Raspberry Pi and write a program to detect an object.
- To interface ultrasonic sensor with Raspberry Pi/ Arduino and write a program to calculate distance of object.
- Study of implementation of Web server using Node MCU and ESP module.

- To create a local server using Node MCU.
- To fetch humidity and temperature using DHT 11 sensor and sent it to local server.
- Write a program to continuously monitor sensor reading through internet.
- To generate API and program Node MCU.
- To create Web page and control Home Appliances through Wi-Fi.
- To create Adafruit account and using Adafruit to read sensor values and send data to node MCU.
- To create local host server.

Note : The practicals are not restricted to this list. Faculties can explore more advanced practicals based on syllabus of ‘Internet of Things’.

Rashtrasant Tukadoji Maharaj Nagpur University, Nagpur

Electronics and Communication / Electronics & Telecommunication Engineering /Electronics Engineering

B.Tech. 6th Semester

Subject : Wireless Sensor Networks L :2 T :0 P:2 Credit : 2

Objectives:

1. Introduce wireless sensor network architectures and communications protocols provide an understanding of mutual relationships and dependencies between different protocols and architectural decisions by offering an in-depth investigation of relevant protocol mechanisms.
2. Introduction to wireless sensor networks: Challenges for WSNs, enabling technologies.
3. Introduce design spaces for sensor networks
4. Study wireless sensor network solutions with practical implementation examples and case studies.
5. Introduce sensor network platforms, operating systems and programming tools for sensor networks.
6. Single node architecture: Hardware components, energy consumption of sensor nodes, operating systems and execution environments.

Outcome: By the end of this course, the students shall be able to
1. Demonstrate advanced knowledge and understanding of the engineering principle of sensor design, signal processing, established digital communications techniques, embedded hardware and software, sensor network architecture, sensor networking principles and protocols.
2. Demonstrate a computing science approach, in terms of software techniques, for wireless sensor networking with emphasis on tiny sensors, sensor specific programming languages, RFID technology, embedded architectures, software program design and associated hardware, data fusion.
3. Demonstrate knowledge of the associated business, legislative, safety and commercial issues; future technological advances and the way these will impact on the engineering product enterprise process.

Unit: I Introduction to Wireless Sensor Networks and its Applications (4)

Introduction and Overview of Wireless Sensor Networks, Commercial and Scientific Applications of Wireless Sensor Networks, Basic Wireless Sensor Technology, Sensor Taxonomy, wireless network environment.

Unit: II Wireless Transmission Technology and Medium Access Control Protocols (5)

Radio technology primer, Available wireless technologies, Fundamentals of Medium Access Control Protocols for Wireless Sensor Networks, MAC protocols for WSN, IEEE 802.15 4LR WPAN, Sensors Network Protocols, Data dissemination and gathering.

Unit: III Transport Control Protocols for Wireless Sensor Networks (5)

Transport Control Protocols for Wireless Sensors Networks, Traditional transport control protocol, transport protocol design issues, examples of existing transport control protocol, performance of TCP,Routing Challenges and design issues in wireless sensor network, Routing strategies in WSN.

Unit: IV Middleware and Network Management for Wireless Sensor Networks (5)

Middleware for Sensor Networks,WSN middleware principles, Middleware architecture, existing middleware.

Network Management for Wireless Sensor Networks, Requirements, Design issues, Examples of management Architecture: MANNA, Performance and Traffic Management Issues, Fundamentals of network security-challenges and attacks.

Unit V – Operating Systems and Hardware for Wireless Sensor Networks (5)

Introduction, Operating System Design Issues, Examples of Operating Systems: TinyOS, MANTIS, Programming tool: nesC,

Hardware: Examples like "Mica Mote" family, EYES nodes, BTnodes, Scatterweb,

Introduction to Network Simulator 3 (ns-3)

Text Books:

1. "Wireless Sensor Networks: Technology, Protocols, and Applications", Kazem Sohraby, Daniel Minoli, Taieb Znati, Wiley Interscience Publication, 2007

2. "Protocols and Architecture for Wireless Sensor Networks", H.Karl and A.Wiling, John Wiley & Sons, India,2012.

