

Faculty of Engineering & Technology

।।अंतरी पेटवू ज्ञाज्योत।।



NORTH MAHARASHTRA UNIVERSITY,
JALGAON.

Syllabus For

**THIRD YEAR ENGINEERING
(T.E.)**

INSTRUMENTATION

SEMESTER -I & II

(W.E.F.2007-2008)

NORTH MAHARASHTRA UNIVERSITY, JALGAON

T.E. INSTRUMENTATION

SEMESTER -I,

Paper-I - Microprocessor Techniques

Teaching scheme:

Lectures: 4Hrs. /Week

Practical: 2 Hrs / Week

Examination Scheme:

Paper: 100 Marks

(3 Hrs. duration)

Term-Work: 25 Marks

Practical: 25 Marks

Unit 1:

Introduction to microprocessors: microcomputer systems; computer languages; microprocessor architecture, operation with memory and input /output devices; 8085 based microprocessor systems. Instructions: Format, Classifications, timing diagrams, Machine Cycles, status flags, basic instructions; assembly language programs. **(10 Hrs.) (20 Marks)**

Unit 2:

Additional instructions and programming techniques: looping, counting, indexing; data transfer and 16 bit arithmetic instructions: logic operations. Basic interfacing concepts: interfacing displays, keyboards, and memory.

I/O mapped I/O memory mapped I/O. Interrupts and interrupt structure of 8085, reset as software interrupt. Stack subroutines, conditional call and return. **(10 Hrs.) (20 Marks)**

Unit 3:

Basic concepts in serial I/Os, software controlled synchronous serial I/Os. Interfacing of RS-232 & IEEE-484. Programmable I/Os and interfacing applications: basics of programmable I/O devices programmable peripheral interface 8255. Programmable interval timer 8253, counter and time delay applications. DMA Controller 8257. **(10 Hrs.) (20 Marks)**

Unit 4:

Programmable interrupt controller 8259, Keyboard & display interface 8279

Floppy disk controller 8272

CRT Controller 8275

Connection diagram and interfacing for each IC.

(10 Hrs.) (20 Marks)

Unit 5:

8086 /8088 CPU architecture programming model segmentation, Addressing modes, instruction sets, Basic 8086 configuration, maximum and minimum modes, system bus timing.

(10 Hrs.) (20 Marks)

References :

1. Ramesh s Gaonkar, 'Microprocessor Architecture, programming and Application with the 8085', third edition, Penram international (India)
2. A P Mathur, 'Introduction to microprocessor', third edition, Tata MCGraw-Hill.
3. Douglas V. Hall ' Microprocessor and interfacing programming and Hardware', Douglas V. Hall, Pearson.
4. Yu -cheng Liu and Gleen A Gibson, 'Microcomputer systems; the 8086 / 8088 Family Architecture, Programming and Design', 2nd Edition, Pearson.

List of Experiments:

1. Programs for addition and subtraction.
2. Programs for multiplication and division.
3. Programs for up /down BCD / binary counters.
4. Program for serial data transfer.
5. Program for block transfer using DMA Controller.
6. Program for input/output operations using IC 8255.
7. Write a program for 0 to 9 counter using IC 8253.
8. Interfacing of ADC/ DAC with IC 8085.
9. Interfacing of Stepper motor with IC 8085.
10. Interfacing a 7-segment LED and keyboard with IC 8085 using IC 8279.
11. Four sources are connected to 8259. Emergency signal, keyboard, ADC/DAC and Printer.
Write a program to emergency signal has highest priority and printer has lowest priority.
12. Study of floppy disk controller.
13. Study of CRT controller.
14. Program for string manipulation.
15. Write a program for HEX-BCD conversion.
16. Write a program for BCD -HEX conversion.
17. Program using MACRO.

The term work should include a minimum of **eight** experiments based on above syllabus & minimum one experiment on each unit.

NORTH MAHARASHTRA UNIVERSITY, JALGAON

T.E. INSTRUMENTATION SEMESTER-I, Paper-2-Control System Components

Teaching scheme:

Lectures: 4 Hrs/week
Practical: 2 Hrs/week

Examination scheme:

Paper: 100 marks (3 Hrs duration)
Termwork: 25 marks
Practical: 50 marks

Unit 1:

Introduction to control system components: hydraulic, pneumatic, electronic; comparison of different systems.

Transmitters: 2 - wire transmitters, buoyancy, differential pressure, temperature, electro-hydraulic transmitters.

Converters: resistance-to-current, voltage-to-current, pneumatic-to-electrical, electrical-to-pneumatic, Square-root extractor, integrator and totalizer. **(10 Hrs)(20 marks)**

Unit 2:

Control Valves: terminology, types and characteristics, selection of control valves, concept of Cv, calculation of Cv and trim size, cavitation and Flashing, Noise in control valves, testing of control valves.

Valve positioners: necessity, types and effect on performance of control valves;
Actuators: Electrical, Pneumatic, Hydraulic, Electro-pneumatic, Electro-Hydraulic. **(10 Hrs)(20 marks)**

Unit 3:

PID controllers: pneumatic, hydraulic and Electronic controllers

PLC: relay ladder diagrams, introduction to programmable logic controllers (PLC), architecture and specifications, development of simple ladder diagrams, pressure switch, temperature switch, flow switch, limit switch, proximity switch, and reed switch. **(10 Hrs)(20 marks)**

Unit 4:

Pneumatic components: instrument air supply, air filter regulator, linear motors(piston-cylinder), rotary motors, non-return valves, directional control valve, pressure reducing valves, simple pneumatic circuits, fluidic gates.

