Rayat Shikshan Sanstha's

Yashavantrao Chavan Institute of Science, Satara (Autonomous)

Department of Electronics

Syllabus for Bachelor of Science (Electronics)
W.E.F. (June 2023)

1. **SUBJECT: Electronics**

2. **YEAR OF IMPLEMENTATION:** New Syllabi for the B.Sc. Electronics will be implemented from June 2023 onwards.

3. **PREAMBLE:**

Bachelor of Science is an integrated academic degree in faculty of Science. The faculty is not ignoring the developments in the field of Electronics. The revision of existing syllabus of Electronics subject in science faculty is essential. This is a humble endeavor to initiate the process towards an era of knowledge. The students from science faculty should also be competent for this change in the technology.

In this year, a student will able to understand handling of laboratory equipment's, build Electronics circuits with confidence. In the subject, the student will also get a basic and proper knowledge in the field of Embedded System design

4. **GENERAL OBJECTIVES OF THE COURSE:**
   1. To create graduates with sound knowledge of fundamentals of Electronics, who can contribute towards advancing science and technology.
   2. To create graduates with sufficient capabilities in Electronics who can become researchers and developers to satisfy the needs of the core Electronics industry.
   3. To develop ability among students to formulate, analyze and solve real life problems faced in Electronics industry.
   4. To provide opportunity to students to learn the latest trends in Electronics and make them ready for life-long learning process.
   5. To make the students aware of professional ethics of the Industry, and prepare them with basic soft skills essential for working in community and professional teams.
   6. To prepare the students for graduate studies through competitive examinations, enabling them to reach higher echelons of excellence
   7. To produce electronic professionals who can be directly employed or start his/her own work as Electronic circuit Designer, Electronics consultant, testing professional, Service engineer and even an entrepreneur in electronic industry.

5. **DURATION:**

   03 Years (Full Time)

6. **PATTERN:**

   SEMESTER EXAM

7. **MEDIUM OF INSTRUCTIONS : ENGLISH**
8. **STRUCTURE OF COURSE:**

B.Sc. III (Electronics)

1. STRUCTURE OF COURSE:

1. FIFTH SEMESTER

Sr. No.	SUBJECT TITLE	Theory			Practical		
		Course NO & Course Code	No. of lectures per week	Credits		No. of lectures Per week	Credits
1	Electronics	Course -IX:BET501	12	8	Practical Course – V & VI (BEP508& BEP509)	20	8
		Course -X: BET502					
		Course -XI: BET503					
		Course -XII: BET504 (Elective)					
		SECCET507	01	01	SECCEP510	02	01

2. Structure and Title of Courses of B.Sc. Course:
   - **B. Sc. III Semester V**

Course IX: BET501: Power Electronics Devices and Applications
Course X: BET502: Digital logic design using HDL
Course XI: BET503: 8051 microcontroller Interfacing and Application
Course XII: BET504: Elective (Any one from the list)

1. Optoelectronics and IoT
2. Mechatronics
3. Nanoelectronics

SECCET507: **Basic Numerical Skill:** MATLAB Programming
SECCEP510: MATLAB Programming LAB

3. SIXTH SEMESTER

Sr. No.	SUBJECT TITLE	Theory			Practical		
		Course NO & Course Code	No. of lectures per week	Credits		No. of lectures Per week	Credits
1	Electronics	Course -XIII:BET601	12	8	Practical Course – VII & VIII (BEP 608& BEP 609)	20	8
		Course -XIV: BET602					
		Course -XV: BET603					
		Course -XVI: BET604 (Elective)					
		SECCET607	01	01	SECCEP610	02	01

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

Course XIII: BET601: Electronic Instrumentation
Course XIV: BET602: Antennas and Wave Propagation
Course XV: BET603: Advanced Microcontroller: PIC
Course XVI: BET604: Elective (Any one from the list)

1. Digital Signal Processing and Artificial Intelligence
2. Industrial Process control and PLC Programming
3. Robotics

SECCET607: Entrepreneurship Development Program
SECCEP610: Industrial Project

BET/Pxyz:
B: B.Sc.
E: Electronics
T: Theory
P: Practical
x: Semester I to VI
yz: 01 to 10
SECC: Skill Enhancement Compulsory Course

9. OTHER FEATURES:

a. LIBRARY:

