Rayat Shikshan Sanstha's

Sadguru Gadage Maharaj College, Karad.

(An Empowered Autonomous College)

Department of Electronics

B. Sc. III Course Structure NEP 2020

(W. E. F. June 2025)

Year	Semester	Course Type	Course Code	Course Title	Credits
B. Sc. III	V	Major	MJ-BET23-501	Power Electronics Devices and Applications	02
		Major	MJ-BET23-502	Linear Integrated Circuit	02
		Major	MJ-BET23-503	8051 microcontroller Interfacing and Application	02
		Major	MJ-BET23-504	Optoelectronics and IoT	02
		Major-Elective	MJE-BET23-505	Mechatronics	02
		Minor	MN-BET23-506	8051 microcontroller Interfacing and Application	02
		Major - Practical	MJ-BEP23-507	Practical based on MJ-BET23- 501, MJ-BET23-502, MJ-BET23- 503 & MJ-BET23- 504	08
		Field Project	FPE23-508	Field Project	02
	VI	Major	MJ-BET23-601	Electronic Instrumentation	02
		Major	MJ-BET23-602	Antennas and Wave Propagation	02
		Major	MJ-BET23-603	Advanced Microcontroller: PIC	02
		Major	MJ-BET23-604	Industrial Process control and PLC Programming	02
		Major-Elective	MJE-BET23-605	Computer Organization	02
		Minor	MN-BET23-606	Computer Organization	02
		Major - Practical	MJ-BEP23-607	Practical based on MJ-BZT23- 601 & MJE-BZT23- 602, MJ-BZT23-603 & MJ-BZT23- 604	08
		On Job Training	OJTE23-608	On Job Training	02
					44

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Sadguru Gadage Maharaj College, Karad
(An Empowered Autonomous)

Department of Electronics

Evaluation Pattern: B.Sc. III Electronics

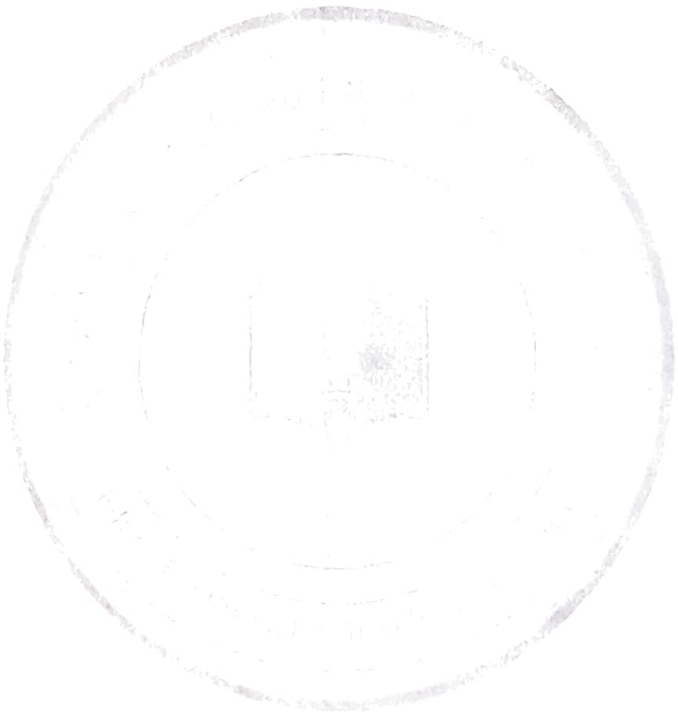
(w.e.f.June 2025)

