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

Semester	Code	Title of the Course	Semester Exam	IA	Total	L	T	P	Credits
Third		**Hard Core**							
	HCT 3.1	Embedded Systems	**80**	**20**	**100**	**4**	**0**	**0**	**4**
	HCT 3.2	Process Instrumentation	**80**	**20**	**100**	**4**	**0**	**0**	**4**
		Soft Core (Any One)							
	SCT 3.1	Digital Signal Processors and Applications	**80**	**20**	**100**	**4**	**0**	**0**	**4**
	SCT 3.2	PLC and its Applications	**80**	**20**	**100**	**4**	**0**	**0**	**4**
		Open Elective (Any One)							
	OET 3.1	Introduction to Microprocessors and Microcomputer	**80**	**20**	**100**	**5**	**1**	**0**	**6**
	OET 3.2	MATLAB and its Applications	**80**	**20**	**100**	**5**	**1**	**0**	**6**
		Practical							
	HCP 3.1	Embedded Systems Programming and Interfacing Lab	**40**	**10**	**50**	**0**	**0**	**2**	**2**
	HCP 3.2	Process Instrumentation Lab	**40**	**10**	**50**	**0**	**0**	**2**	**2**
		Soft Core (Any One)							
	SCP 3.1	DSP Programming and Interfacing Lab	**40**	**10**	**50**	**0**	**0**	**2**	**2**
	SCP 3.2	PLC Programming Lab	**40**	**10**	**50**	**0**	**0**	**2**	**2**
		Total for Third Semester	**440**	**110**	**550**	**17**	**01**	**06**	**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.

III – SEMESTER

Course HCT 3.1: EMBEDDED SYSTEMS

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

Preamble:

Embedded systems are systems which contains both computer like hardware and software and designed for a particular task. Now days embedded systems play an important role in day to day life. Hence this paper deals with the embedded systems architecture/description of various elements/ classification / programming of embedded systems. Finally some typical embedded systems are covered in this paper.

UNIT I: Introduction to Embedded Systems 16 Hrs

Definition and classification: overview of processors and hardware units in an embedded system. Software embedded into the system, employing embedded system. Embedded Systems on a Chip (SOC) and the use of VLSI designed units. Processor and Memory organization: structural units in a processor, processor selection for an embedded systems, Memory devices, Memory selection for an embedded systems, allocation of program segments and blocks and memory map of a system DMA, Interfacing Processors, memories and I/O devices, T/O devices types, timer counting devices, serial communication using I^2C, CAN and advance I/O buses between the networked Multiple devices. Host system or computer, parallel communications between network I/O multiple devices using the ISA PCI, PCI-X and advanced buses.

UNITI I: Programming concepts and Embedded Programming in C and C++ 16 Hrs

Software programming in assembly language program and high level languages 'C' program elements: Header and source file and processor derivatives, Program elements: Macros and Functions , Data types, Data Structures, Modifiers, statements, loops and pointers, Queues, lists and Ordered list, embedded programming in C++, Embedded programming in Java. RTOS: Operating system services, I/O subsystems, Network operating system, Real time and embedded system operating system, Interrupt routines in RTOS environment, RTOS Task scheduling models, Interrupt latency and response time of the tasks., performance metric in scheduling models for periodic, sporadic and Aperiodic tasks. Embedded Linux internals: Case studies.

UNIT III: Typical Embedded System Architecture and Programming 16 Hrs

Cygnal C8051F020 microcontroller architecture, memory organization, description of functional units of microcontroller: ports, interrupts, on chip ADCs, DACs, serial peripheral interface, timers, programmable counter array. Comparative study of C8051F020 with C8051F060 and C8051F350.

UNIT IV: Typical Embedded System 16 Hrs

Design and development of C8051F020 based Lock-in amplifier, Air quality monitoring system. DC motor position control system, DC motor speed control system, and temperature control system, waveform generation. C8051F060 based level control system.

BOOKS FOR STUDY:

1. Embedded Systems Architecture, Programming and Design- Raj Kamal
2. Cygnal C8051F020/F060/F350 Data Manuals
3. Silabs IDE Manual

BOOKS FOR REFERENCE:

1. Embedded Systems Design – Steve Heath
2. Embedded Systems - John B. Peatman.

Course HCT 3.2: PROCESS INSTRUMENTATION

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

Preamble:

This paper deals with the study of principle/ design/ working of various instrumentation systems for the measurement of various parameters such as temperature pressure, flow, force, humidity, moisture, level, density etc.

UNIT I: Temperature and Pressure Measurement Systems 16 Hrs

Temperature measurement, International practical temperature scale, Non–electrical temperature measurement systems, Electrical temperature measurement systems and Radiation type temperature measurement systems. Moderate Pressure measurement

systems, High pressure measurement systems, Low pressure or vacuum measurement systems, calibration and testing.

UNIT II: Flow and Force Measurement Systems 16 Hrs

Primary or quantitative meters, secondary or Rate Meters, Special Methods – Ultrasonic flow meters, Electromagnetic flow meters, Anemometers, Laser Doppler Anemometers. Force: Balance, Hydraulic Load cells, Pneumatic Load cells, Elastic Force (Proving Ring) and Electric Force measurement systems.

