AC 25.04.24 ITEM NO: 21.4

Deccan Education Society's

Kirti M. Doongursee College of Arts, Science and Commerce (AUTONOMOUS)

Affiliated to

UNIVERSITY OF MUMBAI

T.Y.B.Sc. Physics

Syllabus for

Program: Bachelor of Science Course

Subject: **Electronic Instrumentation (Applied Component)**

with effect from

Academic Year 2024-2025

SEMESTER V			
Theory			
KUSEI24505	**Analog Circuits, Instruments and Consumer Appliances.**	**No. of Credits**	**Lectures/Week**
Unit I	Transducers, Sensors and Optoelectronics Devices	02	04
Unit II	Signal conditioning, SMPS and Measuring Instruments		
Unit III	Data Acquisition and Conversion		
Unit IV	Modern Techniques and Consumer Appliances		
Practicals			
KUSEI245P3	**Analog Circuits, Instruments and Consumer Appliances.**	02	04

SEMESTER VI			
Theory			
KUSEI24605	**Digital Electronics, Microprocessor, Microcontroller and OOP.**	**No. of Credits**	**Lectures/Week**
Unit I	Digital Electronics.	02	04
Unit II	Advanced 8085 Programming and 8255 (PPI) interfacing.		
Unit III	Introduction to Microcontrollers.		
Unit IV	Basic Concepts of Object Oriented Programming and C++.		
Practicals			
KUSEI246P3	**Digital Electronics, Microprocessor, Microcontroller and OOP.**	02	04

Course Code	ANALOG CIRCUITS, INSTRUMENTS AND CONSUMER APPLIANCES.	Credits	Lectures / Week
KUSEI24505		2.5	4

About the Course: The objective of these papers is to introduce the students to sensors and transducers, Signal conditioning, data acquisition systems and measuring instruments used in the laboratory. To master Programming and interfacing skills of microprocessor and microcontrollers. To develop object oriented programming skills and programming in C++. To develop various experimental skills.

Course Objectives:

1. Understand the difference between a transducer and a sensor.
2. Understand the concept of signal conditioning, devices used and their operations.
3. Get the insight of the modern medical instruments in principle, which are used in day to day life.
4. Analyze/design and implement combinational logic circuits.

Unit	Topics	No of Lectures
I	**Transducers, Sensors and Optoelectronic Devices** **1. Transducers:** Definition, Classification, Selection of transducer. **2. Electrical transducers:** Thermistor, Thermocouple, Pressure Transducer: Strain gauges (wire, foil, & semiconductor), Displacement transducer: LVDT, Peizo-electri Transducer. [Ref. 2, 3, 6 & 9] **3. Chemical sensors:** PH sensor,Gas sensor (Fundamental aspects), Humidity sensor (Resistive). [R6 R7]. **4. Electronic Weighing Systems:** Operating principle, Block diagram, features [Ref12 & 13]. **5. Optoelectronic Devices:** LDR, LED (Construction, Working & Applications), Multicolour LED, Seven Segment Display, Liquid Crystal Display (LCD), Photodiode	15

	(construction, Characteristics & applications), Phototransistor. [Ref. 1, 2 & 3]	
II	**Signal Conditioning, SMPS and Measuring Instruments** 1. Half wave precision rectifier, Active Peak detector, Active Positive Clamper 2. Active Positive and Negative Clippers 3. **Microphones:** characteristics, types (list only), carbon microphone and dynamic type microphone (principle, construction and working) 4. **Loud speakers:** Characteristics, Dynamic (Moving coil type) speaker, Multi-way speaker system (woofer and tweeter) 5. **Switching Regulators:** Basic and Monolithic Switching regulators (buck, boost and buck – boost) (Only basic Configurations) 6. **Cathode Ray Oscilloscope:** Single trace CRO (Block diagram), Front Panel Controls (Intensity, Focus, Astigmatism, X & Y position, Level knob, Time base (Time/Division) and attenuation (Volts/Division) knobs, X-Y mode), Dual Trace CRO (Block diagram), Probes: 1:1&10:1. Digital Storage Oscilloscope **7. DMM:** 3 ½ Digit, resolution and sensitivity, general specification.	**15**
III	**Data Acquisition and Conversion** **1. Data acquisition system:** Objectives of DAS, Signal conditioning of inputs, Single channel Data Acquisition system, Multichannel Data Acquisition system. [Data Transmission systems IEEE-488 GPIB*] **2. D to A Converters:** Resistive divider network, Binary ladder network. **3. A to D Converters:** Successive approximation type, Voltage to Time (Single slope, Dual slope).	**15**

