

IIIrd to VIIIth Semester B.E.
Instrumentation Engg.

Prospectus No. 101710

संत गाडगे बाबा अमरावती विद्यापीठ
SANT GADGE BABA AMRAVATI UNIVERSITY

(FACULTY OF ENGINEERING & TECHNOLOGY)

PROSPECTUS

PRESCRIBED FOR
FOUR YEAR DEGREE COURSE
BACHELOR OF ENGINEERING
INSTRUMENTATION ENGINEERING
THIRD & EIGHTH SEMESTER
EXAMINATIONS, 2009-2010
SEMESTER PATTERN



2009

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SYLLABUS

PRESCRIBED FOR
B.E. INSTRUMENTATION ENGG
THIRD & FOURTH SEMESTER
THIRD SEMESTER

Inplant Training & Industrial Visit in the faculty of Engineering & Technology

- 1) a) the inplant training shall not be compulsory,
b) the inplant training shall be taken by students strictly during Summer vacation. after IVth or VIth Semester examination and / or during Winter vacation after Vth or VIIth Semester examinations,
c) the inplant training shall not be part of examination system, however, student shall prepare and submit report after completion of training to the concerned Head of Department alongwith certificate issued by the industry,
d) the inplant training shall be of minimum two weeks duration,
e) there shall not be any liability whatsoever on the Institution with respect to inplant training of the students,
f) students shall undertake inplant training on their own risk and cost. An undertaking in this regards signed by student and parents shall be submitted before proceeding for training to the concerned Head of Department/ Head of Institution.
g) the students shall complete inplant training under the supervision of concerned person in the industry,
h) Institutes shall help students to organise inplant training by way of correspondance,
- 2) Industrial Visit : Industrial visit may be organised for the students. Students should prepare & submit the report on Industrial visit to the concerned Head of Department/Head of Institution.

3S RULI 1 : MATHEMATICS-III

SECTION-A

UNIT-I Ordinary differential equations:- Complete solution, Operator D, Rules for finding complementary function, the inverse operator, Rules for finding the particular integral, Method of variations of parameters, Cauchy's an Legendre's linear

2
differential equations (10 Hrs.)

UNIT-II Laplace transforms: definition, standard forms, properties of Laplace transform, inverse Laplace transform, initial and final value theorem, convolution theorem, Laplace transform of impulse function, Unit step function, Laplace transforms of periodic function, solution of Linear differential equations, Simultaneous differential equation by Laplace transform method. (10 Hrs.)

UNIT-III a) Difference equation:- solution of difference equations of first order, Solution of difference equations of higher order with constant co-efficients,
b) Z-transform:- Definition, standard forms, Z-transform of impulse function, Unit step functions, Properties of Z-transforms (linearity, shifting, multiplication by k, change of scale), initial and final values, inverse Z-transforms (by direct division and partial fraction), Solution of difference equation by Z-transforms. (10 Hrs.)

SECTION-B

UNIT-IV a) Fourier transforms- Definition, standard forms, inverse Fourier transforms, properties of Fourier transforms, convolution theorem, Fourier sine and Fourier cosine transforms and integrals.
b) Prtial differential equation of first order of following form-
(i) $f(p,q)=0$; (ii) $f(p,q,z)=0$; (iii) $f(x,p)=g(y,q)$; (iv) $Pp+Qq=R$ (Lagranges Form); (v) $Z=px+qy+f(p,q)$ (Clairaut form) Statistics.
Binomial, Poisson and Normal Distribution. (10 Hrs.)

UNIT-V Complex Analysis :- Functions of complex variables, Analytic function, Cauchy-Reimann conditions, Harmonic function, Harmonic conjugate functions, Milne's method, conformal mappings translation, rotation, magnification, inversion and bilinear transformation), singular points, expansion of function in Taylor's and Laurent's series. Cauchy's integral theorem and formula, Residue theorem. (10 Hrs.)

UNIT-VI Vector calculus:- Scalar and vector point functions, Differentiation of vectors, Curves in space, Gradient of a scalar point function, Directional derivatives, Divergence and curl of a vector point function and their physical meaning, expansion formulae (with out proof), line, surface, volume

integrals, irrotational and solenoidal vector fields, Stoke's and Divergence theorem (without proof). (10 Hrs.)

BOOKS RECOMMENDED:-

- 1) Elements of Applied Mathematics by P.N. Wartikar and J.N. Wartikar
- 2) A text book of Differential Calculus by Gorakh Prasad.
- 3) Engg. Mathematics by Chandrika Prasad.
- 4) Advancing Engg. Mathematics by E.K. Kreyzig.
- 5) A text book of Applied Mathematics by P.N. Wartikar and J.N. Wartikar.
- 6) Higher Engg. Mathematics by B.S. Grewal.
- 7) Control System by Gopal and Nagrath.
- 8) Integral Transforms by Goyal & Gupta.

3SULI2 ELECTRONIC DEVICES AND CIRCUITS-I

SECTION-A

- UNIT-I P-N Junction diode theory, Rectifiers - Half wave, full wave and bridge. Filters-C, LC and their analysis, Zener diode and its applications.
- UNIT-II Theory and Analysis of BI Junction transistor, 'H' Parameter, Methods of biasing, their needs, 'Q' and stability factor.
- UNIT-III Study of typical transistor amplifier circuits:
- i) Emitter follower,
 - ii) Darlington emitter follower.
 - iii) Bootstrap emitter follower,
 - iv) RC coupled amplifier,
 - v) Transformer coupled amplifier,
 - vi) Cascaded amplifier,
 - vii) Direct coupled amplifier,
 - viii) Cascade stage.

SECTION-B

- UNIT-IV Class 'A', 'B', 'AB' and 'C' amplifiers, Configuration of audio amplifiers, Calculations of power gain, efficiency, power

dissipation and distortion, Oscillators, their criteria, Hartley, Colpitt and R-C oscillators, Crystal oscillator,

- UNIT-V Theory, construction and applications of Schottky diode, Tunnel diode, Varactor diode, Selenium diode, LED, Photo diode, PIN diode, photo-transistor.

UNIT-VI **FETs (JFET & MOSFET):**

Types, Characteristics and parameters (μ , g_m & R_{ds}), Biasing of FET Amplifiers, UJT: Characteristics, working, UJT as relaxation oscillator.

BOOKS RECOMMENDED:

- 1) Milliman H. and Halkies: "Integrated Electronics", Tata Mc-Graw Hill Book Co., New Delhi.
- 2) Mottershead Allen: "Electronics Devices & Circuits" Prentice Hall of India Private Limited, New Delhi, 1986.
- 3) Boylestad R. and "Electronics Devices & Circuits", Prentice Hall of India Private Limited, New Delhi (Fifth Edition), 1993.
- 4) Ramanan K.V.: "Functional Electronics", Tata Mc-Hill Publication Co. Ltd., New Delhi, 1989.
- 5) Milliman S., Tube H. and Halkies: "Electronics Devices & Circuits", Mc-Graw Hill Int. Co., Auckland, 1982.