3. C. S. Raghavendra, Krishna M. Sivalingam, Taieb F. Znati , 'Wireless sensor networks',Edition: 2, Published by Springer, 2004 .

Reference Books:

1. Morgan Kaufmann F. Zhao and L. Guibas, ' Wireless Sensor Networks',San Francisco, 2004.

2. "Computer Networks", Andrew Tanenbaum, 4th Edition, Pearson Education,2007

Rashtrasant Tukadoji Maharaj Nagpur University, Nagpur

Electronics and Communication / Electronics & Telecommunication Engineering /Electronics Engineering

B.Tech. 6th Semester

Subject : Wireless Sensor Networks Laboratory L :0 T :0 P:2 Credit : 1

SubJect: Wireless Sensor Network

List of Practical:

1 Introduction of Wireless sensor network applications and its simulation.

2 Network Simulator installation of wireless sensor network.

3 Write TCL script for transmission between mobile nodes.

4 Write TCL script for sensor nodes with different parameters.

5 Generate TCL script for udp and CBR traffic in WSN nodes.

6 Generate TCL script for TCP and CBR traffic in WSN nodes.

7 Implementation of routing protocol in NS2 for AODV protocol.

8 Implementation of routing protocol in NS2 for DSR protocol.

9 Implementation of routing protocol in NS2 for TORA protocol.

10 Study other wireless sensor network simulators.

Rashtrasant Tukadoji Maharaj Nagpur University, Nagpur

Electronics and Communication / Electronics & Telecommunication Engineering /Electronics Engineering

B.Tech. 6th Semester

Subject : Computer Architecture (Elective-II) [L: 2 T:1 P:0]

Subject Code :BEEETC-604PE

Course Objective:

1. Discuss the basic concepts and structure of computers.
2. Understand the concepts of register transfer logic and arithmetic operations.
3. Understand the concept of memory management and virtual memory.
4. To identify and compare different methods for computer I/O.
5. Learn about Parallel Organizations –Parallel Processing and Multi Core Computers.

Course Outcomes:

Upon completing the course, students will be able to:

1. Demonstrate computer architecture concepts related to design of modern processors, memories and I/Os.
2. To develop logic for assembly language programming using arithmetic and logical operations.
3. Distinguish the organization of various parts of a system memory hierarchy
4. Describe fundamentals concepts of pipeline and vector processing.
5. Analyze the performance of commercially available computers.

UNIT I: BASIC STRUCTURE OF COMPUTERS AND ITS PROCESSING UNIT:

Functional units, Basic operational concepts, Bus structures Addressing modes, subroutines: parameter passing, Instruction formats, expanding opcodes method.
Bus architecture, Execution of a Complete Instruction, sequencing of control signals, Hardwired control, Micro programmed Control, microinstruction format, and Bit slice concept.

UNIT II: ARITHMETIC OPERATIONS:

Number representations and their operations, Design of Fast Adders, Signed multiplication, Booth's Algorithm, bit-pair recoding, Integer Division, Floating point numbers and operations, guard bits and rounding.

UNIT III: THE MEMORY SYSTEM:

Various technologies used in memory design, higher order memory design, multi-module memories and interleaving, Associative Memory, Cache memory, Virtual Memory.

UNIT IV: INPUT/OUTPUT ORGANIZATION:

I/O mapped I/O and memory mapped I/O, interrupts and interrupts handling mechanisms, vectored interrupts, synchronous vs. asynchronous data transfer, Direct Memory Access COMPUTER PERIPHERALS: I/O devices such as magnetic disk, magnetic tape, CDROM systems.

UNIT V:

RISC philosophy, pipelining, basic concepts in pipelining, delayed branch, branch prediction, data dependency, influence of pipelining on instruction set design, multiple execution units, performance considerations.
Basic concepts in parallel processing & classification of parallel architectures. Vector Processing, Array Processors.