- **REFERENCE BOOKS**

1. R. S. Sedha, Textbook of Applied Electronics, S. Chand Publication
2. Soni and Gupta, Network Analysis,
3. S. A. Nasar, Electric Circuits, Schaum's outline series, Tata McGraw Hill (2004)
4. Electrical Circuits, M. Nahvi and J. Edminister, Schaum's Outline Series, Tata McGraw-Hill.(2005)
5. Robert L. Boylestad, Essentials of Circuit Analysis, Pearson Education (2004)
6. W. H. Hayt, J. E. Kemmerly, S. M. Durbin, Engineering Circuit Analysis, Tata McGraw Hill(2005)
7. Alexander and M. Sadiku, Fundamentals of Electric Circuits , McGraw Hill (2008)
8. S. M. Sze, Semiconductor Devices: Physics and Technology, 2nd Edn, Wiley India edition (2002).
9. Ben G Streetman and S. Banerjee, Solid State Electronic Devices, Pearson Education (2006)
10. Dennis Le Croissette, Transistors, Pearson Education (1989)
11. Jasprit Singh, Semiconductor Devices: Basic Principles, John Wiley and Sons (2001)
12. Kanaan Kano, Semiconductor Devices, Pearson Education (2004)
13. Robert F. Pierret, Semiconductor Device Fundamentals, Pearson Education (2006)
14. M. Morris Mano Digital System Design, Pearson Education Asia, (Fourth Edition)
15. Thomas L. Flyod, Digital Fundamentals, Pearson Education Asia (1994)
16. W. H. Gothmann, Digital Electronics: An Introduction To Theory And Practice, Prentice Hall of India(2000)
17. R. L. Tokheim, Digital Principles, Schaum's Outline Series, Tata McGraw- Hill (1994)
18. Electronic Devices and circuit theory, Robert Boylestad and Louis Nashelsky, 9th Edition, 2013, PHI
19. Electronic devices, David A Bell, Reston Publishing Company
20. D. L. Schilling and C. Belove, Electronic Circuits: Discrete and Integrated, Tata McGraw Hill (2002)
21. Donald A. Neamen, Electronic Circuit Analysis and Design, Tata McGraw Hill (2002)
22. J. Millman and C. C. Halkias, Integrated Electronics, Tata McGraw Hill (2001)
23. J. R. C. Jaegar and T. N. Blalock, Microelectronic Circuit Design, Tata McGraw Hill (2010)
24. J. J. Cathey, 2000 Solved Problems in Electronics, Schaum's outline Series, Tata McGraw Hill (1991)
25. Allen Mottershed, Electronic Devices and Circuits, Goodyear Publishing Corporation
26. R. S. Sedha, Textbook of Applied Electronics, S. ChandPublication
27. Electronic Communication Systems: Fundamentals through Advanced, W. Tomasi, Pearson Education, 3rd Edition
28. Electronic Communications, D. Roddy and J. Coolen, Pearson Education India.
29. Modern digital and analog Communication systems- B. P. Lathi, 4rd Edition 2009 Oxford University press.
30. Principles of Electronic communication systems Frenzel, 3rdedition, McGraw Hill.
31. Communication Systems, S. Haykin, 2006, Wiley India
32. Electronic Communication systems, G. Kennedy, 3rd Edn, 1999, Tata McGraw Hill.
33. Electronic Communication system, Blake, Cengage, 5th edition.
34. Op-amp and Linear Integrated Circuits-Ramakant Gaikwad.
35. Op-Amp with Linear integrated circuits-William D Stanley(Pearson)
36. Electronics Devices and Circuits:An Introduction- Allen mottershed.Electronic
37. Communication Systems: Fundamentals through Advanced, W.Tomasi, Pearson Education, 3rdEdition.
38. Principles of Electronic communication systems – Frenzel, 3rdedn, McGraw Hill
39. Martin S. Roden, Analog & Digital Communication Systems, Prentice Hall, Englewood Cliffs, 3rdEdn.
40. Martin S. Roden, Analog & Digital Communication Systems, Prentice Hall, Englewood Cliffs, 3rdEdn.
41. Modern digital and analog Communication systems- B. P. Lathi, 4th Edition 2009 Oxford University press.

42. Telecommunication Switching Systems and Networks, Thiagarajan Vishwanathan, Prentice Hall of India.
43. Communication Systems, S. Haykin, 2006, Wiley India
44. Wireless Communications Principles and Practice, Theodore S. Rappaport, 2nd Edition, Pearson Education Asia.
45. Electronic Communications, D. Roddy and J. Coolen, Pearson Education India.
46. Mobile Communication Design and Fundamentals, Lee, William C.Y.,(1999) 4th Ed
47. Electronic Communication systems, G. Kennedy, 3rdEdn., 1999, Tata McGraw Hill.
48. Electronic Communication system, Blake, Cengage, 5thedition.
49. Wireless communications, Andrea Goldsmith, 2015, Cambridge University Press
50. The 8051 Microcontroller and Embedded Systems Using Assembly and C, M. A. Mazidi, J. G. Mazidi, and R. D. McKinlay, 2nd Ed., 2007, Pearson Education India.
51. The 8051 Microcontroller, Kenneth Ayala, 3rd edition, CENGAGE Learning.
52. Microprocessor Architecture, Programming and Applications with the 8085, Ramesh S. Gaonkar, 3rd edition.
53. Microcontrollers (Theory and Applications), Ajay V. Deshmukh, Tata McGraw Hill.
54. An Embedded Software Primer by David E Simon, Addison Wesley
55. Embedded Systems: Design & applications, S.F. Barrett, 2008, Pearson Education India
56. Introduction to embedded system, K.V. Shibu, 1st edition, 2009, McGraw Hill
57. Embedded Microcomputer systems: Real time interfacing, J.W. Valvano 2011, Cengage Learning
58. Embedded system Design - Frank Vahid and Tony Givargis, John Wiley, 2002