IV	**Modern Techniques and Appliances** **1.Printed Circuit Board:** Idea of PCB, advantages, copper clad, Etching processes, Principle of Photolithography (For PCB). **2.Microwave Oven:** Operating principle, block diagram, features. **3.Medical instruments:** Bio-Potential, Types of electrodes, ECG, EEG, EMG, CT Scan and MRI (principle,blockdiagram and features), Ultrasonography: working principle	**15**

References:

1. A Textbook of Applied Electronics – R S Sedha, S Chand & Company, New Delhi.
2. Basic Electronics Solid state - B. L. Thereja, S Chand & Company, New Delhi.
3. Electronic Instrumentation – H S Kalsi, Tata McGraw-Hill Publishing Company Limited, New Delhi.
4. Electronic components and materials: Principles, Manufacture and Maintenance- S. M. Dhir, Tata McGraw-Hill Publishing Company Limited, New Delhi.

Additional References:

1. .Measurement and Instrumentation Principles: Alan S. Morris., Butterworth-Heinemann.
2. Transducers and display systems: B. S. Sonde, Tata McGraw-Hill Publishing Company Limited, New Delhi.
3. Digital principles and applications: A.P. Malvino and D. P. Leach. Tata McGraw-Hill.
4. Data Converters– B. S. Sonde, Tata McGraw-Hill Publishing Company Limited, New Delhi.
5. Modern Electronic Instruments and Measurement techniques- Albert
6. D. Helfrick, Willam D. Cooper, Prentice Hall India Pvt. Ltd, New Delhi

Course Code	PRACTICALS (Semester V)	Credits	Lectures/ Week
KUSEI245P3	EI PRACTICAL	3	3

Learning Outcome:

On successful completion of this course students will be able to :

1. Get acquainted with the measuring instruments used in laboratory.
2. Get the insight of the modern medical instruments in principle, which are used in day to day life.
3. Analyze/design and implement combinational logic circuits.

GROUP A	
	1. Thermistor Characteristics –Thermal and electrical. (H & C) 2. Thermistor as sensor in temperature to voltage converter using OPAMP. (C&D Ch.8) 3. Study of LVDT characteristics. (K Ch. 13) 4. Study of Load Cell / Strain Guage. (K Ch. 13) 5. Study of seven segment display. 6. Characteristics of Photo diode and photo transistors.
GROUP B	
	1. Basic Instrumentation Amplifier using 3 Op-Amps coupled to resistance bridge. (C & D Ch. 8) 2. Temperature to frequency Conversion using 555 timer. (C & D Ch.13) 3. OPAMP D/A Converter: Binary weighted resistors. 4. OPAMP D/A Converter: Ladder network. (M & L Ch. 12) 5. Sample and hold circuit using op-amp 741. (G Ch. 8) 6. Peak detector using op-amp 741. (G Ch. 8)
GROUP – C (Must be performed on Bread Board)	

	1. Half wave precision rectifier using precision op-amps (OPA177) (C & D Ch. 7) 2. Positive and Negative Clippers using op-amp.(G Ch. 8) 3. Positive and Negative Clampers using single power supply op-amp (124/324). (G Ch. 8) 4. Second Order active Low Pass filter (frequency response & phase relation) 5. Second Order active High Pass filter (frequency response & phase relation) (K.Ch15) 6. Active Notch Filter (frequency response & phase relation) (K.Ch.15) 7. Square and Triangular wave generator using OPAMPs with concept of duty cycle (M.Ch 23)
GROUP - D	
	1. Study of variable dual power supply using LM 317& LM 337 (± 3v to ± 15v). (C&D Ch.13) 2. Constant Current source using OPAMP and PNP transistor (o/p current less than 50 mA) (C & D Ch 5) 3. Simple microphone amplifier using a transistor. 4. Low voltage audio amplifier using IC LM386 5. Construction of Audio power amplifier using IC TBA 810. 6. Making PCB for simple circuits (like rectifiers, regulators, oscillators, multivibrators, op-amp applications, single stage amplifier etc.), building and testing of the circuit. 7. Visit to Hospital/Diagnostic Center/ Bio-medical Research Laboratory and submission of its report.

