Rayat Shikshan Sanstha's

Sadguru Gadage Maharaj College, Karad. (Autonomous)

Department of Electronics

Syllabus for Bachelor of Science (Electronics)

B. Sc. III (Electronics)

1. STRUCTURE OF COURSE:

FIFTH SEMESTER

Sr. No.	SUBJECT TITLE	Theory			Practical		
		PAPER NO & Paper Code	No. of lectures per week	Credits		No. of lectures Per week	Credits
1	Electronics	Paper-IX:BET22-501	12	8	Practical Paper – V & VI (BEP508& BEP509)	20	8
		Paper-X: BET22-502					
		Paper-XI: BET22-503					
		Paper-XII: BET50X (Elective: BET22-504/505/506)					
		AECC: BET: English	03	02	00	00	00

1. Structure and Title of Papers of B. Sc. Course:
   - **B. Sc. III Semester V**

Paper IX: BET22-501: Power Electronics Devices and Applications

Paper X: BET22-502: Linear Integrated Circuit

Paper XI: BET22-503: 8051 microcontroller Interfacing and Application

Paper XII: BET22-50X: Elective

Elective: BET50X

1. **BET22-504**: Optoelectronics and IOT
2. **BET22-505**: Mechatronics
3. **BET22-506**: Nanoelectronics

AECC: BET: English

3. SIXTH SEMESTER

Sr. No.	SUBJECT TITLE	Theory			Practical		
		PAPER NO & Paper Code	No. of lectures per week	Credits		No. of lectures Per week	Credits
1	Electronics	Paper-XIII:BET22-601	12	8	Practical Paper – VII & VIII (BEP 608& BEP 609)	20	8
		Paper-XIV: BET22-602					
		Paper-XV: BET22-603					
		Paper-XVI: BET60X (Elective: BET604/605/606)					
		AECC: BET: English	03	02	00	00	00

4. Structure and Title of Papers of B. Sc. Course:

Paper XIII: BET22-601: Electronic Instrumentation

Paper XIV: BET22-602: Antennas and Wave Propagation

Paper XV: BET22-603: Advanced Microcontroller: PIC

Paper XVI: BET22-60X: Elective

Elective: BET60X

1. **BET22-604**: Industrial Process control and PLC Programming
2. **BET22-605**: Digital Signal Processing and Artificial Intelligence
3. **BET22-606**: Robotics

AECC: BET: English

BET/Pxyz:

B: B.Sc.
E: ElectronicsT: Theory
P: Practical
x: Semester I to VIyz: 01 to 10

Syllabus
B.Sc. III
(Electronics)

Implemented from

2024-25

Rayat Shikshan Sanstha's

Sadguru Gadage Maharaj College Karad (Autonomous)

Syllabus Introduced from June, 2024

B.Sc. Part III: **Electronics**

Semester V

Paper IX: BET22-501: Power Electronics Devices and Applications

- **Learning Objectives:**
  1. To learn about Power Electronic Devices and their characteristics
  2. To study simple Power circuits and their performance parameters
  3. To learn different control techniques and applications of Power Circuits as case studies
  4. To understand Safety Measures, Protections and Measurements

Unit I: Power Devices **15**

Introduction: Need for semiconductor power devices, Power diode, Enhancement of reverse blocking capacity, Introduction to family of thyristors.

Silicon Controlled Rectifier (SCR): structure, I-V characteristics, Turn-On and Turn-Offcharacteristics, ratings, Factors affecting the characteristics/ratings of SCR,

Diac and Triac: Basic structure, working and V-I characteristics, application of a Diac as a triggering device for a Triac, Triac as a switch.

Insulated Gate Bipolar Transistors (IGBT): Basic structure, I-V Characteristics, switching characteristics, device limitations and safe operating area (SOA) etc.

Power MOSFETs: operation modes, switching characteristics, power BJT, second breakdown, saturation and quasi-saturation state.

Unit II: Controlled Rectifier 09

Gate-triggering circuits, Control circuits design and Protection circuits (Snubber circuit).

Application of SCR: SCR as a static switch, phase controlled rectification, single phase half wave, full wave and bridge rectifiers with inductive & non-inductive loads; AC voltage control using SCR with inductive and non-inductive load.

Unit III: Power Inverters and Choppers 11

Power Inverters: Need for commutating circuits and their various types, Invertors: Parallel capacitor commutated invertors with and without reactive feedback and its analysis, Series Invertor,limitations and its improved versions, bridge invertors.

Choppers: Basic chopper circuit, types of choppers(Type A-D), step-down chopper, step-up chopper, operation of DC chopper circuits using self-commutation (A & B-type commutating circuit), cathode pulse turn-off chopper(using class D commutation), load sensitive cathode pulse turn-off chopper (Jones Chopper), Morgan's chopper, Smart Grid.

Unit IV: Electromechanical Machines **10**

DC Motors, Basic understanding of field and armature, Principle of operation, EMF equation, Back EMF, Factors controlling motor speed, Thyristor based speed control of dc motors.

AC motor (Induction Motor only), Rotor and stator, torque & speed of induction motor, Thyristor control of ac motors(block diagrams only).

BLDC motor, Introduction to e-vehicle, renewable energy.

- **Learning Outcomes:**

1. Build and test circuits using power devices such as SCR, IGBT and MOSFET.
2. Analyze and design controlled rectifier, DC to DC converters, DC to AC inverters.
3. Able to design regulated power supplies.
4. Able to understand working Principle of DC and AC Motors.

- Reference Books:

1. Power Electronics, P.C. Sen, TMH
2. Power Electronics & Controls, S.K. Dutta
3. Power Electronics, M.D. Singh & K.B. Khanchandani, TMH
4. Power Electronics Circuits, Devices and Applications, 3rd Edition, M.H. Rashid.
5. Power Electronics, Applications and Design, Ned Mohan, Tore.
6. Power Electronics, K. HariBabu, Scitech Publication.
7. Power Electronics, M.S. JamilAsghar, PHI.

Semester V

Paper X: BET22-502: Linear Integrated Circuits

- **Learning Objectives:**
  1. To learn operational amplifier and their parameters, applications.
  2. To learn Signal conditioning circuits.
  3. To study applications of Operational amplifier
  4. To study operation of phase lock loop and their applications.

Unit I: Op-Amp as Analog System Building Blocks **12**

Open and closed loop configuration, Frequency response of an op-amp in open loop and closed loop configurations, Concept of Virtual Ground.Inverting, Non-inverting, Summing and difference amplifier, Bridge amplifier,DC differential amplifier, Voltage to current converter, Current to voltage converter. Sample and hold Circuits, Integrator, Differentiator, Log and antilog amplifiers.

Unit II: Non-Linear Analog Systems **12**

Comparators: Basic comparator, Level detector, Voltage limiters, Schmitt Trigger, Zero Crossing Detector.