BOOKS:·

V. C. Hamacher, Z. G. Vranesic and S. G. Zaky, Computer Organisation, McGraw Hill,5thed,2002.
Computer Architecture & Organization III Ed- J.P.Hayes.
A.S.Tanenbaum, "Structured Computer Organization" 4th Edition, Pearson Education

REFERENCES BOOKS:

M Mano, "Computer System and Architecture", Pearson Education
W. Stallings, "Computer Organization & Architecture", Pearson Education

Rashtrasant Tukadoji Maharaj Nagpur University, Nagpur

Electronics and Communication / Electronics & Telecommunication Engineering /Electronics Engineering

B.Tech. 6th Semester

Subject : Data Base Management System(Elective-II) L :2 T :1 P:0 Credit : 3

Course Code		**Department**	ETC /ECE
Type	Elective - II	**Semester**	6 Sem
Credits	3	**Pre-requisites, if any**	
Exam Duration	T: 3 Hrs, P: 0	**Max marks**	70 + 30 (Internal)
Course Objectives	Get introduced to Data Base Management System 1. To understand general idea of data base management system 2. To develop skills to design databases using data modeling and design techniques 3. To develop skills to implement real life applications which involves data handling 4. Demonstrate an understanding of careers opportunities in subject areas of designing, storage techniques, data handling and managing techniques		
Course Outcome	**At the end of this course students will able to** 1.Understands basic database concepts and data modeling techniques used in data base design . 2. Study the concept of functional dependency and perform the calculus with design database by using different normalization techniques 3. Study query processing and perform optimization on query processing 4. Understand the concept of transaction processing and different recovery techniques used in RDBMS 5. Study and Implement advanced database which are used in real time system		

Course Details:

Unit No.	Particulars*	TH
1	**Introduction to Database Systema:** Approaches to building a database, Three Schema architecture of database, Challenges in building a DBMS, DBMS architecture, Various components of DBMS, Types of Data models.	7
2	**Relational Data Model:** Concepts of Relation, Schema-instance Distinction, keys, referential integrity	8

	and foreign keys, Relational algebra operators, Tuple Relational calculus, Domain relational calculus, **Physical and Logical hierarchy** : Concept of index, B trees, hash index, function index, bitmap index, concepts of functional dependency , normalization (1NF, 2NF, 3NF, BCNF etc)	
3	**Query Processing and Optimization :** Query processing and optimization process, measures of query cost estimation in query optimization, pipelining and materialization, structures of query evaluation plans	7
4	**Transactions:** Transaction concepts, properties of transactions, Serializability of transactions, testing of serializability, system recovery, Two phase commit protocol, Recovery and Atomicity, Log based recovery, concurrent execution of transactions, Locking mechanisms, solotion to concurrency related problems, deadlock, Isolation	7
5	**Recovery system and advanced database:** Failure classification, recovery and atomicity, log based recovery, check points, buffer management, advanced recovery techniques, Web databases, Distributed databases, Data warehousing, Data Mining, Data security, NOSQL databases.	7
	Total	36

Text Books:

1. Database system concepts by Avi Silberschtz, Henry F Korth, S Sudarshan, Tata McGraw Hill
2. Fundamental of Database systems – Elmasiri and Navathe Addison Wesley 2000 Systems – C J Date, A Kannam, S Swamynathan, 8th edition
3. An introduction to Database

Reference Books

1. Database Management system by Raghu Ramkrishnan and Johannes Gehrke, Tata McGraw Hill publications, 3rd edition
2. Introduction to database management system by Kahate, Pearson publication

Rashtrasant Tukadoji Maharaj Nagpur University, Nagpur

Electronics and Communication / Electronics & Telecommunication Engineering /Electronics Engineering

B.Tech. 6th Semester

Subject : Control System Engineering (Elective-II) L :2 T :1 P:0 Credit : 3

Course Code		**Department**	ETC /ECE
Type	Elective - II	**Semester**	6th Sem
Credits	3	**Pre-requisites, if any**	Linear Differential Equation; Laplace Transform; Network Theory
Exam Duration	T: 3 Hrs, P: 0	**Max marks**	70 + 30 (Internal)
Course Objectives	Get introduced to Control System Engineering 5. Learn to derive mathematical models of typical engineering processes 6. Learn the construction of Root locus. 7. learn about the use of Transfer function 8. learn about the Stability of Control system 9. Learn about the State space Analysis.		
Course Outcome	**At the end of this course students will able to** 1.Understand the basic linear feedback principles and find out the transfer function using various methods. 2. Sketch the root locus and determine the location of the closed loop poles. 3. Analysis of Time response 4. Understand the different types of controller 5. Analysis of State space model		