UNIT III: Humidity, and Moisture Measurement Systems 16 Hrs

Humidity: Definitions of absolute, specific and relative humidity and Dew point. Psychrometers, Hair hygrometer, Electrolysis type hygrometer, Dew point measurement. Moisture: Definition, Resistivity, Conductivity and Capacitance type, NMR and IR methods for moisture measurement

UNIT IV: Level and Density Measurement Systems 16 Hrs

Float type, Displacer type, Hydrostatic type level measurement systems, Electrical methods - Resistance and capacitance type level measurement systems, Radiation methods – Ultrasonic and Radioactive type level measurement systems. Liquid density, units and definitions - Displacement and float type Densitometers. Hydrometers – Hydrostatic, ultrasonic sludge, sonic, ball type, Capacitance – Oscillating corilosis and Radiation Densitometers.

BOOKS FOR STUDY:

1. Industrial Instrumentation and Control – S. K. Singh
2. Instrumentation Measurement Analysis–Nakra & Chaudhry
3. Instrumentation Devices and systems –Rangan, Mani & Sharma
4. Instrumentation and Control Systems – S. Bhaskar
5. Process Instrumentation – Patranabis
6. Industrial Instrumentation – T.R. Padmanabhan

BOOKS FOR REFERENCE:

1. Industrial/Process Instrumentation – Douglas M. Considine
2. Instrument Engineer's Handbook: Process Measurement and Analysis - B. G. Liptak
3. Instrument Engineer's Handbook: Process Control – B. G. Liptak

Course SCT 3.1: DIGITAL SIGNAL PROCESSOR AND APPLICATIONS

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

Preamble:

DSP is one of the important digital devices used in instrumentation. This paper deals with the study of DSPs. Preliminary mathematical fundamentals such as Fourier series, Fourier Transform, Z-Transform are dealt. Theoretical design of digital filters such as IIR, FIR filters are described. Architecture/Programming/ Interfacing of TMS320C5X is dealt along with typical applications.

UNIT I: Introduction to Digital Signal Processing 16 Hrs

Signals, Systems & signal processing, Discrete time Signals, Systems, Types, Advantages of DSP, Fourier series and Fourier transform – Definition, theorem & properties. Z- Transform – Definition, Theorem & Properties. Inverse Z- transform- solutions of differential equations and Transfer function.

UNIT II: Digital Filter Design 16 Hrs

Analog filters v/s Digital filters. Design of IIR Filters from Analog filters, IIR filter deign by approximation of derivatives, by impulse invariance, by bilinear transformation. Design of Butterworth & Chebyshew filters. Design of FIR filters using windows.

UNIT III: Architecture and Programming of TMS320C5X Digital Signal Processor 16 Hrs

Architectural overview: Functional Block Diagram, Internal Hardware. Memory Organization: Data memory, Program memory, Interrupts, Serial ports. Addressing modes. Instruction set of TMS320C5X and Programming.

UNIT IV: Interfacing and Applications 16 Hrs

Interfacing of Codec (A/D and D/A Converters) with TMS320C5X DSP. FIR Digital Filter: Low-pass, High-pass, Band-pass and Band reject. Interfacing of DDS with DSP and generation of Sine/Cosine and other waveforms. DSP based lock-in Amplifier.

BOOKS FOR STUDY:

1. Digital Signal Processing: Principles, algorithm & applications–J G Proakis, D G. Manolakis
2. Introduction to Digital Signal Processing –Johnny R. Johnson
3. Digital Signal Processing – S. Salivahan, A. Vallaraj, C. Gnanapriya
4. Digital Filters Analysis, Design and Application – Andreas Antonio
5. DSP TMS320C5X Architecture, Programming - B. Venkataramani and M. Bhaskar

BOOKS FOR REFERENCE:

1. Digital Signal Processing – Sanjit K.Mitra
2. Digital Signal Processing and Application – Pamos E. Papamichalis.
3. TMS3205X User's Guide – Texas Instruments

Course SCT 3.2 PLC AND ITS APPLICATIONS

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

Preamble:

PLC is one of the important devices used for automation. This paper deals with the architecture, programming using ladder diagram, interfacing of programmable logic controller (PLC). Typical applications are also covered.

UNIT I: Introduction to PLC 16 Hrs

Introduction, History, Fundamental Description, Input and Output Systems, Central Processing Unit, Memory Unit, Programming Unit, Peripheral Devices, Difference between Computer and PLC, Justification for use of PLCs, Features of Allen-Bradley PLC.

UNIT II: PLC Programming 16 Hrs

Types of PLC programming languages, Ladder Diagram Fundamentals: Drawing symbols, Arithmetic and logical instructions, Timing and counting instructions, Input and output instructions, operational procedure, programming examples.