- **JOURNALS AND PERIODICALS**

1. Journal of Instrument Society of India
2. Express Computer
3. Embedded For You
4. Electronics Maker
5. Electronics For You
6. PCQUEST
7. Digit

b. <u>SPECIFIC EQUIPMENTS:</u>

Computers, Laptops, Printers, Scanners, LCD Projectors, E- Podium, Smart Board, Document Camera, Visualizer,3D printer

c. <u>LABORATORY EQUIPMENTS</u>:

i. Digital storage Oscilloscope: 60 MHz
ii. Signal generator
iii. Microwave Test bench (Gunn Source)
iv. Antenna Trainer
v. Arduino Development Board
vi. CPLD development boards
vii. Microcontroller Boards – 8051, MSP430, PIC18F, AVR MEGA32, ARDUINO NANO, UNO, MEGA
viii. KEIL - IDE
ix. Mikro C Compilers for 8051, PIC and ARM
x. Soft Computing Tools – SCILAB, MATLAB
xi. PCB Designing Tool: DipTrace

Semester V

Course IX: BET 501: Power Electronics Devices and Applications

Course Objectives: Student will be able to

1. Study of Power semiconductor devices
2. Study and Familiarize with Thyristor.
3. Understand terminology and concepts of Power Circuits
4. Understand Applications of Power Devices

Credits (Total Credits 2)	**SEMESTER-V BET 501 Power Electronics Devices and Applications**	**No. of hours per unit/credits**
UNIT - I	**Introduction to Power Electronics**	**(10)**
	A) Introduction: Definition of power electronics, scope and Applications of power electronics, classification of power semiconductor devices, control characteristics of devices, characteristics of power devices as a switch, types of Power circuits, Concept of single phase and three phase using phase supply B] Power semiconductor devices: Need for semiconductor power devices, Power Diode, Power BJT, Power MOSFET, IGBT, SCR, TRIAC (Symbol, types, construction (Drift layer), working and their characteristics, two transistor analogy of SCR)	
UNIT - II	**Thyristor**	**(10)**
	A] Introduction to Thyristor family:- Classification, Symbols and Rating. B] Thyristor turn ON methods:- High voltage, high temperature, Light turn on, dv/dt turn on, Gate turn on. C] Thyristor Turn off (Commutation)Process:- Class A Commutation, Class B Commutation, Class C Commutation, Class D Commutation, Class E Commutation, Class F Commutation Thyristor Protections:- Over a voltage protection, Over a Current protection, Gate protection, Over temperature protection. Firing circuit of Thyristors:- Simple Resistor triggering circuit, RC triggering circuit, UJT relaxation oscillator	
UNIT - III	**Power circuits**	**(16)**
	A] AC Voltage Controllers:- Principle of On-Off and phase controls, Single phase ac voltage controller with resistive and inductive loads (Analysis of all these circuits with resistive load only) B] Single phase controlled Rectifier: Half wave controlled rectifier with resistive and inductive load, semiconverter with resistive and inductive load, Full wave controlled rectifier with resistive and inductive load (Analysis of all these circuits with resistive load only) C] Chopper: Introduction, Need, applications, types, Block diagram and working of Step up and Step down chopper. D] Inverters: Introduction, Need, applications, types, circuit diagram and working of series Inverter and parallel Inverter	

UNIT - V	**Applications of Power Devices**	**(09)**
	SMPS, UPS, Electronic Ballast, Power factor correction. Principle of induction and dielectric heating, Introduction to e-vehicle, renewable energy.	

Course Outcomes: The students should be able to…

1	Identify power Electronics devices in circuit
2	Apply the techniques of thyristor use.
3	Design various Power circuits
4	Utilize power devices skill in power application

Reference Books:

1. Power Electronics: Converters, Applications, and Design, Ned Mohan, Tore M. Undeland, Wiley publisher, 2nd ed.,2002
2. Fundamentals of Power Electronics, Robert W. Erickson, Springer,3rd ed. 2020.
3. Power Electronics: Essentials & Applications, L. Umanand, Wiley publisher, 2009.
4. Power Electronics,P. S. Bimbhra, Khanna Publisher, 2012
5. Power electronics: Circuits, Devices and Applications , M.H. Rashid, third Edition Pearson Education, (2004)

Course X: BET 502: Digital logic design using HDL

Course Objectives: Student will be able to

1. Understand the concepts of VHDL Programming Language.
2. Understand the use of VHDL statements by writing program in VHDL
3. Design Combinational circuits using VHDL Programming.
4. Design Sequential circuit using VHDL Programming.

