Rashtrasant Tukadoji Maharaj Nagpur University

Formerly Known as Nagpur University

SCHEME OF EXAMINATION FOR

B.E. SEVENTH SEMESTER (ELECTRONICS ENGINEERING)

Sub . Code	Board	SUBJECT	Work Load				Credit				Marks				
											Theory		Practical		Total Marks
			L	P	T	Total	L	P	T	Total	Internal	University	Internal	University	
BEENE701T	Electronics	DSP Processor & Architecture	4	0	1	5	4	0	1	5	20	80	0	0	100
BEENE701P	Electronics	DSP Processor & Architecture	0	2	0	2	0	1	0	1	0	0	25	25	50
BEENE702T	Electronics	Embedded system	4	0	1	5	4	0	1	5	20	80	0	0	100
BEENE702P	Electronics	Embedded system	0	2	0	2	0	1	0	1	0	0	25	25	50
BEENE703T	Electronics	Optical Communication	4	0	0	4	4	0	0	4	20	80	0	0	100
BEENE704T	Electronics	Advanced Digital System Design	4	0	1	5	4	0	1	5	20	80	0	0	100
BEENE704P	Electronics	Advanced Digital System Design	0	2	0	2	0	1	0	1	0	0	25	25	50
BEENE705T	Electronics	Elective-I	3	0	1	4	3	0	1	4	20	80	0	0	100
BEENE706P	Electronics	Project Seminar	0	2	0	2	0	2	0	2	0	0	50	0	50
Total			**19**	**8**	**4**	**31**	**19**	**5**	**4**	**28**	**100**	**400**	**125**	**75**	**700**

Elective-I – 1. Digital Image Processing 2. .Mobile Communication 3. Biomedical Instrumentation 4.Random Signal Theory

B. E. Seventh Semester

(Electronics /Electronics & Communication/ Electronics & Telecommunication Engg)

DSP PROCESSOR & ARCHITECTURE

Duration: 3 Hrs.
College Assessment: 20 Marks
University Assessment: 80 Marks

Subject Code: BEECE701T/ BEETE701T/ BEENE701T [4 – 0 – 1 – 5]

Objectives:

1. **To study Programmable DSP Processors.**
2. **To provide an understanding of the fundamentals of DSP techniques.**
3. **To study implementation & applications of DSP techniques.**
4. **To study multi-rate filters.**
5. **To understand architecture of DSP processor..**

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

1. To describe the detailed architecture, addressing mode, instruction sets of TMS320C5X
2. To write program of DSP processor.
3. To design & implement DSP algorithm using code composer studio
4. To design decimation filter and interpolation filter.

UNIT 1: FUNDAMENTALS OF PROGRAMMABLE DSPs

(10)

Multiplier and Multiplier accumulator, Modified Bus Structures and Memory access in P-DSPs, Multiple access memory , Multi-ported memory , VLIW architecture, Pipelining , Special Addressing modes in P- DSPs , On chip Peripherals, Computational accuracy in DSP processor, Von Neumann and Harvard Architecture, MAC

UNIT 2: ARCHITECTURE OF TMS320C5X

(08)

Architecture , Bus Structure & memory, CPU ,addressing modes , AL syntax.

UNIT 3: Programming TMS320C5X (10)

Assembly language Instructions , Simple ALP – Pipeline structure, Operation Block Diagram of DSP starter kit , Application Programs for processing real time signals.

UNIT 4: PROGRAMMABLE DIGITAL SIGNAL PROCESSORS:

(12)

Data Addressing modes of TMS320C54XX DSPs, Data Addressing modes of S320C54XX Processors, Program Control, On-chip peripheral, Interrupts ofTMS320C54XX processors, Pipeline Operation of TMS320C54XX Processors , Block diagrams of internal Hardware, buses , internal memory organization.

UNIT 5: ADVANCED PROCESSORS

(07)

Code Composer studio - Architecture of TMS320C6X - architecture of Motorola DSP563XX – Comparison of the features of DSP family processors.

