DR. BABASAHEB AMBEDKAR MARATHWADA UNIVERSITY

CIRCULAR NO.SU/Sci./C.B.C. & G.S./P.G. Syll./39/2015

It is hereby inform to all concerned that, the revised Curriculum under **Choice Based Credit and Grading System** submitted by the various Ad-hoc Boards which are run at college level only and recommended by the Dean, Faculty of Science, the Hon'ble Vice-Chancellor has accepted the same on behalf of the Academic Council under Section-14[7] of the Maharashtra Universities Act, 1994 as under :-

[1]	M.Sc. Forensic Science Ist Year, Semester-I & II Progressively
[2]	M.Sc. Electronics Ist & IInd Year, Semester-I to IV Progressively
[3]	M.Sc. Industrial Automation Ist & IInd Year, Semester-I to IV Progressively [Under Innovative Programme of U.G.C.]
[4]	M.Sc. Industrial Chemistry Ist & IInd Year, Semester-I to IV Progressively
[5]	M.Sc. Herbal Technology Ist & IInd Year, Semester-I to IV Progressively [Under Innovative Programme of U.G.C.]
[6]	M.Sc. Biophysics Ist & IInd Year, Semester-I to IV Progressively
[7]	M.Sc. Bioinformatics Ist & IInd Year, Semester-I to IV Progressively
[8]	M.Sc. Plant Breeding & Molecular Genetics Ist & IInd Year, Semester-I to IV Progressively
[9]	M.Sc. Plant Biotechnology Ist & IInd Year, Semester-I to IV Progressively
[10]	M.Sc. Geology Ist & IInd Year, Semester-I to IV Progressively.

This is effective from the Academic Year 2015-16 & onwards as appended herewith.

All concerned are requested to note the contents of the circular and bring the notice to the students, teachers and staff for their information and necessary action.

University Campus,
Aurangabad-431 004.
REF.NO.SU/S.S./C.B.C. & G.S. /
P.G.Syll./2015/ 9893-10142
Date:- 20-07-2015.

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Director,
Board of College and
University Development.

Copy forwarded with compliments to:-

1] The Principals, affiliated concerned colleges,
Dr. Babasaheb Ambedkar Marathwada University

Copy to :-

1] The Controller of Examinations,
2] The Director, [E-Suvidha Kendra], in-front of Registrar's Quarter, Dr. Babasaheb Ambedkar Marathwada University,
3] The Superintendent, [M.Sc. Unit],
4] The Programmer [Computer Unit-1] Examinations,
5] The Programmer [Computer Unit-2] Examinations,
6] The Record Keeper.

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S-Cover Page

DR. BABASAHEB AMBEDKAR MARATHWADA UNIVERSITY, AURANGABAD.

Curriculum under Choice Based Credit &

Grading System

M.Sc. I & II Year

Semester–I to IV

INDUSTRIAL AUTOMATION

Under U.G.C. Innovating Programme

[Effective from 2015-16 & onwards]

Syllabus for M.Sc. (Industrial Automation)

The M.Sc. (Industrial Automation) programmed is divided into four semesters having 2000 marks. There are 09 theory courses and 6 laboratory courses. Final semester includes one Major project and Implant training.

Eligibility:

Those who have completed B. Sc. with Physics or Electronics or Maths or Computer Sci. or B.C.S or B.C.A.(Science) or B.Sc. Automobile or B.Sc. Optometry or B.E.(any faculty) from any recognized University/ Institution are eligible for registration subject to the rules and regulations laid down by Dr. Babasaheb Ambedkar Marathwada University, Aurangabad. Preference will be given to the candidates who have completed their B. Sc. with Physics or Electronics.

Admission / Promotion Process:

In response to the advertisement for registration, interested students will have to register themselves. Admission will be done on the basis of performance of students at their qualifying graduate level examination. Once the student is admitted he / she will be promoted to the next semester with full carryon, however students have to register themselves for every consecutive semester. Dropout students will be allowed to register for respective semester as and when the concerned courses are offered by the department, however he / she should not exceed more than twice the duration of the course from the date of first registration at parent department.

Course Structure:

M.Sc. (Industrial Automation) In Choice Based Credit System under Academic Flexibility.

100 Credits against 2000 Marks

Semester I

Course	Course Title	Teaching time/week	Internal		External		Total	
			Marks	Credit	Marks	Credit	Marks	Credit
IA-1.1	Basic Electronics	4 hours	20	1	80	4	100	5
IA-1.2	Computer Hardware, Networking & Industrial Communications	4 hours	20	1	80	4	100	5
IA-1.3	Basic Instrumentations	4 hours	20	1	80	4	100	5
IA-1.4	Laboratory first (Electronics + Computer Networking, Comm.)	4 hours	--	--	100	5	100	5
IA-1.5	Laboratory second (Instrumentation)	4 hours	--	--	100	5	100	5

An internal mark consists of test, Tutorials, Seminars, Attendance, performance of student, while External marks are only for University theory Examination.
Practical marks include, practical performance, oral, regular completion of record books.