Signal generators: Phase shift oscillator, Wein bridge oscillator, Square wave generator, triangle wave generator, saw tooth wave generator.

Unit III: Filters **11**

Active filters: Advantages of active filters over passive filters, Study and design low pass, high pass, band pass and band stop and all pass filters.(up to second order),Butterworth filter,Chebyshev filters(low pass).

Unit IV: Phase Locked Loop(PLL) **10**

Functional block diagram– Phase detector/Comparator, Voltage Controlled Oscillator, Low pass filter, Applications: Frequency multiplier/ Division, AM detection, IC565.

- **Learning Outcomes:**
  1. Able to design and develop various analog Op-Amp circuits.
  2. Able to design OP-Amp filters of various orders.
  3. Avail the skill of design and development of PLL system
  4. Able to design Operational amplifier Circuits.

- **Reference Books:**

1. Op-Amps and Linear IC's, R. A. Gaikwad, Pearson Education (2003)
2. Operational amplifiers and Linear Integrated circuits, R. F. Coughlin and F. F. Driscoll, PearsonEducation (2001)
3. Integrated Electronics, J. Millman and C.C. Halkias, Tata McGraw-Hill,(2001)
4. Electronic Principals, A. P. Malvino, 6th Edition , Tata McGraw-Hill,(2003)
5. OP-AMP and Linear Integrated Circuits, K. L. Kishore, Pearson(2011)

Semester V

Paper XI: BET22-503: 8051 microcontroller Interfacing and Application

- **Learning Objectives:**

1. To study basics of C programming
2. To study 8051 C programming
3. To learn the advanced architectures for advanced Embedded systems
4. Student should perform I/O port, timer, counter and interrupt operations

Unit I: Serial communication in 8051 **12**

Serial Port : Serial port of 8051, RS-232 standard and IC MAX–232, Concept of Baudrate, Baud rate in 8051, Baud rate doubling using crystal frequency and PCON,SBUF,SCON registers, various modes of serial port, Importance of TI and RI flags, programming for data transmission and reception in mode–1 in ALP External Hardware Interrupts Programming and Setting Priority.

Unit II:Programming of 8051 in C **12**

Advantages and disadvantages of Program in 8051-C & Assembly Language. Data types and time delay in 8051-C,I/O programming in 8051-C,Accessing SFR addresses in 8051- C, Logical operation in 8051 C. Data conversion programs in 8051 C. Accessing code ROM space in 8051 C, programming for Time delay generation(using timer), external interrupts (Level and edge triggering) and transmits, receive data serially

Unit III :Real World Interfacing of 8051 **10**

Interfacing LED, LCD, Switch, Relay, 4X4 matrix keyboard, opto-coupler, thumb wheel switch and seven segment display, seven segment (multiplexing mode), Stepper Motor, DAC0808 and ADC0804,RTC,Speed Control of DC motor by PWM technique.

Unit IV: Applications of 8051 **11**

Case study's: i) Temperature measurement using LM35, ADC0804, LCD. ii) Water level controller iii) Traffic Light controller iv) speed measurement of motor v) Gate Emulator (Logic Gate study using microcontroller) (Use ALP/C during programming)

- **Learning Outcome:**

1.Avail the skill of write code using embedded C

2.Able to write code for 8051 using C programming

3.Design and test advanced Embedded systems using 8051 microcontrollers

4.Able to perform interfacings of various real world devices

- **Reference Books:**

1.The 8051 Microcontroller -K. J. Ayala, (Penram International)

2.The 8051 Microcontroller and Embedded Systems, M. A. Mazadi,J. G. Mazadi, Pearson Education,Asia

3.Programming and customizing the 8051 Microcontroller - MYKE Predko(TMH, NewDelhi)

4.C and the 8051: Programming and Multitasking, Schultz, P T R Prentice-Hall, Inc. Embedded C,Michael J. Pont

Semester V
Elective
BET22-504: Optoelectronics and IOT

- **Learning Objectives:**

1. To avail the knowledge of Light behavior in glass medium.
2. To study the basic principles of optical fiber communication
3. To study and Implementing IOT concepts with python
4. To Design and Development IOT system for various applications.

Unit I: Optical Communication **12**

Principle of optical communication, total internal reflection, optical fiber modes and configuration, step index & graded index fiber, single mode fiber, fiber materials, fiber fabrication, basic structure of optical fiber. Overview of optical fiber communication system, transmission link, fiber optic transmitter and receiver, advantages and applications of optical fiber communication.

Signal degradation in optical fiber, attenuation, intrinsic & extrinsic absorption losses, scattering losses, bending losses and joint loss linear & nonlinear scattering losses, distortion in optical wave guide, fiber to fiber joints, fiber splicing technique, fiber connectors.

Unit II: Photonic Devices **10**

Optical Sources: LASER, Basic concepts of laser, Optical emission from semiconductors, Semiconductor injection laser (ILD), Injection laser characteristics. LED: power and efficiency, LED structures, LED characteristics.

Optical detectors: p-n photodiodes, p-i-n photodiodes, Avalanche photodiodes, Phototransistor.

Optical receiver: Receiver operation, digital receiver performance and noise.

Unit III: Introduction to IOT **12**

Basics of internet of things (IOT): Introduction to Internet of Things, Physical Design of IOT,Logical Design of IOT, IOT Levels.**IOT Enabling Technologies:** Wireless sensor networks**,** Cloud Computing, Big dataAnalytics, Communication Protocols.

Domain Specific IOTs: Home Automation, Cities, Environment, Energy, Retail, Logistics, Agriculture, Industry, Health & Life Style.

Unit IV: Developing IOTs **11**

Developing Internet of Things & Logical Design using Python: Introduction, IOT Design Methodology, Installing Python, Python Data Types & Data Structures, Control Flow, Functions, Modules,Packages, File Handling, Date/ Time Operations, Classes, Python Packages.

IOT Physical Devices: What is an IOT Device, Exemplary Device, Board, Linux on Raspberry Pi, Arduino, Node MCU, Interfaces, and Programming & IOT Devices.

