

Shiksha Mandal's
Bajaj College of Science, Wardha
 (An Autonomous Institution Affiliated to RTM Nagpur University, Nagpur)

CREDIT STRUCTURE

B.Sc. Sem – VIII (Honors in Electronics)

S N	Course Category	Name of Course	Course Code	Teaching Scheme (Hrs.)			Total Credits
				TH	TU	PR	
1	DSC - XI	Object-Oriented Programming Using 'C++'	UEL480T	4	-	-	4
2	DSC - XII	Embedded Systems Design	UEL485T	4	-	-	4
3	Practical – III	Object-Oriented Programming Using 'C++'	UEL480P	-	-	6	3
4	Practical – IV	Embedded Systems Design Practical	UEL485P	-	-	6	3
4	DSE - IV	Electronic Instrumentation/ Digital Communications	UEL484T	4	-	-	4
5	OJT/FP	Apprenticeship /Field Project (Related to DSC)	UEL487P	-	-	8	4
Total				12	-	20	22

SYLLABUS FOR Fourth Year B.Sc. (HONORS in ELECTRONICS)
(Approved in BoS Meeting held on 24.03.2026 to be implemented from the academic Session 2026-27)
SEMESTER VIII

Course Name: DSC-XI Object-Oriented Programming Using 'C++'
Course code: UEL480T

Credits: 4

No. of Hrs.: 60

Learning Objective and Course Learning Outcome

SN	Learning Objectives	Course Learning Outcomes
	<i>Students will try to learn:</i>	<i>After successful completion of the course student will be able to:</i>
1.	To cover the fundamentals of object-oriented programming, such as classes, objects, abstraction, encapsulation, and polymorphism.	Recognize the importance of OOP and its features, as well as the differences between C and C++.
2.	To understand the concepts of constructor and destructor; also familiar with operator overloading.	Understand and implement various sorts of overloading using C++ programs.
3.	To get an idea of inheritance, dynamic objects, and inheritance.	Choose an appropriate inheritance when offering a solution to the given problem.

4.	To investigate the working of virtual functions, polymorphism, and console I/O.	Implement virtual functions and console I/O.
5.	To introduce pointers and file handling in C++.	Handle pointers, memory, and effective file management.
6.	To study exception handling mechanisms and ways to handle exceptions.	Write C++ programs based on effective exception-handling constructs.

Unit I: Object Oriented Methodology: Elements of Object-Oriented programming, Objects, Classes, OOPs features.

Classes & Objects: Specifying a Class, Creating Objects, Accessing Class members, Defining member function, Outside Member Functions as inline, Accessing Member Functions within the class, Static data member, Access Specifiers: Private, Protected and Public Members.

Unit II: Constructors & Destructors: Introduction, Parameterized Constructors, Constructor Overloading, Constructors with Default Arguments, Copy Constructor, Dynamic Constructor, Destructor, Order of Construction and Destruction, Static data members with Constructor and Destructors, Virtual Destructor.

Operator Overloading: Definition, Overloadable Operators, Unary Operator Overloading, Binary overloading, Rules for Operator Overloading.

Unit III: Dynamic Objects: Pointers to Objects, Creating and Deleting Dynamic Objects: New and Delete operators, Array of Objects, Array of Pointers to Objects, Pointers to Object Members, this Pointer.

Inheritance: Definition, Abstract classes, Single, Multilevel, Multiple, Hierarchical, Hybrid Inheritance, Constructor and Destructor in Derived Classes.

Unit IV: Virtual Functions: Need for Virtual Functions, definition, Pure Virtual Functions, Abstract Classes and Rules for Virtual Function. Runtime polymorphism.

Managing Console I/O Operations: C++ Streams and Stream Classes, Unformatted and Formatted Console I/O operations.

Unit V: Working with Files: Introduction, Classes for File Stream operations, Opening and Closing a File, Detecting end-of-file, File Modes, File Pointers and their Manipulation, Sequential Input and Output Operations, Updating a File: Random Access

Unit VI: Exception Handling: Exception Handling Model, List of Exceptions, catch with ellipses catch() Handling Uncaught Exceptions, Fault Tolerant Design Techniques, Memory Allocation Failure Exception, Rules for Handling Exception Successfully.