Semester II

Course	Course Title	Teaching time/week	Internal		External		Total	
			Marks	Credit	Marks	Credit	Marks	Credit
IA-2.1	Pneumatics and Hydraulics	4 hours	20	1	80	4	100	5
IA-2.2	Embedded Systems	4 hours	20	1	80	4	100	5
IA-2.3	PLC fundamentals and Programming	4 hours	20	1	80	4	100	5
IA-2.4	Laboratory third (Pneumatics and Hydraulics)	6 hours	--	--	100	5	100	5
IA-2.5	Laboratory forth (Embedded Systems)	6 hours	--	--	100	5	100	5

An internal mark consists of test, Tutorials, Seminars, Attendance, performance of student, while External marks are only for University theory Examination.
Practical marks include, practical performance, oral, regular completion of record books.

Semester III

Course	Course Title	Teaching time/week	Internal		External		Total	
			Marks	Credit	Marks	Credit	Marks	Credit
IA-3.1	Mechatronics & Robotics	4 hours	20	1	80	4	100	5
IA-3.2	HMI, SCADA Basics, Databases	4 hours	20	1	80	4	100	5
IA-3.3	Process Control and DCS	4 hours	20	1	80	4	100	5
IA-3.4	Laboratory five (Mechatronics & Robotics)	6 hours	--	--	100	5	100	5
IA-3.5	Laboratory six (PLC, HMI & SCADA Interfacing, DCS)	6 hours	--	--	100	5	100	5

An internal mark consists of test, Tutorials, Seminars, Attendance, performance of student, while External marks are only for University theory Examination.
Practical marks include, practical performance, oral, regular completion of record books.

Semester IV

Course	Course Title	Teaching time/week	Internal		External		Total	
			Marks	Credit	Marks	Credit	Marks	Credit
IA-4.1	Project Engineering and Management (Two Week)	4 hours	50	2	--	--	50	2
	+							
	One Major Project	--	50	3	--	--	50	3
IA-4.2	Implant Training (Five month)	--	300	15	100	5	400	20

During Implant training student should present at least 400 hours in the company and he/she will have to produce attendance cum performance certificate to college.

Notes:

(1) Tutorials consist of conceptual as well as numerical problems / questions based the respective theory courses in the semester. Total marks assigned for test will be 10/per paper and total marks assigned for tutorials will be 05/per paper. Remaining 05 mark/paper is assigned for seminar.
(2) Each course / paper should be taught for 40 to 45 contact hours.
(3) Teaching duration for LAB COURSES in first semester should be of 4 hours and for those in second and third semester and project should be 06 hours per week per batch
(4) Each of the courses is divided into five units.
(5) The content of theory course / paper as well laboratory (practical) course may be modified time to time (with the approval DC) to keep pace with the recent developments and trends in the subject.

Attendance:

Students must have 75 % of attendance in each core, specialized, elective and laboratory course for appearing examination otherwise he / she will not be strictly allowed for appearing the examination of each course. However, students having 65 % attendance with medical certificate may request Principal for the condonation of attendance. Monthly attendance of the students for each course will be displayed on the notice board.

Registration for Service Course:

- Students will have to register themselves for the service course of his / her interest after the start of semester in the department on official registration form. The teacher in-charge of the respective course will keep the record of the students registered. Maximum fifteen days period will be given from the date of admission for completion of registration procedure. The departmental committee shall follow a selection procedure after counseling to the students to avoid the overcrowding to a particular course at the expense of some other courses.
- No student shall be permitted to opt more than one service course in a semester.
- Students will have to pay the prescribed fees per course per semester / year for the registration as decided by the university.

Departmental Committee:

The existing Departmental Committee (DC) will monitor the smooth functioning of M. Sc. programme.

Results Grievances / Redressal Committee

Grievances / redressal committee will be constituted in the department to solve all grievances relating to the evaluation. The committee shall consist of Head of the department and the concerned teacher of a particular course.

Evaluation Methods:

- The grades for courses will be based on 20: 80 ratios of continuous internal assessment (CIA) and semester end examination (SEE).

Internal Evaluation Method:

- There will be two mid semester examinations (20 marks each) as a part of continuous internal assessment (CIA), first based on 40 percent of the syllabus taught and second based on 60 percent of the syllabus taught. The setting of the question paper and the assessment will be done by the concerned teacher who has taught the course. Average score obtained out of two mid semester examinations will be considered for the preparation of final sessional marks / grades.