Course Details:

Unit No.	Particulars*	TH
1	**Introduction to Control System:** Introduction, Classification of Control system, Representation of Electrical, Mechanical, Electro mechanical, Thermal, Pneumatic, Hydraulic system with differential equation, Concept of Transfer Function and State space representation. Advantages of State Space representation over Classical representation.	6

2	**Transfer Function, Block Diagram & Signal flow graph:** Representation of Transfer Function of Electrical & Mechanical , Block diagram algebra, Signal flow graph	8
3	**Time Response Analysis :** Time response of system, first order and second order system, standard inputs, concept of gain and time constants. Steady state errors, type of control system, approximate methods for higher order system. Types of Controllers.	6
4	**Stability & Root Locus:** Stability of control systems, condition of stability, characteristics equation, Routh Hurwitz criterion, special cases for determining stability, relative stability. Root location and effect on time response, elementary idea of root locus, Construction of root locus effect of addition of pole and zero in proximity of imaginary axis	8
5	**State Space Analysis:** State variable method of analysis, characteristics of system state. Choice of state variables, representation of vector matrix differential equation, standard form, relation between transfer function and state variables.	8
	Total	44

Suggested Books:

1.I.J.Nagrath, M.Gopal, " Control System Engineering",6th Edition, New age International Publishers

2.B.C.Kuo , "Automatic Control System", PHI

3. B.S. manke, "Linear Control Systems", Khanna Publishers

Reference Books

3. A.K.Jairath, " Problems and Solutions of Control systems", CBS Publishers, New Delhi
4. Nagrath&Gopal, "Control System Analysis".

Rashtrasant Tukadoji Maharaj Nagpur University, Nagpur

Electronics and Communication / Electronics & Telecommunication Engineering /Electronics Engineering

B.Tech. 6th Semester

Subject : Antenna and Wave Propagation (Elective-II) L :2 T :1 P:0 Credit : 3

Prerequisites: Basic knowledge of Electromagnetic Fields

Course Objectives:

1. To study transmission line characteristics.
2. To study the basics of radiating elements and effect of propagation of radio waves in actual environment.
3. To study the antennas, their principle of operation, analysis and their applications.
4. To study the features of Antenna array, Microstrip antenna and reflector antenna.
5. To study designing aspects of Antenna.

Course Outcomes:

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

1. Describe transmission line characteristics.
2. Calculate antenna parameters (radiation pattern, beam width, lobes, directivity, gain, impedance, efficiency, polarization)
3. Analyze wire antennas (monopoles, dipoles, and loops).
4. Analyze and design antenna arrays.
5. Describe the operation of broadband and traveling wave antennas.
6. Describe the operation of aperture and reflector antennas.
7. Analyze and design Microstrip antennas.

SYLLABUS

UNITS	**Hours per Week**
UNIT I: **Transmission Lines** Transmission line equations and their solution, transmission line parameters, characteristics impedance, propagation constant, attenuation constant and	10

phase constant, waveform distortion, distortionless transmission lines, loading of transmission lines, reflection coefficient and VSWR, Equivalent circuits of transmission lines, transmission lines at radio frequency, open and short circuited lines, smith chart, stub matching.	
UNIT II **Antenna Basics & Thin Linear Wire Antennas** **Antenna Basics** Introduction, basic antenna parameters – patterns, beam area, radiation intensity, beam efficiency, directivity, gain, resolution, antenna apertures, effective height, front to back ration, antenna basic concepts. **Linear wire & loop antennas:** Infinitesimal dipole, its radiation field, radiation resistance, radiation sphere, near field, far field, small dipole, finite length dipole, half wave length dipole, linear elements near or on infinite perfect conductors, ground effects and their application, folded dipole, Small loop, comparisons of small loop with magnetic dipole, radiation pattern its parameters and their application.	12
Unit III **Antenna Arrays** Linear arrays, planer arrays and circular arrays. Array of two isotropic point sources, non – isotropic sources, principle of pattern multiplication, linear arrays of n elements, broadside, End fire, radiation Pattern, directivity, Beam width and null directions, array factor, Antenna analysis using Dolph-Tschebyscheff, the Log-periodic antenna	08
Unit IV **Microstrip antennas & Reflector antennas** **Microstrip antennas:** Radiation Mechanism of Microstrip antenna, feeding methods, methods of analysis, Multiband Microstrip antenna for Mobile Communication, Circularly Polarized Patch antenna, Rectangular & circular patch, Circular polarization and feed network. **Reflector antennas:** Simple reflectors, the design of a shaped Cylindrical reflector, Radiation patterns of Reflector Antennas, Dual shaped Reflector Systems Plane reflector, Corner reflector, horn antenna, aperture antenna.	10
Unit V **Antenna Measurements** Reciprocity in antenna Measurements, Near-Field & Far-Field, Co-ordinate System, Sources of Error in antenna measurements, measurement ranges, measurement of different antenna Parameters, antenna ranges, radiation pattern, Gain and directivity, Polarization, Radio Wave Propagation: Atmosphere of Earth, Terrestrial Propagation of Electromagnetic waves, Fading, Noise and interference, Ground wave propagation, Ionospheric propagation	08