ELECTRONIC DEVICES AND CIRCUITS-I

LIT OF EXPERIMENTS

Experiments based on -

| Topic | Nos. |
|---|------|
| 1) Characteristics of Devices (Such as diode BJT, FET etc) | 02 |
| 2) Rectifiers & Filters | 03 |
| 3) Transistorized Amplifiers | 02 |
| 4) Oscillators | 03 |
| 5) Special Devices | 02 |

Minimum 8 Experiments to be conducted from above. Minimum one experiment from each topic

SECTION-A

UNIT-I : Introduction:Defination,Static & Dynamic characteristics of Instruments, Types of error,Data types, Comparison of Analog & Digital instruments.

Measurement standards for time, frequency,voltage current. ANSI,ISI standards. Introduction to reliability and safety. Response of indicating instruments for step, linear and sinusoidal inputs, Relation between undamped natural frequency and damped natural frequency, damping ratio & Settling time of Second order system. (11)

UNIT-II : DC Bridges: Wheatstone Bridge, Bridge sensitivity, analysis by Thevenin's theorem, Errors in bridge circuits, Null type, Current and Voltage sensitive bridges, Kelvin Bridge.

AC Bridges:Inductance bridge (Maxwell's), capacitance bridge (Hay's), Wein bridge,Anderson bridge, Schering bridge,Storage & dissipation factors & their measurements. (09)

UNIT-III : Potentiometers:Measurement of voltage & current calibration sensitivity,self balancing techniques, Multirange potentiometers, Instrument transformers, Techniques of current,voltage,phase and insulating testers.

Recorders:Curvilinear & rectilinear recording, strip-chart & circular chart X-Y recorders.

General purpose, Cathode Ray Oscilloscope, CRT Block schematic, controls on CRO panal, Measurement of phase, frequency, Time duration,Rise & fall time Amplitude etc, Z modulation using CRO,Introduction to X-Y & Dual Trace Oscilloscopes, Synchronisation, Z modulation. (11)

SECTION-B

Unit-IV : Wave and Spectrun Analyzer, Harmonic Distortion Analyzer,Heterodyne Frequency meter, Function Generator (09)

Unit-V : Different Codes and their Conversions (BCD, Octal,Hex,Excess Three, Gray), Arithmetic Operations & Floating point Arithmetic, Boolean Algebra, OR, AND, NOT, NOR, AND, EX-OR,EX-NOR Operation, Negative & Positive Logic, Laws of Boolean Algebra, Reduction of Boolean Functions.

Unit-VI : RTL,DTL,ECL,TTL,PMOS,NMOS,CMOS Logic & their characteristics, Interfacing of different families,tri-state logic & their use in computers.

List of experiments:

1. Study of multimeter and design and calibration of multirange Ammeter & Voltmeters.
2. Design & calibration of series & shunt type ohm meter.
3. Watt-meter configurations for Resistive power measurement.
4. Energy meter calibration
5. A measurement of voltage, frequency & phase on CRO.
6. Study of strip-chart & X-Y recorder.
7. Design of wheatston bridge
8. Measurement of reactive elements using AC bridges.
9. Expt on Harmonic distortion

Note: Students are expected to perform minimum 8 experiments.

Reference Books:

1. Electronic Instruments & Measurement by Jones & Chin
2. Electronic Instrumentation Techinques by Cooper & Helfrick.
3. Electronis Instrumentation & Measurement by Sawhney
4. Electrical Measurement by Baldwin.
5. Digital principles and application-Malvino & Leach
6. Digital Electronic by Bothman.
7. Electronic Instrumentation-H.S. Kalsi (TMH)

3SI4 TRANSDUCER AND SIGNAL CONDITIONING

SECTION A

UNIT I : Transducer : Defination, Classification, Selection criteria.Errors Loading effects, Basic configuration of control system Transducer specifications. (07)

UNIT II : Displacement,Fore & Torque Transducers: Displacement Resistive, Inductive, Strain gauge, Capacitive, Piezo electric Digital, fibre optic, Laser type transducers.

Force-Force measuring transducers, Electric load cell,LVDT,

Piezo electric type.

Torque Strain Gauge transducers. (08)

UNIT III : Temperature Transducers: Temperature scales, Glass thermometers, Bimetallic & memory shaped alloy thermometers, Semiconductor, temperature detector (thermistor & P-N junction). Resistance thermometer, Thermocouples, Ultrasonic, Crystal, Infrared thermometers

Velocity Transducers: Tachometers, Toothed rotor tachometers, photo electric, Stroboscopic principles.

(09)

SECTION-B

UNIT IV : Flow Transducers: Basic measurement principles, Bernoulli's theorem, Differential pressure type (Orifice, Venturi, Anubar Pitot tube), Variable area type, Magnetic, Ultrasonic, Positive displacement type, Mass flow meter, Anemometer, Total flow meter.

Level Transducers: For liquids & solids - float type displacer, Diaphragm box level gauge, DP cell Ultrasonic, Radioactive transducers, Microwave. (10)

UNIT V : Pressure Transducers: Pressure scales & standards, Manometers, Elastic (Bellows, Bourdon tube, Diaphragm) type, Electrical pressure sensors (LVDT, Strain gauge, load cell, Piezo-electric, Capacitive), Differential pressure sensors (Capacitive, Force balance & vibrating cylinder type), vacuum pressure measurement, thermal conductivity & ionization type, Transducers for very high pressure measurement. (09)

UNIT VI : Humidity Transducers: Psychrometer, Hygrometer (Hair, wire & Electrolysis type), Dew point meter, Piezo-electric humidity meter, Infrared conductance & Capacitive type probes for moisture measurement. Acoustic Transducer & sound level measurement.

pH & Conductivity sensors: pH scales & standards, principle of pH measurement, Different types of reference & measuring electrodes. Principles of conductivity measurement, conductivity cells & bridges. (09)

LIST OF EXPERIMENTS

1. Testing & calibration of T, J, K, R & S thermocouples

2. Calibration of pt-100.
3. a) Calibration of strain indicator
b) Weight measurement by load cell.
4. Study of LVDT & its application in thickness measurement
5. Level measurement by capacitance probe.
6. Flow measurement by Differential pressure type transducers
7. Study of Bellows, Bourdon tubes & Diaphragms.
8. RPM measurements using photodetector technique.
9. Study of electrical pressure probes.
10. Study of pH meter, conductivity meter.
11. Humidity measurement by psychrometer.