Term end Examination and Evaluation:

- Semester end examination (SEE) time table will be declared by the Dr. Babasheb Ambedkar Marathwada University, Aurangabad. Conduct practical examination with external expert, evaluate, satisfy the objection / query of the students (if any) and submit the result to DC in one week time from the date of examination of that particular course / paper.
- The semester end theory examination in each theory course / paper will be of 80 marks. The total marks shall be 100 for each theory course / paper (80 marks semester end exam + 20 marks internal tests).
- Pattern of semester end question paper will be as below:
    - The semester end examination of theory course / paper will have two parts (10+70 = 80 Marks)
    - Part A will carry short questions of 2-3 marks (answer in sentence / multiple choice questions) as compulsory question and it should cover entire syllabus (10 Marks)
    - Part B will carry 8 questions (14 marks each). Students will have to attempt any five questions (70 Marks).
    - 20 to 30% weightage can be given to problems wherein use of non-programmable scientific calculator may be allowed.
    - Number of sub questions (with allotment of marks) in a question may be decided by the examiner.
- Semester end practical examination will be of 100 marks each (semester end examination only). Student must perform at least sis experiments from each lab course. The final practical / project examination will be conducted at the end of each semester along with the theory examination. Students will be examined by one external and one internal examiner.

I.A.1.1 : Basic Electronics : 100 marks (45 Periods)

Unit 1. Number System & Codes: Decimal, Binary, Octal, Hexadecimal, Binary arithmetic, BCD, EBCDIC, ASCII, gray code, Excess-3 code. Logic Gates: Basic gates- AND, OR, NOT, Derived gates- NAND, NOR, EX-OR, EX-NOR

Unit 2. Boolean algebra, minimization of Boolean function using K-map, Combinational Circuits. Multiplexer, De multiplexer, Encoder, Decoder, Sequential Circuits. Flip-flops-RS, JK, D, T type

Unit 3. Analog Electronics: Diodes, Transistors, SCR, TRIAC, Isolators : Opto, Galvanic Filters : Low, high, band pass, band rejection

Unit 4. Signal conditioning : OPAMP parameters, inverting, non-inverting, OPAMP as differentiator, OPAMP as integrator, OPAMP as Schmitt trigger. Electronic bridges: Wheatstone bridge, Wein bridge, Hay bridge,

Unit 5. Power Supply: AC power Supply, Three Phase Power Supply, DC Power Supply: Regulated Power Supply (using Transistor, ICs), Single phase AC-DC converters: working principles, performance parameters, control of ac-dc converters. DC-DC converters: control of dc-dc converter, different types, working principles and analysis, applications

Reference Books:

1) Electrical Technology, B.L.Theraja.
2) Industrial Electronics, Petruzella
3) Microelectronics- Millman
4) Op-Amp and linear integrated circuit theory -Ramakant A Gaykwad
5) Operational amplifier -Clayton
6) Electronic Principles (4th Edition) -Malvino A.P. (McGraw Hill)
7) Power Electronics –Rashid
8) Digital principal and applications - Malvino and Leach; (McGraw Hill)
9) Power Electronics (3rd Edition) -Ned Mohan.
10) Principal of Electronics - V.K,Mehta
11) Digital Electronic Principles and applications by Ronald J. Toccii, Pearson
12) Digital Electronics by R. P.Jain
13) Digital Logic and Computer design by Mano M.M. (Prentice Hall)
14) Digital Logic: Operation and Analysis (2nd edition) by Boyce J.C. (Prentice Hall)

I.A.1.2 : Computer Hardware, Networking & Industrial Communications : 100 marks (45 Periods)

Note: Visual basic and c programming (Prerequisite or by self study)

Unit 1. Computer Hardware: BIOS/CMOS setting, PC maintenance & Troubleshooting, Operating System supporting Skills: Basics of O.S. Windows XP professional, Windows 7, Devices & driver installation & troubleshooting

Unit 2. Study of 8086 Microprocessors, Architecture, Programming, Interrupts, Interfacing devices (Stepper Motor, Key board, Displays)

Unit 3. Networking: Network components, Network hardware, Transmission media, LAN – Topologies, Networking technologies, 802 standards, Media access, Ethernet, Other Network architectures, Network software, Switches & bridges, Internet work connectivity devices

Unit 4. TCP/IP, TCP/IP services, IP addresses, Network applications, Client server systems, Introduction to WAN technologies, Network security, Testing & troubleshooting networks, Network performance & monitoring, Wireless networking

Unit 5. Industrial Communications, Serial: RS 232/485, HART, FF, Profibus, Profinet, Device net, Confitnet, Wireless : RF, GSM, Modbus

Reference Books:

1) Fundamentals of Wireless Networking by Price
2) TCP/IP Networking by Peterson
3) Computer Networking for Systems Programmers (Data Communications & Networking for Computer Programmers) by Gerald D. Cole
4) Computer Networking: A Top-down Approach Featuring the Internet by James F. Kurose Keith W. Ross
5) Computer Networking with Internet Protocols by William Stallings
6) An Introduction To Computer Networking by Antonakos James L. Mansfield Jr. Kenneth C.
7) Microprocessor peripherals and Applications by Gaonkar

I.A.1.3: Basic Instrumentations: 100 marks (45 Periods)