Hydraulic components: hydraulic power pack, pumps, power cylinders, servomotors, DC valves, simple hydraulic circuits and transmission. **(10 Hrs)(20 marks)**

Unit 5:

Control system components: synchros, servo motor, stepper motor, amplidyne, magnetic amplifier.

Auxiliary components: feeders, dampers, differential links and gears, intrinsic safety components, gyroscope, indicators and alarm annunciator. **(10 Hrs)(20 marks)**

References:

1. C.D.Jhonson , 'Process control and Instrument Technology' , Prentice-Hall of India.
2. D.Patranabis, 'Principles of process control', Tata McGraw-Hill.
3. N.A.Anderson, 'Instrumentation for process measurement and control', CRC Press.
4. Pipepinger, 'Industrial Hydraulics'.
5. Mujumdar, 'Pneumatic components and circuits', Tata McGraw-Hill.
6. I.J.Nagrath, M.Gopal., 'Control system Engineering', PHI..
7. JhonWebb, 'Programmable logic controllers', PHI.
8. Francis Raven, 'Automatic Control Engineering', McGraw-Hill.
9. Bela Liptak , 'Handbook of Instrumentation Engineers (process control)'.
10. Andrew Willams, 'Applied Instrumentation in process control (vol-1)', Gulf Publications.

List of Experiments:

1. To control any one process variable in the control loop (Flow, Level, Pressure, or Temperature) & plot the graph of controlled variable Vs time.
2. To plot the characteristics of two-wire transmitter.
3. To plot the characteristics of I/P or P/I converter.
4. Calibration of DP transmitter for flow/ level interface.
5. Tuning of PID controller.
6. To plot the characteristics of Control valve.
7. Test and find the time constant of a given control valve.
8. Study of pneumatic components and simple pneumatic circuits.
9. Study of hydraulic components and simple hydraulic circuits.
10. Implement various ISA sequence on alarm annunciator.
11. To plot the characteristics of synchros / AC servo motor.
12. To plot the characteristics of square root extractor.
13. To plot the characteristics Pressure switch / Temperature switch.
14. Implement ladder diagram for simple Applications on PLC.
15. Study of specific/related equipment e.g. RTD, T/C, PH simulator, pressure regulator, safety devices.

The term-work should include a minimum of **eight** experiments from the above list.

NORTH MAHARASHTRA UNIVERSITY, JALGAON

T.E. INSTRUMENTATION

SEMESTER-I,

Paper-3- Linear Techniques

Teaching Scheme:
Lectures: 4 Hrs./week
Practicals: 2 Hrs./week

Examination Scheme:
Paper: 100 marks (3 hrs. duration)
Term work: 25 marks
Practical : 25 marks

Unit 1

Differential Amplifiers: dual input-balanced output ; single input-balanced output; their analysis, constant current bias, current mirror, level translators, Basic Operational amplifier; equivalent circuit, IC Operational amplifiers-characteristics, specification , parameter measurements, frequency response, types (741,308,356,OP07) and their properties.

(10 Hrs.) (20 marks)

Unit 2

Negative feedback applications: Voltage amplifier, current amplifier, Voltage to current and current to voltage converter, Op-amp as integrator and differentiator, Instrumentation amplifier.

Positive feedback applications: Crystal oscillator and Function generator.

(10 Hrs.) (20 marks)

Unit 3

Comparator and Converter : basic comparator, zero-crossing detector, Schmitt trigger, precision AC/DC converters, logarithmic amplifier, sample-and –hold circuit, analog-to-digital and digital-to –analog converters, clippers and clampers using op-amp.

(10 Hrs.) (20 marks)

Unit 4

Timer ICs.-Timer 555, its block diagram and applications- astable , monostable multivibrator, Timers- 7555 and XR2240, their block diagram and applications.

Phase locked loop (PLL)- operating principle, IC 565 applications, Voltage controlled oscillator (VCO) and its applications.

(10 Hrs.) (20 marks)

Unit 5

Voltage regulators : 3 terminal positive and negative voltage regulators, variable voltage regulators (3085,723), tracking regulators.

Active filters: Butterworth & Chebychev filter, design and evaluation of second order filters- low pass, high pass , band pass, band reject and all pass filter.

(10 Hrs.) (20 marks)

References:

1. Ramakant A. Gayakwad, 'Op-Amp and Linear Integrated Circuits', Third edition, Prentice-Hall of India
2. Graeme, Tobey and Huelsman, 'Operational Amplifiers: Design and Application', McGraw-Hill International edition.
3. D.Roy Choudhury and Shail Jaon, 'Linear Integrated Circuits' New Age International
4. Albert Paul Malvino, 'Electronic Principles', 6th edition, Tata McGraw-Hill.