Note : Students are expected to perform minimum eight experiments

REFERENCE BOOKS :

1. Measurement System by E.O. Doebelin
2. Principles of Industrial Instrumentation by Patranbis
3. Experimental Methods for Engineers by J.P. Holman
4. Mechanical Industrial Measurements by R.K. Jain

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WORKSHOP TECHNOLOGY

SECTION-A

UNIT-I : SHEET METAL WORKING:

Study of various processes such as shearing, blanking, punching, notching, bending, forming, drawing, coining, swaging etc.

Equipment used for sheet metal working:-

Crank presses, toggle presses, single and double acting presses, introduction to press tools. Other sheet metal working processes like spinning, rolling tube bending etc.

(07)

UNIT-II : Foundry and Casting processes:-

Introduction to pattern making, type of patterns. Preparation of sand molds of different types, Melting furnaces. Cupola and Electric hearth furnace. Elementary and special moulding

and casting processes such as sand casting Shell molding, investment Casting, Vacuum moulding and centrifugal casting. Introduction to principle of die casting. Casting Defects. (12)

UNIT-III : Joining processes:-

Different type of welding processes. Arc welding, resistance welding, brazing, soldering, rivetting.

TIG & MIG welding process. Equipment and process details . PCB WORK & SURFACE TREATMENT. Etching, Anodising, Electroplating, electroforming and shot peening.

(12)

SECTION-B

UNIT-IV : LATHE:

Types of Lathes, different operations performed on Lathe Turning, facing, boring, taper turning, Thread cutting etc. Study of construction, accessories, attachments and tools used in center lathe, turret lathe. (09)

UNIT-V : Milling and NC/CNC M/c tools:-

Types, different operations performed, field of application of Milling, drilling and planning m/c, Introduction to NC/CNC M/c classification, basic components. NC/CNC control system, fundamentals and system devices, NC Actuation system, feedback devices, control devices. (11)

UNIT-VI : Non-conventional machining processes:-

Principles of operation, construction of machine tools and application for Anodic, Electron beam, Laser beam, Electric discharge, Chemical, Electrochemical and ultrasonic machining. (10)

TERMWORK :

Term work consists of Jobs on the following processes:

- | | |
|----------------------------------|---------------|
| 1. Plain and Taper turning | 1 Job |
| 2. Welding, soldering | 1 Job |
| 3. PCB etching, drilling etc. | 1 Job + 1 Job |
| 4. Sheet metal working/Panel box | 1 Job |

Text Books recommended

1. Workshop Technology by Chapman Vol.I, II, III.
2. Modern Machining Processes-Pandey & Shaan.
3. Computer Control of Manufacturing System-Yoven Koren.

FOURTH SEMESTER

4 SI 1

ELECTRICAL MACHINES

SECTION-A

UNIT-I : **Electric circuits and Measurements**

Basic ideas of DC circuits, Norton's theorem, Maximum power transfer theorem, Principle of operation, errors of different types of ammeters, Voltmeters, wattmeters and energymeters; Measurements and calculation of real and reactive power in three phase balance circuits, two wattmeter method.

UNIT-II : **D.C. Machines**

Construction types (shunt, series & compound), generator action. emf equation, motoring action, significance of back emf; Torque and speed equations, Torque armature current, speed armature current and torque-speed characteristics of different types of motors, Different methods of speed control; starter Applications.

UNIT-III : Transformers

Single phase transformer- Equivalent circuits, Separation of core losses into its components, parallel operation, Autotransformer, Welding transformer, Pulse transformer, Ferrite core transformer, CT and PT; Connections, of 3-phase transformers-Star/delta, delta Star, Vcc and Scott Connections.

SECTION-B

UNIT-IV : **Synchronous Machines**

a) Alternators;

Constructional features, synchronous speed, emf equation, winding factors, regulation by synchronous impedance method.

b) Synchronous Motor:

Concept of rotating magnetic field, Principle of working, effect of variation of load, Vcc curves, Hunting, method of starting; Applications as synchronous condenser..

UNIT-V : Induction Motor

Three phase motors, types, principles of operation, slip, torque equation; Torque-slip characteristic; Relationship between slip and rotor copper loss; equivalent circuit, different types of starters, Applications.

Single phase motors: Principle of working, type applications.

UNIT-VI : Special purpose machines

Principle, working and applications of stepper motor, Servomotors, Universal motors. Amplidyne, Matadyne and Rosenberg generator

List of Experiments

1. Verification of Norton's theorem.
2. Calibration of ammeter, voltmeter and wattmeter by using DC potentiometer.
3. Verification of maximum power transfer theorem.
4. Two wattmeters method of power measurement in 3-phase balance circuit.
5. Measurement of reactive power.
6. Speed control of DC shunt motor by armature voltage and flux control method.
7. Load test on DC shunt motor
8. Load test on DC series motor
9. Load test on DC compound motor
10. Scott connection to convert 3-ph supply into 2-ph supply.
11. Regulation of alternator by synchronous impedance method.
12. Regulation of alternator by direct loading method.
13. To plot Vcc curves and power-factor curve for synchronous motor.
14. Study of various type of special purpose motors.
15. Study of DC machine starters.

Note : Minimum TEN experiments from the above list must be performed

Text Books :

1. Principles and Practice of Electrical Engineering
Gray Wallace (International Student Edition 8 th Ed.)
2. Performance & Design of DC Machine-Clayton and Hancokk
3. Theory of AC Machines-Langsdorf, Mc Graw Hill.
4. Electrical Machinery-Nagrath Kothari(Tata Mc Graw Hill)
5. Advanced Electrical Technology-H.Cotton (Wheeler Publication)
6. Electrical Engineering-Vol I, Direct currents-C Dewes,4th Ed.

4SULI2 COMPUTER PROGRAMMING AND APPLICATIONS

SECTION-A

Unit I : Principles of object oriented Programming-Oops paradigm, basic concept of Oop's Benefits of Oop's, structure of C++ Programming, Basic data types, user defined data type, derived data type operator and control statement.

Unit II : Functions classes and object in C++ Functions, Function over loading, Friend and Virtual Functions, Difference between class and structures types of classes and its use concept of object and its implementation, constructor and destructors.

Unit III : Operator's overloading
Operator and their definition, overloading unary and binary operator, Rules for overloading operators, overloading binary operators using friends and string manipulation.

SECTION-B

UNIT IV- Inheritance and Polymorphism-

Defining derived classes, single and multiple inheritance, multilevel inheritance, member classes pointer to objects, pointer to derived classes, virtual function.

Unit V : **INTRODUCTION TO SPICE/ PSPICE:-**

Description, types, circuit elements, sources, Types of analysis, output commands, Format of files.

DC CIRCUIT ANALYSIS : Registers, modelling of elements, Independent & dependent sources, DC output variables, types of DC analysis.

TRANSIENT ANALYSIS - Capacitors & Inductors, modelling

of transient sources, transient Response.

AC CIRCUIT ANALYSIS : AC output variables AC sources & analysis.