SEMESTER VIII

Course Name: DSC-XI Object-Oriented Programming Using 'C++' Practical

Course code: UEL480P

Credits: 2 (4Prs.)

No. of Hrs.: 60

Students are expected to perform at least 15 experiments from Object-Oriented Programming Using 'C++' course (DSC-XI).

SEMESTER VIII

Course Name: DSC-XII Embedded Systems Design

Course code: UEL485T

Credits: 4

No. of Hrs.: 60

Course Objective and Course Outcome

SN	Course Objectives	Course Outcome
	Students will learn:	After successful completion of the course student will be able to:
1	The 8051 microcontroller and Embedded systems	Understand the Von Neuman and Harvard Architectures, Multicore processors, Embedded systems
2	Software Development Tools	Use IDE, Cross-compilers, Emulators and Simulators
3	Interfacing and Communication	Understand Serial and parallel communication, Wireless communication, protocols
4	Real Time Operating System	Understand the architecture of RTOS, functions, scheduling algorithms

Unit I: Architecture of Microcontroller 89C51: Architecture, GPR, SFR, Address, Data & Control bus generation, Memory structure (Data and Program memory), IO Ports, Interrupts, Timer/Counter, serial communication, Block diagram and description of architectures of Processors: Von Neumann, Harvard, RISC, CISC, DSP, Multi Core Processor.

Unit II: Introduction to Embedded System: Embedded Systems versus General Computing Systems, History, advantages and disadvantages, Classification of Embedded System: Small scale, medium scale, sophisticated, stand-alone, real time, Networked, Mobile, major application areas.

Unit III: Embedded System Design: Embedded System block diagram, Components of embedded system, characteristics of embedded system, Memories for embedded systems, Design Metrics/Specifications- General Purpose and Domain Specific Processors, Processor power, memory, operating system, Reliability, power consumption, flexibility, time-to prototype.

Unit IV: Software Development Tools: Operation and selection, Integrated Development Environment (IDE), Cross- Compiler, Assembler, compiler, cross compiler, Emulator and Flash/OTP Programmer. In-Circuit Emulator (ICE), debugger, Embedded C-Assembly Language V/S Embedded C, Programming Microcontroller 89C51 with C.

Unit V: Communication Protocols, Need of communication interface in embedded system, Serial V/S Parallel Communication, Synchronous V/S Asynchronous Communication, RS232, MAX 232, 8051 connections with RS232, Concepts of Communication protocols- Serial Communication Protocol: I2C, CAN, USB, Wireless Communication Protocol: IrDA, Bluetooth, Zigbee, IEEE802.11

Unit VI: Real Time Operating System Operating System, Comparison between general purpose OS and RTOS, Architecture of RTOS, functions of RTOS, concepts of

various task scheduling algorithms of RTOS, Inter-task Communication, Share data problem- Semaphore, Mutex, Dead lock

SEMESTER VIII

Course Name: DSC-XII Embedded Systems Design Practical

Course code: UEL485P

Credits: 2

No. of Hrs.: 60

Students are expected to perform at least 10 experiments from Embedded Systems Design course (DSC-XII).

Text books:

1. The 8051 Microcontroller and Embedded System Using Assembly and C, Mazidi, Mazidi & McKinlay, Prentice Hall
2. Introduction to Embedded Systems, Shibu K. V., McGraw-Hill
3. Mike Predko: The 8051 microcontroller

Reference books:

1. The 8051 Microcontroller by K. J. Ayala, Penram International
2. Embedded Systems by Raj Kamal, TMH
3. Microcontrollers Theory and Applications, Ajay V. Deshmukh, Tata McGraw Hill

SEMESTER VIII

(Elective)

Course Name: DSE-IV Electronic Instrumentation

Course code: UEL484T

Credits: 4

No. of Hrs.: 60

Course Objective and Course Outcome

SN	Course Objectives	Course Outcome
	Students will learn:	After successful completion of Biomedical Instrumentation students shall be able to:
1	Transducer & Instrumentation systems, Characteristics	Understand various transducers, types, their characteristics and applications
2	Analog & Digital data acquisition system	Understand the function of multimeters, Recorders, encoders
3	Various Sensors and measurement Systems	Apply the knowledge for various measurement
4	Data acquisition systems	Understand Data Acquisition System