List of Experiment :

1. Measurement of different Op-Amp parameters.
2. Design and implement Instrumentation Amplifier
3. Design and implement Function Generator using Op-amp.
4. Design and implement Half-wave precision rectifier.
5. Design and implement Zero-crossing detector
6. Design and implement Schmitt trigger.
7. Design and implement Clipper / Clamper circuits using op-amp
8. Design and implement A/D and D/A converter
9. Design and implement Butterworth second order low-pass / high-pass filter.
10. Design and implement Astable multivibrator using IC555.
11. Design and implement Monostable multivibrator using IC555.
12. Design and implement application of Phase locked loop PLL-565.

The term work should include a minimum of **eight** experiments from the above list.

NORTH MAHARASHTRA UNIVERSITY, JALGAON

T.E. INSTRUMENTATION SEMESTER-I,

PAPER-4 -ELECTRONIC INSTRUMENTATION

Teaching Scheme:

Lectures: 4Hrs/week
Practical :2Hrs./week

Examination Scheme:

Paper:100marks
(3Hrs.duration)
Termwork:25marks.

Unit 1:

Signal Sources: sinusoidal signal sources, pulse generators, frequency synthesis, square wave generators, function generators, Analog switches and multiplexers, sample and hold circuits, programmable amplifiers, lock in amplifiers. **(10Hrs) (20Marks)**

Unit 2:

Signal analysis – distortion analyzer, wave analyzer, spectrum analyzer, FFT analyzer, logic analyzer, network analyzer, optical spectrum analyzer and optical time domain reflectometer (OTDR) **(10Hrs) (20Marks)**

Unit 3:

Voltage to time, voltage to frequency converter, digital frequency counter and timers, period mode, frequency mode, time interval mode, errors in digital counters, universal counter, Digital voltmeter and multimeter, accuracy of DMM, Automation in DVM & DMM, True rms voltmeter, vector voltmeter, RLC and –Q meter, Insulation tester, opto-isolators, Data loggers. **(10Hrs) (20Marks)**

Unit 4:

Power supplies : Introduction to the unregulated power supply, DC voltage regulation, AC Ripple voltage, Design procedure for a full-Wave Bridge unregulated supply, Bipolar and two valve unregulated power supply, Need for voltage regulation, Linear IC voltage regulators, +/- 15V power supplies, Adjustable three terminal positive voltage regulator (LM 317 HV) and negative voltage regulator (LM 337 HV). **(10Hrs) (20Marks)**

Introduction to UPS and SMPS..

Unit 5:

Virtual Instrumentation - Historical perspective, Need of VI, Advantages of VI, Define VI, Block Diagram and architecture of VI, data flow techniques, graphical programming in data flow, comparison with conventional programming.

Programming techniques in the software like Labview – VIS, Sub VIS, Loops, Charts, arrays, clusters, graphs, case and sequence structures, formula modes, local and global string and file input application of VI in equipments like Oscilloscope and Digital multi-meter.

(10Hrs) (20Marks)

References:

1. Cooper and Helfric, 'Electronic instrumentation and measurement Techniques', third edition, Prentice – Hall of India.
2. Chin and jones, 'Electronic instrumentation and measurement', wiley.
3. J.J.carr, 'Elements of Electronic instrumentation and Measurement', second Edition, Reston.
4. Oliver and cage, 'Electronic Instrumentation and measurement', McGraw-Hill.
5. Rangan, Sarma, Mani, 'Instrumentation Devices and systems', Tata Mcgraw Hill.
6. S.Soclof, 'Application of Analog integrated circuits', prentice Hall.
7. Robert F. Coughlin, Frederick,'Operational Amplifier and linear integrated Circuits', Pearson Education .
8. David Bell, 'Electronic measurement & instrumentation', PHI.
9. Gary Johnson , 'Labview Graphical programming', second edition, MC GrawHill.
10. Lisa k.Wells & Jettrey Travis , 'Labview for Everyone', PHI..
11. Sokoloff, 'Basic concepts of labview 4', PHI..

Practical List:

1. Design Wein bridge Oscillator as a sine wave generator.
2. Design function generator using IC 8038 and study its outputs.
3. Design Q-meter circuit.
4. Study of RLC meter.
5. Study of DMM.
6. Design and implement frequency counter.
7. Study of universal counter.
8. Study of spectrum analyzer.
9. To measure the harmonic distortion using Distortion meter.
10. Study of virtual Instruments.
11. Study of logic analyzer.
12. Study of UPS.

The term work should include minimum of **eight** experiments from the above list.

T.E. INSTRUMENTATION
SEMESTER-I, Paper 5 - UNIT OPERATION

Teaching Scheme:

Lectures: 4 Hrs. / Week

Examination Scheme:

Paper: 100 Marks
03 Hrs. Duration

Unit 1

Introduction: - Concept of unit operations & unit processes, material balance and energy balance.

Evaporation: - Liquid characteristics, types of evaporators, Method of Feeding, principle & operation of single & capacity & economy of multiple effect evaporation, Vapour recompression, Operation of mechanical and thermal Recompression, Instrumentation and control for this process.

Drying: - Classification of dryers, Principle & operations, Drying equipments, Instrumentation for this process. **(10Hrs) (20 Marks)**

Unit 2

Distillation:- Equipment set up, Operation of flash Distillation, Batch Distillation, Continuous Distillation, Fractionating Column; slue plate arrangement, Rectification and stripping, Instrumentation and control for this process.