Sem.	Paper Code	Credits	Title of Paper	Evaluation Scheme (Marks)			Grand Total Marks
				CCE	SEE	Total	
V	MJ-BET23-501	02	Power Electronics Devices and Applications	10	40	50	550
	MJ-BET23-502	02	Linear Integrated Circuit	10	40	50	
	MJ-BET23-503	02	8051 microcontroller Interfacing and Application	10	40	50	
	MJ-BET23-504	02	Optoelectronics and IoT	10	40	50	
	MJE-BET23-505	02	Mechatronics	10	40	50	
	MN-BET23-506	02	8051 microcontroller Interfacing and Application	10	40	50	
	MJ-BEP23-507	08	Practical based on MJ-BET23-501, MJ-BET23-502, MJ-BET23-503 & MJ-BET23-504	--	200	200	
	FPE23-508	02	Field Project	--	50	50	
VI	MJ-BET23-601	02	Electronic Instrumentation	10	40	50	550
	MJ-BET23-602	02	Antennas and Wave Propagation	10	40	50	
	MJ-BET23-603	02	Advanced Microcontroller: PIC	10	40	50	
	MJ-BET23-604	02	Industrial Process control and PLC Programming	10	40	50	
	MJE-BET23-605	02	Computer Organization	10	40	50	
	MN-BET23-606	02	Computer Organization	10	40	50	
	MJ-BEP23-607	08	Practical based on MJ-BET23-601 & MJ-BZT23-602, MJ-BET23-603 & MJ-BET23-604	--	200	200	
	OJTE23-608	02	On Job Training	--	50	50	
Total		44			Total		1100

SEE-Semester End Examination, **CCE**-Continuous Compressive Evaluation

Nature of question paper and evaluation scheme:

- **Evaluation Scheme**
- **Separate passing for Theory, Practical and internal examination is mandatory.**



Rayat Shikshan Sanstha's

Sadguru Gadage Maharaj College, Karad.

(An Autonomous College)

Department of Electronics

Syllabus for **Bachelor of Science Major (Electronics)** Part III

1. **SUBJECT: Electronics**

2. **YEAR OF IMPLEMENTATION:** New Syllabi for the B.Sc. II Electronics will be implemented from **June 2025** onwards.

3. **STRUCTURE OF COURSE:**

FIFTH SEMESTER

Sr. No.	SUBJECT TITLE	Theory			Practical		
		Paper No. & Paper Code	No. of lectures Per week	Credits	Practical	No. of lectures Per week	Credits
1	Electronics	Paper-V: (MJ-BET23-501)	10	10	(MJ-BEP23-507)	16	8
		Paper-VI: (MJ-BET23-502)					
		Paper-VI: (MJ-BET23-503)					
		Paper-VI: (MJ-BET23-504)					
		Paper-VI: (MJE-BET23-505)					

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

B. Sc. III Semester V

Paper IX: MJ-BET23-501: Power Electronics Devices and Applications
Paper X: MJ-BET23-502: Linear Integrated Circuit
Paper XI: MJ-BET23-503: 8051 microcontroller Interfacing and Application
Paper XII: MJ-BET23-504: Optoelectronics and IoT
Paper XIII: Elective

1. **BET505**: Mechatronics
2. **BET506**: Nanoelectronics

SIXTH SEMESTER

Sr. No.	SUBJECT TITLE	Theory			Practical		
		Paper No. & Paper Code	No. of lectures Per week	Credits	Practical	No. of lectures Per week	Credits
2	Electronics	Paper-V: (MJ-BET23-601)	10	10	(MJ-BEP23-607)	16	8
		Paper-VI: (MJ-BET23-602)					
		Paper-VI: (MJ-BET23-603)					
		Paper-VI: (MJ-BET23-604)					
		Paper-VI: (MJE-BET23-605)					

Paper XIV: BET601: Electronic Instrumentation
Paper XV: BET602: Antennas and Wave Propagation
Paper XVI: BET603: Advanced Microcontroller: PIC
Paper XVII: BET604: Industrial Process control and PLC Programming
Paper XVIII: BET60X: Elective

Elective: BET60X

1. **BET605**: Computer Organization
2. **BET606**: Robotics

Syllabus B.Sc. III
(Electronics)

Implemented from

2025-26

Rayat Shikshan Sanstha's

Sadguru Gadage Maharaj College Karad

(An Empowered Autonomous)

Syllabus Introduced from June, 2025

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

Semester V

Paper IX: BET501: 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 **10**

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-Off characteristics, 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 **08**

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 **06**

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 **06**

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: MJ-BET23-502: 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 **09**

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 **08**

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 **06**

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) **07**

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, Pearson Education (2001)
3. Integrated Electronics, J. Millman and C.C. Halkias, Tata McGraw-Hill,(2001)
4. Electronic Principals, A. P. Malvino, 6thEdition , Tata McGraw-Hill,(2003)
5. OP-AMP and Linear Integrated Circuits, K. L. Kishore, Pearson(2011)