- **Learning Outcomes:**
    1. Able to design, fabrication and characterization of photonic materials & evaluate their interactionwith light.
    2. Able to differential the behavior of light in different mediums
    3. Design IOT applications in different domain and be able to analyze their performance
    4. Implement basic IOT applications on embedded platform
- **Reference Books:**
    1. Optics, Ajoy Ghatak, Tata McGraw Hill, New Delhi (2005)

2. Vijay Madisetti, Arshdeep Bahga, “Internet of Things: A Hands-On Approach”
3. Optics, E. Hecht, Pearson Education Ltd. (2002)
4. Optoelectronics: An Introduction, J. Wilson and J. F. B. Hawkes, Prentice Hall India(1996)
5. Optoelectronics and Photonics: Principles and Practices, S. O. Kasap, Pearson Education (2009)
6. Introduction to fiber optics, Ghatak A. K. and Thyagarajan K., Cambridge Univ. Press. (1998)
7. Optical Fiber Communication – G. Keiser – MGH
8. Fundamentals of Optics – Jenkins & White – MGH
9. Optical Fiber Communication – J.M. Senior - PHI
10. Optical Communication – Gagliardi& Karp – Wiley
11. Semiconductor Optoelectronics Devices-Bhattacharya &Pallab - Pearson Education.
12. Optoelectronics an Introduction to Materials and Devices - Singh, &Jasprit - McGraw-Hill
13. Fiber Optics & Optoelectronics - Khare, R.P. - Oxford Univ. Press
14. Text Book of Optical Fiber Communication & Its Applications- Gupta & S.C. Pren
15. Waltenegus Dargie,Christian Poellabauer, "Fundamentals of Wireless Sensor Networks: Theory andPractice

Semester V
Elective
BET22-505: Mechatronics

- Learning Objectives:
  1. To avail the knowledge of Mechatronics
  2. To study the basic principles of Mechatronics
  3. To study and Implementing Signal Conditioning in System
  4. To Design and Development Mechatronics system for various applications.

Unit I : Introduction to Mechatronics **12**
Introducing Mechatronics, Sensors and Transducers, Signal Conditioning, Digital Signals, Digital Logic

Unit II :Actuation Systems **11**
Pneumatic and Hydraulic Actuation Systems, Mechanical Actuation Systems, Electrical Actuation Systems

Unit III :Properties of Models **12**
Basic System Model, System Models, Dynamic Responses of System, System Transfer Functions, Frequency Response

Unit IV :Application of Mechatronics **10**
Closed-loop Controllers, Input/Output Systems, Communication Systems, Fault Finding, Mechatronic Systems

- **Learning Outcomes:**

1. Able to design, fabrication of Mechatronics based systems.
2. Able to design Hydraulic Actuation Systems
3. Design Fault Finding, Mechatronic Systems
4. Implement basic Mechatronicsapplications.

Reference Books

1. William. Bolton, Mechatronics, fourth Edition, New Delhi : Pearson Education in South Asia, 2011

2. Principles, Concepts and Applications – Mechatronics" by Nitaigour and Premchand Mahilik
3. Introduction to Mechatronics and Measurement Systems" by David G Alciatore and MichelBiHistand
4. Introduction to Mechatronics (Oxford Higher Education)" by Dr K K Appukuttan
5. Mechatronics : Principles, Concepts and Applications" by W Bolton

Semester V
Elective

BET22-506: Nanoelectronics

- **Learning Objectives:**

1.To present the state of the art in the areas of semiconductor device physics and materials technologyto enable the Nanoelectronics.
2.To make aware various growth techniques of nanomaterial's
3.To study the measuring properties and characterizationtechniques for nanomaterial's
4.To study fabrication of nanomaterial with different structured nanomaterials

Unit I:Introduction of Nanoelectronics 12

Introduction: Definition of Nano-Science and Nano Technology, Applications of Nano-Technology. Introduction to Physics of Solid State: Size dependence of properties, bonding in atoms andgiant molecular solids, Electronic conduction, Systems confined to one, two or three dimension and their effect on property Quantum Theory for Nano Science: Time dependent and time independent Schrodinger wave equations. Particle in a box, Potential step: Reflection and tunneling (Quantum leak). Penetration of Barrier, Electron trapped in 2D plane (Nano sheet), Quantum confinement effect in nanomaterials. Quantum Wells, Wires and Dots: Preparation of Quantum Nanostructure; Size and Dimensionality effect, Fermi gas; Potential wells; Partial confinement; Excitons; Single electron Tunneling, Infrared detectors; Quantum dot laser Superconductivity

Unit II:Growth Techniques of Nanomaterials 12

Synthetic aspects: bottom up and top down approaches, Lithograpahic and Nonlithograpahic techniques, Sputtering and film deposition in glow discharge, DC sputtering technique (p-CuAlO2 deposition). Thermal evaporation technique, E-beam evaporation, Chemical Vapour deposition(CVD), Synthesis of carbon nano-fibres and multi-walled carbon nanotubes, Pulsed Laser Deposition, Molecular beam Epitaxy, Sol-Gel Technique (No chemistry required), Synthesis of nanowires/rods, Electro deposition, Chemical bath deposition, Ion beam deposition system, Vapor-Liquid –Solid (VLS) method of nanowire

Unit III :Methods of Measuring Properties and Characterization techniques 11

Microscopy: Scanning Probe Microscopy (SPM), Atomic Force Microscopy (AFM), Field Ion Microscopy, Scanning Electron Microscopy (SEM), Transmission Electron Microscopy (TEM) including energy dispersive X-ray (EDX) analysis, low energy electron diffraction (LEED), reflection high energy electron diffraction (RHEED)

Spectroscopy: Infra-red and Raman Spectroscopy, X-ray Spectroscopy, Magnetic resonance, Optical and Vibrational Spectroscopy Characterization and application like biopolymer tagging and light emitting semiconductor quantum dots

Unit IV:Carbon nanotubes, nano cuboids, graphene, carbon quantum dots 10

Fabrication, structure.electrical, mechanical, and vibrational properties and applications. Use of nano particles for biological application, drug delivery and bio-imaging, Impact of nanotechnology on the environment.

- **Learning Outcomes:**

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

1. Elaborate the fundamentals of classical CMOS technology and the issue in scaling MOSFET.
2. Elucidated the need for non-classical transistors with new device structure and nano materials
3. The issues in realizing Germanium and compound semiconductor MOSFET will be presented.
4. Fabricate nanoparticles with various size and shape for biomedical applications

- **Reference Books:**

1. Antenna and Wave Propagation, Yadava, PHI Learning. Nanoscale Science and Technology,Robert W. Kelsall, Ian W. Hamley and Mark

   Geoghegan, John Wiley & Sons, Ltd., UK, 2005.
2. Nanomaterials: synthesis, properties and applications, Institute of Physics, 1998.
3. Introduction to Nanotechnology, Charles P. Poole Jr and Frank J. Owens, WileyInterscience, 2003.
4. Electron Microscopy and analysis, 2nd ed. Taylor and Francis, 2000.
5. Bio-Inspired Nanomaterials and Nanotechnology, Edited by Yong Zhou, NovaPublishers.
6. Quantum dot heterostructures, Wiley, 1999.
7. Modern magnetic materials: principles and applications, John Wiley & Sons, 2000.
8. Nano: The Essentials: Understanding Nanoscience and Nanotechnology, T. Pradeep, Tata McGraw-Hill Publishing Company Limited, New Delhi, 2008.
9. NanobIOTechnology, concepts, applications and perspectives, Wiley-VCH, 2004.