Unit **1. Temperature Measurement:** Thermometers: Bimetallic strip, metal expansion type, mercury in glass, liquid thermometer, vapor pressure. Thermostat.RTD: Types- PT100, CU60, 2 wire, 3wire and 4 wire. Bare and Industrial RTD. Lead wire compensation. Self heating effect.Thermistors: Types: NTC, PTC, Thermocouples: characteristics, law of thermoelectricity, thermocouple tables, cold junction compensation methods, change of table reference construction and protection, thermowell, thermopile. Semiconductor temperature sensors: Diode and IC temp sensors. Ultrasonic temp detector, quartz crystal temp. detector. Radiation: Pyrometers (Total and Radiation)

Unit **2. Flow Measurement:** Positive displacement flow meters. Bernoulli's theorem, Reynolds Number. Differential pressure type flow sensors: Orifice and their types, Venturi and Nozzle. Pressure taps Pitot tube, annubar Variable area meter (Rotameter). Turbine type flow meter, Electromagnetic flow type, ultrasonic flow meter, Vortex shedding type, mass flow meters, anemometers, flow totalizers and solid flow measurement.

Unit **3. Pressure measurement:** Pressure scale and standards Manometers: U-tube, well type, inclined tube, ring balance and digital manometer. Elastic pressure sensors: Bellows, bourdon tubes, diaphragm. Secondary pressure sensors, Differential pressure measurements: Force balance type, motion balance type, capacitive (delta cell), ring balance, vibrating cylinder type. High-pressure sensors: Dead weight tester, Bulk modulus cell, Bridge man type (Pressure sensitive wires).Vacuum sensors: McLeod gauge, thermal conductivity (Pirani, Thermocouple gage) ionization types, molecular momentum gage, penning gage.

Unit 4.**Level measurement:** Float, displacers, bubbler, and DP- cell, Ultrasonic, capacitive, microwave, radar, radioactive type, laser type transducers, level gages, resistance, thermal, TDR/ PDS type, solid level detectors, fiber optic level detectors.

Unit **5.Control Systems:** Open vs close loop, control loop components, P, I, D Control, Inst. Symbols: P & ID, Signal conditional circuits. Types of control actions: Discontinuous: ON/OFF, Time proportional. Continuous: Proportional, integral, derivative, proportional-Integral, Proportional-Derivative, Proportional-Derivative-Integral, Anti-reset windup, Rate before reset. Concept of bump less transfers in PID controller, Effect of process Characteristics on PID combination, control actions for various processes. Digital PID controllers: concept of velocity & position algorithm, block schematic of series and parallel combinations.

Reference books

1) Measurement Systems - E.O. Doebelin (4th Edition).
2) Principle of industrial Instrumentation – Patranabis.
3) Process Control Instrumentation Technology - C.D. Johnson (5th Edition).
4) Process Measurement & analysis - B.G. Liptak (Vol-I)
5) Instrumentation and Measurement Principles – D.V.S. Murthi
6) Instrumentation Measurements and Analysis – B.C.Nakra and K.K.Choudhari
7) Electronic Instruments & Measurement - A. K. Sawhney
8) Applied Instrumentation volume 2, William Andrews
9) Instrument Technology, E. B. Jones, vol. III
10) Instrumentation–Devices and Systems by C.S.Ragan, G.R.Sarma and V.S.V.Mani,TMH Public.
11) Electronic Instruments and instrumentation Technology by M.M.S.Anand.,Prentice-Hall of India.
12) Measurement Systems - E.O. Doebelin (4th Edition).
13) Instrumentation and Measurement Principles – D.V.S. Murthi
14) Alan S. Morris; Principle of Measurement &Instrumentation (2/e) , PHI
15) Electronic Instrumentation by H.S. Kalsi – TMH.
16) Process Measurement & analysis - B.G. Liptak (Vol-I)

I.A.1.4: Laboratory first (Electronics + Computer Networking, Comm.) : 100 marks (45 Periods)

1. Study of logic gates (OR,AND, NAND, NOR, EX-OR)
2. Study of RS, JK, D, T flip-flops
3. Study of Multiplexer, De multiplexer
4. Study of OPAMPS (Inverting, Non-Inverting, Adder, Subtracter, Integrator)
5. Design of Power supply (Using Transistor, IC)
6. Wireless network setup, GSM/RF Modems
7. Transistor amplifiers (CE, CB, A, B)
8. Study of RS/232/RS485 SERIAL COMMUNICATION, Modbus communication, HART/FF Communication
9. SCR firing angle control
10. Programming with microprocessor.
11. Interfacing of different memories to microprocessors
12. Study and implementation of multiplexer and demultiplexer
13. Study and implementation of encoders and decoders
14. Design and implementation of synchronous /asynchronous counters
15. Study and implementation of DAC/ADC