UNIT 6: IMPLEMENTATION OF BASIC DSP ALGORITHMS:

(08)

Study of time complexity of DFT and FFT algorithm, Use of FFT for filtering long data sequence, Interpolation filter, Decimation filter, wavelet filter.

Text- Books:

1. B. Venkata Ramani and M. Bhaskar, Digital Signal Processors, Architecture, Programming and TMH, 2004.
2. Avtar Singh, S.Srinivasan DSP Implementation using DSP microprocessor with Examples from TMS32C54XX -Thamson 2004.
3. E.C.Ifeachor and B.W Jervis, Digital Signal Processing - A Practical approach, Pearson Publication
4. Salivahanan. Ganapriya, Digital signal processing, TMH , Second Edition

Reference Books:

1. DSP Processor Fundamentals, Architectures & Features – Lapsley et al. , S. Chand & Co, 2000.
2. Digital signal processing-Jonathen Stein John Wiley 2005.
3. S.K. Mitra, Digital Signal Processing, Tata McGraw-Hill Publication, 2001.
4. B. Venkataramani, M. Bhaskar, Digital Signal Processors, McGraw Hill

B. E. Seventh Semester

(Electronics /Electronics & Communication/ Electronics & Telecommunication Engg)

DSP PROCESSOR AND ARCHITECTURE

Duration: 2 Hrs.
College Assessment: 25 Marks
University Assessment: 25Marks

Subject Code: BEENE701P/ BEECE701P/ BEETE701P [0 – 2 – 0– 2]

Objectives:

1. The DSP algorithms are better implemented on DSP processors having specially tailored architectures.

2. It enables the designers to understand different processors and apply them in system design

Outcome: The students shall be able to

1. **Understand the architecture of TMS and Motorola Processors.**
2. **Implement different processing algorithms on DSP processors.**
3. **Design different types of filters and study their characteristics.**

Any Eight practicals are to be conducted

LIST OF EXPERIMENTS

1. To study architecture of *TMS320C54XX* & Motorola DSP563XX
2. To generate basic signals using *TMS320C54XX*.
3. Write an ALP using instruction of TMS processors to add two numbers.
4. Write ALP to subtract two numbers.
5. Write an ALP to multiply two numbers of unsigned 32 bit data.
6. Write an ALP to divide 16 –bit data by an eight bit data.
7. Implementation of FFT using code Composer studio.
8. To implement Interpolation filter by Matlab.
9. To implement Decimation filter by Matlab.
10. To design FIR filter using MATLAB and find finite word length effect & cross verify using DSP processor.
11. To design IIR filter using MATLAB and find finite word length effect & cross verify using DSP Processor.

B. E. Seventh Semester

(Electronics Engineering)

EMBEDDED SYSTEMS

Duration: 3 Hr.
College Assessment: 20 Marks
University Assessment: 80 Marks

Subject Code: BEENE702T **[4 – 0 – 1 – 5]**

Objectives:

1. To give sufficient background for understanding embedded systems design.
2. To give knowledge of RISC processor.
3. To understand connections of various peripherals with microcontroller based system
4. To study of embedded system design aspects.

Outcome:

By the end of the course, the students shall be able to

1. design embedded based system .

2. design embedded system based on RTOS and communication protocols.

UNIT I: EMBEDDED SYSTEM INTRODUCTION **(10)**

History, Design challenges, Optimizing design metrics, Time to market, NRE and UNIT cost design metrics, Application of embedded systems and recent trends in embedded systems.

UNIT II: EMBEDDED SYSTEM ARCHITECTURE **(10)**

Hardware and software architecture, Processor selection for Embedded System, Memory Architecture and IO devices , Interrupt Service Mechanism ,Context switching, Device Drivers.