UNIT VI : SPICE COMMANDS & DEVICES SIMULATION :

Advanced commands, modelling and analysis of diode, BJT & FET

Practicals-

Minimum Eight experiments based on the above syllabus out of which at least four experiments should be based on the last two units.

BOOKS RECOMMENDED :

- 1) Object Oriented Programming with C++ -E. Balaguruswamy, Tata Mc-Graw Hill publishing Co.Ltd., New Delhi,1995.
- 2) Object Oriented Programming in Turbo C++ Rober Lofore, Galgretia Publications Pvt.Ltd., New Delhi,1995
- 3) The C++ Programming Language (Third Edition) - Bjarne Stroustrup Pub.Co.,New York,1995 (Addison Wesley)
- 4) C++ Primer - Lipman Stanley B., (Second Edition) New York, Addison Wesley Pub. Company,1995
- 5) SPICE FOR CIRCUITS AND ELECTRONICS USING PSPICE Muhammad H. Rashid. (PHI).

4SRULE13

NETWORK ANALYSIS

SECTION-'A'

- Unit-I : Basic Circuit elements: Circuit components- assumptions for Circuit analysis, sources of electrical energy-standard input signals- Kirchoff's laws-source transformation- mesh and node analysis-network equation for RLC network-magnetic coupling. (10)
- Unit-II : Graph theory and network equation:- Graph of a network-Trees and loops, cut set of a network, Tie-set matrix and loop currents- analysis of network, Network equilibrium equation,duality-network transformation. (10)
- Unit-III : Laplace transformation and its applications:- Laplace transformations-basic theorems-gate function-Impulse function-

Laplace transform of periodic functions.

Solution of linear differential equations-Heaviside's partial fraction expansion-Solution of network problems.

(10)

SECTION-'B'

- Unit-IV : Network theorems:- Superposition theorem-Reciprocity theorem, Thevenin's theorem-Norton's theorem-Milliaman's theorem-Max. power transfer theorem-Substitution theorem-Compensation theorem, Tellegen's theorems. (10)
- Unit V : Twoport network:- Open circuit impedance parameters-short circuit admittance parameters-Transmission parameters-Inverse transmission parameters-Hybrid and inverse hybrid parameters. interrelationship between the parameters-two port symmetry interconnection of two port networks, input impedance in terms of two-port parameters output impedance-image impedance. (10)
- Unit-VI : Network functions:- Ports and terminal pairs-network functions-poles and zeros-necessary conditions for driving point function-necessary conditions for transfer function-Applications of network analysis in driving network functions-positive real functions-driving point and transfer impedance function-LC network (10)

TEXT BOOK :

Network and systems-D,Roy Choudhary (Wiley Eastern Ltd.1988)

REFERENCES-

1. Circuit Theory-ISKV Iyer (Tata Mcgraw Hill)
2. Network Analysis, M.E.Van Valkenburg (Prentice Hall India) 3rd Ed.

PRACTICALS-

About 10 experiments based on above syllabus.

4SRULE14 SOCIAL SCIENCES & ENGINEERING ECONOMICS

SECTION - A

- Unit I : Study of Social Science : Importance to Engineer, salient features of Indian constitution. Fundamental Rights and Duties. Directive Principles of State Policy. (9)
- Unit II : Indian Parliament : composition and powers.

President of India : Election and Powers.

Council of Ministers and Prime Minister (9)

Unit III Impact of Science and Technology on Culture and Civilization.
Human Society : Community Groups, Social Control :
Meaning, Types and Agencies. Marriage and Family :
Functions, Types and problems.

SECTION - B

Unit IV Nature and scope of Economics : Special significance of
Economics to Engineers.

Production : Factors of production, Laws of return, Various
Economic systems, Forms of Business Organisation.
(9)

Unit V : Banking : Functions of Central and Commercial Banks.

Taxation : Principle of taxation, Direct and Indirect taxes.

Market : Forms, perfect and imperfect competition, pricing
under perfect and imperfect competition, prices discrimination
under monopoly. (9)

Unit VI Economics of Development : Meaning, Characteristics of
under development, obstacles to Economic growth and
vicious circle of poverty.

Economic Planning : meaning, objective and salient features
of current five years plan of India.

Planning horizons, life structuring the alternatives.

Economics of comparison of different alternative projects.
(10)

Books Recommended :

1. Pylee M.V. : Constitutional Govt. in India, S.Chand and Co.
2. Joshi G.N. : The Constitution of India, Macmillan India Ltd.
3. Mahajan : The Constitution of India, S.Chand, New Delhi.
4. Maclaver and Page : Principle of Sociology.
5. Davis K. : Human Society
6. Dewett and Varma J.D. : Elementary Economic Theory, S.Chand and Co.
7. A.N.Agrawal : Indian Economy. Problem of Development and Planning (Wiley Eastern Ltd), New Delhi.
8. S.K.Mishra : Indian Economy, Its Development Experience, Himalaya

Pub.House, Bombay.

9. Datt R.K. : Indian Economy, S.Chand and Comp. New Delhi P.M.Sundharam
10. Dhingra I.C. : Indian Economy
11. E.Kuper : Economics of W.R.Development, McGraw Hill Co.,
12. James L.E., R.R.Lee : Economics of W.R.Planning, McGraw Hill Co.

4SI5 THERMAL & FLUID POWER ENGINEERING

SECTION-A

UNIT-I : Basic concepts of thermodynamics: Thermodynamic system
& its properties, closed & open system, process &
cycles. Properties of pure substance (water): Saturation pressure
& saturation temp, degree of superheat, enthalpy of water &
steam, dryness fraction, tables & mollier chart.

Thermodynamic laws: Heat, work & energy; statement of I
Laws, heat capacity, internal energy, enthalpy of ideal
gases. Steady flow process. II law and entropy concept,
Relation for change in u, h, & s for ideal gases & pure
substances. (10)

UNIT-II : **Power Cycles:**

Carnot and ideal gas power cycles : Otto, Diesel & Brayton.

Carnot vapor cycle & ideal Rankine cycle, Saturated and
superheated vapor cycle. Use of HP boiler & condenser to
improve efficiency.

Reverse cycles & Air Conditioning :

Reversed Carnot & ideal v-c cycle, refrigerants as Ammonia, R₁₂
and R₁₃₄

Specific humidity & relative humidity, DBT, WBT.

Psychrometric chart; sensible cooling & heating. Cooling &
dehumidification process. Window air conditioner and central
a/c plant. (10)

UNIT-III : **Steam Turbines:**

Delaval nozzle & nozzle equation: Graphical method of power
output of Delaval turbine. Governing & Compounding.
Working principle of parson turbine.

I.C. Engines: Nomenclature of reciprocity machine,
Calculation of IP, BP & n of 4 stroke petrol & diesel engine.