UNIT III: PLC Interfacing 16 Hrs

Analog PLC operation: Analog modules& systems, Analog signal processing, Multi bit Data Processing, Analog output Application Examples, PID principles, position indicator with PID control, PID Modules, PID tuning, PID functions. Developing ladder diagram programs, Interfacing: Switches (Start/Stop push button), Electro-mechanical relays (EMR), Solid state relays (SSR). Generate accurate delays and timing sequences.

UNIT IV: PLC Applications 16 Hrs

Applications of PLC: Turn on/off a Lamp and motor, measure frequency, produce PWM wave, control the DC motor speed. PLC based temperature control, consistency control, level control, effluent discharge control.

BOOKS FOR STUDY:

1. Instrument Engineers Handbook: Process Control – B G. Liptak
2. Programmable Controllers – George L. Batton
3. Computer based Industrial Control – Krishna Kanth

BOOKS FOR REFERENCE:

1. Programmable Logic Controllers- Principles & Applications - J W. Webb & R A. Reiss
2. Programmable Logic Controllers- Programming Method and Applications –J R. Hackworth &F.D Hackworth Jr

Course OET 3.1: INTRODUCTION TO MICROPROCESSORS AND MICROCOMPUTER

(Open Elective Paper-II offered to other Department Students)

Teaching hours per week: 5 *Total Hours: 64*

Preamble:

This paper is opted by other department students. This paper deals with the introduction to16-bit microprocessors and their comparative study 8086 Microprocessor architecture/ instruction set/programming/interfacing will be dealt. The architecture of IBM PC is dealt. MATLAB and its structure/ programming/simulink/GUI are discussed. Typical applications of MATLAB in instrumentation are discussed in the last unit.

UNIT I: Introduction to 16-bit Microprocessor 16 Hrs

Architecture of 8086 Microprocessor, Addressing modes, Instruction set, Assembly language programs using Assemblers, Procedures and Macros, Assembly language program development tools, Debugging assembly language programs, Comparative study with 8088, 80286, and 80486 Microprocessors.

UNIT II: Interfacing 16 Hrs

Memory and I/O organization, Memory Banks, Interfacing of Memory (RAM and EPROM), Programmable Peripherals 8255, 8254: Block diagram, programming, and Interfacing with 8086 µP. 8086 Interrupts and their responses. Interfacing of Binary Counter Display and Seven Segment Display with 8086 through 8255.

UNIT III: Personal Computer 16 Hrs

Hardware details of PC, Architecture of IBM PC, Memory and I/O map of PC. I/O Addressing and Decoding, Techniques, Memory Address Decoding. PC extension slots (ISA and EISA). BIOS and DOS Interrupts of PC, Printer port, Serial ports.

UNIT IV: MATLAB and Application of PC 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. Application of PC for Temperature Measurement using MATLAB.

BOOKS FOR STUDY:

1. Microprocessor and Interfacing: Programming and Hardware – Douglas V. Hall
2. IBM PC and Clones – B. Govindarajalu
3. Interfacing to IBM Personal Computer – Lewis C. Eggebrecht
4. MATLAB – An introduction with Applications – Amos Gilat

BOOKS FOR REFERENCE:

1. IBM PC and Clones – Rajesh Hongal
2. MATLAB Programming – Kiran Singh, B. B. Chaudhuri

Course OET 3.2: MATLAB AND ITS APPLICATION

(Open Elective Paper-II offered to other Department Students)

Teaching hours per week: 5 *Total Hours: 64*

Preamble:

This paper of offered to the other department students. This paper deals with the MATLAB and its structure, programming concepts, designing of Graphical user interface (GUI), creating models using SIMULINK, and also the typical applications of MATLAB in instrumentation.

UNIT I: Introduction to MATLAB 16 Hrs

MATLAB : Schematic Diagram of MATLAB, MATLAB Toolboxes, MATLAB Windows, Common System Commands and Mathematical operations, Handling of Matrices, Handling of graphics, File Dialog Boxes.

UNIT II: MATLAB Programming 16 Hrs

Matrices and Arrays: Entering Matrices, Sum, Transpose and Diagonal, Subscripts, colon operator, Magic Function. Expressions: variables, numbers, operators, functions. Command window I\P &O\P: Format Function, Suppressing O\P, Entering Long Statements, Command Line Editing. Graphics: Plotting Techniques, Graph Components, Editing Plots, Basic Plotting Functions. Simulink.

UNIT III: Graphical User Interface 16 Hrs

Graphical User Interface, M-File Dialog boxes, Predefined Dialog Boxes, GUI Creations Fundamentals, GUI Development Environment, GUI Components, GUI Object Hierarchy, Capturing Mouse Actions.

UNIT IV: Application of MATLAB 16 Hrs

Application of MATLAB for simulation of various models, Designing of PID and Fuzzy Logic Controllers. Application of MATLAB for controlling rotational speed and angular position of DC motor.

BOOKS FOR STUDY:

1. MATLAB Programming- Y. Kirani Singh & B.B Chaudhury
2. Introduction to MATLAB- Gulati
3. Getting Started with MATLAB 7- Rudra Pratap

BOOKS FOR REFERENCE:

1. An Introduction to fuzzy logic control- Driankov, H Hellendroon & M. Reifrank