UNIT III: ARM PROCESSOR **(10)**

Architecture and Programming: RISC and CISC, ARM organization, ARM Programmers model, operating modes, Exception Handling, Nomenclature, Core Extensions, ARM Assembly Language Programming, Introduction to ARM instruction set

UNIT IV: PROTOCOLS **(08)**

Bluetooth, IEEE 802.11 and IEEE 802.16, GPRS, MODBUS CAN, I2C and USB

UNIT V: REAL TIME OPERATING SYSTEM CONCEPTS **(10)**

Architecture of the kernel, Task scheduler, ISR, Semaphore, Mailbox, Message queues, Pipes, Events, Timers, Memory Management.

UNIT VI: CASE STUDY OF EMBEDDED SYSTEM: **(07)**

Based on Communication, Automation, Security, Automobile Fields

Text 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 .

Reference Books:

1) Dr. K.V.K.K. Prasad , “Embedded / Real Time Systems”, Dreamtech Publications
2) Iyer, Gupta , “Embedded Real systems programming”, TMH Publications.
3) Steve Heath, “Embedded System Design”, Neuwans Publications
4) Jonathan,W. Valvano, “ Embedded Microcomputer System Realtime Interfacing”, Cenage Publications, 3rd Edition.

B. E. Seventh Semester

(Electronics Engineering)

EMBEDDED SYSTEMS

Duration: 2 Hrs.
College Assessment: 25 Marks
University Assessment: 25Marks

Subject Code: BEENE702P **[0 – 2 – 0– 2]**

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 for a specific task .**

Outcome:

1. **Student will be able to understand different instruction used in programming.**
2. **Student will be able to design Effective algorithm design for specific experiment.**
3. **Student will be able to perform experiments on different peripheral devices like LCD, Seven segment, GSM, etc.**

Any EIGHT practicals are to be conducted

LIST OF EXPERIMENTS

1. To swap data byte
2. To perform addition, subtraction of 16 bit number
3. To find larger of a two numbers.
4. To perform factorial of a given number
5. To perform ON/OFF LED and show status of LED on LCD
6. To display number from 0 to 9 on seven segment display.
7. To ON/OFF LED using Switch.
8. To rotate a stepper motor in clockwise & anti-clock wise direction with equal delay.
9. To Perform experiment on DAC of LPC2103
10. To read ADC and display value on LCD.
11. To find 1's complements of a given number.
12. Study of RTOS
13. Write device driver for UART.
14. Modify scheduler in such a way that it will assign highest priority to keypad.
15. To read values from RTC and display on LCD.
16. To send SMS to any mobile number.
17. Interface pen drive for writing predefined file

(Raspberi Pi Kit may be used)

B. E. Seventh Semester

(Electronics /Electronics & Communication/ Electronics & Telecommunication Engg)

OPTICAL COMMUNICATION

Duration: 3 Hrs.
College Assessment: 20 Marks
University Assessment: 80 Marks

Subject Code: BEECE703T/ BEETE703T/ BEENE703T **[4 – 0 – 0 – 4]**

Objectives:

1.To understand optical fiber technology to sophisticated modern telecommunication systems.
2.To understand the fundamental behavior of the individual optical components, describes their interactions with other devices in an optical fiber.
3. To measure & analyze different measurements, parameters & properties of optical fiber.

Outcome:

By the end of the course, the students shall be able to

1.Learn the basic elements of optical fiber.
2.Understand the different kinds of losses, signal distortion in optical wave guides & other signal degradation factors.
3. Classify various optical source materials, LED structures, LASER diodes.
4. Learn the fiber optic receivers such as PIN, APD diodes, receiver operation & performance.
5. Uderstand the operational principal of WDM, SONET, measurement of attenuation, dispersion, refractiveindex profile in optical fibers.

UNIT I: OVERVIEW OF OPTICAL FIBER COMMUNICATION

(05)

Introduction, advantages, disadvantages and applications of optical fiber communication, Ray theory, classification of Optical Fibers

UNIT II: TRANSMISSION CHARACTERISTICS OF OPTICAL FIBERS

(10)

Fiber manufacturing & Fiber materials, manufacturing methods, Attenuation, Absorption, scattering losses, bending loss, dispersion, Intra modal dispersion, Inter modal dispersion.