BOOKS

Text Books:

1. Antenna Theory analysis and design – Costantine A. Balanis, John Wiley publication
2. Antenna and Wave propagation, - K.D. Prasad, Satya Prakashan
3. Electromagnetic – Jordan Balmann, Prentice Hall of India publication
4. Antenna Theory and Design , Robert S. Elliott , Wiley Student Edition
5. Electromagnetic Waves- R. K. Shevgaonkar

Reference Books:

1. Antenna & Wave Propagation , Sisir K Das, Mc Graw Hill
2. Harish A. R., Antenna and wave Propagation, Oxford University Press
3. Antennas and Radio Propagation, R.E. Collins, Mc Graw –Hill

Rashtrasant Tukadoji Maharaj Nagpur University, Nagpur

Electronics and Communication / Electronics & Telecommunication Engineering /Electronics Engineering

B.Tech. 6th Semester

Course Code :BEETC605OE **Sem. : 6th semester** **Course: Consumer Electronics (Open Elective-I)**

Total Credits : 3 **Th.: 2 Tu.: 1 Pr.: 0** **hours per week:- 3**

Prerequisites: Basic knowledge of Electrical and Electronics Engineering

Course Objectives:

6. To give students an in depth knowledge of various electronic consumer Electronics gadgets,
7. To study various audio and video devices and systems.
8. Further this subject will introduce the students with working principles, block diagram, main features of consumer electronics gadgets/goods/devices.

Course Outcomes:

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

8. Describe various audio gadgets used in domestic and commercial applications
9. Describe various video gadgets used in domestic and commercial applications
10. Explain satellite communication technology along with DTH for day to day application
11. Describe various types of home appliances used in domestic life like washing machine, oven RO plant, Mixer, grinder, vaccume cleaner etc
12. Understand various types of home appliances used in domestic life like printers, food processors, Induction devices, scanner and fax machines etc.

