W.E.F. SESSION 2011-12
B.Sc. Part-III
INSTRUMENTATION
Scheme of Examination

Max. Marks 300

Semester -V

Theory Paper-I: Microprocessors –I Max. Marks: 40

(Internal Assessment: 5 Marks + External Examination: 35 Marks Time : 3 Hours)

Theory Paper-II: Instrumentation Systems-I Max. Marks:40
(Internal Assessment: 5 Marks + External Examination: 35 Marks Time : 3 Hours)

Semester –VI

Theory Paper-I: Microprocessors –II Max. Marks: 40
(Internal Assessment: 5 Marks + External Examination: 35 Marks Time : 3 Hours)

Theory Paper-II: Instrumentation Systems-II Max. Marks:40
(Internal Assessment: 5 Marks + External Examination: 35 Marks Time : 3 Hours)

Paper-III: Practical **Max. Marks: 80 Time: 3+3 Hours (on two days)**
(Details of the Conduct of Practical Examination is noted below)

On- job-Training Viva-Voce **Max. Marks: 60 (on two days)**

Practical examinations will be held at the end of even semesters i.e., in 2nd, 4th and 6th semesters.

Note*: Instructions for paper setter for theory papers*.

1. The syllabus in each theory paper is divided in 5 units. 10 questions are to be set. Two questions are to be set from each unit and the students are to attempt any 5 selecting at least one from each unit. A student is to attempt 5 questions in all.
2. 20% numerical problems are to be set .
3. Use of simple(non-Programmable) calculator is permissible.
4. Instructions should be imparted using SI System of Units .
   Familiarity with CGS system of units should also be ensured.

Note: Practical

Practical examinations will be held at the end of even semesters i.e., in 2nd, 4th and 6th semesters.

1. The practical examination will be held in two sessions of three hours each(first session starting in the evening of the first day and the second session in the following morning).
2. Distribution of Marks:
   Experiments (Two) 20+20 Marks
   Viva Voce 20 Marks

Laboratory Record 20 Marks

3. Laboratory notebook will be assessed by both external examiners. Marks for each experiments, laboratory record and viva voce examination concerning the experiments in the syllabus for each session will be as indicated above.
4. Use of simple(non-Programmable) calculator is permissible

Note: On Job Training: The training will be one month duration and will be undertaken in an industry on a topic approved by the college. The candidates will be required to submit a project report and viva voce will be conducted on the basis of this report.

Syllabus & Courses of Reading
Semester V

Theory Paper-I: Microprocessors –I

Max. Marks: 40
External Examination: 35 Marks
Time: 3 Hours
Internal assessment: 5 Marks

Unit – I

1. Introduction: Microprocessor its need in instrumentation. Advantages of microprocessor based instrumentation over conventional instrumentation

Unit II

2. Review of digital Electronics: Shift registers, counters, decoders, encoders, tristate buffer and multiplexed display systems.

Unit-III

Memory & Register organization in Microprocessor :

(i) Memory organization: Types of memories (RAM, EPROM, ROM, PROM, DRAM). Basic concepts of memory organization (Number of address lines require, arrangement of memory cells, control lines, memory extension). Concept of control lines such as Read/Write chip enables Register to Register transfer via Data Bus).

(ii) Arithmetic and Logic Unit (ALU) Function of ALU, Detail design of a small ALU. An ALU which perform four basic (4-bit) operations(ADD, SUBT, OR, AND). Need for instruction decoder,. Integration of ID with "ALU" to form an "ALU" with control signals.

(iii) Control and timing unit: Need for this unit, concept of sequence of execution of an instruction. Detail design of control unit.

Unit-IV

3. Introduction to 8085 Architecture:
   Block Diagram, Address Bus, Control Bus, Data Bus, need to multiplex address and data bus. Memory organization (with emphasis on multiplexing address and data bus during memory read or memory write). Control and timing Unit, ALu details, registers Flags, memory mapped I/O and I/O mapped I/O.

Unit V

4. Instruction Set:
   Introduction, classification of instruction set, op-code format, some basic instructions.

   (i) Data transfer instructions, this must include-
   a) Immediate addressing b) Register addressing
   c) Direct addressing d) Indirect addressing

   (ii) Arithmetic and Logic Instructions:
   ADD, SUB, AND, OR, XOR, CMP

Books:

1. Microprocessor Architecture, Programming and Application by Gaonkar
2. Digital Computer Electronics by Albent Paul Malvino (TMH) 1st Edition
3. Microprocessors and Applications by Mathur

Theory Paper-II: Instrumentation Systems-I
Analytical Instrumentation:

Max. Marks: 40
External Examination: 35 Marks
Time: 3 Hours
Internal assessment: 5 Marks

Unit – I

1. Introduction to Instrumentation systems, need for an integrated approach. Zero order, First order, second order systems; dead time element, specification and testing of dynamic response.
   Multiplexer, Demultiplexer, Decoder, Encoder, Tristate buffer, Priority Encoder,
2. Displays and display drivers, Analogue to digital and digital analogue conversion.

Unit II

3. Display systems LED, LCD, Seven segment, CRT, DOT Matrix
4. Filters: passive and active filters, types of filters: first order and second order, low pass, band pass, band reject, and their frequency and phase response.
   (For higher order filters qualitative explanation & not mathematical)

Unit-III

5. Analytical Instruments: Working principle, operation, and data analysis of the following: Spectrophotometer, atomic absorption spectrometer, electron microscopes

Unit-IV

6. Nuclear Magnetic resonance Spectrometer: Principles of operation, sample preparation and data analysis, stability of magnetic fields and electronics.
7. Mass Spectrometer: Application areas, working principles of static and dynamic instruments, analysis of data

Unit V

8. X-ray techniques and dynamic instruments, analysis of X-ray techniques and their application radiography, fluorescence and diffractometry. Interpretation of Data.
9. Mossbauer Spectrometer: Principles of operation, measurement of radioactivity, analysis of data.