UNIT III: OPTICAL SOURCES AND COUPLERS & CONNECTORS OF FIBER

(08)

Introduction, fiber alignment and joint loss, single mode fiber joints, fiber splices, fiber connectors and fiber couplers.

Optical sources: LED's, LASER diodes.

UNIT IV: OPTICAL DETECTORS AND RECEIVER

(06)

Photo detectors, Photo detector noise, Response time, comparison of photo detectors

Optical Receiver Operation, receiver sensitivity, quantum limit, coherent detection, burst mode receiver operation, Analog receivers

UNIT V: ANALOG AND DIGITAL LINKS (08)

Analog links – overview of analog links, CNR, multichannel transmission techniques, Digital links – point–to–point links, System considerations, link power budget, rise time budget, transmission distance for single mode links.

UNIT VI: WDM CONCEPTS AND COMPONENTS (08)

Operational Principles of WDM, basic applications and types of optical amplifiers, semiconductor optical amplifiers, EDFA. Measurement of Attenuation and dispersion. Study of various application of optical fiber communication.

TEXT BOOKS:

1. "Optical Fiber Communication", Gerd Keiser, 3rd Ed., McGraw Hill,
2. "Optical Fiber Communications", John M. Senior, Pearson Education. 3rd Impression, 2007.

REFERENCE BOOK:

1. Fiber Optic Communication - Joseph C Palais: 4th Edition, Pearson Education.
2. "TextBook on Optical Fiber Communication & its Application", S.C. Gupta, PHI Publications
3. "Optical Communication & Networks", M.N. Bandopadhyay, PHI Publications

B. E. Seventh Semester

(Electronics /Electronics & Communication/ Electronics & Telecommunication Engg)

Advanced Digital System Design

Duration: 3 Hrs.
College Assessment: 20 Marks
University Assessment: 80 Marks

Subject Code BEECE704T/ BEETE704T/BEENE704T [4 – 0 – 1 – 5]

Objectives:

1. To motivate the students to learn basic foundation course in VHDL.

2. To address the challenges in Hardware design by discussing the role of digital components in system design

3. To concentrate on HDL based digital design, HDL terminology, architecture and design of combinational and sequential circuit.

4. To learn about modeling of system tested with test benches & synthesis also implementation on FPGA/CPLD.

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

1. Design of combinational & sequential circuit.

2. Develop skilled VLSI front end designers

3. Implementation of digital system.

4. Experimentation on Hardware /Software co-design.

UNIT I (08)

INTRODUCTION TO DIGITAL SYSTEM DESIGN: Device technologies, System representation, Levels of abstraction, Development tasks and EDA software, Development flow, Hardware description language, VHDL in development flow, Basic VHDL concepts.

UNIT II (10)

BASIC LANGUAGE CONSTRUCTS OF VHDL: Skeleton/syntax of VHDL program, elements and program format, Objects, Data type and operators, Concurrent Signal Assignment, Combinational versus sequential circuits, Signal assignment statements, conditional signal assignment, Selected signal assignment, Conditional versus selected signal assignment statements.

UNIT III: (08)

SUBPROGRAM:

Functions, Procedures, attributes, generic, generate, package, IEEE standard logic library, file I/O, test bench, component declaration, instantiation, configuration.

UNIT IV: (10)

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: **(09)**

HDL SYNTHESIS: The Synthesis Concept, Timing Analysis of Logic Circuits, Efficient Coding Styles, Combinatorial Logic Synthesis, Partitioning for Synthesis, Pipelining Resource sharing, Optimizing arithmetic expressions. Power Analysis of FPGA based system.

UNIT VI: **(10)**

Programmable Logic Devices:-Introduction to place & route process, Architecture of CPLD (Xilinx / Altera), FPGA XILINX 4000 Series ,Overview of PLDs, CPLD, FPGA,
Design Examples: ALU, barrel shifter, 4*4 Keyboard Scanner, multiplier.

