GULBARGA UNIVERSITY

SYLLABUS

For

M.Sc. ELECTRONICS AND INSTRUMENTATION

I, II, III, & IV Semesters

(Under CBCS & CGPA with effect from 2017-18 and onwards)

Department of Studies and Research in

INSTRUMENTATION TECHNOLOGY

Post Graduate Centre, Yerigera - 584 133, RAICHUR,

Karnataka, INDIA

Web: www.gulbargauniversity.kar.nic.in

Phone: 08532 204441

Fourth		**Hard Core**							
	HCT 4.1	Personal Computer for Measurement and Control	**80**	**20**	**100**	**4**	**0**	**0**	**4**
	HCT 4.2	Scientific/Analytical Instrumentation	**80**	**20**	**100**	**4**	**0**	**0**	**4**
		Soft Core (Any One)							
	SCT 4.1	Biomedical Electronics	**80**	**20**	**100**	**4**	**0**	**0**	**4**
	SCT 4.2	Industrial Components and Systems	**80**	**20**	**100**	**4**	**0**	**0**	**4**
		Practical							
	HCP 4.1	Personal Computer Based Lab	**40**	**10**	**50**	**0**	**0**	**2**	**2**
	HCP 4.2	Analytical Instrumentation Lab	**40**	**10**	**50**	**0**	**0**	**2**	**2**
		Soft Core (Any One)							
	SCP 4.1	Biomedical Electronics Lab	**40**	**10**	**50**	**0**	**0**	**2**	**2**
	SCP 4.2	Industrial Components and Systems Lab	**40**	**10**	**50**	**0**	**0**	**2**	**2**
	*HCMP 4.3	**Major Project (90 for Project Evaluation +30 for Viva-voce + 30 for IA = 150 Marks)**	**120**	**30**	**150**	**0**	**0**	**6**	**6**
		Total for Fourth Semester	**480**	**120**	**600**	**12**	**0**	**12**	**24**

L= Lecture, T= Tutorials, P= Practicals
4 Credits of Theory = 4 Hrs of Teaching per week
2 Credits of Practicals = 4 Hrs per week
Study Tour: An academic/ industrial study tour of duration 10-15 days can be conducted during the vacations of II or III Semesters.
***Project work can be carried out in the parent department or industries/R&D Organization/IISc,/IITs/Any Universities. Project shall be conceptualized soon after the completion of the II semester and III semesters. Student shall work for the project during the mid-term vacation in the II semester and III semester if the work is carried outside the department.**

Outcome of the course: After the completion of M.Sc. (Electronics & Instrumentation) the students will be able to design/develop/fabricate instrument for the measurement of various parameters such as process/biomedical/scientific/analytical etc., using microcontroller/ Microprocessor/PC/DSP etc.

IV - SEMESTER

Course HCT 4.1: PERSONAL COMPUTER FOR MEASUREMENT AND CONTROL

Teaching hours per week: 4 *Total Hours: 64*

Preamble:

This paper throws light on both theoretical and practical understanding of using IBM PC for measurement and control. Organization, block diagram, and functional units of PC are discussed. Working of few important peripherals such as CRT controller, mass data storage systems, and printer mechanism are dealt. Use of serial and parallel ports, design of DIOT and AD-DA cards are also discussed. Introduction to MATLAB programming, and simulink/GUI are discussed. Finally, role of PC in instrumentation is discussed with a

specific application to measurement and control of few process parameters so that students can design and develop a complete PC based system

UNIT I: Introduction to Personal Computer 16 Hrs

A basic microcomputer organization – Block diagram and functional units. Block diagram of mother board. Computer peripherals – CRT operation, CRT controller, Mass data storage systems – Floppy disk overview, floppy disk controller, hard disk data storage, optical disk data storage and printer mechanisms.

Unit Ii: PC I/O, Memory, Ports & Extension Slots 16 Hrs

I/O addressing and decoding techniques, memory address decoding. Interrupts in computer. Serial, parallel and USB ports. PC extension slots (ISA & EISA). Digital input/output register interfacing techniques, interfacing of memory and design of digital input/output and timer (DIOT) cards. Design of AD-DA (digital to analog converter, analog to digital converter) cards for IBM PC.

UNIT III: Introduction to MATLAB 16 Hrs

Working in the command window, Arithmetic operations, Display Formats, Built-in Functions, Defining scalar variables. Handling of arrays, Mathematical operations with arrays, Script files functions, two directional plots. Programming in MATLAB. Application of MATLAB using Simulink and GUI based systems.