Semester V

Numerical Skills

SECCET22-507: Mathematical Methods and Circuit Analysis using MATLAB

- **Learning Objectives:**

1. To learn features of MATLAB as a programming tool.
2. To promote new teaching model that will help to develop programming skills andtechnique to solve mathematical problems.
3. To understand Laplace Transform and Fourier series and its applications.
4. To use MATLAB as a simulation tool.

Unit I: Fundamentals of MATLAB 05

Introduction, starting and ending a MATLAB session, MATLAB environment, Help feature, types of MATLAB files, MATLAB commands, MATLAB toolboxes, advantages of MATLAB, disadvantages of MATLAB, Introduction to top -down design Techniques, MATLAB editor, MATLAB programming- creating M-files, types of M-files, function subprograms, types of functions, function Handles, errors and warnings, MATLAB Debugger.

UNIT II: Simulink Basics 05

Introduction, starting Simulink, Simulink modeling- Collecting blocks to create a model, modifying block parameters, labeling blocks, connecting blocks, labeling signal lines, saving the model, solvers, simulating a model, using variable from MATLAB, data import/export, state space modeling & simulation, simulation ofnon-linear systems.

Unit III: Fourier Series and Laplace Transform and its applications 05

Definition, Evaluation of Fourier Coefficient, Fourier series for square wave, triangular, sawtooth wave,half wave & full wave rectifiers. MATLAB exercise: To evaluate Fourier coefficients for given waveform function, Definition, Laplace transform of simple functions, properties of L.T. (Linearity, shifting, change ofscale), Inverse L.T., Partial fraction technique to find inverse L.T.functionApplications. Series RC circuit, RL circuit, RLC circuit for dc input.MATLAB Exercises: 1.To find Laplace Transform and Inverse LT of any given function.2.Transient analysis of RC / RL/RLC (series) circuit

Unit-4. Mathematical Applications 05

Curve fitting(Straight line, Exponential) and its application to Diode characteristics, Ohm's Law, RC Filter.MATLAB Exercises: Real root of algebraic equation

- **Outcomes:**
  1. Develop MATLAB applications in different domain and be able to analyze their performance
  2. Implement basic MATLAB applications on simulation platform
- **Reference books:**

1.MATLAB and Its applications in Engineering- Bansal, Goel, Sharma- Pearson.
2.Getting Started with MATLAB –RudraPratap- Oxford University Press
3.MATLAB Programming for Engineers- Chapman-Cengage Learning
4.Programming in MATLAB- Herniter- Cengage Learning
5.Stephen J. Chapman MATLAB Programming For Engineers. Thomas Learning

3. SIXTH SEMESTER

Structure and Title of Papers of B. Sc.Course:

Sr. No.	SUBJECT TITLE	Theory			Practical		
		PAPER NO & Paper Code	No. of lectures per week	Credits		No. of lectures Per week	Credits
1	Electronics	Paper-XIII:BET22-601 Paper-XIV: BET22-602 Paper-XV: BET22-603 Paper-XVI: BET22-60X (Elective:BET22-604/605/6 06)	12	8	Practical Paper – VII & VIII (BEP 608 & BEP 609)	20	8

Paper XIII: BET22-601: Electronic Instrumentation

Paper XIV: BET22-602: Antennas and Wave Propagation

Paper XV: BET22-603: Advanced Microcontroller: PIC

Paper XVI: BET22-60X: Elective

Elective: BET60X

4. **BET22-604**: Digital Signal Processing and Artificial Intelligence
5. **BET22-605**: Industrial Process control and PLC Programming
6. **BET22-606**: Robotics

Semester VI

Paper XIII: BET22-601: Electronics Instrumentation

- **Learning Objectives:**

1. To learn the principles of a sensor and transducer
2. To give exposure to the modern instruments and tools
3. To learn the principles of Various Biomedical Instruments, construction & working
4. To give exposure to the modern biomedical instruments and tools

Unit I: Measurements **12**

Specifications of instruments, their static and dynamic characteristics, Accuracy and precision, Error (Gross error, systematic error, absolute error and relative error) and uncertainty analysis.Statistical analysis of data and curve fitting.

Basic Measurement Instruments: PMMC instrument, galvanometer, DC measurement - ammeter, voltmeter, ohm meter, AC measurement, Digital voltmeter systems (integrating and non-integrating types), digital multimeters, digital frequency meter system (different modes and universal counter).
Connectors and Probes: low capacitance probes, high voltage probes, current probes, identifying electronic connectors – audio and video, RF/Coaxial, RS 232, GPIB, USB etc.

Unit II: Measurement of Resistance and Impedance **12**

Low Resistance: Kelvin's double bridge method, Medium Resistance by Voltmeter Ammeter method, Wheatstone bridge method, High Resistance by Megger, A.C.bridges, Measurement of Self Inductance, Maxwell's bridge, Hay's bridge, and Anderson's bridge, Measurement of Capacitance, Schering's bridge, DeSauty's bridge, Measurement of frequency, Wien's bridge.
Data acquisition systems: Block diagram, brief description of preamplifier, signal Conditioner

Unit III: Oscilloscopes **11**

CRT, waveform,display and electrostatic focusing, time base and sweep synchronization, measurement of voltage, frequency and phase by CRO, Dual trace oscilloscope, Sampling Oscilloscope, DSO and Powerscope: Block diagram, principle and working, Advantages and applications, CRO specifications (bandwidth, sensitivity, rise time).
Signal Generators: Audio oscillator, Pulse Generator, Function generators.

Unit IV: Transducers and sensors **10**

Classification of transducers, Basic requirement/characteristics of transducers, active & passive transducers, Resistive (Potentiometer, Strain gauge – Theory, types, temperature compensation and applications), Capacitive (Variable Area Type – Variable Air Gap type – Variable Permittivity type), Inductive (LVDT) and piezoelectric transducers. Transducers for Measurement of displacement, velocity and acceleration (translational and rotational). Transducers for Measurement of pressure (manometers, diaphragm, bellows), Measurement of temperature (RTD, thermistor, thermocouple, semiconductor IC sensors), Light transducers (photoresistors, photovoltaic cells, photodiodes).
Bio-medical instrumentation: Bio-Amplifiers: Bio potentials -Bio-electricity - Necessity for special types of amplifiers for biological signal amplifications - Different types of Bio-OP - Amps. Electrodes for ECG, EEG, and EMG, block diagram of ECG and EEG systems, brief analysis of graphs. Green Electronics (E-waste awareness and management)

- **Learning Outcomes:**

1. Students will become versatile with basic principles of measurement techniques.
2. Students will get knowledge of various instruments and extend their analytical abilities withexposure to learn and use modern instruments and tools.
3. Students will get detail knowledge of various biomedical instruments Electrodes, other tools and canhandle it properly