Compressor: Operation of a single stage reciprocaty compressor. Isothermal work. Saving in work input by multistage compresion (10)

SECTION-B

- UNIT-IV : Reynolds number and its significance,Laminar and Turbulant flow,Bernaullies equation,Equation of pipe flow,Losses due to sudden expansion and contraction,Hydraulic and energy grade linesa. (08)
- UNIT-V : I) Dynamic action of fluid: Force exerted by jet on stationary and moving vanes,velocity digrams.
 ii) Eulers equation of turbomachines,Degree of reaction,General classification of rotodynamic machines,efficiencies of machines Volumetric meachanical, hydraulic and overall efficiency. (10)
- UNIT-VI : I) Water Turbines: Pelton, Francis and Kaplon turbinesw, their basic theory,characteristic and speed regulation
 ii) Centrifugal pumps:Constructional details,Basic theory and charactersticsd.
 ii) Hydraulic systems:Hydraulic crane Hydraulic lift fluid drive for machine tool. (10)

PRACTICALS

Minimum eight experiments from the following:

1. Study of Lamont/Benson boiler .
2. Study of steam turbine plant.
3. Study and traial on I.C. Engine.
4. Study of domestic refrigerator/air conditioning plant.
5. Determination of dryness fraction of steam.
6. Study of simple gas turbine plant.
7. Determination of Reynolds Number.
8. Major lass in pipes.
9. Loss due to sudden expansion.
10. Loss due to sudden contraction.
11. Varification of Bernaillis equation.
12. Study & trial on pellow turbine
13. Study & trial on Francis turbine.

14. Study & trial on Kaplan turbine.
15. Study & trial on centrifugal pump.

Books:

1. Thermodynamics-Cengel & Boles(MGH-II Edition)
2. Thermodynamics cycles & Process-R Hoyle & CLarke (Longamn)
3. Basic Engineering Thermodynamics-joel(ELBS)
4. Heat Engineering Kumar Vasandani(Metropolitan)
5. Heat power-K.C.Pal(TTTI)
6. Power Engineering (Fluid & Thermal)-Mir Publication
7. Fluid Mechanics-Streeter & Wylie
8. Engg.Fluid Mechanics-Kumar.
9. Hydraulic Machines- Vasandani
10. Fluid Meachanics & Hydraulic Machines-Bansal.

ENVIRONMENTAL STUDIES**Total Marks : 100****PART-A****SHORT ANSWER PATTERN****25 Marks****1. The Multidisciplinary nature of environmental studies**

- . Definition, scope and importance.
- . Need for public awareness.

(2 lecture hours)

2. Social Issues and the Environment

- . From Unsustainable to Sustainable development
- . Urban problems related to energy
- . Water conservation, rain water harvesting, watershed management
- . Resettlement and rehabilitation of people; its problems and concerns. Case studies.
- . Environmental ethics : Issues and possible solutions.
- . Climate change, global warming, acid rain, ozone layer depletion, nuclear accidents and holocaust. Case studies.
- . Wasteland reclamation.
- . Consumerism and waste products.
- . Environment Protection Act.
- . Air (Prevention and Control of Pollution) Act.
- . Water (Prevention and Control of Pollution) Act.
- . Wildlife Protection Act.
- . Forest Conservation Act.
- . Issues involved in enforcement of environmental legislation.
- . Public awareness.

(7 lecture hours)

3. Human Population and the Environment

- . Population growth, variation among nations.
- . Population explosion - Family Welfare Programme.
- . Environment and human health.
- . Human Rights.
- . Value Education.
- . HIV / AIDS.
- . Women and Child Welfare.
- . Role of Information Technology in Environment and human health.
- . Case Studies.

(6 lecture hours)

PART-B**ESSAY TYPE WITH INBUILT CHOICE****50 Marks****4. Natural resources :****Renewable and non-renewable resources :**

- . Natural resources and associated problems.
 - Forest resources : Use and over exploitation, deforestation, case studies. Timber extraction, mining, dams and their effects on forests and tribal people.
 - Water resources : Use and over-utilization of surface and ground water, floods, drought, conflicts over water, dams-benefits and problems.
 - Mineral resources : Use and exploitation, environmental effects of extracting and using mineral resources, case studies.
 - Food resources : World food problems, changes caused by agriculture and overgrazing, effects of modern agriculture, fertilizer - pesticide problems, water logging, salinity, case studies.
 - Energy resources : Growing energy needs, renewable and non renewable energy sources, use of alternate energy sources, Case studies.
 - Land resources : Land as a resource, land degradation, man induced landslides, soil erosion and desertification.
- . Role of an individual in conservation of natural resources.
- . Equitable use of resources for sustainable lifestyles.

(8 lecture hours)

5. Ecosystems

- . Concept of an ecosystem.
- . Structure and function of an ecosystem.
- . Producers, consumers and decomposers.
- . Energy flow in the ecosystem.
- . Ecological succession.
- . Food chains, food webs and ecological pyramids.
- . Introduction, types, characteristic features, structure and function of the following ecosystem :-
 - Forest ecosystem
 - Grassland ecosystem
 - Desert ecosystem
 - Aquatic ecosystems (ponds, streams, lakes, rivers, oceans, estuaries)

(6 lecture hours)

6. Biodiversity and its conservation

- . Introduction - Definition : genetic, species and ecosystem diversity.
- . Biogeographical classification of India.
- . Value of biodiversity : consumptive use, productive use, social, ethical, aesthetic and option values.
- . Biodiversity at global, National and local levels.
- . India as a mega-diversity nation.

- . Hot-spots of biodiversity.
- . Threats to biodiversity : habitat loss, poaching of wildlife, man-wildlife conflicts.
- . Endangered and endemic species of India.
 - . Conservation of biodiversity : In-situ and Ex-situ conservation of biodiversity. (8 lecture hours)

7. Environmental Pollution

- . Definition
 - . Causes, effects and control measures of :-
 - Air pollution
 - Water pollution
 - Soil pollution
 - Marine pollution
 - Noise pollution
 - Thermal pollution
 - Nuclear hazards
- . Solid Waste Management : Causes, effects and control measures of
 - . Role of an individual in prevention of pollution.
 - . Pollution case studies.
 - . Disaster management : floods, earthquake, cyclone and landslides. (8 lecture hours)

PART-C ESSAY ON FIELD WORK 25 Marks

8. Field work

- . Visit to a local area to document environmental assets - river / forest / grass land / hill / mountain
- . Visit to a local polluted site - Urban / Rural / Industrial / Agricultural
- . Study of common plants, insects, birds.
- . Study of simple ecosystems - pond, river, hill slopes, etc. (5 lecture hours)

- (Notes :**
- i) Contents of the syllabys mentioned under paras 1 to 8 shall be for teaching for the examination based on Annual Pattern.
 - ii) Contents of the syllabys mentioned under paras 1 to 4 shall be for teaching to the Semester commencing first, and
 - iii) Contents of the syllabys mentioned under paras 5 to 8 shall be for teaching to the Semester commencing later.