Credits (Total Credits 2)	**SEMESTER-V BET 502 Digital logic design using HDL**	**No. of hours per unit/credits**
UNIT - I	**Introduction to VHDL**	08
	A]HDL design tool: Introduction HDL, Xilinx Simulator(XSIM), SMASH, SIMILI VHDL,ModelSim and Questa,ISE Simulator, Incisive Enterprise Simulator, GHDL,NVC B] History of VHDL, Introduction to VHDL, Opportunities C]Data objects, classes and data types, Operators, Overloading, logical operators. Types of delays D] Entity and Architecture declaration. E] Introduction to behavioral, dataflow and structural models..	
UNIT - II	**VHDL statements**	15
	A] Introduction, General format for VHDL program . B] Assignment statements, sequential statements and process, conditional statements, case statement Array and loops, resolution functions, Packages and Libraries, concurrent statements. C] VHDL code example: AND, OR, NOT. NAND, NOR, X-OR and X-NOR Gates.	
UNIT - III	**Combinational circuit design**	**10**
	A] Introduction, Adders, Subtractors. B] Multiplexers, Demultiplexers, encoders, decoders. C] Code converters, comparators, implementation of circuit using Boolean functions.	
UNIT - IV	**Sequential circuit design**	**12**
	A] Introduction, B] Flip, flip-flops: D flip-flop, RS flip-flop, Clocked RS Flip-flop, and JK flip-flop C] Shift Registers: SISO, SIPO, PISO, PIPO D] Counters: Synchronous, Asynchronous, design of counters, UP counter, Down Counter, UP/DOWN synchronous counter, ring counter, Johnson counter	

Course Outcomes: The students should be able to…

1. Explain VHDL programming languages.
2. Describe Program in VHDL.
3. Develop Combinational circuits using VHDL Programming.
4. Develop Sequential circuit using VHDL Programming.

Reference Books:

1. VHDL Programming by Examples, Douglas Perry, Mc Graw Hill Publications,2002.
2. Digital system Design using VHDL, Charles.H.Roth,Thompson Publishers, 2/e Edition,2007.
3. Circuit Design with VHDL,Volnei. A.Pedroni, MIT Press Cambridge, 2004.
4. Fundamentals of Digital Logic with VHDL, Stephen Brown and ZvonkoVranesic, 2nd Edition, TMH,2008
5. Digital System Design using VHDL: Charles. H.Roth ; PWS (1998).

Semester V
Course XI: BET 503: 8051 microcontroller Interfacing and Application

Course Objectives: Student will be able to

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

Credits (Total Credits 2)	SEMESTER-V BET 503 8051 microcontroller Interfacing and Application	No. of hours per unit/credits
UNIT I	**Serial communicationin8051**	**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 8051inC**	**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)	

Course Outcomes: The students should be able to

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 8051microcontrollers
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

Course XII BET 504: Optoelectronics and IoT

- **Course Objectives:** Student will be able to

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

Credits (Total Credits 2)	**SEMESTER-V BET 504 Optoelectronics and IoT**	**No. of hours per unit/credits**
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 data Analytics, 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.	

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

Elective
BET504: Mechatronics

- **Course Objectives:** Student will be able

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.

Credits (Total Credits 2)	**SEMESTER-V** **BET 504** **Mechatronics**	**No. of hours per unit/credits**
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 Mechatronics applications.

Reference Books

1. William. Bolton, Mechatronics, fourth Edition, New Delhi : Pearson Educationin South Asia,2011
2. Principles, Concepts and Applications – Mechatronics" by Nitaigour and PremchandMahilik
3. Introduction to Mechatronics and Measurement Systems" by David G Alciatore and Michel BiHistand
4. Introduction to Mechatronics (Oxford Higher Education)" by Dr K KAppukuttan
5. Mechatronics : Principles, Concepts and Applications" by WBolton

Semester V Elective
BET504: Nanoelectronics

Course Objectives: Student will be able

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 characterization techniques for nanomaterial's
4. To study fabrication of nanomaterial with different structured nanomaterials

Credits (Total Credits 2)	**SEMESTER-V BET 504 Nanoelectronics**	**No. of hours per unit/credits**
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.	

- **Course Outcomes:** Student 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 nanomaterials
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
SECCET507:Bsic Numerical Skills
Mathematical Methods and Circuit Analysis using MATLAB

Course Objectives: Student will able to…

1. Learn features of MATLAB as a programming tool.
2. Promote new teaching model that will help to develop programming skills and technique to solve mathematical problems.
3. Understand Laplace Transform and Fourier series and its applications.
4. Use MATLAB as a simulation tool.

Credits (Total Credits 1)	**SEMESTER-V SECCET507 Mathematical Methods and Circuit Analysis using MATLAB**	**No. of hours per unit/credits**
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 of non-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.function Applications. 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 - V	**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	

Course Outcomes: The students should be able to…

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

Semester V
BEP508: Power Electronics Devices and VHDL Programming
(Hardware and Circuit Simulation Software)

Course Objectives: Student will able to…

1. Understand and relate concepts learned in classroom to the real-world situations
2. Study of scientific, analytical skills about modern instruments and tools.
3. Study of software/tools for professional practices.
4. Understand and design Combinational and Sequential Circuits.