SYLLABUS

UNITS	**Hours per Week**
Unit I:- Audio Systems (8 Periods)	8

Audio amplifier, microphone, loudspeaker, Public address systems, What is DJ,Audio as Data and Signal, Digital Audio Processes Outlined, Time Compression and Expansion.block diagram of home theatre & working	
Unit II:-Video Systems (15 Periods) Elements of TV communication system,Scanning and its need, Difference between a conventional CTV with LCD & LED TVs. Principle of LCD and LED TV and function of its different section. Basic principle and working of 3D TV. IPS panels and their features. Different types of interfaces like HDMI, USB, RGB etc. TV Remote Control–Types, parts and functions, IR Code transmitter and IR Code receiver. Working principle, operation of remote control. Different adjustments, general faults in remote control Projectors:- Differentiate LCD and LED projectors. Specifications of LED Projector Working principle of LED Projector. Most frequently occurring faults in a LED projector and Cameras:- Types of cameras and their specifications used in CCTV systems. CCTV setup and its components Working of Digital Video Recorders and types of DVRs	15
Unit III:-Satellite Communication and Technology(10 Hours) Basic satellite communication, Merits& Demerits of satellite communication, applications, types of satellite & its orbits, Satellite Frequency Bands. Basic components of DTH system: PDA, LNBC, Satellite receiver terminal, dish installation aspects, Azimuth & elevation settings of dish/ DTH receiver. Types of cables used in DZTH system, impedance and specification Multi-dwelling unit design, headed amplifier, line amplifier, cascaded in/out multi-switch, tap, and splitter. Set top box features, block diagram of set top box, I/O ports, Cable modem termination system, software & customer premises equipments	15
Unit IV4.Introduction to different type of domestic/commercial appliances Part I:- Washing M/c: different types of machines, washing techniques, (Block diagram) parts of manual, semiautomatic and fully automatic machines, basic working principle of manual, semi- automatic and fully automatic machines, study the working of motors, different types of timers, power supply circuits. Vacuum cleaner (Block diagram) working principle, main parts of Vacuum cleaner, study of different features of the machine, study & working of motor used, Electronic circuit, power supply. Various parts & functions of Mixer/Grinder, speed control circuit & auto overload protector. Principle of electric iron, parts of steam iron, thermostat heat controls. Working principal of RO and UV type of water purifiers, Different components of water purifier, consumables required, Most frequently occurring faults and their remedial procedures referring to the manual. Principal of Immersion heater, part of immersion heater, Insulation in Immersion heater. Working principle of Induction cook top, study of	13

different features of machine. Types of induction tubes, study of different component of induction cooktop, Fault identification, Heat sinking in induction cooktop.	
Unit V5.Introduction to different type of domestic/commercial appliances Part II:- Operation of Micro-wave oven: Different types of oven, study the various functions of Oven, Block diagram of microwave oven, Electrical wiring diagram of microwave oven, Microwave generation system-circuit, Food Processors and their parts and functions:-Printers:-Printer & its types, principle, parts, working of dot matrix , inkjet & Laser printer, Advantages, disadvantages of each, comparison between impact &non-impact printers & cables used to connect the various printers to computer. Digital Electronic Lock,Xerox Machine,Scanner, fax machine	13

BOOKS

Text Books:

1) Consumer Electronics 1 Edition (English, Paperback, Bali S. P.)
2) Consumer Electronics (English, Paperback, Gupta B R)
3) **"Consumer Electronics – A Conceptual Approach" by Dr J S CHITODE**
4) **"A Beginners Guide to Consumer Electronics Repair: Hand Book and Tutorial" by Douglas Kinney**
5) **"Consumer Electronics" by Anand**
6) **"Troubleshooting Consumer Electronics Audio Circuits" by H Davidson**

Rashtrasant Tukadoji Maharaj Nagpur University, Nagpur

Electronics and Communication / Electronics & Telecommunication Engineering /Electronics Engineering

B.Tech. 6th Semester

Course Code :BEETC605OE	**Sem. : 6th semester**	**Course: Industrial Electronics (Open Elective-I)**
Total Credits : 3	**Th.: 2 Tu.: 1 Pr.: 0**	**hours per week:- 3**

Unit 1:- Electronic and Electromechanical Sensors(15 hours)

Mechanical and Electrical Switch Classifications • Mutually and mechanically Activated Electronic Circuit Switches, Discrete Output Devices, Relays, Control Diagrams. Discrete Automation Sensors and Devices , Introduction to Electronic Sensors, Non-contact Sensors, Sensor Output Interfaces, Analog Automation Sensors, Sensor Applications and Selection, Integrating Sensors into Power and Control Circuits, Position, displacement, velocity, acceleration, force, flow, level temperature, humidity, Thermocouples, RTD, LVDT, Servo-pots, strain gauges, P, PI, PID converters, average to rms converters

Unit 2:-Smart Sensors(10 hours)

Accelerometers; Force Sensors; Load Cells; Torque Sensors; Pressure Sensors; Microphones; Impact Hammers; MEMS Sensors; Sensor Arrays. Smart Transducers: Ultrasonic Transducers; Sonic Transducers; Air Transducers

Unit 3:- Actuators(13 hours)

Smart Actuators: Displacement Actuators; Force Actuators; Power Actuators; Vibration Dampers; Shakers; Fluidic Pumps; Motors, Solenoid valves, Hydraulic systems, Pneumatic Systems, DC and AC stepper motors, Dosing equipment weigh feeders, dosing pumps, extrusion – bulk and film electronic components. Medical equipments.