Unit I: Transducer & Instrumentation systems Transducer classification: Active/Passive. Primary/Secondary. Analog/Digital and transduction Principles. Basic Signal

conditioning Circuits. Resistive/Capacitive/Inductive reactance bridge. Current/Voltage Sensitive Wheatstone bridges & Generalized instrumentation system with particular examples

Unit II: Static characteristics, errors & statistical parameters: Static characteristics: Accuracy, Precision, Sensitivity, Threshold, Resolution, Repeatability and Hysteresis. Errors: Gross error, Systematic error, Random error, Limiting error. Statistical Parameters: Arithmetic mean Average deviation Standard deviation. Probable error, Histogram, Normal & Gaussian curve of errors.

Unit III: Electronics Instrumentation: Analog & Digital data acquisition system, Analog electronic multimeter, Introduction to digital voltmeter & universal counter. Strip chart & X-Y recorders. Optical Encoders. Seismic mass vibration transducer. Introduction to microphones & loud speaker.

Unit IV: Measurement of Temperature & Strain Temperature Sensors: LM335, RTD. THERMISTORS, Thermocouples, Thermocouples laws & its compensation, methods. Pyrometers: Total/Partial radiation & optical pyrometers. Strain Gauges, Gauge factor. Strain measurement & temperature compensation methods.

Unit V: Measurement of Displacement. Pressure & Level. Displacement Measurement: using resistive, capacitive, inductive (LVDT & RVDT) & Eddy current. Pressure Measurement: Elastic, Inductive, Piezoelectric & capacitive transducers, Low pressure measurement using ionization gauge, pirani gauge, thermocouple vacuum gauge. Level Measurement: Using ultrasonic, capacitive, inductive, resistive with float, gamma rays & eddy currents techniques.

Unit VI: Measurement of Flow, Humidity, Velocity Flow Measurement: using ultrasonic, electro aquatic & hotwire Anemometer. Humidity Measurement: using resistive, Capacitive & Crystal transducers. Velocity Measurement: Using photo detectors (both linear & angular velocity). Introductory block diagram of smart sensors, Wave analyser & spectrum analysers.

Text Books:

1. Sawhney A.K.: A course in Electrical/Electronic Measurement & Instrumentation, Dhanpat Rai & Sons., Delhi.
2. Rangan C.S., Sharma G.R. , & Mani V.S.V.: Instrumentation Devices & System, Tata Mc- Graw Hill.
3. R. K. Rajput: Electrical & Electronics Measurement & Instrumentation.

Reference Books:

1. Patranbis D. : ' Sensors & Transducers', A.H. Wheeler & Company, Prayag, India.
2. H. S. Kalsi : Electronics Instrumentation, Tata McGraw Hill, 2nd Edition
3. U.A. Bakshi & A. V. Bakshi : Electronics Instrumentation, Technical Publication
4. Robert A. Witte: Electronics Test Instrumentation : Analog & Digital Measurement

SEMESTER VIII

(Elective)

Course Name: DSE-II Digital Communications

Course code: UEL364T

Credits: 4

No. of Hrs.: 60

Course Objective and Course Outcome

SN	Course Objectives	Course Outcome
	Students will learn:	After successful completion of Biomedical Instrumentation students shall be able to:
1	Fundamentals of Digital Communication	Understand basic building blocks of digital communication system and formatting of digital signal.
2	Different digital modulation techniques.	Analyze performance of different digital modulation techniques.
3	Different error control coding schemes	Understand error controlling and Coding, Controlling errors.
4	Modern techniques of communication	Understand various multiple access schemes and spreading techniques

Unit I: DIGITAL COMMUNICATION SYSTEM Comparison of analog and digital communication System, advantages- disadvantages of digital communication System, block diagram of digital communication System, source encoder, decoder, Channel encoder, decoder, modulator, demodulator and their important parameters, Concepts of synchronization.

Unit II: INFORMATION THEORY AND CHANNEL CODING Digital Signal, Bits, bit rate and baud rate, Probability, laws of probability, joint and conditional probability, information content, rate of information, entropy, joint entropy & conditional entropy, Theoretical Concepts of Binary communication channel, discrete communication channel, Channel capacity, Shannon's theorem on channel capacity, Hartley's law, Source coding, Huffman coding algorithm, and simple numerical.