- **Reference Books:**

1. Electronic Instrumentaion, H. S. Kalsi, TMH(2006)
2. Electronic Instrumentation and Measurement Techniques, W. D. Cooper and A. D. Helfrick,Prentice- Hall (2005).
3. Instrumentation Measurement and analysis: Nakra B C, Chaudry K, TMH
4. E.O.Doebelin, Measurement Systems: Application and Design, McGraw Hill Book - fifthEdition(2003).
5. Elements of Electronic Instrumentation and Measurement, Joseph J Carr, Pearson Education (2005)
6. Electronic Instrumentation and Measurements,David A. Bell, Prentice Hall (2013).
7. Electronic Measurements and Instrumentation, Oliver and Cage, TMH (2009).
8. Measurement and Instrumentation Principles, Alan S. Morris, Elsevier (Buterworth Heinmann-2008).
9. Electrical and Electronics Measurements and Instrumentation, A. K Sawhney, DhanpatRai andSons(2007).
10. Instrumentation Devices and Systems, C. S. Rangan, G. R. Sarma and V. S. Mani, TataMcgrawHill(1998).
11. Electrical Measurement in Measuring Instruments, Goldwing E.W. and Widdies
12. Handbook of biomedical instrumentation: Khandpur R S, TMH
13. Measurement systems applications and design: Doeblin E O, McGraw Hill, 1990.

Semester VI

Paper XIV: BET22-602: Antennas and Wave Propagation

- **Learning Objectives:**

1. To analyze and understand the Uniform plane wave propagation in various media
2. To solve the electric field and magnetic fields for a given wire antenna.
3. To study electromagnetic radio signal
4. To Study different mode of Radio waves Propagation.

Unit I: Antenna Basics **12**

Antenna Parameters: Introduction, Radiation Mechanism, Antenna Parameters-Radiation Patterns, Main Lobe and Side Lobes, Beam widths, Beam Area, Radiation Intensity, Beam Efficiency, Directivity, Gain, Impedance, Antenna Apertures, Aperture Efficiency, Effective Height.

Unit II: Antenna as a Transmitter/Receiver **12**

Power delivered to antenna, Input impedance. Radiation from an infinitesimal small current element, Radiation from an elementary dipole (Hertzian dipole), Reactive, Induction and Radiation fields, Power density and radiation resistance for small current element and half wave dipole antenna.

Unit III: Radiating wire Structures (Qualitative idea only**)** **09**

Monopole, Dipole, Folded dipole, Loop antenna and Biconical broadband Antenna. Basics of Patch Antenna and its design. Examples of Patch antenna like bowtie, sectoral, fractal. Concept of smart antenna.

Unit IV: Propagation of Radio Waves **12**

Different modes of propagation: Ground waves, Space waves, Space Wave propagation over flat and curved earth, Optical and Radio Horizons, Surface Waves and Troposphere waves, Ionosphere, Wave propagation in the Ionosphere. Critical Frequency, Maximum usable frequency (MUF), Skips distance. Virtual height, Radio noise of terrestrial and extraterrestrial origin. Elementary idea of propagation of waves used in Terrestrial mobile communications.

- **Learning Outcomes:**
  1. Formulate the wave equation and solve it for uniform plane wave
  2. Analyze the given wire antenna and its radiation characteristics
  3. Identify the suitable antenna for a given communication system
  4. Avail the knowledge of Electromagnetic signals
- **Reference Books:**

  1. Principles of Electromagnetics, M. N. O. Sadiku, Oxford University Press (2001)
  2. Fundamentals of Electromagnetics with MATLAB,Karl E. Longren, Sava V. Savov, Randy J. Jost.,PHI
  3. Engineering Electromagnetics, W. H. Hayt and J.A. Buck, Tata McGraw Hill (2006)
  4. Field and Wave Electromagnetics, D. C. Cheng, Pearson Education (2001)
  5. Electromagnetics, J. A. Edminster, Schaum Series, Tata McGraw Hill (2006)
  6. Elements of Engineering Electromagnetics, N. Narayan Rao, Pearson Education (2006)
  7. Antennas and Propagation, G. S. N. Raju, Pearson Education (2001)
  8. Antenna Theory, Ballanis, John Wiley & Sons, (2003) 2nd Ed.

Semester VI

Paper XV: BET22-603: Advanced Microcontroller: PIC

- **Learning Objectives:**
  1. To perform I/O port, timer, counter and interrupt operations
  2. To learn the advanced architectures for advanced Embedded systems
  3. To learn design and development of Electronics systems using PIC
  4. To make able to use Embedded system to solve daily life problems

Unit I: Introduction to Embedded Systems **12**

Overview of Embedded Systems, Features, Requirements and Applications, Recent Trends in the Embedded System Design, Common architectures for the Embedded System Design, Embedded Software design issues. Introduction to microcontrollers, Overview of Harvard architecture and Von Neumann architecture, RISC and CISC microcontrollers

Unit II: PIC 18Fxx Microcontrollers **12**

Introduction to PIC Microcontrollers, Architecture overview, status register, general purpose register file, memories, Instruction set, Data Transfer Instructions, Arithmetic and Logic Instructions, Branch Instructions, Bit and Bit-test Instructions, MCU Control Instructions. Simple programs in Assembly Language / C Language, I/O port programming in PIC

Unit III: Timers, Interrupts and on chip Peripherals in PIC 18Fxx **10**

Introduction to System Clock, Reset sources, Introduction to interrupts, External interrupts, IO Ports, 8-bit and 16-bit Timers, Introduction to different modes, Input Capture and Compare Match.Analog Comparator, Analog-to-Digital Converter, Serial Peripheral Interface (SPI), The Universal Synchronous and Asynchronous serial Receiver and Transmitter (USART), Two Wire Interface (TWI) / I2C bus

Unit IV: Real World Interfacing with PIC **11**

Interfacing of LED, switch, Relay, optocoupler, seven segment displays, LCD, Keypad, stepper motor, servo motor, speed control of DC motor using PWM technique. Interfacing of sensors and actuators.

- **Learning Outcomes:**
  1. Student should design electronic systems using PIC
  2. Design and test advanced Embedded systems using PIC microcontrollers
  3. Student should perform interfacings of various real world devices
  4. Able to implement Electronics in industry
- **Reference Books:**
  1. PIC Microcontroller and Embedded Systems: Using Assembly and C by Muhammad Ali Mazidi,SarmadNaimi, SepehrNaimi, PHI
  2. Embedded system Design - Frank Vahid and Tony Givargis, John Wiley, 2002
  3. An Embedded Software Primer, David E Simon, Addison Wesley

Semester VI
Elective
BET22-604: Industrial Processes control and PLC programming

- **Learning Objectives:**

1. To understand the fundamentals of automation and various automation systems used inindustry such as PLC, DCS, and SCADA.
2. To understand how to design Automation system.
3. To Study of Ladder programming language.
4. Able to design PI,PD and PID Controllers

UNIT I: Introduction to control system **12**

Basic elements of control system, open loop control system, closed loop control system, control system terminology, manually controlled closed loop systems, automatic controlled closed loop systems, comparison closed-loop system and open-loop control, feed-forward control system, adaptive control system, classification of control system. ON-OFF controller, proportional controller, PI controller, PD controller and PID controller.

