UNIVERSITY OF MUMBAI

Syllabus for Sem V & VI Program: B.Sc.

Course: Electronic Instrumentation

(Applied Component)

(Credit Based Semester and Grading System with effect from the academic year 2018 –2019)

SEMESTER V			
Theory			
USACEI501	**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			
USACEI5P1	**Analog Circuits, Instruments and Consumer Appliances.**	02	04

SEMESTER VI			
Theory			
USACEI601	**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			
USACEI6P1	**Digital Electronics, Microprocessor, Microcontroller and OOP.**	02	04

The revised syllabus under the credit based grading system in the subject of **Electronic Instrumentation** (Applied Component) for Third Year B.Sc. Physics (Single/Twin major subject) will be implemented **from the academic Year 2018-19**

The scheme of examination in the subject of Electronic Instrumentation (Applied Component) will be as follows:

Semester V & VI: Theory

Course Code: USACEI501 & USAEI601

Theory Examination: 100 marks

- Duration of each Theory paper will be of **three** hours.
- Each theory paper shall consist of **five questions**, one from each unit and the fifth question will be from all the units. All questions are compulsory and will have internal choice.
- The theory examination will be conducted by the respective colleges and the marks will be forwarded to the University

Objectives

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. Students are to be exposed to know, in principle, the modern techniques in the field of medical science. To learn PCB designing and working of consumer electronic devices. To develop logic circuit design and implementation. To know advanced programming skills and interfacing techniques. To understand basic building blocks of microcontrollers. To know the terminologies like embedded, CISK and RISK processors. 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.

Expected learning outcomes

Learner will be able to:

- Understand the difference between a transducer and a sensor.
- Understand the construction, working and uses of different types of transducers.
- Understand the concept of signal conditioning, devices used and their operations.
- Get acquainted with the measuring instruments used in laboratory.
- Get the insight of the modern medical instruments in principle, which are used in day to day life.
- Analyze/design and implement combinational logic circuits.
- Develop assembly language programing skills and real time applications of microprocessor.
- Illustrate how to interface the I/O peripheral (PPI) with 8085 microprocessor
- Understand architecture, silent features, instruction set, programming and interfacing of 8051 microcontroller.
- Develop the programming skills in programming Language C++.
- Train their practical knowledge through lab experiments.
- Get practical training to interface different programmable peripherals and I/O devices to microprocessor and microcontroller.

SEMESTER V

COURSE CODE: USACEI501

ANALOG CIRCUITS, INSTRUMENTS AND CONSUMER APPLIANCES.

Unit- I:	**Transducers, Sensors and Optoelectronic Devices**	(15 lect.)
1.	**Transducers:** Definition, Classification, Selection of transducer.	
2.	**Electrical transducers:** Thermistor, Thermocouple, Pressure Transducer: Strain gauges (wire, foil, & semiconductor), Displacement transducer: LVDT, Peizo-electric 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 (construction, Characteristics & applications), Phototransistor. [Ref. 1, 2 & 3]	
Unit-II:	**Signal Conditioning, SMPS and Measuring Instruments**	(15 lect.)
1.	Half wave precision rectifier, Active Peak detector, Active Positive Clamper [M & B].	
2.	Active Positive and Negative Clippers [G]	
3.	**Microphones:** characteristics, types (list only), carbon microphone and dynamic type microphone (principle, construction and working) [R4].	
4.	**Loud speakers:** Characteristics, Dynamic (Moving coil type) speaker, Multi-way speaker system (woofer and tweeter) [R4]	
5.	**Switching Regulators:** Basic and Monolithic Switching regulators (buck, boost and buck – boost) (Only basic Configurations) Ref M: 24.7	

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 [R3 &10].	
7.	**DMM:** 3 ½ Digit, resolution and sensitivity, general specification. [R3]	
Unit- III:	**Data Acquisition and Conversion**	(15 lect.)
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*] [Ref. 11]	
2.	**D to A Converters:** Resistive divider network, Binary ladder network [Ref 7 & 8]	
3.	**A to D Converters:** Successive approximation type, Voltage to Time (Single slope, Dual slope). [Ref. 7 & 8]	
Unit-IV:	**Modern Techniques and Appliances**	(15 lect.)
1.	**Printed Circuit Board:** Idea of PCB, advantages, copper clad, Etching processes, Principle of Photolithography (For PCB). [Ref. 4, 14 & 15].	
2.	**Microwave Oven:** Operating principle, block diagram, features. [Ref. 12 & 13]	
3.	**Medical instruments:** Bio-Potential, Types of electrodes, ECG, EEG, EMG, CT Scan and MRI (principle, block diagram and features), Ultrasonography: working principle [R 16, 17 and18].	

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.