Credits (Total Credits 4)	**Semester V Practical V Power Electronics Devices and VHDL Programming (Hardware and Circuit Simulation Software)**		**No. of hours per week 10**
Group A			
	1	To study characteristics of SCR and measure latching and holding currents	
	2	To study characteristics of TRIAC	
	3	To study characteristics of Power MOSFET	
	4	To study characteristics of IGBT	
	5	Study of AC Voltage controller	
	6	Study of DC/AC Timer	
	7	Study of DC Motor /AC motor Control/ BLDC motor control	
	8	Design a power supply for 5/9/12V	
GroupB			
	1	Study of VHDL Simulator	
	2	Study of Basic and Derived gates	
	3	Study of Arithmetic Circuits	
	4	Study of multiplexer	
	5	Study of Demultiplexer	
	6	Study of Flip-Flops	
	7	Study of Shift Registers	
	8	Study of up and down counter	

Course Outcomes: The students should be able to…

1 Describe and Explain Characteristics of power devices and VHDL Programming.
2 Utilize various instruments and extend their analytical abilities with exposure to learn and use modern instruments and tools.
3 Demonstrate and utilize software/tools for professional practices
4 Develop various VHDL language programs for Combinational and Sequential Circuits.

- **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:** Student will be able to
  1. learn the basic programming concepts of 8051
  2. learn different Interfacing using 8051
  3. learn the principles of a sensor and transducer
  4. learn Arduino development board and modern OPC

Credits (Total Credits 4)		**Semester V Practical VI Semester V Practical VI BEP509:8051 microcontroller Interfacing, Optoelectronics and IoT/Mechatronics/Nanoelectronics Lab (Hardware and Circuit Simulation Software)**	**No. of hours per week 10**
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	
Group B			
Elective Optoelectronics and IoT			
	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, or Analog IR proximity sensors B) Analog directional light intensity sensors,	
	7	Interface Wi-Fi module with IoT Platform to toggle LEDs and control relays	
	8	To develop IoT system for Smart Homes	

Group B		
OR Elective Mechatronics		
	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

Group B		
OR Elective Nanoelectronics		
	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

- **Course Outcomes:** Student will be able

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”

Numerical Skills

SECCEP510: MATLAB Programming LAB

Course Objectives: Student will able to…

1.To Study the Fundamental concepts of MATLAB

2.To study MATLAB programming

3.To Design and Development MATLAB Application

Credits (Total Credits 1)	**Semester V** SECCEP510: MATLAB Programming LAB		**No. of hours Per week 2**
LAB			
	1	Arithmetic &Logical Operation	
	2	Basic Operation on Matrices	
	3	Debugging, Functions and problems solving	
	4	Data Input/output functions	
	5	Conditional statement and Loops	
	6	MATLAB for Numerical Techniques	
	7	Generation of Various Signals & sequences (periodic and a periodic)	
	8	Study of toolbox	

Course Outcomes: The students should be able to…

1 Develop MATLAB applications in different domain and be able to analyze their performance

2 Implement basic MATLAB applications on simulation platform

3. SIXTH SEMESTER

Sr. No.	SUBJECT TITLE	Theory			Practical		
		COURSE NO & Course Code	No. of lectures per week	Credits		No. of lectures Per week	Credits
1	Electronics	Course-XIII:BET601	12	8	Practical Course – VII & VIII (BEP 608& BEP 609)	20	8
		Course-XIV: BET602					
		Course-XV: BET603					
		Course-XVI: BET604 (Elective)					
		SECCET607	01	01	SECCEP610	02	01

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

Course XIII: BET601: Electronic Instrumentation **Course XIV: BET602:** Antennas and Wave Propagation
Course XV: BET603: Advanced Microcontroller: PIC
Course XVI: BET604: Elective (Any one from the list)

1. Digital Signal Processing and Artificial Intelligence
2. Industrial Process control and PLC Programming
3. Robotics

SECCET607: Entrepreneurship Development Program
SECCEP610: Industrial Project

Semester VI

Course VI: BET 601: Electronic Instrumentation

Course Objectives: Student will able to…

1. Gain the knowledge of constructions and working principle of different types of sensors and transducers.
2. Study different types of ADC, DAC, and Operational Amplifiers.
3. Understand Data Acquisition System and Instrument Characteristics.
4. Understand working of Electronics Instruments and Display devices.

Credits (Total Credits 2)	**SEMESTER-VI BET 601 Electronic Instrumentation**	**No. of hours per unit/credits**
UNIT - I	**Transducers and Sensors**	**(12)**
	Definition, Classification of transducers, Characteristics of transducers, General application of Transducers. **Pressure/Force:** Strain Gauge, Capacitive, Inductive (LVDT), load cell and piezoelectric transducers, Pneumatic Sensors, Hall Effect sensors. **Temperature**: RTD, Thermistor, Thermocouple, Semiconductor IC (LM 35) sensors, **Optical:** Photovoltaic Cell, Photodiodes, PIR sensor **Biomedical Sensors:** EMG Sensor, GSR Sensor, Heart Rate Sensors, wearable sensors	
UNIT - II	**Signal Conditioning and Data Convertors**	**(10)**
	Introduction, AC and DC Signal conditioning, A.C and D.C Bridges, Pre amplifiers, Concept of Filters, Principles and working of different types of ADC and DAC, Comparators, Instrumentation Amplifier, Differential Bridge Amplifier.	
UNIT - III	**Data Acquisition Systems and Introduction to Measurement**	**(12)**
	Definition & Principle, Generalized Data Acquisition System, Signal conditioning for DAS, sample and Hold Circuit, Computer based DAS, Data Logger. Introduction to measurement, performance characteristics: Static characteristics, Dynamic characteristics, Error in measurement, Types of Static Error, Sources of Error, Statistical Analysis, Standards, Electrical Standards	
UNIT - V	**Electronic Instruments and Display Devices**	**(11)**
	Digital Voltmeter, Digital Multimeter, Digital Frequency Meter, Universal Counter, Digital PH Meter. **Signal Generators:** Pulse Generator, Function generators. **Display Devices**: CRT, Block Diagram of CRO, Concept of DSO, LCD, LED, PLASMA, OLED Displays (Comparative Study). instrument enclosure.	