Leaching and Extraction: - Principles, Various types of equipments for this process. **(10Hrs) (20 Marks)**

Unit 3

Material Handling Equipments: - Transport Equipments, Positioning Equipments, Unit load formation Equipment, Storage equipment, Identification & control equipment.

Size Reduction :- Principle of comminution, Equipment, Classification and operation of crushers & grinders. **(10Hrs) (20 Marks)**

Unit 4

Crystallization: - Definition, Magma, Supersaturation, formation of Crystal, Equipment classification & operation. Instrumentation & control for this process.

Filtration: - Centrifuges, cyclones, Types of Industrial filters, Rotary filter, Bag filter, electrostatic precipitators. **(10Hrs) (20 Marks)**

Unit 5

Heat Exchangers:- Theory, Types, Characteristics, Combustion processes-liquid and solid fuels.

Application of above Unit operations in Paper, Cement, Fertilizer, Petrochemical and sugar industry. **(10Hrs) (20 Marks)**

Books: -

- 1) McCabe Smith , 'Unit Operation of chemical engineering', 5th edition, McGraw Hill.
- 2) Perry , 'Chemical engineers Handbook', 6th Edition, McGraw Hill int. Student ed. 1984.
- 3) Felder, Rotsseau, Herriot, 'Elementary principles of chemical processes', Wiley 1978
- 4) W.F.Stoeker , 'Design of Thermal System', 3rd Edition McGraw Hill int. ed. 1989
- 5) M. Gopalrao & M.Sitting , 'Outline of Chemical technology', 2nd edition east west 1973

NORTH MAHARASHTRA UNIVERSITY, JALGAON

T.E. INSTRUMENTATION

SEMESTER-I,

paper-6-Programming practice-III

Teaching scheme:

Theory-1 Hrs/week

Practical: 4 Hrs/week

Examination scheme:

Termwork:25marks

Practical: 50 marks

Unit 1:

Study of one of back-end tool like Oracle/ Ms-Access as database package for following facility in the software.

Create tables, rows, records, columns & fields.

Store text, number, dates, pictures, & sound files in the tables & column.

Define, manipulate, retrieve & delete data, using SQL command.

Joins & Sub queries.

Use of constraints

Introduction to PL / SQL

Member function & procedure, views, sequence.

Cursor management.

Practicals:

- 1) Performing the DDL command.
- 2) Performing the DML command.
- 3) Performing the DCL, DQL & DTL Command.
- 4) Use of joins & Sub-queries.
- 5) PL / SQL command – Block structured language.
- 6) Use of function & procedures.
- 7) Use of views & sequence.

Unit 2:

Study of one of the front-end tool like Visual Basic / Developer as a database package for following facilities.

Introduction to the front end tool.

Working with controls.

Working with menus, mouse events & dialog Boxes.

Concept of ODBC & DAO.

Practicals:

- 1) Creation of forms & use the different. Properties of forms.
- 2) Working on controls like text Box, label control, Command, Scroll Bar.
- 3) Creation of menus & Dialog Boxes.
- 4) Creation of Events.
- 5) Practical implementation of tool bar & status bar.
- 6) Mini Project.

The term-work include a minimum of **4 assignment** from the above each unit.

References:

- 1) Charles E Brown , “ Access VBA Programming”, Tata Mc Graw hill.2) Abraham Silberschatz, Henry E Korth, “ Data Base system concept” Tata Mcgraw Hill international edition
- 3) Abramson, “Oracle Database log”, A beginner’s guide oracle press.
- 4) Julia case Poradley, “ Programming in Visual Basic 6.0” ,Tata Mcgraw-hill edition
- 5) Jerke, “ Visual Basic 6: the complete reference”, Tata Mcgraw Hill
- 6) Paolo Atzeri, “ DataBase systems” ,Tata Mcgraw hill

NORTH MAHARASHTRA UNIVERSITY, JALGAON

T.E. INSTRUMENTATION

SEMESTER –II,

Paper-1 -Microcontroller & Application

Teaching scheme:

Lectures: 4 Hrs/week

Practical: 2 Hrs/week

Examination scheme:

Paper: 100 marks (3 Hrs duration)

Termwork: 25 marks

Practical: 50 marks

Unit 1:

Introduction to Microcontrollers: microcontrollers & microprocessors, history of microcontrollers & microprocessors, Embedded versus External memory devices, 8-bit & 16-bit microcontrollers, CISC and RISC Processors, Commercial microcontroller devices.

8051 microcontrollers:- MCS-51 Architecture, Registers in MCS-51, 8051 pin description, 8051 connections, 8051 parallel ports, memory organization. **(10 Hrs)(20 marks)**

Unit 2:

8051 Addressing modes, MCS-51 Instruction set, 8051 Instructions and simple programs, stack pointers, 8051 Assembly Language Programming, Development systems and Tools, Software Simulators of 8051, Interrupts in MCS-51, Timers and Counters, Serial Communication.

(10 Hrs)(20 marks)

Unit 3:

Atmel microcontrollers (89CXX and 89C20XX), Architectural Overview of Atmel 89C51 and Atmel 89C2051, pin description of 89C51 and 89C2051, Using Flash Memory Devices Atmel 89CXX and 89C20XX, Power saving Options, Applications of MCS-51 and 89C51 and 89C2051 microcontrollers, square wave generation, Rectangular waves, Pulse Generation, Pulse Width Modulation (PWM), Staircase Ramp Generation, Sine Wave Generation, Pulse Width Measurement, Frequency Counter.