References:

1. H & C: Modern Electronic Instrumentation & Measurement Techniques by Albert D.Helfrick & William D. Cooper PHI) Edition.
2. C & D: OPAMPs and linear integrated circuits" by Coughlin & F. F. Driscoll (6th edition PHI)
3. G: OPAMPs and linear integrated circuits by R.A. Gayakwad (4th edition, PHI).
4. M: Electronic Principles by A. P. Malvino, (PHI), 6th edition.
5. K: Electronic Instrumentation by H. S. Kalsi, (TMH) 2nd Edition
6. M & L: Digital Principle and Applications" by Malvino and Leach, (TMH), 5th edition,
7. RPJ: Modern Digital Electronics, R .P. Jain, (TMH), 3rd edition.

Note : Perform Minimum TWO Experiments from each group.
Group C experiments must be performed on Bread Boards.

Experiment No. 5 & 6 are Hands-on experiments. Learner have to prepare report, PPT and viva voice. Which is equivalent to 2 regular experiments.

Visit to Hospital/Diagnostic Center/ Bio-medical Research Laboratory and submission of its report which is also equivalent to 2 regular experiments.

Learner will be examined for Expt. No. 5, 6 and 7 on the basis of submitted report, PPT and viva, and need not perform regular experiment during the Practical Examination.

Course Code	DIGITAL ELECTRONICS, MICROPROCESSOR, MICROCONTROLLER AND OOP	Credits	Lectures / Week
KUSEI24605		**2.5**	**4**

Course Objectives:

1. Develop assembly language programing skills and real time applications of microprocessor.
2. Illustrate how to interface the I/O peripheral (PPI) with 8085 microprocessor
3. Understand architecture, silent features, instruction set, programming and interfacing of 8051 microcontroller.
4. Develop the programming skills in programming Language C++.

Unit	Topics	No of Lectures
I	**Digital Electronics** 1.**Combinational Logic Design**: Introduction, Boolean identities, K – map (2, 3 and 4 variable), Ref: N G P 4.1 – 4.8. (additional ref. RPJ) 2.**Design and implementations of:** Decoders, Encoders, Multiplexers, De- multiplexers, Use of MUX and DEMUX in Combinational Logic design. Code Converters (based on – binary, BCD, Gray and Excess – 3 codes). Tri-State logic, buffers, D latch.	**15**
II	**Advanced 8085 Programming and 8255(PPI)** 1. Introduction to advanced instructions and applications Ref. RG: 10.7, 10.8, 10.9 2. Stack and Subroutines: Stack, Subroutine Ref. RG: 9.1, 9.1.1, 9.2&9.2.1 3. The 8255 Programmable Peripheral Interface: Block Diagram of the 8255,Mode 0 – Simple Input / Output mode, BSR (Bit Set/Reset Mode) Ref. RG: 15.1.1, 15.1.2& 15.1.3	**15**

III	**Introduction to Microcontrollers** 1. Introduction, Microcontrollers and Microprocessors, History of Microcontrollers and Microprocessors, Block diagram of 8051 Microcontroller*, Embedded Versus External Memory Devices, 8-bit & 16-bit Microcontrollers, CISC and RISC Processors, Harvard and Von Neumann Architectures, Commercial Microcontrollers. Ref. AVD-Ch: 1 Ref. MMM - For * Refer 1.2 The 8051 Microcontroller & Embedded Systems by M.A. Mazidi, J.G. Mazidiand R. D. Mckinlay, Second Edition, Pearson. **2. 8051 Microcontrollers:** Introduction, MCS-Architecture, Registers in MCS-51, 8051 Pin Description, 8051 Connections, 8051 Parallel I/O Ports, Memory Organization. AVD-Ch: 2, 3. **3. 8051 Instruction Set and Programming:** MCS-51 Addressing Modes and Instructions: 8051 Addressing modes, MCS-51 Instruction Set, 8051 Instructions and Simple Programs, Using Stack Pointer AVD-Ch: 4	**15**
IV	**Basic Concepts of Object Oriented Programming and C++** **1. Basics of Object-Oriented Programming & Beginning with C++:** Basic concepts of Object-Oriented Programming, Benefits of OOP, Object- Oriented Languages, Applications of OOP. What is C++?, Applications of C++, A simple C++ program, More C++ Statements, Example with Class, Structure of C++ Program, Creating the Source File, Compiling and Linking. Ref EB: 1.5, 1.6, 1.7 & 1.8 EB: 2.1, 2.2, 2.3, 2.4, 2.5, 2.6, 2.7 & 2.8 **2. Tokens and Expressions in C++:** Introduction, Tokens, Keywords, Identifiers and Constants, Basic Data Types, User-Defined Data Types, Derived Data Types, Symbolic Constants, Type Compatibility, Declaration of Variables, Dynamic Initialization of Variables, Reference Variables, Operators in C++, Scope Resolution Operator,	**15**