Course Outcomes: The students should be able to…

1 Use concepts in common methods for converting a physical parameter into an electrical quantity
2 Develop signal conditioner for Electronics system.
3 Design Data Acquisition System for various Electronics circuits.
4 Utilize Electronic Instruments and Display Devices for measurement and observation.

Reference Books:

1. Electronic Instrumentation, 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, 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

Course XIV: BET 602: Antenna and Wave Propagation

Course Objectives: Student will able to…

1. Study fundamental antenna parameters and numerical methods to analyze and differentiate the antennas.
2. Understand construction and working of HF, VHF, UHF and Microwave antennas.
3. Understand construction and working of monopole, dipole and patch antennas.
4. Understand basic terminology and concepts of Smart Antennas
5. Understand different modes of propagation of radio waves, critical frequency, skip distance, virtual height etc.

Credits (Total Credits 2)	**SEMESTER-VI BET 602 Antenna and Wave Propagation**	**No. of hours per unit**
UNIT - I	**Antenna Fundamentals**	**(10)**
	A] Introduction, Need, Types, Radiation Mechanism, Scope of antenna design. B] Antenna Parameters-Frequency, Wavelength, Beam widths, Beam Area, Bandwidth, Percentage bandwidth , Radiation Intensity, VSWR, Beam Efficiency, Directivity, Gain, Impedance matching, Antenna Apertures, Aperture Efficiency, Effective Height. C] Antenna Measurements: Near filed and Far Filed, D] Radiation pattern: Introduction, Lobe formation, types of radiation pattern	
UNIT - II	**HF,VHF,UHF ANTENNAS**	**(10)**
	A] HF, VHF & UHF ANTENNAS: Introduction, Traveling wave radiators–basicconcepts, Concept of infinitesimal dipole, finite-length dipole Monopole, Dipole, Folded dipole, Loop antenna and Biconical broadbandAntenna, Long wire antennas, V-antennas, Inverted V-antennas, Rhombic Antennas ,Helical Antennas, Yagi-Uda Arrays, Logperiodic antennas.(Qualitative treatment only)	
UNIT - III	**MICROWAVE ANTENNAS**	**(08)**
	Introduction, Reflector Antennas, Flat Sheet and Corner Reflectors, Paraboloidal Reflectors, Cassegrain, Feeds. Slot antennas, Horn antennas, Lens antennas(Qualitative treatment only)Basics of Microstrip antennas and its design. Examples of Patchantenna like bowtie, sectoral, fractal	
UNIT - IV	**Basic Concepts of Smart Antennas**	**(05)**
	Concept and benefits of smart antennas, Fixed weight beamforming basics,Adaptive beamforming	
UNIT - V	**Wave Propagation**	**(12)**
	A] Electromagnetic spectrums, Frequency band and their uses, Spectrum Allocation, Transmission Limitations, B] Radio Waves: Introduction, Properties of Radio Waves, key features of Radio waves, C] Radio Wave Propagation: Line of sight (LOS) propagation, Ground wave propagation, Sky wave propagation. D] Ionosphere & its Layers: Troposphere, Stratosphere, Ionosphere, Importance of Ionosphere E] Terms in Wave Propagation: Virtual Height, Critical Frequency, Multi-path, Fading, Skip Distance, Maximum Usable Frequency (MUF), Optimum Working Frequency (OWF), Inter Symbol Interference, Skin Depth, Duct Propagation.	

Course Outcomes: The students should be able to…

1	Identify antenna parameters.
2	Describe the various types of HF, VHF, UHF and Microwave antennas.
3	Explain construction, working and applications of monopole, dipole and patch antennas.
4	Describe concept of Smart antenna
5	Analyze the structure of atmosphere for the wave propagation.

Reference Books:

1. Antennas and Propagation for Wireless Communication Systems', 2nd edition, by Simon Saunders, Alejandro Aragón-Zavala, Wiley, 2007.
2. Antenna Theory: Analysis and Design', 3rd Edition, by Constantine A. Balanis, Wiley, 2005
3. Introduction to RF propagation', by John S. Seybold, Wiley, 2005.
4. Antennas for All Applications – John D. Kraus and Ronald J.Marhefka, 3rd Edition, TMH, 2003
5. Electromagnetic Waves and Radiating Systems – E.C. Jordan and K.G. Balmain, PHI, 2nd Edition, 2000.

Semester VI

Course XV: BET603: Advanced Microcontroller: PIC

- **Course Objectives:** Student will able to…

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

Credits (Total Credits 2)	**SEMESTER-VI** **BET603: Advanced Microcontroller: PIC**	**No. of hours per unit**
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.	