(10 Hrs)(20 marks)

Unit 4:

PIC Microcontrollers: Overview and features, PIC 16C6X/7X FSR (File Selection Register), PIC Reset Actions, PIC Oscillator Connections, PIC Memory Organization, PIC 16C6X/7X Instructions, Addressing Modes, I/O Ports, Interrupts in PIC 16C61/71, PIC 16C61/71 Timers, PIC 16C71 Analog-to-Digital Converter (ADC)

PIC 16F8XX Flash Microcontroller: Pin diagram of 16F8XX, STATUS register, OPTION_REG register, Power Control Register (PCON), PIC 16F8XX Program Memory, PIC 16F8XX Data Memory, DATA EEPROM and Flash Program EEPROM, Interrupts in 16F877, I/O ports, Timers.

Master Synchronous Serial Port (MSSP) Module, Universal Synchronous Asynchronous Receiver Transmitter (USART), Analog-to-Digital Converter (ADC)

(10 Hrs)(20 marks)

Unit 5:

Interfacing and Microcontroller Application: Light Emitting Diodes (LEDs), Push Buttons, Relays and Latch Connections, Keyboard Interfacing, Interfacing 7-segment Displays, LCD Interfacing, ADC and DAC Interfacing with 89C51 Microcontroller, 8051 Interfacing to External memory, 8051 Interfacing to the 8255.

Industrial Applications of Microcontrollers: Measurement Applications, Automation and Control Applications.

(10 Hrs)(20 marks)

References:

1. Kenneth J. Ayala, '8051 Microcontroller Architecture, programming, & Applications', 2nd edition, Thomson learning.
2. Muhammad Ali Mazidi, 'The 8051 Microcontroller and Embedded Systems', Pearson Education.
3. Ajay V Deshmukh, 'Microcontrollers (Theory and Applications)', McGraw-Hill.
4. Jhon Peatman, 'Design with Microcontrollers', McGraw-Hill.
5. Jhon Peatman, 'Design with PIC Microcontrollers', Pearson Education.
6. Kenneth Hint, Daniel Tabak, 'Microcontroller: Architecture, Implementation, and programming', McGraw-Hill.

List of Practicals:

Programming of 8051 Microcontroller for

1. Addition of two 16-bit Numbers.
2. Unsigned 32-bit Addition.
3. Subtraction of two 16-bit Numbers.
4. Conversion of 8-bit Signed Number into a 16-bit Signed Number.
5. 16-bit Signed Addition.
6. Binary to BCD Conversion.
7. Integration.
8. Differentiation.
9. Keyboard Interfacing.
10. Interfacing 7-segment Displays
11. LCD interfacing.
12. ADC and DAC Interfacing with 89C51 Microcontrollers.

The term-work should include a minimum of **eight** experiments from the above list.

NORTH MAHARASHTRA UNIVERSITY, JALGAON

T.E. INSTRUMENTATION

SEMESTER –II,

paper 2- Discrete Control System and MATLAB

Examination Scheme:

Teaching Scheme:

Lectures: 4 Hrs/week

Practical: 2hrs/week

Paper : 100marks

(3 Hrs duration)

Termwork : 25 marks

Practical: 25 marks

Unit 1:

State space representation: Definition of state, state variables, state vector, state space representation of multiinput single output system and multiinput multioutput system, properties of state transition matrix, determination of state transition matrix, solution of homogeneous and non homogeneous state equation time domain response from state transition matrix, on interaction of multiinput –multioutput system, linear time varying systems

(10hrs) (20marks)

Unit 2:

Sampling and reconstruction: Sampled data control system, D to A and A to D conversion, sample and hold operation and its mathematical model, sampling theorem.

Linear difference equations: pulse response, Z transforms, relation between z plane and s plane, pulse transfer function.

Analysis of sampled data system: block diagram analysis equivalence between z domain and s domain, stability analysis, system with dead time.

(10hrs) (20marks)

Unit 3:

State space analysis of sampled data systems: discrete time state equations, similarity transformations, Cayley-Hamilton theorem, realization of pulse transfer function, state equation

of sampled data system and its example.

Controllability and observability: Concept, Lyapunov stability analysis, system with dead time.

(10hrs) (20marks)

Unit 4:

Digital control system: Introduction, design specification, design of w plane digital PID controller, multivariable controllers, Design of digital control system using state-space formulation of optimal control problem, optimal state regulator.

(10hrs) (20marks)

Unit 5:

MATLAB Programming and Toolboxes:

Introduction to MATLAB, basic matrix operation, inverse of matrices, solving differential equations, Toolboxes for control system design.

(10hrs) (20marks)

References:

1. Katsuhiko Ogata, 'Modern Control Engineering', second edition, Prentice Hall of India.
2. G.J. Murphy, 'Control Engineering'.
3. Kuo, 'Digital Control System'.
4. M.Gopal, 'Modern Control System Theory', second edition, New Age International
5. M Gopal, 'Digital Control Engineering', New Age International
6. Rudra Prasad , 'MATLAB programming'.
7. Edward Magrab, 'Engineers Guide to MATLAB', Prentice Hall.
8. Willium J. Palm, 'Introduction to MATLAB-7 for Engineers'.