I.A.1.5: Laboratory second (Instrumentation) : 100 marks

1. Study of P & ID development
2. Study of different Temperature Sensors
3. Study of different Pressure sensors
4. Study of different Flow Sensors
5. Study of different Level Sensors
6. Study of different Position Sensors (Proxy, Photo, LS)
7. Study of different Encoders (Speed Sensors)
8. Study of different P + I + D Control
9. Study of on-off Control
10. Control Valve & Positioner
11. I/P Converter
12. Loop Checking / Simulator
13. Study of Pressure & Temperature Switches

I.A.2.1: Pneumatics and Hydraulics : 100 marks (45 Periods)

Unit 1. **Hydraulic components: Properties of hydraulic fluids, Physical characteristics, Influence of temperature on viscosity, types of filters, filter location, Fluid power fundamentals, types of pumps (gear, gerotor, screw, vane, piston), Actuators (linear, rotary), pressure control valves, direction control valves, flow control valves,**

Unit 2. **Hydraulic reservoir and accumulators, Seals and pickings, Hydraulic pipes, hoses and fittings, Fluid conditioners, Accessory components, Hydraulic symbols, Hydraulic circuits, designing of Hydraulic circuits, Electrical control of hydraulic systems**

Unit 3.**Fundamentals of Pneumatics, Pneumatic system and Physical units, basic requirement for Pneumatic system and pipeline layout, Air compressor, Pneumatic cylinders and air motors, Pneumatic valves,**

Unit 4.**Pneumatic circuits, combination circuits, Electrical control in Pneumatic circuits, maintenance and troubleshooting of pneumatic systems, Automation and principal of Pneumatic circuit design.**

Unit 5.**Hydropneumatics, Logic controls in fluid power systems, Hydraulic system maintenance, repair and reconditioning, trouble shooting in fluid power systems.**

Reference Books:

1) Pneumatic Instrumentation, Majumdhar
2) Pneumatic systems, S. R. Majumdhar
3) Hydraulics and Pneumatics controls, K. Shanmuga Sundaram, (S. Chand)
4) Oil hydraulic systems, principles and maintenance, S.R.Mujumdhar
5) Industrial Hydraulics, Pipenger
6) Pneumatics, Festo Didactic
7) Hydraulics, Festo Didactic

I.A.2.2: Embedded Systems : 100 marks (45 Periods)

Unit 1: **Introduction**: Microcontrollers and embedded processors, Choosing a microcontroller, Microcontroller Basics: Internal Block Diagram, 8051 microcontroller hardware, input/output pins, ports and circuits, external memory, counters and timers, serial data and input/output, interrupts

Unit 2: **Assembly language programming**: The assembly language programming process, PAL instruction, programming tools and techniques, programming the 8051, moving data, addressing modes, logical operations, arithmetic operations, jump and call instructions, an 8051 microcontroller design , 8051 timer programming in assembly, 8051 serial port programming in assembly, 8051 interrupts programming in assembly

Unit 3: **External Interfaces**: LCD and keyboard interfacing, ADC, DAC and sensor interfacing, interfacing to external memory, interfacing with 8255, stepper motor interfacing, DC motor interfacing, DS12887 interfacing, Relays and opto-isolators interfacing, Seven segment numeric display, pulse measurement,

Unit 4: **Embedded system:** an embedded system, classification of embedded system, processor in the system, digital signal processor (DSP), ASSP, GPP, power source and power dissipation and consumption, clock oscillator circuit and clocking unit, real time clock(RTC), reset circuits, memories, I/O ports, I/O buses and IO interfaces, interrupt handler, DAC using a PWM, ADC, LED & LCD display, keypad/keyboard, GPIB, linking and interfacing buses, exemplary cases, software embedded into system, embedded SOC and in VLSI

Unit 5: **Programming concepts for embedded system:** programming in ALP and C, C programming elements, headers and source files and processor directives, MACROS and functions, data types, structures, statements, loops, use of function calls, Queues, stacks, list and order list

Reference Books:

1. The 8051 microcontroller – Kenneth J. Ayala, Penram International, 3rd edition
2. 8051 Microcontroller and embedded systems – M. Mazidi, Pearson Higher Education
3. Programming and Customizing the 8051 microcontroller – Myke Predko, TATA McGraw Hill Edition.
4. Embedded System - Raj Kamal, TATA McGraw Hill Edition

I.A.2.3: PLC fundamentals and Programming: 100 marks (45 Periods)

Unit 1. Conventional control systems, PLC based control panels, PLC verses Computers, PLC advantages and disadvantages, Manufacturing and Assembly process, Types of PLC (micro PLC, modular PLC), PLC processor (function, operating systems, parts), Processor scanning, Serial communication between PC and PLC, PLC Installation, Troubleshooting and Maintenance,

Unit 2. PLC hardware components (Input modules and components, Output modules and components), PLC memory organization , PLC addressing methods and file types, PLC ladder logic, symbols used in ladder logic, basic instruction (relay, logical, program control), process scanning consideration, PLC operation faults,