Semester V

Paper XI: MJ-BET23-503: 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 **08**

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 **08**

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 **07**

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 **07**

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

Paper XII: MJ-BET23-504: 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: Photonic Devices **07**

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 II: Optical Communication **09**

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 III: Introduction to IoT **08**

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

Unit IV: Developing IOTs **06**

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 interaction with 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. WaltenegusDargie,ChristianPoellabauer, "Fundamentals of Wireless Sensor Networks: Theory and Practice

Semester V Elective
Paper XIII: MJE-BET23-505: 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 **08**

Introducing Mechatronics, Sensors and Transducers, Signal Conditioning, Digital Signals, Digital Logic

Unit II :Actuation Systems **08**

Pneumatic and Hydraulic Actuation Systems, Mechanical Actuation Systems, Electrical Actuation Systems

Unit III :Properties of Models **07**

Basic System Model, System Models, Dynamic Responses of System, System Transfer Functions, Frequency Response

Unit IV :Application of Mechatronics **07**

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 Michel BiHistand
4. Introduction to Mechatronics (Oxford Higher Education)" by Dr K K Appukuttan
5. Mechatronics : Principles, Concepts and Applications" by W Bolton

Semester V Elective
MJE-BET23-506: Nanoelectronics

Learning Objectives:

1. To present the state of the art in the areas of semiconductor device physics and materials technology to 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 **10**

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 **10**

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 **10**

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

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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, Wiley Interscience, 2003.
4. Electron Microscopy and analysis, 2nd ed. Taylor and Francis, 2000.
5. Bio-Inspired Nanomaterials and Nanotechnology, Edited by Yong Zhou, Nova Publishers.
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 Practical V

MJ-BEP23-507: 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

GROUP C

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 of Relay/Optocoupler with 8051 microcontroller

Group D

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: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 electrodeposition 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 bandgap 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 extend their analytical abilities with exposure to the modern OPC and tools.
6) Students will get knowledge of OFC and extend their analytical abilities with exposure to learn 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. WaltenegusDargie,ChristianPoellabauer, "Fundamentals of Wireless Sensor Networks: Theory and Practice"

Semester VI

Paper XIV: MJ-BET23-601: 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 **07**

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 **08**

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 **08**

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 **07**

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 with exposure to learn and use modern instruments and tools.
3. Students will get detail knowledge of various biomedical instruments Electrodes, other tools and can handle it properly

Semester VI

Paper XV: MJ-BET23-602: 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 **08**

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 **08**

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) **07**

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 **07**

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 XVI: MJ-BET23-603: 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 **08**

Overview of Embedded Systems, Features of PIC microcontroller, Watch dog Timer (WDT), Brownout Reset, ISP, I2C Bus, SPI Bus, Analog comparator, RTC, Current Sink & source capability, Sleep mode, LCD & motor driver, CAN & Zigbee interface, Harvard architecture and Von Neumann architecture, RISC and CISC microcontrollers, Comparison of PIC12Fxx, PIC16Fxx, PIC18Fxx, PIC24Fxx and PIC32Fxx Families, WREG register, PIC File register, SFR, GPR, GP RAM vs EEPROM, File register and Access bank in PIC18, PIC Status register, Pin diagram PIC18F

Unit II: Instruction Set and Programming of PIC18Fxx **08**

Instruction set, Addressing mode, I/O port programming, I/O bit manipulation programming, program for square wave generation at port, Reading and monitoring single bit, ASCII to BCD conversion, Minimum connection(Clock & Reset circuit), Stack and Stack Pointer in PIC18, ROM in PIC18, Bank switching, Pipeling, Instruction cycle time, Branch Penalty, Loop inside loop delay.

Unit III: Facilities in PIC 18Fxx Part I **10**

Programming Timer0: T0CON, PIR1 register, steps in programming(ALP/C), Timer 0 in 8bit and 16 bit mode, Delay calculation(Timer count calculation), Comparison of T0CON, T1CON, T2CON of timer PIC18F.

Analog-to-Digital Converter, ADC in programming in PIC18F, Features of ADC, Programming ADCON0, ADCON1 Register, Conversion time, Steps for programming, ADC using polling,

Unit IV: Real World Interfacing with PIC 18Fxx **11**

Interfacing of LED, switch, Relay, Optocoupler, Seven Segment Displays, LCD, Keypad, stepper motor, servo motor, speed control of DC motor using PWM technique.