List of Experiments:

1. Simulation of step response of first order system.
2. Simulation of step response of second order system.
3. To find the Steady State Error for type 0, type 1 and type 2 system.
4. Design of lead network and find the frequency response for the circuit.
5. Design of lag network and find the frequency response for the circuit.
6. Design of lead-lag network and find the frequency response for the circuit.
7. Simulation on multivariable control system.
8. To check the controllability and observability for the given system.
9. Error detection using synchro transmitter and receiver.
10. Study of different MATLAB tools.
11. Pole-zero plot using MATLAB.
12. Simulation on state transition matrix.
13. State space analysis using MATLAB.
14. Root locus analysis using MATLAB.
15. Bode plot analysis using MATLAB.

Students should perform minimum **eight** experiments from above list.

NORTH MAHARASHTRA UNIVERSITY, JALGAON
T.E. INSTRUMENTATION
SEMESTER-II,
PAPER-3 -POWER ELECTRONICS

Teaching Scheme:

Lectures: 4 Hrs./week

Practical: 2 Hrs./week

Examination Scheme:

Paper: 100 marks (3 hrs. duration)

Term work: 25 marks

Practical : 25 marks

Unit 1

Thyristors: SCR, Triac, Diac, SCS, SUS, LASCR, device characteristics and symbolic representation, constructional details, Methods of turning on an SCR, turn-on characteristic, turn-off mechanism, turn-off characteristic; device specifications, rating and nomenclature; SCR triggering circuits, R, RC, pulse and UJT triggering circuits, internal power dissipation and temperature rise. Multiple connection of SCR: series operation; triggering, parallel operation; triggering; string efficiency.

(10Hrs)(20 Marks)

Unit 2

Controlled rectifier: Single phase and three-phase controlled rectifier circuits, with R, RL load, with FWD, Dual converters, Voltage and current waveforms.

Commutation of SCR: Natural and Forced commutation: class A, B, C, D, E and F;

Inverters: Principle of operation and output voltage waveform of series inverter, parallel inverter and bridge inverter, designing of commutating component, block diagram and operation of UPS & SMPS.

(10Hrs)(20 Marks)

Unit 3

Choppers: Classification of choppers, step-up, step-down chopper, Jones chopper, Morgan chopper, two quadrant chopper, AC chopper, circuit and principle of operation for each method. Chopper control techniques,

Speed control of single- phase induction motor-using triac, using inverter, circuit diagrams and principle of working.

(10Hrs)(20 Marks)

Unit 4

AC Voltage Regulators: single-phase & three-phase AC voltage regulator with R, RL load, sequence control of regulators, two stage sequence control.

Cycloconverter: single-phase & three-phase Cycloconverter

Induction heating and dielectric heating, Resistance welding.

(10Hrs)(20 Marks)

Unit 5

Thyristor control Applications: Static circuit breaker ac and dc; Over protection circuit;

Zero voltage switch; Integral-cycle triggering; Time delay circuit; Soft start circuit.

Temperature regulator, SCR-controlled dimmer circuit, emergency light using SCR, automatic water level indicator, automatic battery charger using SCR, circuit diagram and principle of operation for each application, Ultrasonic and applications.

(10Hrs)(20 Marks)

References:

1. M.Ramamoorthy, 'An introduction to Thyristors and their applications', second edition, East-West Press.
2. S.K.Bhattacharya, S.Chatterjee, 'Industrial Electronics and Control' , Tata McGraw-Hill.
3. P.C.Sen, 'Power Electronics', Tata McGraw-Hill.
4. B.S.Sonde , 'Power Supplies'.
5. M.D. Singh, K.B. Khanchandani, 'Power Electronics', Tata McGraw Hall.
6. Dr. P.S. Bimbhra, 'Power Electronics', Khanna Publisher.

List of Experiment :

1. Design and plot the characteristics of SCR.
2. Design and plot the characteristics of diac.
3. Design and implement different firing circuit for thyristor.
4. Design and implement the time delay circuit.
5. Design and implement single-phase half wave controlled rectifier.
6. Design and implement single-phase full wave controlled rectifier.
7. Design and implement different commutation circuits.
8. Design and implement series inverter.
9. Design and implement parallel inverter.
10. Design and implement step-up chopper.
11. Design and implement step-down chopper.
12. Design and implement SCR Controlled dimmer circuit.

The term work should include a minimum of **eight** experiments from the above list.

NORTH MAHARASHTRA UNIVERSITY, JALGAON
T.E. INSTRUMENTATION
SEMESTER-II,
Paper-4 -Communication Engineering and Telemetry

Teaching Scheme:

Lectures: 4 Hrs./week

Practical: 2 Hrs./week

Examination Scheme:

Paper: 100 marks (3 hrs. duration)

Term work: 25 marks

Unit 1:

Introduction to communication systems: Block diagram of communication system,

Radiation and propagation of waves: Electromagnetic radiation, Ground waves, sky wave propagation, space waves.

Navigational communication: Introduction, Methods of navigation, Radio direction-finding, Radio ranges

(10 Hrs)(20 Marks)

Unit 2:

Navigation: Hyperbolic systems of navigation, DME and TACAN, Aids to approach and landing, Doppler navigation, inertial navigation, Satellite navigation system.