Unit 3. Data control instructions (data comparison, computation, conversion, transfer), PLC arithmetic instructions, File manipulation instructions (FAL, FSC, COP, FLL), file transfer operation

Unit 4. Types of Timers (ON, OFF, RETENTATIVE), Timer Instruction, Types of Counters (UP, DOWN), Counter Instruction, Sequencer Instruction (SQO, SQI, SQL), Shift Register (Synchronous, Asynchronous),

Unit 5. Introduction to the SLC-500 range, Hardware configuration. Select the drivers for communications via RS Linx. Downloading the project. Online monitoring and searching with RS Logix, Application exercises on your plant programs. Simulator door control, Simulator traffic light control, Silo operation. Four stage elevator. Conveyor belt control Water tank filling. Dual compressor. Bottle filling. Robotic hand (three axis)

Reference Books:

1. Introduction to programmable Logic Controller, Gary Dunning
2. Programmable Logic Controllers (principles and applications), John W. Webb and Ronald A. Reis.
3. Programmable Logic Control NIIT; Prentice Hall India

I.A.2.4: Laboratory third (Pneumatics and Hydraulics) : 100 marks

Experiments related to Hydraulics and Electro-Hydraulics

1) Study of Hydraulic power pack
2) Study of Pressure relief valve
3) Study of Directional control valve
4) Study of single acting cylinder
5) Study of double acting cylinder
6) Study of meter in /out flow control
7) Study of regenerative circuits
8) Characteristics of hydraulic pumps
9) Study of pilot operated check valve
10) Study of pressure reducing valve
11) Working with diaphragm type accumulator
12) Study of direct operated pressure relief valve
13) Study of indirect operated pressure relief valve (pilot)
14) Study of Hydraulic motor (gear)
15) Study of Bleed of circuit

Experiments related to Pneumatics and Electro- Pneumatics

1) Study of Air filter, lubricator and regulator
2) Study of manifold block
3) Study of 2/2 way DC valve
4) Study of single acting cylinder
5) Study of double acting cylinder
6) Study of 5/2 way valve
7) Study of 4/2 way DC valve
8) Study of 5/3 way mid position closed valve
9) Study of 5/2 way double pilot valve air operated with manual over ride
10) Study of one way flow control valve
11) Study of quick exhaust valve
12) Study of vacuum generator
13) Study of 5/2 way valve (solenoid operated)
14) Study of OR gate/ shuttle valve
15) Study of AND gate
16) Study of indirectly actuation of single valve

I.A.2.5: Laboratory forth (Embedded Systems and PLC programming) : 100 marks

Practical using PIC-16F877 embedded system
and
Practical using 89C51RD2 embedded system (using cross assembler)
and
Practical using 89C51RD2 embedded system (using cross compiler (Keil))

1. Generate square wave on LED
2. Write routine to display "Hello World" on LCD
3. Using keys toggle LED's state
4. Serial communication between hyper terminal and MCU
5. To display the key pressed on PC AT Key board
6. To show the slow clock
7. Sound synthesis
8. Vary the pot & display hex conversion on LCD
9. To display the real time clock
10. Interfacing EEPROM with microcontroller (using I^2C interface)
11. Interfacing EEPROM with microcontroller (using SPI interface)
12. Generate square wave on LED (using timer interrupt)

Practicals related to PLC

1. PLC ladder programming with Simulator (relay, logical, program control instructions)
2. PLC ladder programming with Simulator (Data control instructions, PLC arithmetic instructions, File manipulation instructions, file transfer operation)
3. PLC ladder programming with Simulator (Timer Instruction, Counter Instruction, Sequencer Instruction, Shift Register)
4. PLC ladder programming with Simulator (door control, Simulator traffic light control, Silo operation. Four stage elevator, Conveyor belt control, Water tank filling, Dual compressor, Bottle filling. Robotic hand)
5. PLC programming for working model of four stage elevator
6. PLC programming for working model of dual water tank
7. PLC programming for working model of traffic light
8. PLC programming for working model of door control

I.A.3.1: Mechatronics & Robotics : 100 marks (45 Periods)

Unit 1. General notions regarding the Mechatronics systems and Mechatronics driving systems. Mechatronics systems; Place of the driving system in the frame of the Mechatronics system; Principles of choice of the driving system ;)

Unit 2. General presentation of the driving system types; Advantages and disadvantages; Robot driving system (definition; structural scheme of a robot; subsystems that robots consists of Electric drives)

Unit 3. D.C. electric motor; D.C. servomotor; Step-by-step electric motor; Rotative and linear step-by-step electric motor;

Unit 4. Tri-phased non-synchronic motor; linear electric motor; Tendencies in the development of the electric motor for the driving of the robots

Unit 5. Special drives: Chemical actuators; Actuators based on the shape memory alloy; Piezo electric actuators; Magnetostictive actuators; electrostatic actuators; Optical actuators etc. Elements of motion transmission

Reference Books:

1) Distributed Computer Control for Industrial Automation, Poppovik Bhatkar, Dekkar Publications.
2) Computer Aided Process Control, S.K.Singh, PHI
3) The Management of Control System: Justification and Technical Auditing, N.E.Battikha, ISA
4) Computer Based Process Control, Krishna Kant, PHI
5) Distributed Computer Control for industrial Automation by Bhatkar (dekkar)
6) Robotics, KS. Fu, R.C. Gonzalez, C.S.G. Lee;, Mcgraw - Hill
7) Introduction to Robotics, John J. Craig, Pearson Education
8) Robotic Engineering An Integrated Approach, Richard D. Klafter, Michael Negin;, PHI

I.A.3.2: HMI, SCADA Basics, Databases : 100 marks (45 Periods)

Unit 1. Plant wide Control Systems and Automation Strategy, Evolution of instrumentation and control, Role of automation in industries, Benefits of automation, Introduction to automation tools PLC, DCS, SCADA, Hybrid DCS/PLC, Automation strategy evolution, Control system audit, performance criteria, Safety Systems.

Unit 2. Advance Applications of PLC and SCADA, PLC programming methods as per IEC 61131, PLC applications for batch process using SFC, Analog Control using PLC, PLC interface to SCADA/DCS using communication links (RS232, RS485) and protocols (Modbus ASCII/RTU)

Unit 3. Instrumentation Standard Protocols: HART Protocol introduction, frame structure, programming, implementation examples, Benefits, Advantages and Limitations. Foundation Fieldbus H1 introduction, structure, programming, FDS configuration, implementation examples, Benefits, Advantages and Limitations. Comparison with other fieldbus standards including Device net, Profibus, Control net, CAN, Industrial Ethernet etc.

Unit 4. MMI/HMI Human Machine Interface: MMI- Introduction of MMI, application of MMI, types of MMI, selection of MMI, h/w of MMI, cable of MMI , ports of MMI, programming s/w of MMI, key field, changing the set points of timer, changing the set points of counter, use of user define function keys, display of outputs, display of faults, display of timer current value.Interfacing with PLC.

Unit 5. SCADA (Wonder ware, Win cc, Intellection or RSview 32): Introduction to SCADA, configuration of different drivers, gateway. Database of tags and its use. Interfacing with PLC and simulation of PLC application in SCADA. selection of SCADA s/w, programming cable of SCADA, creating new SCADA application, crating & editing graphic display, crating & editing elementary graphic, creating data base of tags, start stop command, drivers of SCADA s/w, configuration of drivers file in s/w, communication of SCADA s/w, data entry, analog entry, connectivity between s/w

Reference Books

1) Applied Instrumentation in the process Industries, Volume I, Andrew and Williams Gulf Publishing Company Second Edition
2) Programmable Logic Controllers by Garry Dunning, 3rd Ed, PHI Pub. 2004.
3) Control Valve Handbook by ISA
4) Distributed Computer Control for Industrial Automation, Poppovik Bhatkar, Dekkar Publications.
5) Programmable Logic Controllers: Principles and Applications, Webb and Reis, PHI.
6) Computer Aided Process Control, S.K.Singh, PHI
7) The Management of Control System: Justification and Technical Auditing, N.E.Battikha, ISA
8) Computer Based Process Control, Krishna Kant, PHI

I.A.3.3: Process Control and DCS : 100 marks (45 Periods)

Unit 1. Process Characteristics: Types of processes, Process gain, process reaction curve, process time constant & constant step analysis method for finding time constant, dead time, dynamic elements in control loops, PID control of processes, Process simulator.

Unit 2. Analysis & properties of some common loops: Flow, pressure level, temperature, composition, pH etc., linear & non-linear controllers, review of PID with limitations rate before reset, PID variations & tuning , digital controller, hardware structures, features & specification, single loop & multi loop

controller & the application programs, non-linear controller-two state, three state, proportional time, dual mode optimal switching. Multi loop & multivariable process control systems: Feedback, Feed Forward control, Cascade Control, Ratio Control, Selective Control, Split-range Control. Interaction & Decoupling, Relative Process Gain Matrices (RPG) & applications, Statistical Process Controls.

Unit 3. Control Systems for various processes: Development of control loops, Design aspects and selection criterion for filed instruments and instrumentation scheme for boiler, compressors, pumps, chiller, evaporators, dryer, cooling tower, distillation column, CSTR. Development of control loops: Design aspects of Instrumentation for Power, Water and Waste-Water Treatment, Food and Beverages, Pharmaceuticals (Introduction to International Standards S88, S95 and US FDA 21CFR 11), Cement, Automobile and Building Automation.