TEXT BOOKS:

1. VHDL 4rd Edition Douglas Perry –TMH
2. Fundamentals of Digital Logic with VHDL design –Stephen Brown, Zvonko Vranesic–TMH.
3. Digital Design Principles – Fletcher.
4. VHDL Synthesis –J Bhasker.
5. VHDL Primer–J Bhasker –Pearson Education.

REFERENCE BOOKS:

1. Digital System Design Using VHDL –Charles H. Roth, McGraw Hill Publications.
2. Digital System Design–John Wakerley, McGraw Hill Publications.
3. VHDL –Zainalabedin Navabbi, McGraw Hill publication
4. VHDL– D. Smith,
5. Digital Design with VHDL - Dr.S.S.Limaye, McGraw Hill Publications.

B. E. Seventh Semester

(Electronics /Electronics & Communication/ Electronics & Telecommunication Engg)

Advanced Digital System Design

Duration: 2 Hrs.
College Assessment: 25 Marks
University Assessment: 25Marks

Subject Code: BEENE704P/ BEECE704P/ BEETE704P [0 – 2 – 0– 2]

Objectives:

1. **To acquire knowledge of computer-aided design tools for design of complex digital logic circuits.**
2. **To analyze the results of logic and timing simulations and to use these simulation results to debug digital systems**

Outcome:

The student shall be able

1. **To model, simulate, verify the digital model with hardware description language.**
2. **To design and prototype with programmable logic devices**
3. **To learn the modular design style to create large digital logic circuits.**
4. **To create and simulate basic circuit modules (or macros) using VHDL.**

Any EIGHT practicals are to be conducted

LIST OF EXPERIMENTS

1) Design of basic logic gates using VHDL.
2) Design of full adder/ substractor using VHDL.
3) Design of Multiplexer/ Demultipelxer using VHDL.
4) Design of Priority encoder using VHDL.
5) Design of BCD-to-Seven segment encoder.
6) Design of n-bit up-down counter.
7) Design of n-bit shift register using VHDL.
8) Design of sequence detector using Mealy FSM.
9) Design of sequence detector using Moore FSM.
10) Design of 4-bit ALU using VHDL.
11) Design & Implementation of 4-bit barrel shifter using FPGA / CPLD.
12) Design & Implementation of 4-bit multiplier using FPGA / CPLD.
13) Design & Implementation of 4 X 4 keyboard scanner using FPGA / CPLD.
14) Design of Asynchronous sequential circuit using VHDL.
15) Design & implement Mini project on FPGA/CPLD.

All above practical needs to perform test Bench verification & Synthesis Report.

B. E. Seventh Semester

(Electronics Engineering)

Elective 1-DIGITAL IMAGE PROCESSING

Duration: 3 Hrs.
College Assessment: 20 Marks
University Assessment: 80 Marks

Subject Code: BEENE705T **[3 – 0 – 1 – 4]**

Objectives:

1. Provide the student with the fundamentals of digital image processing.
2. Introduce the students to some advanced topics in digital image processing.
3. Give the students a useful skill base that would allow them to carry out further study in the field of Image processing.

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

1. Have an appreciation of the fundamentals of Digital image processing including the topics of filtering, transforms and morphology, and image analysis and compression.
2. Implement basic image processing algorithms in MATLAB.
3. Have the skill base necessary to further explore advanced topics of Digital Image Processing.
4. Make a positive professional contribution in the field of Digital Image Processing.

Unit 1: Digital Image Fundamentals

(06)

Components of Image Processing System. , Image Sensing and Acquisition, Image Sampling & Quantization, Spatial and Gray Level Resolution, Basic Relationships between Pixels. Statistical parameters, Measures and their significance, Mean, standard deviation, variance, SNR, PSNR etc.

Unit 2: Image Enhancement

(10)

Enhancement in Spatial Domain: basic gray level transformations, histogram processing, equalization, Arithmetic and logical operations between images, Basics of spatial filtering, smoothening and sharpening spatial filters, Image Enhancement in frequency Domain: smoothening and sharpening frequency domain filters, Fundamental of color image processing: color models, RGB, CMY, YIQ, HIS, Pseudo Color Image processing: Intensity filtering, gray level to color transformation, Basics of full color image processing.