Unit 4:- Analog Process Control Devices and safety (12 hours)

Process Actuators and Output Devices, Control Valves, Electrical Heating Elements, Control Sensors, Transmitters, and Transducers, Temperature Sensors, Pressure Sensors, Flow Sensors, Level Sensors, Position Sensors, Presence Sensors, Interlock Devices,

Unit 5:- Programmable Logic Controllers(PLCs) SCADA(Supervisory Control and Data Acquisition System)(15 hours)

Rotory encoders, digipots.0-10V and 4-20mA systems, used in PCLs for analog input and output signals, Automation: Transfer machines, robotics basics, Application of PLCs,Industrial heating: Arc furnace, high frequency heating, High frequency source for induction heating, dielectric heating and microwave heating, Ultrasonic- Generation and applications, Case studies of industrial applications.

Books

- S. K. Bhattacharya and S. Chatterjee, "Industrial Electronics &Control", Tata McGraw Hill, 2003.
- Terry. L. M. Bartell, "Industrial Electronics", Delmer Publishers, 1997.
- Thomas. E. Kissell, " Industrial Electronics", 2002.
- INDUSTRIAL ELECTRONICS AND CONTROL Paperback – 1 July 2017by S Bhattacharya (Author), S. Chatterjee (Author)

Rashtrasant Tukadoji Maharaj Nagpur University, Nagpur

Electronics and Communication / Electronics & Telecommunication Engineering /Electronics Engineering

B.Tech. 6th Semester

Subject: Effective technical Communication (Theory)

Course Code :BEETC606T CREDITS: 02

Teaching Scheme Examination Scheme

Lectures: 2 Hours/Week Duration of Paper: 02 Hours

Tutorial: 1 hour/week University
Assessment: 35 Marks
College Assessment: 15 Marks

Objective: At the end of the semester, students will have enough confidence to face competitive examinations(IELTES/ TOEFL/CAT/ MAT/ XAT/SNAP/GMAT/GATE etc.)to pursue masters degree. They will also acquire language skills required to write their Reviews/Projects/Reports. They will be able to organize their thoughts in English and hence face job interviews more confidently.

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

1. acquire knowledge of structure of language.
2. Build vocabulary and face interview process and can become employable.
3. develop business writing skills.
4. Understand technical and scientific writing skills.

Course Structure

Unit1.FunctionalGrammar: (6 hours**)**

Common errors, Transformation of Sentences (Change the voice, Change the narration,

transformation of Simple , Compound, Complex sentences), Use of Phrases, Idioms& Proverbs.

UnitII. English for Competitive Exams & Interview Techniques:

(6hours)

Prefix, Suffix, Word building processes, **English** words /phrases derived from other languages, Technical Jargons, Synonyms/Antonyms, Verbal Analogies, Give one word for, Types &Techniques of Interview

Unit III.Formal Correspondence and Analytical Comprehension

(6hours)

Job applications and Resume Writing, Business Letters,(Enquiry, Quotation, Orders, Complaints), Writing Memorandum, Circulars, notices, e-mail etiquettes, Unseen Comprehension passages

UnitIV. Technical &Scientific Writing:

(6hours)

Features of Technical Writing, Technical Report writing, Writing Manuals, Writing Project and research Proposals, Writing Research papers.

- **Reference Books:**
- EffectivetechnicalCommunicationbyBarunK.Mitra,OxfordUniversityPress,
- *TechnicalCommunication-PrinciplesandPractice*byMeenakshiRaman&Sharma,OxfordUniversityPress,2011, ISBN-13-978-0-19-806529-
- *HowtoPrepareaResearchProposal*:GuidelinesforFundingandDissertationsintheSocialandBehavioralSciencesbyKrathwohl&RDavid
- *TechnicalWriting-ProcessandProduct*bySharonJ.Gerson&StevenM.Gerson,3rdedition,PearsonEducation Asia, 2000
- *Developing Communication* skills by Krishna Mohan & Meera Banerjee
- *Functional English by* Dr. P. Mahato and Dr. Dora Thompson, Himalaya Publications