UNIT II: Components of Control System: **10**

Op-Amp as a zero crossing detector, non-inverting comparator, inverting comparator, Two position controller using op-Amp, proportional controller, integral controller using Op-Amp, derivative controller, PI controller, PID controller.

UNIT III: Introduction to PLC **12**

Programmable logic controller (PLC) basics: Definition, overview of PLC systems, block diagram of PLC, Input/output modules, power supplies, isolators, features like scan time, system scale, user interface. Modular PLC and Redundant PLC and Applications, communication protocols: RS485, Profibus, Modbus.
Advance control Algorithm Distributed control system, DCS components/block diagram, SCADA, adaptive control system.

UNIT IV: Ladder Programming basics **11**

Basic components: fuse, pushbutton, selector switches, limit switches, indicators, relay, time Delay relays functions and symbols. General PLC programming procedures, programming on-off Inputs/outputs. Auxiliary commands and functions: PLC Basic Functions: Register basics, timer functions, counter functions. Ladder Programming: Programs for Boolean logic and flip-flops, counters, timers, flasher. Application: Bottle filling plant, elevator control, washing machine control, Four-wheeler parking.

- **Learning Outcomes:**

1. Able to design PLC based application by proper selection and sizing criteria and ladder program.
2. Able understand evolution and architecture of DCS, SCADA architecture.
3. Able to design communication systems in SCADA, develop any application based on SCADA.
4. Able design Automation Plant programming using Ladder programming Language

- **Reference Books :**

1.John W. Webb and Ronald A. Reiss, Programmable Logic Controllers – Principle andApplications, Fifth Edition, PHI

2.Programmable Logic Controllers And Industrial Automation : An Introduction byMadhuchhanda Mitra

3.JR. Hackworth and F.D Hackworth Jr. Programmable Logic Controllers – ProgrammingMethod and Applications. – Pearson, 2004..

4.Introduction To Programmable Logic Controller- Gray and Dunning (2nd editionThomsonEducation)

Semester VI
Elective
BET22-605: Digital Signal Processing and Artificial Intelligences

- **Learning Objectives:**

1. To give the comprehension of the concepts of discrete-time signals and systems and about the mostimportant issues in sampling and reconstruction.
2. To give the comprehension of the Z- and their inverse.
3. To introduce fundamental concepts of artificial intelligence and provide them the ability to analyzeand design intelligent systems.
4. To study application of Artificial Intelligence (AI) techniques to improve the performance of DSP.

Unit I: Discrete-Time Signals and Systems **12**

Classification of Signals, Transformations of the Independent Variable, Periodic and A periodic Signals, Energy and Power Signals, Even and Odd Signals, Discrete-Time Systems, System Properties. Impulse Response, Convolution Sum, Graphical Method, Analytical Method, Properties of Convolution, Commutative, Associative, Distributive, Shift Sum Property System Response to Periodic Inputs, Relationship Between LTI System Properties and the Impulse Response, Causality, Stability, Invertibility, Unit Step Response.

Unit II: Discrete Fourier Transform **12**

Need of transform, Discrete-Fourier Transform & Fast Fourier Transform, The discrete Fourier Series and its Properties Fourier Transform of Periodic Signals, Sampling the Fourier Transform, The Discrete-Fourier Transform, Properties of DFT, Linear Convolution using DFT. FFT-Efficient Computation of DFT, Goertzel Algorithm, radix2 Decimation-in-Time and Decimation - in - Frequency FFT Algorithms, Introduction to other transforms.

Unit III: Z-Transform **10**

Definition and properties, Inverse Z Transform and stability Inverse *z*-Transform, Relationship Between *z*-Transform and Discrete-Time Fourier Transform, *z*-plane, Region-of-Convergence, Properties of ROC, Time Reversal, Differentiation in the *z*-Domain, Power Series Expansion Method (or Long Division Method), Analysis and Characterization of LTI Systems, Transfer Function and Difference-Equation System, Solving Difference Equations.

Unit IV: Digital Filters and Artificial Intelligence **11**

Analog filter review, Advantages and Disadvantages of Digital Filters, Types of Digital Filters, FIR and IIR Filters; Difference Between FIR and IIR Filters, Design of FIR and IIR filter, Windowing Method, Rectangular, Triangular, Kaiser Window. Introduction to Digital signal processor, Application of digital signal processing, Introduction to AI, Artificial intelligence: History, Trends and Future Application of Artificial Intelligence (AI).

- **Learning Outcomes:**

1. The student will be capable of calibrating and resolving different frequencies existing in anysignal.
2. The student will be in position to understand use of different transforms and analyze thediscrete time signals and systems.
3. The student will realize the use of LTI filters for filtering different real world signals.
4. The student will be in a position to understand fundamental of AI.

- **Reference Books:**

1. John G Prokis, Manolakis, Digital Signal Processing-Principles, Algorithms and Application, 4th Edition, Pearson Education Publication
2. Salivahanam, A Vallavaraj, C. Guanapriya, Digital Signal Processing, 1st Edition, TataMcGrawHill, New Dehli

3. P. Ramesh Babu, Digital Signal Processing, 4th Edition, Scitech Publication.
4. A. Ambardar, Digital Signal Processing: A Modern Introduction, Cengate Learning IndiaPvt Ltd, New Dehli
5. P. Pirsch, Architectures for Digital Signal Processing, John Wiley publication, New Delhi
6. Phil Lapsley, DSP Processor Fundamentals: architectures and Features, Wiley publication
7. S.K. Mitra,Digital Signal Processing Computer Based Approach, TMH. New Dehli. 200

Semester VI Elective
BET22- 606: Robotics

- **Learning Objectives:**
  1. To study robotics Fundamentals.
  2. To study sensors and actuators in robotics.
  3. To learn the various I/O devices interfacing with robots.
  4. To establish communication of robot with various protocols.