Books:

1. Instrumental Methods of Analysis: H Willard, LL Merritt, JA Dean, FA Seattle

Syllabus & Courses of Reading
Semester VI

Theory Paper-I: Microprocessors –II

Max. Marks: 40
External Examination: 35 Marks
Time: 3 Hours
Internal assessment: 5 Marks

Unit – I

Introduction to 8085 Architecture:

1. Control and Timing:
   Sequence of execution of instruction, Concept of instruction cycle and macjhine cycle. Various types of machine cycles along with associated control and status signals (Opcode, etch, memory read, memory write, I/O read, I/O write, IO/M, SO, SI, MR, MW/ Detail timing diagram of some instructions).

Unit II

2. Advance Instructions:
   Branching, conditional and unconditional subroutines conditional and unconditional concept of stack, need for stock pointer

Unit-III

3. Interfacing:
   Interrupts, classification interrupts, various types of hardware interrupts Software interrupts RSTO to RST7. Instruction associated with interrupts (RIM, SIM, EI, DI) Typical Examples illustration usage.

Unit-IV

4. Interfacing with Peripherals:
   Concept of Input and Output ports. Study of 8255, 8279, 8253(General description, how to programme, usage) Interfacing of A/D and D/A converters

Unit V

5. Introduction to 8086:
   Architecture block diagram, instruction set. Interfacing applications.

Books:

1. Microprocessor Architecture, Programming and Application by Gaonkar
2. Digital Computer Electronics by Albent Paul Malvino (TMH) 1st Edition
3. Microprocessors and Applications by Mathur

Theory Paper-II: Instrumentation Systems-II
Bio-Medical and Environmental Instrumentation

Max. Marks: 40
External Examination: 35 Marks
Time: 3 Hours
Internal assessment: 5 Marks

Unit – I

1. Bio-Medical Instrumentation: EEG, ECG and other potential working principle and precaution.
2. Blood pressure measurement, introduction to thermodynamics

Unit II

3. Introduction to ultra sound and tomographic techniques. Interpretation of data and precaution for measurements. Introduction to working principle and operation of pacemakers, diffribillators, heart-lung and other ICU instrumentation.

Unit-III

4. Environmental Instrumentation: General Introduction to physical environment. Physical aspect like pressure, temperature, humidity, noise, visibility, air quality, and water quality.
5. Humid atmosphere, hygrometers, and dew point instruments, controlled humidity environment. Wind velocity and effect on dispersion of pollution. Cup-anemometer, Hot-wire anemometer, Radar.

Unit-IV

6. Particulate matter in air, soiling index and visibility.
7. Sound level meter, tape recorders, noise dosimeters, sound level monitors, and acoustical calibrators.
8. Thermal comfort meter, heat stress monitor, and temperature monitors, solar flux, pyrnometers, and pyreheliometers.

Unit V

9. Water quality by turbidity meter, calorimeter, pH meter, microscopes, atomic absorption spectroscopy.
10. Air-quality measurement, using gas chromatography, high pressure liquid chromatography, gas chromatography, mass spectrometer, conductivity meter, Congenial environment for work, artificial lightening, acoustic consideration, and air-conditioning,.

BOOKS:

1. Air-Pollution: Physical and Chemical Fundamentals, JH Seinfeld, Mc-Graw Hill, New York, 1975
2. Meteorological Instruments: WE Knowles, Middleton and AF Spilhass, University of Toronto Press, 1953.
3. Environmental Instrumentation: LJ Frichtschen, and LW Gay
4. Thermal Comfort: PO Fanger, Robert, E., Krieger Publishing Company

Paper – III (Practical)
List of Experiments

Max Marks: 80
Time: 6 Hours
(Two Sessions)

Section – I

(i) Design a half-adder using NAND Gates
(ii) Design a 4-bit adder.
(iii) Design a 4-bit adder using 7483.
(iv) Design a 4-bit parallel Adder/ Subtractor using 7483 and 7486 .
(v) Design a code converter (BCD to cyclic codes) using NAND gates
(vi) Design the decoder circuit using NAND Gates
(vii) Design a 8:1 multiplexer using NAND Gates
(viii) Generate f(x,y,z)-xy+yz=xyz on the 8:1 multiplexer
(ix) Use SN 74LS 151 as a parallel to serial converter.
(x) Design a 1:4 demultiplexer using NAND gates.
(xi) Use 741, S138 as a demultiplexer
(xii) Use 74151 and 74138 to design IDM scheme which multiplexer 8 input lines into a single transmission line and then to 8 output lines IS may be controlled parallel using divide by 8 counter.

Section- II

(i) Find the characteristics of an RS flip-flop.
(ii) To study the characteristics of a JK flip-flop.
(iii) To study the characteristics of a D flip-flop.
(iv) Make a ripple binary counter using JK flip-flops.
(v) To construct and study a BCD decade counter using JK Flip-flop.
(vi) Design a controlled counter which counts as a modulo-8 counter when control C=1 and counts as modulo-5 counter. When C=0 using flip-flops.
(vii) Design a modulo-8 up down counter using JK flip-flops.
(viii) Design a 4-bit SISO shift register.