(10 Hrs)(20 Marks)

Unit 3:

Modulation: Need of modulation, A.M. , Frequency spectrum of A.M. wave, Representation of A.M., Power relation in the A.M. wave , Generation of A.M., Demodulation of A.M., A.M. Receivers.

Frequency modulation : Theory of frequency and phase modulation , mathematical representation of F.M., frequency spectrum of F.M., generation of F.M., Demodulation of F.M., F.M. Receivers.

(10 Hrs)(20 Marks)

Unit 4:

Introduction to digital modulation techniques : ASK, FSK, PSK, Multiplexing, TDM, FDM., **Pulse modulation and demodulation-** types, PAM, PWM, PPM, PCM, Effect of noise, Telegraph and Telex.

Transmissions of Instrumentation signal through a transmitter like 2-wired transmitter, 3-wired transmitter and 4-wired transmitter.

(10 Hrs)(20 Marks)

Unit 5:

Fiber Optics communication: Ray Theory of transmission, total internal reflection, acceptance angle, numerical aperture, optical propagation modes, cylindrical modes, mode coupling, Types of fiber optics cable-step, index, multimode and single mode fibers, graded index fiber , applications of fiber optic.

Losses: Material absorption, linear scattering, non linear scattering, bending losses, Intermodel dispersion, material and waveguide dispersion, model noise polarization.

(10 Hrs)(20 Marks)

References:

1. Kennedy, 'Electronic Communication Systems', Tata McGraw Hill.
2. A.B. Carlson, 'Communication Systems', Tata McGraw Hill.
3. N.S. Nagaraja, 'Elements of Electronic Navigation', Tata McGraw Hill.
4. Taub and Schilling, 'Principles of Communication System', Tata McGraw Hill.
5. John Senior, 'Optical Fiber Communication - Principal & parches', Prentice Hall.
6. G. Keiser, 'Optical Fiber Communication', Tata McGraw Hill.

List of Experiment:

1. Study of Radio direction finding.
2. Study of Distance Measuring Equipment.
3. Design and implement A.M. circuit.
4. Design and implement F.M. circuit.
5. Design and implement PWM
6. Design and implement PAM
7. Design and implement FSK
8. Design and implement AM Receiver
9. Design and implement FM Receiver
10. Measurement of Numerical Aperture for FOC.
11. Measurement of Losses in FOC.
12. Data communication by Fiber Optic.

The term work should include a minimum of **eight** experiments from the above topics.

NORTH MAHARASHTRA UNIVERSITY, JALGAON
T.E. INSTRUMENTATION
SEMESTER-II , PAPER-5 -ANALYTICAL INSTRUMENTATION

Teaching Scheme:

Lectures: 4hrs /week
Practicals: 2 hrs /week

Examination Scheme:

Paper: 100 marks.
(3 Hrs. duration)
Term work: 25 marks

Unit 1:

Introduction to chemical instrumental analysis: advantages over classical methods, classification – spectral, electroanalytical and separative methods, and introduction to each method.

U.V. and VIS absorption methods: laws of photometry, Beer and Lambert's law, U.V. and VIS absorption instrument components, monochromator design and associated equipment, monochromator performance.

U.V. and VIS instruments: Colorimeters, single beam and double beam spectrophotometers, dual wavelength and double monochromatic systems, direct reading multichannel spectrophotometers, diode array rapid scanning spectrophotometers, reverse optics technique infra-red (IR) spectrophotometers, Fourier transform technique. **(10 Hrs)(20 marks)**

Unit 2:

Emission spectrophotometer: theoretical concepts, mountings like –Rowland circle, Wadsworth, Seyanamioka, Eagle, instrumentation –source unit, electrodes,

Flame photometry: Principle, constructional details, fuel gases, atomizer, burner, optical system, recording system.

Atomic absorption spectrophotometers: theoretical concepts, instrumentation-hollow cathode lamps, burners and flames, plasma excitation sources, optical and electronic systems. **(10 Hrs.) (20 marks)**

Unit 3:

Nuclear Magnetic Resonance (NMR) spectrometry: Principle ,nuclear spin, nuclear energy levels, resonance condition, NMR absorption spectra, chemical shift, constructional details of NMR spectrometer, sensitivity enhancement techniques, spin decoupler ;Fourier transform NMR Spectroscopy; Electron spin resonance (ESR) spectrometry – principle, constructional details.

Fluorimeters and phosphorimeters; principle, single and double beam filter fluorimeter, ratio fluorimeter, spectrofluorimeter, microprocessor-based instruments, phosphorescence spectrometer, Raman Spectrometry; Raman effect, Raman spectrometer components, LASER Raman spectrophotometer, photo acoustic and phtothermal spectrometers. **(10 Hrs.) (20 marks)**

Unit 4:

Mass spectrometry: basic mass spectrometer components, types, magnetic deflection type, time of flight, ratio frequency, double focusing, quadrupole type; Gas chromatograph mass spectro-meter – GCMS Systems; resolution of mass spectrometer, applications.

Electron and ion spectroscopy: surface spectroscopic techniques, electron spectroscopy for chemical analysis (ESCA), Auger spectroscopy (AES), Secondary ion mass spectrometry (SIMS) and ion scattering Spectroscopy (ISS), densitometer.