Unit 3: Image Transforms

(08)

2D-DFT, FFT, DCT, the KL Transform, Walsh/Hadamard Transform, Haar Transform, slant Transform , Basics of wavelet transform.

Unit 4: Image Coding and Compression

(08)

Image Coding Fundamentals, Image Compression Model, fundamentals- redundancy: coding, interpixel, psychovisual, fidelity criteria, Basic compression methods Error Free Compression - variable length, bit plane, LZW arithmetic Lossless Predictive, Lossy Compression- Lossy Predictive. Fundamentals of JPEG, MPEG, fractals.

Unit 5: Image Analysis **(08)**

Segmentation: Point, line, Hough Transform, Edge detection, Boundary detection and Thersholding, Region Based segmentation.

Representation & Description :Boundary representation by chain codes, signature & skeleton Boundary descriptors, shape number, Fourier descriptors ,Basics of Regional descriptor, boundary representation by chain codes and B splines, Hough Transform, Morphological Image Processing: Dilation, Erosion, Opening, Closing on Binary Images.

Unit 6: Image restoration and reconstruction

(05)

Image Degradation Mode, Noise Models, and Restoration in Presence c Noise in spatial Domain. Inverse Filtering, wiener filtering, Introduction to Image reconstruction from projections applications of Image Processing.

Text Books

1. Gonzalez and Woods, "Digital Image Processing", Pearson Education,
2. Arthur Weeks Jr., "Fundamentals of Digital Intake Processing", PHI.
3. S Jayaraman, " Digital Image Processing" , Tata McGraw Hill Publications .
4. A. K. Jain, "Fundamentals of Digital Image Processing"; Pearson Education

Reference Book

1. Pratt William, "Digital Image Processing", John Wiley & Sons
2. Milan Sonka, Vaclav Hlavac and Roger Boyle, "Image Processing, Analysis and Machine Vision", Second Edition, Thomson Learning, 2001
3. Milan Sonka, Vaclav halvac , "Image Processing analysis & Machine Vision", Cenage Learning

B. E. Seventh Semester

(Electronics Engineering)

Elective 1-MOBILE COMMUNICATION

Duration: 3 Hrs.
College Assessment: 20 Marks
University Assessment: 80 Marks

Subject Code: BEENE705T **[3 – 0 – 1 – 4]**

Objectives:

1. To understand the basic knowledge about the generation of mobile communication.
2. To familiarize with the recent trends in the field of wireless communication
3. To study and relate the different types of mobile communication system.
4. To study architecture of mobile communication.
5. To get knowledge about application's of mobile communication

Outcome:

At the end of the course, the student should be able to :

1. Have an introduction to Mobile Communication
2. Understand the Cellular Systems
3. Know the concept of Switching systems
4. Understand the concept of Base station subsystems

UNIT- I: **(06)**

The cellular concept: Evolution of mobile radio communication, Cellular telephone system, frequency reuse, channel assignment and handoff strategies, interference and system capacity, trunking and grade of service, improving capacity in cellular system.

UNIT II: **(08)**

The mobile radio environment: causes of propagation path loss, causes of fading -long term and short term, definition of sample average, statistical average, probability density function, cumulative probability distribution, level crossing rate and average duration of fade, delay spread, coherence bandwidth, inter-symbol interference.

UNIT III: **(08)**

Modulation techniques for mobile communication: BPSK, QPSK. Transmission and detection techniques, 4 -QPSK transmission and detection techniques, QAM, GMSK.

UNIT IV: **(08)**

Equalization, diversity and channel coding: fundamentals of equalization, space polarization, frequency and time diversity techniques, space diversity, polarization diversity, frequency and time diversity, fundamentals of channel coding.