Serial Peripheral Interface (SPI), The Universal Synchronous and Asynchronous serial Receiver and Transmitter (USART), Two Wire Interface (TWI) / I2C bus

□ 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

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

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

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 - fifth Edition(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 and Sons(2007).

10. Instrumentation Devices and Systems, C. S. Rangan, G. R. Sarma and V. S. Mani, Tata McgrawHill(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 XVIII: MJE-BET23-605:
Computer Architecture & Organization (30)

Unit I MEMORY ORGANISATION: **(07)**
Introduction, Characteristics of memory systems ,Main memory design, Memory hierarchy, Cache memory, Memory mapping, Virtual Memory, Memory management concepts (paging and segmentation).

Unit II CONTROL UNIT: **(07)**
Introduction, Hardware control-design methods, Microprogrammed control unit, Microinstruction addressing and architecture of typical micro programmed control unit.

Unit III I/O ORGANISATION: **(08)**
Peripheral devices, Input output Interface, IO mapped IO, Memory mapped IO, Asynchronous data transfer, Modes of transfer, Priority Interrupts, Direct memory access, Input output Processor, serial communication.

Unit IV CPU ORGANISATION: **(08)**
Introduction, General register organization, Stack Organization, Instruction formats, Addressing modes Program Control, Arithmetic and Logic Unit (One bit and multiple bit), Bit processor.

Reference Books
Computer Organization - J.P. Hays TMH

Sem. VI
Paper XVIII: MN-BET23-606:
Computer Architecture & Organization (30)

Unit I MEMORY ORGANISATION: **(07)**
Introduction, Characteristics of memory systems ,Main memory design, Memory hierarchy, Cache memory, Memory mapping, Virtual Memory, Memory management concepts (paging and segmentation).

Unit II CONTROL UNIT: **(07)**
Introduction, Hardware control-design methods, Microprogrammed control unit, Microinstruction addressing and architecture of typical micro programmed control unit.

Unit III I/O ORGANISATION: **(08)**
Peripheral devices, Input output Interface, IO mapped IO, Memory mapped IO, Asynchronous data transfer, Modes of transfer, Priority Interrupts, Direct memory access, Input output Processor, serial communication.

Unit IV CPU ORGANISATION: **(08)**
Introduction, General register organization, Stack Organization, Instruction formats, Addressing modes Program Control, Arithmetic and Logic Unit (One bit and multiple bit), Bit processor.

Reference Books
Computer Organization - J.P. Hays TMH

MJ-BEP23-607: 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

GROUPA

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

GROUPB

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-UDA3/ 5Element Simple dipole antenna
5. Study of Yagi-UDA 3Foldeddipoleantenna
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 their analytical abilities with exposure to the modern instruments and tools.
2. Students will get knowledge of various instruments and extend their analytical abilities with exposure 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 Instrumentation, H.S.Kalsi,TMH(2006)
2. Digital Signal Processing, Tarun Kumar Rawat, Oxford University Press, India.
3. Electronic Instrumentation and Measurement Techniques, W. D. Cooper and A. D. Helfrick, Prentice-Hall (2005).

4. Motorized Antenna Unit Scientech2261A
5. Antenna Theory, Ballanis, John Wiley &Sons,(2003) 2nd Ed.

Semester VI Practical VIII

Advanced Microcontroller: PIC, Industrial Processes control and PLC programming

(Hardware and Circuit Simulation Software)

- **Course Objectives:**
  1. To learn design and development of electronic systems usingPIC18Fxx
  2. To able to use Embedded system to solve daily life problems

GROUP C

1. Interfacing of LEDandRELAYusingPIC18FxxcontrollerwithMPLAB
2. Write an assembly language program to add, subtract, multiply, divide16bit data by PIC18Fxxmicrocontroller.
3. Write an assembly language program togenerate10 KHz frequency using interrupts on P1.2.
4. To study Serial communication usingPIC18Fxx
5. ProgrammingofPIC18FxxonchipADC
6. Interfacing KEYPAD to display value on LCD when a key is pressed
7. Interfacing GSM modem to send and receive the message
8. DisplayamessageusingI2C Protocol

Group D

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 op-amp.