- **Course 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
BET604: Digital Signal Processing and Artificial Intelligences

- **Course Objectives:** Student will able to…

1. Give the comprehension of the concepts of discrete-time signals and systems and about the most important issues in sampling and reconstruction.
2. Give the comprehension of the Z- and their inverse.
3. Introduce fundamental concepts of artificial intelligence and provide them the ability to analyze and design intelligent systems.
4. Study application of Artificial Intelligence (AI) techniques to improve the performance of DSP.

Credits (Total Credits 2)	**SEMESTER-V BET 604 Digital Signal Processing and Artificial Intelligences**	**No. of hours per unit/credits**
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).	

- **Course Outcomes:**

1. The student will be capable of calibrating and resolving different frequencies existing in any signal.
2. The student will be in position to understand use of different transforms and analyze the discrete time signals andsystems.
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, Tata McGrawHill, NewDehli
3. P. Ramesh Babu, Digital Signal Processing, 4th Edition, Scitech Publication.
4. A. Ambardar, Digital Signal Processing: A Modern Introduction, Cengate Learning India Pvt Ltd, NewDehli
5. P. Pirsch, Architectures for Digital Signal Processing, John Wiley publication, NewDelhi
6. Phil Lapsley, DSP Processor Fundamentals: architectures and Features, Wileypublication
7. S.K. Mitra,Digital Signal Processing Computer Based Approach, TMH. New Dehli.2009

Semester VI

Course XIV: BET604: Industrial Processes control and PLC programming

Course Objectives: Student will able to…

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

Credits (Total Credits 2)	**SEMESTER-VI BET604 Industrial Processes control and PLC programming**	**No. of hours per unit/credits**
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.	
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. 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.	

Course Outcomes: The students should be able to…

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

Reference Books:

1. John W. Webb and Ronald A. Reiss, Programmable Logic Controllers – Principle and Applications, Fifth Edition, PHI
2. Programmable Logic Controllers And Industrial Automation : An Introduction by Madhuchhanda Mitra
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)

Semester VI

Elective

BET604: Robotics

- **Course Objectives:**

  Student will able to…

1. Study robotics Fundamentals.
2. Study sensors and actuators in robotics.
3. Identify robots and its peripherals
4. Understand various operation and control of robots for industrial and non-industrial applications.

Credits (Total Credits 2)	**SEMESTER-V BET 604 Robotics**	**No. of hours per unit/credits**
UNIT I	**ROBOT BASICS**	**12**
	Robot-Basic concepts, Need, Law, History, Anatomy, specifications. Robot configurations-cartesian, cylinder, polar and articulate. Robot wrist mechanism, Precision and accuracy of robot. End effectors-Classification, Types of Mechanical actuation, Gripper design, ROBOT ELEMENTS: Robot drive system Types, Position and velocity feedback devices-Robot joints and links-Types, Motion interpolation	
UNIT II	ROBOT KINEMATICS AND CONTROL	**12**
	Robot kinematics – Basics of direct and inverse kinematics, Robot trajectories, 2D and 3D Transformation-Scaling, Rotation, Translation Homogeneous transformation. Control of robot manipulators – Point to point, Continuous Path Control, Robot programming	
UNIT III	ROBOT SENSORS	**11**
	Sensors in robot – Touch sensors-Tactile sensor – Proximity and range sensors. Force sensor-Light sensors, Pressure sensors, Introduction to Machine Vision and Artificial Intelligence.	
UNIT IV	ROBOT APPLICATIONS	**10**
	Industrial applications of robots, Medical, Household, Entertainment, Space, Underwater, Defense, Disaster management. Applications, Micro and Nanorobots, Future Applications.	

- **Course Outcomes: On completion of the course, the student will be able to:**

1. List and explain the basic elements of industrial robots
2. Analyze robot kinematics and its control methods.
3. Classify the various sensors used in robots for better performance.
4. Summarize various industrial and non-industrial applications of robots.

- **Reference Books:**

1. Mikell P. Groover, Mitchell Weiss, Roger N Nagel, Nicholas G Odrey, “Industrial Robotics Technology,
2. Programming and Applications”, Tata –McGraw Hill Pub. Co., 2008.
3. Deb.S.R and Sankha Deb, "Robotics Technology and Flexible Automation", Tata McGraw Hill
4. Publishing Company Limited, 2010.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.
5. Electricity and Magnetism: J. H. Fewkes and John Yarhood ,Vol I , Publication by Oxford University Press Vth Edition.