UNIT V: **(08)**

Multiple access techniques: Introduction to multiple access, FDMA, TDMA, Spread spectrum multiple access, frequency hopped multiple access (FHMA), code division multiple access (CDMA), space division multiple access (SDMA).

UNIT VI: **(07)**

GSM- global system for mobile: services and features, GSM system architecture, GSM radio subsystem, GSM channel types, GSM frame structure, signal processing in GSM, introduction to CDMA digital cellular standard.

TEXT BOOKS:

1. "Wireless Communication – Principles and practice", T S. Rappaport, Prentice Hall PTR, upper saddle river, New Jersey.
2. "Mobile Communications – Design fundamentals", William C. Y. Lee, John Willey Publications

REFERNCE BOOKS:

1. "Wireless digital communication", Kamilo Feher, PHI Publications
2. "Mobile Cellular Communication", W.C.Y.Lee, Mc Graw Hill Publications
3. "The Mobile Radio Propagation channel" , J.D. Parson, Wiley Publication.

B. E. Seventh Semester

(Electronics Engineering)

Elective 1- BIOMEDICAL INSTRUMENTATION

Duration: 3 Hrs.
College Assessment: 20 Marks
University Assessment: 80 Marks

Subject Code: BEENE705T **[3 – 0 – 1 – 4]**

Objectives: The objective of this course is to provide students with the understanding of

1. **An acquaintance of the physiology of cardiovascular system, respiratory system and nervous system**
2. **Biomedical sensing and measuring devices.**
3. **Awareness of electrical safety of medical equipments.**
4. **Latest knowledge of medical assistance/ techniques and therapeutic equipments.**
5. **Importance of modern methods of imaging techniques.**

Outcome: Upon the completion of this course, students shall be able to:

1. **Understand the physiology of various systems in human body.**
2. **Understand application of electronics in Medical field.**
3. **Identify various sensing devices and their applications in medical field**
4. **Understand working of bioelectronics systems such as EEG, EEG, MRI etc. and various imagining techniques.**

Unit 1: Physiological Systems and signals **(06)**

Physiological Systems of the Body - Cardiovascular System, The Respiratory System, The Nervous System, Basic Medical Instrumentation System, Origin of Biomedical Signals, Basics and Waveforms of Bioelectric Signals like ECG, EEG and EMG.

Unit 2: Physiological Transducer **(08)**

Displacement, Position and Motion Transducers, Pressure Transducers, Transducers for body temperature measurement, photoelectric transducers, biosensors, smart sensors.

Unit 3: Biomedical Recorders **(08)**

Basic working and block diagram of biomedical recorders - Electrocardiograph, Phonocardiograph, Electroencephalograph, Electromyograph.

Unit 4: Patient Monitoring Systems **(08)**

System Concept, Cardiac Monitor, Bedside Patient Monitoring Systems, Central Monitors, Measurement of heart rate, Measurement of pulse rate, Blood pressure measurement, Measurement of respiration rate.

Unit 5: Imaging Techniques **(08)**

X Ray: Production of X Ray, X-Ray Machines.
CT-Scanning: Basic principle of X-Ray Computed Tomography, System Components of CT Scan.
MRI: Nuclear Magnetic Resonance (NMR) basic components.
Ultra Sound: Ultrasonic basic pulse-echo apparatus.

Unit 6: Patient Safety **(07)**

Electric Shock Hazards, Leakage Currents, Safety code for Electrical Equipment, Electrical Safety Analyzers, Testing of Biomedical Equipments.

Text Books:

1. Khandpur R. S., "Handbook of Biomedical Instrumentation", Tata McGraw Hill, second edition, 2003
2. Carr and Brown, "Introduction to biomedical equipment technology", fourth edition, Pearson press, 2003
3. Sujata V. Bhat, "Biomaterials", Narosa Publishing House, 2002.
4. W.R.Hendee & E.R.Ritenour, "Medical Imaging Physics" , 3rd edition, Mosbey Year-Book, inc 1992.