Radio chemical instrumentation: Radio chemical methods, radiation detectors – ionization chamber, Geiger Muller counter, proportional counter, Scintillation counter, Semiconductor detectors, pulse height analyzer. X-ray spectrometry: X-ray spectrum, instrumentation for X-ray spectrometry, X-ray diffract meters, X-ray absorption meter. **(10 Hrs.) (20 marks)**

Unit 5:

Gas and liquid chromatography: Classification; basic parts of gas chromatograph – carrier gas, sample injection system, chromatographic column, thermal compartment, temperature programming, dual column system, detectors-thermal conductivity, flame ionization, electron capture, Argon ionization detector, recording instruments; introduction to liquid chromatography Other methods of gas analysis- oxygen, carbon monoxide, carbon dioxide, Nitrogen analyzer, gas density analyzers.

Refractrometry: Principle, Abbe and dipping type refractrometer.

Interferometry: Principle, types-Rayleigh, Jamin and Twyman interferometers.

Moir technique: introduction and use as a transducer for length measurement.

(10 Hrs.) (20 marks)

References:

1. R.S. Khandpur, 'Handbook of Analytical instruments', Tata McGraw-Hill.
2. D.Patranabis, 'Principles of Industrial instrumentation', second edition, Tata McGraw-Hill.
3. Willard, Merrit, Eean, 'Instrumental methods of Analysis',
4. E.W.Ewing , 'Instrumental Methods of Chemical Analysis'.
5. Robert D. Braun , 'Introduction to Instrumental Analysis'.
6. B.K.Sharma, 'Instrumental Methods of Chemical Analysis', goyal publications
7. S.G.Skoog , 'Principles of Instrumental Analysis', Thomson.

List of Experiments :-

1. Study of filter photometer.
2. Study of flame photometer.
3. Study of Densitometer.
4. Study of spectrophotometer (visible and infra-red region)
5. Study of single beam spectrophotometer for UV/VIS range.
6. Study of double beam spectrophotometer for UV/VIS range.
7. Study of mass spectrometers.
8. Study of gas chromatographs.
9. Study of liquid chromatographs.
10. Study of refractometer
11. Study of N.M.R. and E.S.R. spectrometer.
12. Study of atomic absorption spectrophotometer.

The term work should include minimum of **eight** experiments from the above list.

NORTH MAHARASHTRA UNIVERSITY, JALGAON
T.E. INSTRUMENTATION
SEMESTER-II
Subject 6 - Electronics Workshop

Teaching scheme:

Practical: 2 Hrs/week

Examination scheme:

Term work: 25 marks

The study of following topics are expected in the electronics workshop

- i) Fabrication of PCB (printed circuit boards)
- ii) Study of different tools required in electronic workshop (e.g. stripper, cutter, nose pliers, crimping tools, drilling machine, tube bender, pipe cutters, etc.)
- iii) Testing of different electronic components (e.g. resistor, capacitor, inductor, diodes, Transistors, etc)
- iv) Study of different auxiliary electronic/electrical components and different cables (e.g. lugs, ferrules, glands, relays, contractors, Audio/Microphone cables, ribbon cables, data transmission cables, power cables, Fiber optic cables, video/TV cable etc)

The term-work should include a minimum of **eight** assignments from the above topics.

NORTH MAHARASHTRA UNIVERSITY, JALGAON
T.E. INSTRUMENTATION
SEMESTER-II

Subject 7 -In-plant Training / Mini Project

Examination scheme:

Term work: 25 marks.

- Every student has to undergo industrial / practical training for a minimum period of two weeks either during summer vacation between (S.E. Second Term) fourth term and (T.E. First term) fifth term or during winter vacation between fifth term and sixth term (T.E. First Term and Second Term).
- The Industry in which practical training is taken should be a medium or large-scale industry.
- The paper bound report on training must be submitted by every student in the beginning of (T.E. Second Term) sixth term along with a certificate from the company where the student took training.
- The report on training should be a detailed one.
- Maximum number of students allowed to take training in a company should be five. Every student should write the report separately.
- In case if the student is not able to undergo in-plant / practical training, then such students should be asked to prepare a mini project related to Instrumentation engineering.
 1. The circuit for mini project must be designed by a student.
 2. The circuit should be simulated using any of the standard simulation software available.
 3. Result verification for paper design and simulation should be carried out and discrepancies should be discussed.
 4. Verified circuit should be assembled and tested on general purpose PCB / Protoboard for actual working and practical results.
 5. Layout of circuit using standard Layout tool (Orcad / Protel / CADstar / Pads / Ultiboard) should be designed and PCB making process should be carried out.
 6. Assemble and test the circuit on PCB. Prepare bill of materials.
 7. Project report should be detail of work carried out by student, including layouts, circuits, bill of materials and relevant details.
- The In-plant training / mini project shall carry a term work of 25 marks. Every student shall be required to present a seminar in the respective class in the presence of two teachers. These teachers (appointed by the head of department in consultation with the Principal) shall award marks based on the following:

(a) Report	10 marks.
(b) Seminar presentation	10 marks.
(c) Viva-voca at the time of Seminar presentation	05 marks.

Total: 25 marks.

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