Unit I: Programming Environments **12**

Integrated Development Environment (IDE) for AVR microcontrollers, free IDEs like AVR Studio, WIN AVR. Installing and configuring for Robot programming, In System Programmer (ISP), loading programme on Robot

Unit II: Sensors and Actuators **11**

Actuators: DC Motors, Gearing and Efficiency, Servo Motors, Stepper motors, Motor Control and its implementations

Sensors: White line sensors , IR range sensor of different range, Analog IR proximity sensors , Analog directional light intensity sensors, Position encoders, Servo mounted sensor pod/ Camera Pod, Wireless colour camera , Ultrasound scanner , Gyroscope and Accelerometer, Magnetometer, GPS receiver, Battery voltage sensing, Current Sensing

Unit III: Interfacing I/O Devices **10**

LCD interfacing with the robot (2 x 16 Characters LCD),Other indicators: Indicator LEDs, Buzzer, Timer / Counter operations: PWM generation, Motor velocity control, Servo control, velocity calculation and motor position Control, event scheduling

Unit IV: Communication **12**

Wired RS232 (serial) Communication, Wireless ZigBee Communication, USB Communication, Simplex infrared Communication (IR remote to robot)

- **Learning Outcomes:**
  a. Able to develop programs for robots
  b. Able to interface various sensors and actuators with robots as per need
  c. Able to interface various displays and indicators robots as per need
  d. Able to operate robot from remote locations
- **Reference Books:**

1. Saha, S.K., Introduction to Robotics, 2nd Edition, McGraw-Hill Education, New Delhi, 2014 2. R.K. Mittal, I.J. Nagrath, “Robotics & Control”, Tata McGraw & Hills, 2005.
2. Electricity and Magnetism: J. H. Fewkes and John Yarhood ,Vol I , Publication by Oxford University Press Vth Edition.

Semester V
Practical V
BEP 508: Power Electronics Devices and Linear Integrated Circuits Lab(Hardware and Circuit Simulation Software)

- **Course Objectives:**
  1. To study simple Power circuits and their performance parameters
  2. To learn different control techniques and applications of Power Circuits as case studies
  3. To study filter design circuits.
  4. To learn design and development of Op-Amp circuits.

GROUP A

1. Study of AC Voltage controller
2. Study of SCR firing by UJT / Phase Shift control of SCR
3. Study of ON/OFF Temperature controller (LM34/LM35/AD590)
4. Study of DC/AC Timer
5. Study of DC Motor /AC motor Control/ BLDC motor control
6. Design a power supply for 5/9/12V
7. Design of RC triggering circuit HWCR and FWCR
8. Design of Single phase full wave controlled rectifier

GROUP B

1. To design an inverting amplifier/non-inverting amplifier using Op-amp (741,351)for dc voltage of given gain & study frequency response
2. To Study Op amp as adder and subtractor
3. To Study Op amp as integrator and differentiator
4. To Study Op amp as Schmitt trigger
5. To design phase shift and Wien bridge oscillator for given frequency using an op-amp.
6. To study the zero-crossing detector and comparator.
7. To design a precision rectifier using an op-amp.
8. To Study of VCO using IC 565

- **Learning Outcomes:**

1) Build and test circuits using power devices such as SCR, IGBT and MOSFET.
2) Analyze and design controlled rectifier, DC to DC converters, DC to AC inverters, how to analyze these inverters and some basic application examples.
3) Design various Op-amp circuits for different applications
4) Study of op amp IC 741 characteristics

- **Reference Books:**

1. Power Electronics, P.C. Sen, TMH
2. Power Electronics & Controls, S.K. Dutta
3. Power Electronics, M.D. Singh & K.B. Khanchandani, TMH
4. Power Electronics Circuits, Devices and Applications, 3rd Edition, M.H. Rashid,
5. Op-Amps and Linear IC's, R. A. Gaikwad, Pearson Education (2003)
6. Integrated Electronics, J. Millman and C.C. Halkias, Tata McGraw-Hill,(2001)
7. OP-AMP and Linear Integrated Circuits, K. L. Kishore, Pearson(2011)

Semester V
Practical VI
BEP509:8051 microcontroller Interfacing, Optoelectronics and IOT/Mechatronics/Nanoelectronics Lab

(Hardware and Circuit Simulation Software)

- **Course Objectives:**
  1. To learn the basic programming concepts of 8051
  2. To learn different Interfacing using 8051
  3. To learn the principles of a sensor and transducer
  4. To learn Arduino development board and modern OPC

GROUP A

1. To generate 10 kHz square wave using 8051 microcontroller
2. To study the implementation & interfacing of LCD
3. To study implementation & interfacing of LED Matrix
4. Interfacing of seven segment using thumbwheel switch display
5. To study implementation & interfacing DC /stepper motor with 8051 microcontroller
6. To study implementation & interfacing of keypad with 8051 microcontroller
7. To study implementation & interfacing of servo motor with 8051 microcontroller
8. Interfacing ofRelay/Optocoupler with 8051 microcontroller

Elective
BET504:Optoelectronics and IOTGroup B

1. Frequency Modulation and Pulse Width Modulation System
2. Study of Propagation loss and Bending loss in Optical Fiber
3. Measurement of Optical Power using Optical power meter
4. Measurement of Propagation Loss using OPM and Numerical Aperture
5. Interfacing with Bluetooth module with IOT Platform.
6. Interfacing of:
   A) Ultrasound transceiver, IR range sensor of different range, Analog IR proximity sensors
   B) Analog directional light intensity sensors, Position encoders
   C) Interfacing of Gyroscope, Accelerometer, Magnetometer, GPS receiver
7. Interface Wi-Fi module with IOT Platform to toggle LEDs and control relays
8. To develop IOT system for Smart Homes

OR
Elective BET22-505:Mechatronics
Group B

1. Study of Signal conditioning unit
2. Designing of Mechanical Actuation Systems
3. Designing of Proportional Controller
4. Development of application of mechatronics: rain sensor wiper
5. Development of application of mechatronics: line following robot
6. Development of application of mechatronics: solar tracker)
7. Car Engine temperature management System
8. Distance measurement using ultrasonic sensor

OR

Elective BET506: Nanoelectronics

Group B

1. Calculate thickness of given films using weight difference method
2. Preparation of thin film of given sample using electro deposition method
3. Preparation of ZnO this film using chemical bath Deposition method
4. Preparation of given material using Sol Gel technique
5. To study the plotting tools of given data using Origin software
6. Calculation of band gap properties of given sample using UV visible spectrometer
7. To study IR spectroscopy properties of given material
8. To study the X-Ray Diffraction properties of a given sample

- **Learning Outcomes:**

1) Familiarize with the assembly level and embedded C programming using 8051.
2) Familiarize with the KeilµVision-3/4
3) Design circuits for various applications using microcontrollers.
4) Apply the concepts on real- time applications.
5) Students will become versatile with basic principles of measurement techniques and extendtheir analytical abilities with exposure to the modern OPC and tools.
6) Students will get knowledge of OFC and extend their analytical abilities with exposure tolearn and use modern OPC and tools.
7) Implement basic IOT applications on embedded platform