LIST OF REFERENCES :-

- 1) Agarwal, K.C., 2001, Environmental Biology, Nidi Publ. Ltd., Bikaner.
- 2) Bharucha Erach, The Biodiversity of India, Mapin Publishing Pvt. Ltd., Ahmedabad - 380 013, India, Email : mapin@icenet.net (R)
- 3) Brunner R.C., 1989, Hazardous Waste Incineration, McGraw Hill Inc. 480p.

- 4) Clark R.S Marine Pollution, Clanderson Press Oxford (TB)
- 5) Cunningham, W.P.Cooper, T.H.Gorhani, E & Hepworth, M.T., 2001, Environmental Encyclopedia, Jaico Publ. House, Mumbai, 1196p.
- 6) De A.K., Environmental Chemistry, Wiley Eastern Ltd.
- 7) Down to Earth, Certre for Science and Environment (R)
- 8) Gleick, H.P. 1993, Water in Crisis, Pacific Institute for Studies in Dev., Environment & Security. Stockholm Env. Institute, Oxford Univ. Press. 473p.
- 9) Hawkins R.E., Encyclopedia of Indian Natural History, Bombay Natural Histroy Society, Mumbai (R)
- 10) Heywood, V.H. & Watson, R.T. 1995, Global Biodiversity Assessment, Ca mbridge Univ. Press 1140p
- 11) Jadhav, H & Bhosale, V.M. 1995, Environmental Protection and Laws, Himalaya Pub. House, Delhi. 284 p.
- 12) Mckinney, M.L. & Schoch, R.M. 1996, Environmental Science Systems & Solutions, Web Enhanced Edition. 639 p.
- 13) Mhaskar A.K., Matter Hazardous, Techno-Science Publications (TB)
- 14) Miller T.G. Jr., Environmental Science, Wadsworth Publishing Co. (TB)
- 15) Odum, E.P., 1971, Fundamentals of Ecology, W.B.Saunders Co., U.S.A., 574p.
- 16) Rao M.N. & Datta A.K.,1987, Waste Water Treatment, Oxford & IBH Publ. Co. Pvt. Ltd. 345 p.
- 17) Sharma B.K., 2001, Environmental Chemistry, Goel Publ. House, Meerut.
- 18) Survey of the Environment, The Hindu (M)
- 19) Townsend C., Harper J., and Michael Begon, Essentials of Ecology, Blackwell Science (TB)
- 20) Trivedi R.K., Handbook of Environmental Laws, Rules, Guidelines, Compliances and Standards, Vol. I and II, Enviro Media (R)
- 21) Trivedi R.K. and P.K. Goel, Introduction to Air Pollution, Techno-Science Publications (TB)
- 22) Wagner K.D., 1998, Environmental Management, W.B.Saunders Co., Philadelphia, USA 499p.
- 23) डॉ. विठ्ठल धारपूरे : पर्यावरणशास्त्र- पिंपळापूरे अॅन्ड कंपनी पब्लिशर्स, नागपूर.(R)
- 24) Dr. Deshpande, A.P.Dr. Chudiwale, A.D., Dr. Joshi, P.P., Dr. Lad, A.B.: Environmental Studies, Pimpalpure & Co., Publishers, Nagpur.(R)
- 25) R.Rajagopalan : Environmental Studies, Oxford University Press, New Delhi, 2005 (R)

(M) Magazine
(R) Reference
(TB) Textbook

APPENDIX-B
FOUR YEAR B.E. DEGREE COURSE
SEMESTER PATTERN
SEMESTER : THIRD
BRANCH : INSTRUMENTATION

L : Theory Lecture
T : Tutorial
P : Practical
D : Drawing / Design

ABBREVATIONS :-
S - SEMESTER PATTERN
U - ELECTRONICS & TELE.
L - INDUSTRIAL ELECTRONICS
I - INSTRUMENTATION
E - ELECTRICAL

| Sr. No. | Sub. Code | SUBJECT | Teaching Scheme | | | Examination Scheme | | | | | | | | | |
|---------|-----------|----------------------------------|-----------------|---|-----|--------------------|--------------------------|--------------------------|----------------------------------|-------|-----------------|---------------------|---------------------|-------|--------------------|
| | | | L | T | P/D | Theory | | | | | Practical | | | | |
| No. | No. | | | | | Total Hours/Week | Duration of Papers (Hrs) | Max. Marks Theory Papers | Maximum Marks College Assessment | Total | Min. Pass Marks | Max. Marks External | Max. Marks Internal | Total | Minimum Pass Marks |
| 1. | 3SULI1 | Mathematics-III | 4 | 1 | - | 5 | 3 | 80 | 20 | 100 | 40 | — | — | — | — |
| 2. | 3SULI2 | Electronic Devices & Circuits-I | 4 | 1 | 2 | 7 | 3 | 80 | 20 | 100 | 40 | 25 | 25 | 50 | 25 |
| 3. | 3SI3 | Electrical Measurement | 4 | - | 2 | 6 | 3 | 80 | 20 | 100 | 40 | 25 | 25 | 50 | 25 |
| 4. | 3SI4 | Transducer & Signal Conditioning | 4 | - | 2 | 6 | 3 | 80 | 20 | 100 | 40 | 25 | 25 | 50 | 25 |
| 5. | 3SI5 | Work Shop Technology | 4 | - | 2 | 6 | 3 | 80 | 20 | 100 | 40 | 25 | 25 | 50 | 25 |
| TOTAL | | | 20 | 2 | 8 | 30 | | | | 500 | | | | 200 | |

GRAND TOTAL : 700

SEMESTER : FOURTH
BRANCH : INSTRUMENTATION

| Sr. No. | Sub. Code | SUBJECT | Teaching Scheme | | | Examination Scheme | | | | | | | | | |
|---------|-----------|--|-----------------|---|-----|--------------------|--------------------------|--------------------------|----------------------------------|-------|-----------------|-------------------------------|------------|-------|--------------------|
| | | | L | T | P/D | Theory | | | | | Practical | | | | |
| | | | | | | Total Hours/Week | Duration of Papers (Hrs) | Max. Marks Theory Papers | Maximum Marks College Assessment | Total | Min. Pass Marks | Max. Marks College Assessment | Max. Marks | Total | Minimum Pass Marks |
| 1. | 4SI1 | Electrical Machines | 4 | 1 | - | 5 | 3 | 80 | 20 | 100 | 40 | — | — | — | — |
| 2. | 4SULI2 | Computer Programming and Applications. | 4 | 1 | 2 | 7 | 3 | 80 | 20 | 100 | 40 | 25 | 25 | 50 | 25 |
| 3. | 4SULEI3 | Network Analysis | 4 | 1 | 2 | 7 | 3 | 80 | 20 | 100 | 40 | 25 | 25 | 50 | 25 |
| 4. | 4SRULEI4 | Social Science and Engineering Economics | 4 | - | - | 4 | 3 | 80 | 20 | 100 | 40 | — | — | — | — |
| 5. | 4SI5 | Thermal & Fluid Power Engineering | 4 | 1 | 2 | 7 | 3 | 80 | 20 | 100 | 40 | 25 | 25 | 50 | 25 |
| TOTAL | | | 20 | 4 | 6 | 30 | | | | 500 | | | | 150 | |

GRAND TOTAL : 650

Four Practicals Based on Electrical Machines & Four Practicals based on Network Analysis in 4SULEI3.