	Member Dereferencing Operators, Memory Management Operators, Manipulators, Type Cast Operator, Expressions and Their Types, Special Assignment Expressions, Implicit Conversions, Operator Overloading, Operator Precedence. Ref EB: 3.1, 3.2, 3.3, 3.4, 3.5, 3.6, 3.7, 3.8, 3.9, 3.10, 3.11, 3.12, 3.13, 3.14, 3.15, 3.16, 3.17, 3.18, 3.19, 3.20, 3.21, 3.22 & 3.23 **3 Control Structures and Functions:** Control Structures, Functions: The Main Function, Function Prototyping, Call by Reference, Return by Reference, Inline Functions, Default Arguments, Constant Arguments, Function Overloading, Math Library Functions. Ref EB: 3.24, 4.1, 4.2, 4.3, 4.4, 4.5, 4.6, 4.7, 4.8, 4.9 & 4.11	

References:

1. N G P - 5.1 (only introduction), 5.3, 7.1 -7.6 (except 7.5) RPJ - 4.20.
2. RG: 3.5.1, 3.5.2, 3.5.3, 3.5.4 & 3.5.5
3. NGP: Digital Electronics and Logic design by N G PALAN, https://archive.org/details/hellomr82k_gmail_DE
4. RG: Microprocessor Architecture, Programming and Applications with the 8085, Ramesh Gaonkar, 5th Edition.
5. RPJ: R. P. Jain, Modern Digital Electronics, Tata McGraw Hill, 4th Edition.
6. RG: Microprocessor Architecture, Programming and Applications with the 8085, Ramesh Gaonkar, 5th Edition.
7. RG: Microprocessor Architecture, Programming and Applications with the 8085, Ramesh Gaonkar, 5th Edition.
8. EB: Object Oriented Programming with C++ by E Balagurusamy, Third/ Fourth Edition, Tata McGraw-Hill Publishing Company Limited.

Additional Reference books:

1. The 8051 Microcontroller & Embedded Systems-Dr. Rajiv Kapadia (Jaico Pub. House)
2. 8051 Micro-controller by K.J.Ayala., Penram International.
3. Programming & customizing the 8051 microcontroller By Myke Predko, TMH.
4. The 8051 Microcontroller & Embedded Systems by M.A. Mazidi, J.G. Mazidiand R.D.Mckinlay, Second Edition, Pearson.

Course Code	PRACTICALS (Semester VI)	Credits	Lectures/ Week
KUSEI246P3	EI PRACTICAL	3	3

Learning Outcome:

1. Get practical training to interface different programmable peripherals and I/O devices to microprocessor and microcontroller.
2. Develop the programming skills in programming Language C++.
3. Train their practical knowledge through lab experiments.
4. Get practical training to interface different programmable peripherals and I/O devices to microprocessor and microcontroller.

Sr. No	Name of the Experiments
	GROUP A
	Digital Electronics 1. Study of 3:8 Decoder (74LS138), 8:3 Priority Encoder (74LS148) and their applications. 2. Study of Latch (74LS373) and its application. 3. Study of 8:1 Multiplexer (74LS151), 1: 4 De-multiplexer (74LS155) and their applications. 4. Study of unidirectional buffer (74LS244) and bidirectional buffer (74LS245). 5. Design using K –map and implement 4:1 MUX, 1:4 DEMUX, 2bit comparator, Full adder and Full subtractor. [Note: Use suitable circuit simulator for implementation] 6. Designing (using K –map) and implementation of code convertors. (any two – Binary to Gray, Gray to Binary, BCD to Excess – 3 and Excess-3 to BCD) [Note: Use suitable circuit simulator for implementation
	GROUP B
	8085 Advanced Programming and 8255 interfacing **Note:** The students should be familiar with Keyboard and Display utilities such as READ KEYBOARD, TO DISPLAY ON ADDRESS FIELD, and TO DISPLAY ON DATA FIELD, mentioned in the 8085 μp kit's manual. **8085 programming** 1. Write An ALP: a) To Evaluate simple arithmetic Expression (like Y= a x b + c x d where a, b, c and d are 8-bit HEX numbers) b) To Add parity bit to 7-bit ASCII characters. 2. Write An ALP for code conversion (any two)

3. 16-bit Data manipulation (Addition, subtraction) Display result on Address field.
4. Write ALP for Addition/ Subtraction/Multiplication of two, 8-bit hex, numbers. [Note: Use Read Keyboard Utility for inputting the hex numbers and display the result on the Address field.]