UNIT IV: PC for Measurement and Control 16 Hrs

Role of PC in instrumentation. Application of PC for temperature, liquid level measurement and control. PC based AC motor speed control system. Design of PC based UV, Visible, and IR spectrophotometers.

BOOKS FOR STUDY:

1. IBM PC and Clones – B. Govindarajalu
2. IBM PC and Clones – Rajesh Hongal
3. Interfacing to IBM Personal Computer – Lewis C. Eggebrecht
4. M ATLAB – An introduction with Applications – Amos Gilat

BOOKS FOR REFERENCE:

1. Microprocessor and Interfacing: Programming and Hardware – Douglas V. Hall
2. Computer based Industrial Control – Krishna Kant
3. MATLAB Programming – Kiran Singh, B. B. Chaudhuri

Course HCT 4.2: SCIENTIFIC/ANALYTICAL INSTRUMENTATION

Teaching hours per week: 4 *Total Hours: 64*

Preamble:

The analytical/scientific instruments play an important role in analyzing the sample both qualitatively as well as quantitatively. This paper deals with principles, instrumentation and working of various analytical instruments viz., Colorimeter, Spectrometers, Conductivity meter, pH meter, Polarograph, ESR, NMR, Mass, Photo acoustic, Spectrometer, Electronic microscope, thermal analyzers and Chromatographs and their applications.

UNIT I: Colorimeters and Spectrophotometers 16 Hrs

Colorimeters- Principle and working with a Block diagram. Salient features of individual blocks. Specifications of a colorimeter. Applications of colorimeters to Analytical and Biomedical purposes. Spectrophotometers-Principle and working with block diagram. Salient features of individual blocks. Specification and operation of Spectrophotometer.

Types of spectrophotometers –UV-Visible, and Infrared Raman Spectrometer and atomic absorption spectrophotometer, and Atomic absorption spectrometer. Applications of Spectrophotometers for chemical analysis.

UNIT II: Conductivity, pH Meters and Polarographs 16 Hrs

Conductivity Bridge- Principle and working of a conductivity bridge with a block diagram. Salient features of individual blocks. Applications of conductivity bridges. pH meters- Principle and working with a block diagram. Salient features of individual blocks. Types of pH meters: μC based pH meter, microcontroller PH meter, Applications of pH meters in chemical and industrial fields. Polorograph-principle and working with a block diagram. Salient features of individual blocks. Characteristics of dropping mercury electrode. Polarogram: Computer based pulse Polarograph, Applications of polarograph in chemical and industrial fields.

UNIT III: Resonance and Mass Spectrometers 16 Hrs

Nuclear Magnetic Resonance Spectrometers- Principle and working with suitable schematic/block diagrams. Experimental arrangement. Salient features of individual blocks. Applications of NMR spectrometer. Electron Spin Resonance- Principle and working with suitable schematic/block diagrams. Experimental arrangement. Salient features of individual blocks. Applications of ESR spectrometer. Mass Spectrometer: Principle and working with schematic/block diagrams. Experimental arrangement. Salient features of individual blocks. Applications of Mass spectrometer. PAS: Principle and working with block diagram, experimental arrangement, Salient features of individual blocks. Application of PAS.

UNIT IV: Electron Microscopes, Thermal Analysis and Chromatographs 16 Hrs

Transmission Electron Microscope- Principle and working with a block diagram. Salient features of individual blocks. Scanning Electron Microscope- Principle and working with a block diagram. Description of individual blocks. Applications of Electron Microscopes. Thermo gravimetric and Differential Thermal Analysis-Principle and working with a Schematic diagram Description of individual blocks. Applications. Differential Scanning Calorimeter: Principle, working and Applications. Chromatographs-Gas and Liquid Chromatographs- Principle and working with a block diagrams. Applications.

BOOKS FOR STUDY:

1. Hand Book of Analytical Instruments- R. S. Khandpur
2. Instrumental methods of Analysis- Chatwal and Anand
3. Principles of Instrumental Analysis- Skoog
4. Instrumental methods of Chemical Analysis- B. K. Sharma

BOOKS FOR REFERENCE:

1. Instrumental methods of Analysis- Willard, Merrit and Dean.
2. Molecular Spectroscopy- Singh and Dikshit
3. Instrumental Analysis- Mann, Wickers and Gulick.

Course SCT 4.1: BIOMEDICAL ELECTRONICS

Teaching hours per week: 4 *Total Hours: 64*

Preamble:

This paper deals with a study of various instruments used for measuring biological parameters. Various electrodes/amplifiers/recorders of biological signals are studied. Anatomy/ physiology of Heart, Respiratory system, and Brain are studied along with corresponding equipment. Various modern/ latest biomedical instruments along with block diagram are covered in this paper.