REGULATION NO. 14 OF 2002**Examinations leading to the Degree of Bachelor of Engineering
(Instrumentation Engineering) (Four Year Degree Course....Semester
Pattern)
Regulation, 2002.**

Whereas it is expedient to frame the Regulation in respect of Examinations leading to the Degree of Bachelor of Engineering (Instrumentation Engineering) (Four Year Degree Course....Semester Pattern) for the purposes hereinafter appearing the Management Council is hereby pleased to make a following Regulation.

1. This regulation may be called “Examinations leading to the Degree of Bachelor of Engineering (Instrumentation Engineering) (Four Year Degree Course....Semester Pattern) Regulation, 2002.
2. This Regulation shall come into force w.e.f. the Academic session-
 - i) 2000-01 for Ist & IInd Semester B.E.,
 - ii) 2001-02 for IIIrd & IVth Semester B.E.,
 - iii) 2002-03 for Vth & VIth Semester B.E., and
 - iv) 2003-04 for VIIth & VIIIth Semester B.E.
3. The Schemes of Teachings and Examinations for Ist & IInd, IIIrd & IVth, Vth & VIth, and VIIth & VIIIth Semester in respect of Bachelor of Engineering (Instrumentation Engineering) (Four Year Degree Course....Semester Pattern) shall be as per Appendices A, B, C, and D appended with this Regulation respectively.

FIFTH SEMESTER**5 SI1 MICROPROCESSORS AND MICROCONTROLLER**

- Unit I : Introduction to microprocessor, Intel 8085 microprocessor architecture and its operations, various functions, Data flow to/from memory, from/to microprocessor unit, multiplexing and de-multiplexing of address data bus. Comparative study of 8-bit microprocessors : 8085, Motorola 6800, Zilog Z-80. Architecture of 16-bit microprocessor 8086, addressing modes.
- Unit II : Bus timings, T state, machine cycle, timing diagram, Detail study of 8085 instruction set. Memory mapping. Interrupt : necessity, types and structure, subroutines, interrupt service subroutines.
- Unit III : Programming techniques : looping, counting, indexing. Efficient programming in view of memory and speed, programming practice using subroutines.
- Unit IV : Concept of programmable devices, architecture and programming of 8155/8156 (programmable I/O port timer), 8355/8755 (programmable I/O ports), 8255 (programmable peripheral interface), it's interfacing with 8085 microprocessor.
- Unit V : Concept of general purpose programmable devices, architecture and programming of 8279 (keyboard display controller), 8257 (direct memory access controller), 8251 (universal synchronous, asynchronous receiver transmitter) with 8085 microprocessor. Study of bus interfacing standards IEEE488, RS232.
- Unit VI : Introduction to microcontroller, study of architecture, instruction set of 8051, simple programs and interrupt systems.

EXPERIMENTS : Minimum Eight experiments based on above syllabus.

BOOKS RECOMMENDED :

- 1) Gibson G.A., Liu Y.C. : Microcomputer system the 8086/8088 family, Prentice Hall India Pvt. Ltd., New Delhi (Second edition), 1996.
- 2) Hall D.V. : Microprocessor and Interfacing Programming and Hardware, McGraw Hill Co., New York, 1986.
- 3) Gaonkar R.S. : Microprocessor Architecture Programming and Applications with the 8085, Penram International Pub. (Third Edition), 1997.

- 4) Mathur A.P. : Introduction to Microprocessor, Tata McGraw Hill Pub., New Delhi (Second Edition), 1986.
- 5) Gilmore : Microprocessors Principles and Applications, Tata McGraw Hill Pub. Co. (Second Edition)
- 6) 8051 Intel Manual.

5 SUI2 POWER ELECTRONICS**SECTION-A**

- Unit I : SCR, Triac, Diac-construction, characteristics & applications, two transistor analogy for turning ON-OFF SCR, turn ON mechanism, different methods of turning ON-OFF SCR, turn OFF mechanism, Thyristor firing circuits. Introduction to GTO, power transistor, power MOSFET & IGBT & their construction & characteristics.
- Unit II : Series parallel operation of SCR's, static & dynamic equalising ckt., equalisation of current in parallel connected SCR's, string efficiency, derating factor, Protection of SCR's against di/dt, dv/dt, radio freq., interference, over voltage, over current.
- Unit III : Principle of phase control, half wave controlled rectifier, half controlled bridge & fully controlled bridge rectifier for resistive and RL load derivation for output voltage and current, effect of free wheeling diode, single phase dual converters.
- Three phase half controlled bridge and fully controlled bridge rectifier. (only descriptive approach)

SECTION-B

- Unit IV : Classification of ckt. for forced commutation, series inverter, improved series inverter, parallel inverter, out put voltage and waveform control, principle of operation for three phase bridge inverter in 120 deg. and 180 deg. mode, single phase transistorised bridge inverter.
- Unit V : Basic principles of chopper, time ratio control and current limit control techniques, voltage commutated chopper ckt., Jones chopper, step-up chopper and AC chopper.
- Basic principle of cycloconverters, single phase to single phase cycloconverter.
- Unit VI : Speed control of DC series motors using chopper, speed control of DC shunt motor using phase controlled rectifiers, speed control of three phase induction motor by stator

voltage control, v/f control and slip power recovery scheme.

Static ckt. braker, UPS, fan speed regulator, principle of soft start ckts. Zero Voltage Switch.

PRACTICALS: Minimum 8 practicals based on above syllabus, preferably uniformly distributed.

REFERENCES:

- 1) M. Ramamoorthy - Thyristor and their application.
- 2) M.H.Rashid - Power Electronics Ckts., Devices and Application.
- 3) Dr.P.S. Dhimbra - Power Electronics.
- 4) P.C.Sen - Power Electronics.
- 5) H.C.Rai - Industrial and Power Electronics.
- 6) G.K.Dubey, S.R.Doradia, A.Joshi, R.M.K. Sinha - Thyristorised Power Controller.
- 7) M.D.Singh & K.B.Khanchandani - Power Electronics, Tata McGraw Hill.