	https://books.google.co.in/books?id=sGbwj4J76tEC&pg=PA384&lpg=PA384&dq=4.+Electronic+components+and+materials:+Principles,+Manufacture+and+Maintenance-+S.+M.+Dhir,+Tata+McGraw-Hill+Publishing+Company+Limited,+New+Delhi.&source=bl&ots=U1ekaiN3pB&sig=viKj6soAvVom4Hx9W-53Q-koqFM&hl=en&sa=X&ved=0ahUKEwjCq97viYXaAhUEPo8KHfMNBaQQ6AEIMjAC#v=onepage&q=4.%20Electronic%20components%20and%20materials%3A%20Principles%2C%20Manufacture%20and%20Maintenance-%20S.%20M.%20Dhir%2C%20Tata%20McGraw-Hill%20Publishing%20Company%20Limited%2C%20New%20Delhi.&f=false. https://books.google.co.in/books?id=bftp5ZG8v5kC&pg=PP1&lpg=PP1&dq=digital+Electronics+-+by+A.P+Godse+%26+D.A+Godse+Technical+publications,+Pune,+Revised+third+edition,+2008&source=bl&ots=_ApVT8Km_H&sig=hfrgOdJHfzdZwEy1_JPogAeRhLE&hl=en&sa=X&ved=0ahUKEwif3ZbKssraAhVFPI8KHVaJBKIQ6AEINTAB#v=onepage&q=digital%20Electronics%20-%20by%20A.P%20Godse%20%26%20D.A%20Godse%20Technical%20publications%2C%20Pune%2C%20Revised%20third%20edition%2C%202008&f=false
5.	Measurement and Instrumentation Principles: Alan S. Morris., Butterworth-Heinemann.
6.	Transducers and display systems: B. S. Sonde, Tata McGraw-Hill Publishing Company Limited, New Delhi.
7.	Digital principles and applications: A.P. Malvino and D. P. Leach. Tata McGraw-Hill.
8.	Data Converters– B. S. Sonde, Tata McGraw-Hill Publishing Company Limited, New Delhi.
9.	Modern Electronic Instruments and Measurement techniques- Albert D. Helfrick, Willam D. Cooper, Prentice Hall India Pvt. Ltd, New Delhi.
10.	A course in electrical and electronic Measurements and Instrumentation: A. K. Sawhney, DhanpatRai and Sons. https://www.scribd.com/document/258017718/A-K-sawhney-A-Course-in-Electrical-and-Electronic-Measurements-and-Instrumentation
11.	Instrumentation Devices & Systems , 2nd Edition Tata McGrawHill- C.S. Rangan, G.R. Sarma,V.S. Mani
12.	Consumer Electronics R. P. Bali, Pearson Education (2008)

13.	S.P Bali, "Consumer Electronics", Pearson Education Asia Pvt., Ltd., 2008 Edition,
14.	Printed Circuits Handbook pdf, Clyde F. Coombs. Jr. , McGraw Hill Handbooks, 6th ed.
15.	PCB design basics, Mahmoud Wahby, EDN Networks, Nov 2013.
16.	Introduction to Bio-medical Electronics: Joseph-Du-bary, McGraw Hill Co. Ltd.
17.	Medical instrumentation Application and design- J. C. Wobster
18.	Biomedical instruments and measurements – L. Cromwell, F. J. Weibell, Printice hall of India of India Pvt. Ltd, New Delhi.

SEMESTER VI

COURSE CODE: USACEI602

DIGITAL ELECTRONICS, MICROPROCESSOR, MICROCONTROLLER AND OOP

Unit- I:	**Digital Electronics**	(15 lect.)
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.	
	Ref: N G P - 5.1 (only introduction), 5.3, 7.1 -7.6 (except 7.5) RPJ - 4.20. RG: 3.5.1, 3.5.2, 3.5.3, 3.5.4 & 3.5.5 NGP: Digital Electronics and Logic design by N G PALAN, https://archive.org/details/hellomr82k_gmail_DE RG: Microprocessor Architecture, Programming and Applications with the 8085, Ramesh Gaonkar, 5th Edition. RPJ: R. P. Jain, Modern Digital Electronics, Tata McGraw Hill, 4th Edition.	

Unit-II:	**Advanced 8085 Programming and 8255(PPI)**	(15 lect.)
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	
	RG: Microprocessor Architecture, Programming and Applications with the 8085, Ramesh Gaonkar, 5th Edition.	
Unit- III:	**Introduction to Microcontrollers**	(15 lect.)
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 Ref. AVD: Microcontrollers (Theory and Applications) by Ajay V Deshmukh, The Tata-McGraw-Hill Companies **Ref. Intel's 8031/8051 Data sheet**	

	https://archive.org/details/bitsavers_intel8051M4_15073500 https://www.8051projects.net/download-d215-intel-mcs-51-8051-user-manual.html https://archive.org/stream/212656146The8051MicrocontrollerByIScott Mackenzie4th Edition/212656146-The-8051-Microcontroller-by-I-Scott-Mackenzie-4th-Edition#page/n47/mode/2up 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.

Unit-IV:	**Basic Concepts of Object Oriented Programming and C++**	(15 lect.)
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, 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

Reference:
EB: Object Oriented Programming with C++ by E Balagurusamy, Third /Fourth Edition, Tata McGraw-Hill Publishing Company Limited.

Additional references:

1) Microprocessor and Applications by Vibhute and Borole, Techmax Publications,
2) Microprocessor, Principles & Applications by Gilmore (2nd Ed) TMH
3) Programming with C++ by D. Ravichandran, Tata McGraw-Hill Publishing Company Limited.
4) Starting out with C++ by Tony Gaddis, Third Edition, Addison Wesley Publishing Company.
5) Digital Electronics - by A.P Godse & D.A Godse Technical publications, Pune, Revised third edition, 2008. Pg.No:2.25-2.70 (for K-maps).

https://www.scribd.com/document/103027386/Digital-Electronics-By-D-A-Godse-A-P-Godse

https://books.google.co.in/books?id=JkMrIjNKI7IC&pg=PP1&lpg=PP1&dq=Digital+Electronics+-+by+A.P+Godse+%26+D.A+Godse+Technical+publications,+Pune,+Revised+third+edition,+2008&source=bl&ots=9VG8scIgqH&sig=d7cyhWaM7cCwabgqRMoWz6snI8s&hl=en&sa=X&ved=0ahUKEwiv55-j6cbaAhUBvY8KHUZJBmMQ6AEIPTAD#v=onepage&q=Digital%20Electronics%20-%20by%20A.P%20Godse%20%26%20D.A%20Godse%20Technical%20publications%2C%20Pune%2C%20Revised%20third%20edition%2C%202008&f=false