Unit 4. Control valve design: Designing control valve for gas, vapor, and liquid. Effects and remedies of cavitations, flashing condition, noise, control valve linearizer, valve auxiliary parts, flow characteristics of valve control effects of load changes, high pressure & high temperature service, control valves, installed range ability & viscosity correction for control valve. Control valve application & selection, valve sizing by ANSI/ISA-S-75.01 std. valve capacity & testing by ANSI/ISA-S-75.02 std. Control valve seat leakage, Valve noise calculation & reduction method, Smart valve package. Intelligent-smart actuators, design considerations for actuators (solenoid, pneumatic, hydraulic, digital field bus actuators). Design of orifice plates and related international standards.

Unit 5. Distributed Control Systems Basics: DCS introduction, functions, advantages and limitations, DCS as an automation tool to support Enterprise Resources Planning, DCS Architecture of different makes, Latest trends and developments. Distributed Control Systems Engineering and Design: DCS detail engineering, specifications, configuration and programming, functions including database management, reporting, alarm management, communication, third party interface, control, display etc. Enhanced functions viz. Advance Process Control, Batch application, Historical Data Management, OPC support, Security and Access Control etc. Performance Criteria for DCS and other automation tools.

Reference Books

1) Control System Design – G. Goodwin, S. Graebe, Mario Salgado, Pearson Education.
2) Control System Engineering- Norman Nise, Wiley International
3) Control System Engineering- Nagrath and Gopal , Tata-McGrawHill Publication.
4) Feedback Control of Dynamic Systems- G. Franklin, J.Powell, A. Naeini, Pearson Education.
5) Automatic Control Engineering Francis Raven, McGraw-Hill International. fifth edition.
6) Control System Design, G. C. Goodwin, S. F. Graebe, M. E. Salgado, Pearson education.
7) Process control and instrument technology, C. D. Johnson, TMH
8) Instrumentation for process measurement and control, N. A. Anderson
9) Process Control, Instrument Engineering Hand book, B. G. Liptak
10) Tuning of industrial control systems, ISA
11) Control valve handbook, ISA

I.A.3.4: Laboratory five (Mechatronics & Robotics): 100 marks (45 Periods)

1) Study & analysis of flow, pressure, and level control loop (Analysis includes process parameters such as type of process, dead time, capacity etc.)
2) Implementation of cascade controller.
3) Design & implementation of feed-forward controller.
4) Design of orifice plates as per BS1042 / ISO 5167
5) Control loop design for Power.

6) Control loop design for Water and Waste Water Treatment.
7) Control loop design for Food and Beverages.
8) Control loop design for Cement.
9) Control loop design for Pharmaceuticals.
10) Control loop design for Automobile and Building Automation.
11) Designing of control valve for liquid/gas/vapor applications.
12) Design of pneumatic or electric actuator.

I.A.3.5: Laboratory six (PLC, HMI & SCADA Interfacing, DCS) : 100 marks (45 Periods)

1) HMI; Creating applications, creating tags
2) HMI; Downloading / uploading programs
3) HMI; Creating alarm messages
4) HMI; Communication with PLC
5) HMI; Fault diagnostics
6) SCADA; Programming
7) SCADA; Real time trends, Historical trends
8) SCADA; Alarm generation
9) SCADA; Security, Recipe management, Security
10) SCADA; Communication with Excel, Communication with PLC

Experiments are to be design with CACSD

11) Analysis of continuous and discrete control system.
12) Study of Jury's stability criterion and analysis.
13) Digital controller design with root locus techniques.
14) Digital lead controller design with frequency domain techniques.
15) Digital lag controller design with frequency domain techniques.
16) Digital controller design with pole placement method.

I.A.4.1: Project Engineering and Management (Two Week): 100 marks (08 Periods)

1. Control Panel
2. Project Engineering: Documentation & project Planning
3. Case studies
4. Sample projects
5. International slides & practices
6. Soft skills

1. One Major project

Reference Books:

1) Applied instrumentation in process industries, Andrew and Williams, Gulf publishing.
2) Process control Instrument engineers Handbook, Liptak.
3) Project management: A systems approach to planning Scheduling and Controlling, Harlod Kerzner, Van Nostrand Reinhold publishing.
4) Management systems, John Bacon, ISA.
5) Instrument installation project management, ISA.
6) Handbook of Communication Skills (2nd edition) - Bernice Hurst (Kogen Page)
7) Human Organization Behavior at work - Keith Davis (TMH)
8) Essence of effective Communication - Ludlow & Panton (PHI)
9) Technical writing, process & Product - Gerson & Gerson (PHI)
10) Organization Behavior - Robbins (PHI, 7th edition)

I.A.4.2: Implant Training (five month) : 300 marks+100marks External Examination

The individual student must undergo training in automation sector industries such as process, power plant, and other industries where minimum automation level should be 50% and prepare the minimum 50 pages report and submit to the institute and it should be evaluated by external examiner from related field with 100 marks for external examination.

UGC, Innovative course
Industrial Automation
Education Society's
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Bezonji Science College, Jalna (M.S.)

PRINCIPAL
J.E.S. R. G. Bagdiya Arts S. B. Lakhotiya
Com. & R. Bezonji Sci. College, Jalna