8255 interfacing

1. Design a system (both Software and Hardware) that will cause 4 LEDs to flash when a push button switch is pressed. Assume persistence of vision to be 0.1 seconds.
2. Design a system (both Software and Hardware) using 8 LED display to demonstrate:

a) Binary - up, down and ring counters.
b) Flashing display.

3. Design a system (both Software and Hardware) to control ON/OFF operation of 4 electrical loads (appliances).

4. Interfacing 8 switches and 8 LEDs to 8255:

a) Write ALP to read the status of the switches and display on the LEDs.
b) Write ALP so that when the first switch is made ON all the LEDs should glow and when the second switch is made OFF all the LEDs should become off.

GROUP C
Experiments for 8031 / 8051 / 89C51

8031/51 assembly language programming

a) Simple data manipulation programs. (8/16-bit addition, subtraction, multiplication, division.
b) 8/16 bit data transfer, cubes of nos., to rotate a 32- bit number
c) Finding greatest/smallest number from a block of data, decimal / hexadecimal counter.

Study of IN and OUT port of 8031/51 by Interfacing switches, LEDs and Relays: To display bit pattern on LED's

a) To count the number of "ON" switches and display on LED's,
b) To trip a relay depending on the logic condition of switches
c) Event counter (using LDR and light source)

GROUP D

	C++ Programming 1. Program based on Input, Output Statements. (Programs to read any two numbers through keyboard and to perform simple arithmetic operations and to display the result). 2. Program based on Control Statements a) Program based on if-else statement b) Program based on nested if statement 3. Program based on for loop, while loop and do-while loop. 4. Program using switch statements and if-else ladder. 5. Program to study function declaration, function calling and function prototype.

Note: Perform Minimum TWO Experiments from each group.

Evaluation Scheme for Third Year (UG) under AUTONOMY

I. Internal Evaluation for Theory Courses – 40 Marks

II. External Examination for Theory Courses – 60 Marks

III. Practical Examination : 100 marks

Internal Evaluation for practical Courses –40 Marks

One small experiment 30 + 05 viva

External Examination for practical Courses – 60 Marks

One experiment of two hour duration------ 50 Marks

Journal : 10 marks

Evaluation Scheme for Third Year (UG) under AUTONOMY (2024-2025)

I. Internal Evaluation for Theory Courses – 40 Marks

(i) Continuous Internal Assessment 1 (Assignment- Tutorial/ Ind. Visit/– 20 Marks

(ii) Class Internal Assessment 2 – 20 Marks (Class Test with Fill in the Blanks, True or False & Answer the following)

II. External Examination for Theory Courses – 60 Marks

Duration: 2 Hours

Theory question paper pattern:

All questions are compulsory.

Question	Based on	Options	Marks
Q.1	MCQ and fill in the blanks	6 fill in the blanks and 6 MCQs on (Unit-I, II & III), 1 mark each	12
Q.2	Unit I	*Any 3 out of 5 sub questions, 4 marks each*	12
Q.3	Unit II	*Any 3 out of 5 sub questions, 4 marks each*	12
Q.4	Unit III	*Any 3 out of 5 sub questions, 4 marks each*	12
Q.5	Unit I,II,III	*Solve 3 out of five questions, 4 marks each (problems).*	12

· All questions shall be compulsory with internal choice within the questions. · Each Question may be sub-divided into sub questions as a, b, c, d, etc. & the

allocation of Marks depends on the weightage of the topic.

III. Practical Examination

· Each core subject carries 100 Marks (60 marks External + 40 marks Internal) · Duration: 2 Hours for each practical course.

· Certified Journal is compulsory for appearing at the time of Practical Exam

** This Syllabus will change as per the change according to University of Mumbai and will be implemented accordingly