UNIT I: Biomedical Electrodes and Recorders 16 Hrs

Components of Biomedical system, Bio-electrical signal, Bio-potential electrodes. Bio-potential amplifiers, Bio-potential recorders.

UNIT II: Cardiovascular, and Respiratory System 16 Hrs

Physiology of Cardiovascular system, Anatomy of heart, Electrocardiography, Pace makers, Cardiac defibrillators, Blood pressure measurement, Artificial Heart. Physiology of Respiratory system, Measurement of Respiratory system, Mechanism of breath, Pulmonary function analyzers, Respiratory gas analyzers, Heart-lung machine.

UNIT III: Nervous System and Biotelemetry 16 Hrs

Physiology of Nervous system, Neuronal communication, Organization of brain, Electroencephalography. Telemetry –Elements of Biotelemetry system, Radio telemetry system, Implantable telemetry system, Telephonic telemetry, Uses of Biotelemetry.

UNIT IV: Modern Imaging Systems 16 Hrs

X-ray, computer aided tomography and applications, NMR imaging techniques and Applications. Medical Ultra sound, Echo-Opthalmoscope, Echo-Cardiogram, Biological effects of Ultra sound. Heomodialysis machine. Applications of Ar, He-Ne, Ruby lasers in biomedical field.

BOOKS FOR STUDY:

1. Hand book of Biomedical Instrumentation -R S Khandpur
2. Biomedical Instrumentation & Measurements- Leslie, Cromwell, Fred Wailbell, Erich, Pfeiffer
3. Biomedical Instrumentation – Arumugam
4. Biomedical Equipment and Technology – Joseph Brown

BOOKS FOR REFERENCE:

1. Biomedical Instrumentation and Measurements, Allied- Harry E Thomas.
2. Hand book of Biomedical Engineering –Jacob Kline
3. Transducers for Biomedical Measurements –Richard S C Cobold
4. Biomedical Electronics- Joseph Dubovy

Course SCT 4.2: INDUSTRIAL COMPONENTS AND SYSTEMS

Teaching hours per week: 4 *Total Hours: 64*

Preamble:

This paper deals with the industrial components such as switches, relays, Converts, etc. Basic controllers (P, PI, PID), intelligent controller (Fuzzy logic controllers) and finally the programmable logic controller are covered in this paper.

UNIT I: Industrial Components 16 Hrs

Elements of Process Instrumentation: Switches (Toggle, Push button, DIP, Rotary, Thumbwheel and membrane), Relays (Electromechanical and solid state relays). I/P&P/I converters, Transmitters – Electronic and intelligent, Fiber Optic & Pneumatic Transmitters. Actuators**:** Hydraulic, Pneumatic & Electric type. Valves & their Classification P&ID symbols.

UNIT II: Advanced Industrial Control Systems 16 Hrs

Basic control actions - Proportional (P), Proportional + Integral (PI), Proportional + Derivative (PD), Proportional + Integral + Derivative (PID) Hydraulic, Pneumatic & Electronic Controllers. Single loop controllers. Digital PID Controllers, Cascade & Feed Forward Control

Systems, Direct Digital Control Systems, Supervisory Control Systems, Distributed Control Systems (DCS).

UNIT III: Fuzzy Logic Controllers/Intelligent Controllers 16 Hrs

Fuzzy set theory, concepts and properties, fuzzy logic, block diagram of fuzzy logic controller, membership functions, fuzzification, design and rule base editor, defuzzification techniques, Typical applications: DC motor speed control.

UNIT IV: Programmable Logic Controllers 16 Hrs

PLC block diagram, PLC Hardware, PLC I/O Modules (Digital I/O & Analog I/O Modules), PLC Operations, Programming the PLC, Ladder diagram programming, Bit Instructions, Timers, Counters, Sequences, Advanced instructions. Applications of PLC. ON/OFF Control, Batch Mixing process control.

BOOKS FOR STUDY:

1. Modern Control Technology – Christopher T. Killian
2. Industrial Control Electronics – Michael Jacob
3. Process/Industrial Instrumentation – D. M. Considine
4. Industrial Instrumentation and Control – S. K. Singh
5. Fuzzy sets, fuzzy logic theory & Applications-G J Klir /B Yuan
6. Fuzzy logic with Engineering Application- Timothy J Ross

BOOKS FOR REFERENCE:

1. Computer based Industrial Control – Krishna Kant
2. Control System Engineering - Nagrath & Gopal
3. Programmable Logic Controllers – John Webb
4. Programmable Logic Controllers: Programming Methods & Applications – J R Hackworth