- **Reference Books:**

1.The 8051 Microcontroller -K. J. Ayala, (Penram International)
2. The 8051 Microcontroller and Embedded Systems, M. A. Mazadi,J. G. Mazadi.
3. Programming and customizing the 8051 Microcontroller - MYKE Predko.
4. C and the 8051: Programming and Multitasking, Schultz, P T R Prentice-Hall, Inc.
5. Optical Fiber Communication Scientech 2502
6. Vijay Madisetti, ArshdeepBahga, “Internet of Things: A Hands-On Approach”

7. Waltenegus Dargie,Christian Poellabauer, "Fundamentals of Wireless Sensor Networks:Theory and Practice"

Semester VI Practical VII

BEP 608: Electronics Instrumentation and Antennas and Wave Propagation Lab(Hardware and Circuit Simulation Software)

- **Course Objectives:**

1. To learn the principles of a sensor and transducer
2. To give exposure to the modern instruments and tools
3. To study of antenna radiations
4. To study of beam width, front to back ratio of antenna

GROUP A

1. Study of thermocouple (594/595)
2. Study of characteristics of RTD(PT-100)
3. Study of Instrumentation Amplifier(TL084/LM324)
4. Measurement using Strain Gauge and Bridge Amplifier
5. Study of AC Timer / DC Timer
6. Measurement of displacement using LVDT.
7. To study the Characteristics of LDR/Photodiode/ Phototransistor
8. Study the linearity characteristics Pressure using capacitive transducer

GROUP B

1. Study of Simple Dipole (λ/2) antenna
2. Study of Folded Dipole (λ/2) antenna
3. Study of Simple Dipole (λ/4) antenna
4. Study of Yagi-UDA 3/ 5Element Simple dipole antenna
5. Study of Yagi-UDA 3Folded dipole antenna
6. Study of Yagi-UDA 5Folded dipole antenna
7. Study of Hertz/Helix antenna
8. Study of Ground Plane antenna

- **Learning Outcomes:**

1. Students will become versatile with basic principles of measurement techniques and extend theiranalytical abilities with exposure to the modern instruments and tools.
2. Students will get knowledge of various instruments and extend their analytical abilities withexposure to learn and use modern instruments and tools.
3. Student will able to develop Antenna radiation pattern
4. Able to calculate beam width

- **Reference Books:**

1. Electronic Instrumentaion, H. S. Kalsi, TMH(2006)
2. Digital Signal Processing, Tarun Kumar Rawat, Oxford University Press, India.
3. A Guide to MATLAB, B.R. Hunt, R.L. Lipsman, J.M. Rosenberg, 2014, 3rd
4. Digital Signal Processing, S. K. Mitra, McGraw Hill, India.
5. Electronic Instrumentation and Measurement Techniques, W. D. Cooper and A. D. Helfrick,Prentice- Hall (2005).
6. **Motorized Antenna Unit Scientech 2261A**
7. Antenna Theory, Ballanis, John Wiley & Sons, (2003) 2nd Ed.

Semester VI Practical VIII

BEP609: Advanced Microcontroller: PIC, Digital Signal Processing and Artificial Intelligences /Industrial Processes control and PLC programming /Robotics Lab

(Hardware and Circuit Simulation Software)

- **Course Objectives:**
  1. To learn design and development of electronic systems using PIC18Fxx
  2. To make able to use Embedded system to solve daily life problems
  3. To learn Scilab/MATLAB Programming
  4. To study of signal processing

GROUP A

1. Interfacing of LED and RELAY using PIC18Fxxcontroller with MPLAB
2. Write an assembly language program to add, subtract, multiply, divide 16 bit data byPIC18Fxxmicrocontroller.
3. Write an assembly language program to generate 10 KHz frequency using interrupts on P1.2.
4. To study Serial communication using PIC18Fxx
5. Programming of PIC18Fxx on chip ADC
6. Interfacing KEYPAD to display value on LCD when a key is pressed

7. Interfacing GSM modem to send and receive the message
8. Display a message using I2C Protocol

Elective

BET604: Industrial Processes control and PLC programmingGroup B

1. Study of PLC Simulator (TriLOGI Software) and implementing Boolean function.
2. Programming PLC for sequential logic RS -FF,JK-FF,T-FF,D-FF
3. Study of PLC timers and Counters
4. Programming PLC for Bottle filling plants
5. Programming PLC for Automatic parking Gate
6. Programming PLC for Elevator control
7. Programming PLC for Traffic Light Control
8. Study and implementation of proportional controller using opamp.

BET605: Digital Signal Processing and Artificial Intelligences

Group B

1. Generation of unit sample sequence, unit step, ramp function, discrete time sequence, realsinusoidal sequence.
2. Given x[n], write program to find X[z].
3. To study Fourier Transform, Discrete Fourier Transform and Fast Fourier Transform
4. Design of a Butterworth analog filter for low pass and high pass.
5. Write a program to generate and plot the following sequences: (a) Unit sample sequence $\delta(n)$,

   (b) unit step sequence $u(n)$, (c) ramp sequence $r(n)$, (d) real valued exponential sequence

   $xn = 0.8\ ^{!}u(n)$ for $0 \le n \le 50$.

6. Write a program to compute the convolution sum of a rectangle signal (or gate function) withitself for N = 5
7. Given a casual system $yn = 0.9yn - 1 + (n)$
   (a) Find (z) and sketch its pole-zero plot (b) Plot the frequency response $He^{!"}$ and $\angle He^{!"}$
9. Design a digital filter to eliminate the lower frequency sinusoid of xt =sin $7t$ + sin $200t$. The sampling frequency is $f_{!}$ = 500 Hz. Plot its pole zerodiagram, magnitude response, input and output of the filter.

OR

Elective BEP606: Robotics

Group B

1. Robot I/O and buzzer programming
2. Robot Motion controlling
3. Robot velocity control using PWM
4. On Board Robot LCD interfacing
5. On Board Robot ADC interfacing
6. Accessing robot On Board Interrupts
7. Proximity sensors interfacing for autonomous robot working
8. Designing of obstacle avoiding robot

- **Learning Outcomes:**

1. Student should design electronic systems using PIC
2. Design and test advanced Embedded systems using PIC microcontrollers
3. Student will able to develop MATLAB programs
4. Able to solve signals and system problems

- **Reference Books:**

1. PIC Microcontroller and Embedded Systems: Using Assembly and C by Muhammad Ali Mazidi,SarmadNaimi, SepehrNaimi, PHI
2. Embedded system Design - Frank Vahid and Tony Givargis, John Wiley, 2002
3. Digital Signal Processing, Tarun Kumar Rawat, Oxford University Press, India.
4. A Guide to MATLAB, B.R. Hunt, R.L. Lipsman, J.M. Rosenberg, 2014, 3rd
5. Digital Signal Processing, S. K. Mitra, McGraw Hill, India.

SECCEP610: Industrial Project

Course Work: **25**

Industrial Visits and report writing, Preparation of entrepreneurship Proposal and Presentation.