Unit III: DIGITAL MODULATION TECHNIQUES Digital carrier modulation Schemes, fundamental concepts of coherent Amplitude Shift Keying (ASK), Frequency shift keying (FSK), Phase shift keying (PSK), their transmitter and receiver block diagram and working, bandwidth and probability of errors (only theoretical concepts), comparison of digital modulation systems, block diagram of Differential Phase shift keying (DPSK) transmitter - receiver and working.

Unit IV: ERROR CONTROLLING AND CODING Introduction to error controlling and coding, Methods of controlling errors, type of errors and codes, linear block codes, Matrix description of linear block code, error detection and error correction capabilities of linear block code and simple numerical.

Unit V: BASE BAND TRANSMISSION Concept of Base band signals, Sampling process, Nyquist sampling theorem, Base band PAM system, inter symbol interference, Nyquist criterion, pulse shaping, eye diagram (Theoretical concepts only), scrambler and unscramble concepts and design.

Unit VI: MODERN TECHNIQUES OF COMMUNICATION Access techniques: Need of Multiplexing, Time Division Multiple Access (TDMA) and Frequency Division multiple Access (FDMA), Code Division Multiple access (CDMA), comparison of TDMA, FDMA, CDMA. Introduction to spread spectrum (SS), Pseudo Noise (PN) sequence: definition, generation, Model of Spread Spectrum digital Communication system, D.S. spread spectrum transmitter, receiver and frequency hopping spread spectrum transmitter, receiver, Theoretical concepts only.

Text Books:

- 1) Shanmugam K.S. Digital & analog Communication Systems, John Willey & Sons, New York
- 2) Lathi B. P. Modern Digital and Communication Systems, Oxford University Press

SEMESTER VIII

Course Name: On -the Job-Training (OJT)

Course code: UEL487P

Credits: 4

No. of Hrs.: 120

Course Objective and Course Outcome

SN	Course Objectives	Course Outcome
		The students will be able to:
1	To search for work opportunities in a government or private establishment.	Search for work opportunities in a government or private establishment.
2	To learn to apply the knowledge and values gained through education at workplace.	Learn to apply the knowledge and values gained through education at workplace.
3	To understand the working of an organization, get insights in management of human and other resources.	Understand the working of an organization, get insights in management of human and other resources.
4	To learn to undertake the responsibility of a task and complete within a deadline.	Learn to undertake the responsibility of a task and complete within a deadline.

Guidelines

1. The candidate must undergo a 60-hour on-the-job training/internship/apprenticeship in the Industry/Research Laboratories/ School/ Government office/ Private business shop or showroom/ NGO.
2. During the term of on-the-job training (OJT), the candidate is required to regularly submit weekly reports on their progress and attendance in the specified format to the Head or Coordinator or Manager of the relevant Institute.
3. Students are required to submit the OJT/Field report within 15 days after finishing the OJT/Field project. The report should not exceed 20 pages.

4. The candidate must adhere to the guidelines provided by the relevant industry or institute. Any misconduct or grievances during the OJT/Field work may result in severe consequences for the candidate.
5. Students are required to independently fulfil their responsibilities of completing their OJT/Field work.
6. Students are required to submit their parents' undertakings in the prescribed format to the relevant department prior to commencing their OJT/Field work.
7. Students must submit GPS tagged photo at OJT centre/institute/company to the teacher supervisor on any two days of OJT activity. Photo should be taken during office hours. Students must respond to respective teachers of the department upon requirement.
8. Students are expected to actively interact with their allocated mentors or supervisors during the duration of the course. Frequent engagement facilitates a more comprehensive understanding of assignments, industry norms, and cultivates an environment that is conducive to learning. Students should regularly solicit feedback to evaluate their own development and identify areas requiring improvement.
9. Students are advised to keep a detailed record throughout their on-the-job training (OJT). The documentation should encompass a record of the daily undertakings, encountered difficulties, acquired knowledge, and acquired perspectives.
10. The proposed marking scheme for the OJT is

Sr. No	Evaluation type	Max. Marks
1	Presentation	30
2	Report	50
3	Mentor's Assessment	20
Total		100

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