Semester VI
SECCET607: Entrepreneurship Development programme (EDP)

- **Course Objectives:** Student will able to…
  1. study the product design and development process
  2. Identification of opportunities for development
  3. learn the mechanism of finance and fund raising
  4. understand the importance of marketing for better business opportunities

Credits (Total Credits 2)	**SEMESTER-V BET 607 Entrepreneurship Development programme (EDP)**	**No. of hours per unit/credits**
UNIT I	**Introduction to Entrepreneurship**	**05**
	Concept of Entrepreneurship, Entrepreneurial Process, Entrepreneurial Motivation, Entrepreneurial Barriers, risks, Women as Entrepreneur. Business, Types of Business, Developing Business idea, set up of enterprise, types of enterprise, role of SSE in economic development, factors influencing SSEs.	
UNIT II	**Financial Requirements for New Enterprise**	**05**
	Feasibility Study, market survey, Project report/Business Plan, Financing New Enterprise, Estimating Financial Requirements, identifying source of finance, institutions providing finance assistance, venture capital funding.	
UNIT III	**Management of New Enterprise**	**05**
	Management of new enterprise, Human resource management, marketing management in new enterprise, financial management in a new enterprise, production and operational management in a new enterprise, e commerce, types –B2B, B2C, C2B, C2C.	
UNIT IV	**Small Scale Enterprises and Electronics product design**	**05**
	Small scale enterprises, institutional support for small enterprises, challenges in small enterprises, Concept of Intellectual property, IP audit, Concept of Business ethics, Electronic Product design, Case Study: The success story of ***boAt***	

- **Course Outcomes:** Student will able to…
  1. identify feasibility of product design and development
  2. get the idea about IP rights
  3. Avail the financial and marketing skill
  4. prepare the proposal for small scale industry.
- **Recommended Books:**

1.R. G. Kaduskar, V. B. Baru. Electronic Product Design. Second edition Wiley India
2. AlpanaTrehan. Entrepreneurship. Wiley India
3. G. N. Pandey. A complete guide to successful Entrepreneurship, Vika

Semester VI Practical VII

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

- **Course Objectives:** Student will able to…
  1. learn the principles of a sensor and transducer
  2. give exposure to the modern instruments and tools
  3. Introduced to antennas, their principle of operation.
  4. Study of scientific, analytical skills about modern instruments and tools.

Credits (Total Credits 4)	**Semester III Practical III Electronics Instrumentation and Antennas and Wave Propagation Lab (Hardware and Circuit Simulation Software)**		**No. of hours per 10**
GROUP A			
	1	Study of LM-35 temperature sensor	
	2	Study of characteristics of RTD(PT-100)	
	3	Study of Instrumentation Amplifier(TL084/LM324)	
	4	Distance measurement using sensor	
	5	Measurement Of Resistance Using Wheatstone Bridge	
	6	Study of Function generator using IC 8038	
	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 (ɻ/2) antenna	
	2	Study of Folded Dipole (ɻ/2) antenna	
	3	Study of Simple Dipole (ɻ/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	

- **Course 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. Explain and Analyze antenna parameters with radiation patterns of antennas
4. Utilize various instruments and extend their analytical abilities with exposure to learn and use modern instruments and tools.

- **Reference Books:**

1. Electronic Instrumentation, 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
BEP 609: Advanced Microcontroller: PIC, Digital Signal Processing and Artificial Intelligences / Industrial Processes control and PLC programming /Robotics Lab
(Hardware and Circuit Simulation Software)

- **Course Objectives:** Student will able to…
  1. learn design and development of electronic systems using PIC18Fxx
  2. make able to use Embedded system to solve daily life problems
  3. learn Scilab/MATLAB Programming
  4. study of signal processing
  5. learn Ladder Programming
  6. study and understand PLC software

Credits (Total Credits 4)	**Semester VI Practical VIII BEP 609: Advanced Microcontroller: PIC, Digital Signal Processing and Artificial Intelligences / Industrial Processes control and PLC programming /Robotics Lab (Hardware and Circuit Simulation Software)**		**No. of hours per 10**
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 by PIC18Fxxmicrocontroller.	
	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 LCD Protocol	
Elective BET604: Digital Signal Processing and Artificial Intelligences Group B			
	1.	Generation of unit sample sequence, unit step, ramp function, discrete time sequence, real sinusoidal 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 $0 \leq n \leq 50$.	
	6.	Write a program to compute the convolution sum of a rectangle signal (or gate function) with itself for N = 5	
	7.	Given a casual system$yn = 0.9yn - 1 + x(n)$ (a) Find (z) and sketch its pole-zero plot (b) Plot the frequency response $He^{!"}$ and $\angle He^{!"}$ 8. 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** **BET605: Industrial Processes control and PLC programming Group 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.
OR **Elective BET606: Robotics** **Group B**		
	1	Identify and selection of Sensors such as IR sensors, Proximity Sensor, Ultrasonic Sensor, White line sensor, Temperature Sensor, Touch sensor, Tilt Sensor, Accelerometer, Gyroscopic Sensor etc. based on given application
	2	Identify and selection of Actuators and related hardware such as DC motor, Servo motor, Stepper Motor, Motor drivers based on application
	3	Proximity sensors interfacing for autonomous robot working
	4	Robot Motion controlling
	5	Line following robots
	6	Designing of obstacle avoiding robot
	7	Use of Matlab/ Robo Analyser for direct and inverse kinematics of simple robot configuration
	8	Demonstration of simple robotic system using Matlab/ MscAdam / Robo Analyser software

- **Course 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
5. Student will able to develop Ladder programs
6. Students will be able to explain and apply the concept of electrical ladder logic

- **Reference Books:**

1. PIC Microcontroller and Embedded Systems: Using Assembly and C by Muhammad Ali Mazidi, Sarmad Naimi, 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