Reference Books:

1. John G. Webster, Bioinstrumentation John Wiley and sons,2004
2. Joseph Bronzino (Editor-in-Chief), Handbook of Biomedical Engineering, CRC Press, 1995.
3. Neelina Malsch , Biomedical nanotechnology by CRC press release, Malsch echnoValuation, Utrecht, The Netherlands
4. L.A.Geddes and L.E.Baker,"Principles of Applied Bio-Medical Instrumentation" John Wiley & Sons 1975.
5. Khandpur R S, Handbook of Analytical Instrumentation, Tata Mc Graw Hill
6. Harold E. Smalley, "Hospital Management Engineering – A guide to the improvement of hospital management system", PHI. C. A. Caceras ,"Clinical Engineering"Inc., 1992
7. Shakti Chatterjee, "Biomedical Instrumentation System", Cenage Learnin

B. E. Seventh Semester

(Electronics Engineering) Elective 1- RANDOM SIGNAL THEORY

Duration: 3 Hr. **College Assessment: 20 Marks**

University Assessment: 80 Marks

Subject Code: BEENE705T **[3 – 0 – 1 – 4]**

Objectives:

1. **To Learn the Random Variables and Random Processes**
2. **To Design the systems which involves randomness using mathematical analysis and computer simulations.**

Outcome:

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

1. **Apply theory of probability in identifying and solving relevant problems.**
2. **Define and differentiate random variables and vector through the use of cumulative distribution function (CDF), probability density function (PDF), probability mass function (PMF) as well as joint, marginal and conditional CDF, PDF and PMF.**
3. **Show probability and expectation computations using important discrete and continuous random variable types.**
4. **Define and specify random processes and determine whether a given process is stationary or wide sense stationary.**

Unit I: **RANDOM VARIABLES** **(08)**

Introduction : Random input signals, , random experiments and events.

Random Variables : Concept of random variable, distribution functions, density functions, mean values and moments, density functions related to Gaussian-Rayleigh distribution, Maxwell distribution, Chi-square distribution, normal distribution, uniform distribution, exponential distribution, Conditional probability distribution and density functions.

Unit II: **(09)**

Several random variables : Two random variables, joint conditional probability, statistical independence, correlation between random variables, density function of sum of two random variables, probability density function of two random variables, the characteristic function.

Elements of statistics: curve fitting and linear regression, correlation between two sets of data.

Unit III: RANDOM PROCESSES **(08)**

Random Processes : Continuous and discrete, deterministic and non-deterministic, stationary and non-stationary, ergodic and non-ergodic.

Correlation functions: Introduction, autocorrelation function of a binary process, properties of auto correlation functions, examples of auto-correlation functions, cross-correlation functions,

properties of cross correlation functions, examples and applications of cross-correlation functions.

Unit IV: SPECTAL DENSITY (08)

Introduction, relation of spectral density to the fourier transform, properties of spectral density, mean square values from spectral density, relation of spectral density to the auto-correlation function, White noise, Cross spectral density, examples and applications of spectral density.

Unit V: RESPONSE OF LINEAR SYSTEMS TO RANDOM INPUT (06)

Analysis in the time domain, mean and mean square value of system output auto-correlation function of system output, cross-correlation between input and output, spectral density at the system output.

Unit VI: OPTIMUM LINEAR SYSTEMS (06)

Criteria of optimality, restrictions on the optimum system, optimization by parameter adjustment systems that maximizes signal to noise ratio, systems that minimize mean square error.

Text Books:

1. G.R. Cooper and C.D. Mcgillem : Probabilistic Methods of Signal and System Analysis, Third Ed, Oxford University Press.
2. M. Lefebvre: Applied Probability and Statistics, Springer, McMillan India Ltd.
3. A. Papoulis, S.U. Pillai : Probability, Random Variable and Stochastic Process , TMH.
4. Peyton J. Peebles (Jr), “Problems and Solutions in Probability, Random Variables and Random Signal Principles”, McGraw Hill Publications.
5. P Ramesh Babu, “Probability Theory and Random Processes”, McGraw Hill Publications