5 SI 3 CONTROL SYSTEM COMPONENTS

Unit I : Introduction to control system components - electrical, mechanical, hydraulic, pneumatic. comparison of these systems, representation of components.

Transmitters : buoyancy, differential pressure (DP), temperature, electro-hydraulic, 2-wire transmitters
Converters : resistance-to-current, voltage-to-current, pneumatic-to-electrical and electrical-to-pneumatic.

Unit II : Control actions : two (on/off) and three positions time proportionating, proportional (P), integral (I), derivative (D), PI, PD, PID, PID rate before reset, offset in P action, reset windup, effect of PID on process characteristics

Unit III : PID controllers : pneumatic, hydraulic and electronic auto-manual transfer, frequency response, installation and tuning, sequential and timing control application. Relay ladder diagrams. Introduction to programmable logic controller (PLC) : Architecture, specifications, applications, developments of simple ladder diagrams.

Unit IV : Control valve : terminology, types, characteristics, selection criteria, concept of Cv, Calculation of Cv and trim size. Valve

Positioners : necessity, types and effect on performance of control valve. Actuators : pneumatic, hydraulic, electrical, electro-pneumatic, electro-hydraulic.

Unit V : Hydraulic components : pumps, power cylinders, servo motors, valves, power supply, simple hydraulic circuits and hydraulic transmission.

Unit VI : Auxiliary process components : variable speed drives, feeder, damper, annunciator, square root extractor, computing relays, fluidic gates, high/low selectors, differential links and gears, magnetic amplifiers, synchros, reed relays.

BOOKS RECOMMENDED:

- 1) C.D.Johson : Process Control and Instrument Technology
- 2) E.B.Jones : Instrument Technology, Vol. III
- 3) N.A.Anderson : Instrumentation for Process Measurement and Control
- 4) P.Harriott : Process Control by
- 5) Pipepinger : Industrial Hydraulics by
- 6) Raven : Automatic Control Engineering
- 7) B.G.Liptak : Instrumentation Engg. Handbook, Vol. II by

LIST OF EXPERIMENTS:

- 1) Calibrations and tuning of a PID controllers.
- 2) Test and find the characteristics of a given control valve.
- 3) Study of hydraulic components and simple circuits.
- 4) Study of pneumatic components and simple circuits.
- 5) Study of two-wired transmitter and square root extractor.
- 6) Study of flow control loop.
- 7) Study of alarm annunciator.
- 8) Study of I to P, P to I.
- 9) Study of PLC and simple programming.
- 10) Study of calibrations of DP transmitter for flow/level interface.
- 11) Study of magnetic amplifiers, synchros.
- 12) Study of specific related equipment e.g. RTD (Resistant

temperature Detector), transducer, pH simulator, pressure regulators and safety devices.

5 SI 4 MATERIALS & PROCESSES

- Unit I : Introduction to engineering materials, materials classification and engineering requirements of materials, factor affecting the selection of materials for engineering purposes, properties of engineering materials, testing of materials, tensile test, torsion & shear test, compression test, impact test, hardness test, fatigue test, S-N diagram, creep of materials, Erichsen test.
- Unit II : Introduction to manufacturing processes : casting, cold working & hard working processes like rolling, forging, extrusion, etc. Crystal structure of metals and alloys : F.C.C., B.C.C., H.C.P.
- Unit III : Materials & their applications for electrical & electronic component, materials for Resistors, properties & applications, Superconducting materials, Transducers materials, Semiconductors - commonly used type working applications.
- Unit IV : Thermistors, piezo electric, Ferro electric & Ferro ceramic materials, die electric materials & dia electric constant, capacitors, insulating materials, properties of fibrous materials, ceramic, mica, glass, rubber, plastics, thermosetting & thermoplastic resins, insulating waxes, varnishes & coolants.
- Unit V : Magnetic materials, soft & hard magnetic materials, Ferrites & Di para antiferro, ferromagnetism, special purpose materials & processes.
- Unit VI : Thermocouple materials, soldering materials, fuse materials, contact materials, Fluroscant & phossphoroscent materials, processing of electronic materials, crystal growth, purification junctions, IC fabrication, processes of galvanizing & impregnations.

BOOKS RECOMMENDED :

- 1) Raymond A.Higgins (2nd edition, ELBS, 1988) : Materials for the Engineering Technician
- 2) W.Alagappan, N.T.Kumar, Tata McGraw Hill, 1988 : Electrical Engineering Materials
- 3) R.M.Rose, L.A.Shepard, John Wulff : The Structure and Properties

of Materials, Vol. IV, Electronic Properties

- 4) B.K.Agrawal : Engineering Materials & Metallurgy
- 5) Dr. Kodgire : Material Science & Metallurgy

5 SULI 5 CONTROL SYSTEM ENGINEERING

SECTION-A

- Unit I : Basic definition; closed and open loop systems; transfer function, block diagrams, derivation of transfer functions of physical systems, signal flow graphs, basic control action.
- Unit II : Time response analysis, impulse response function, Analysis of first, second & higher order systems, stability of control system, Routh Hurwitz's stability criterion, static and dynamic errors coefficients, errors criteria.
- Unit III : Introduction of Root Locus method; Root Locus plots, Rules for constructing root loci, stability analysis of systems using Root locus, concept of dominant, closed loop pole pair, Root-contour plots, effect of zeros & poles.

SECTION-B

- Unit IV : Introduction of frequency response, Bode plots, stability margins on the Bode plot, stability analysis of systems using Bode plots, polar plots, Nyquist stability criterion, relative stability.
- Unit V : State space representation of systems, conversion of state variable models to transfer functions, conversion of transfer functions to state variable models, solution of state equations, concepts of controllability and observability.
- Unit VI : Sample data control systems :
representation of sampled data (Discrete) systems, review of Z-transforms, sampler and hold ckt., zero order hold, sampling theorem, Z-transform analysis of sampled data of sampled data control systems (open & closed loop systems), Z transform of systems. Solution of difference equation by Z-transform methods. Response of discrete systems. Pulse Transform functions of open loop, closed loop systems with different sampler locations. Digital controller & its transfer functions. Stability analysis of discrete time system using bilinear transformation.

BOOKS :

- 1) K. Ogata : Modern Control Engg. (PHI)
- 2) M. Gopal : Digital Control Systems Principles & Design (TMH)
- 3) I.J. Nagrath & M.Gopal : Control System Engg. (Wiley Eastern)

SIXTH SEMESTER**6 SI 1 ANALYTICAL INSTRUMENTATION**

Unit I : Introduction to chemical/instrumental analysis, advantages over classical (gravimetric and volumetric analysis) methods. Classification : spectral, electro-analytical and separative methods. (introduction to each method)

Ultraviolet (UV) and Visible absorption instruments components, Beer-Lamberts law, monochromator : design and associated equipment, monochromator performance. UV and Visible instruments : colorimeters, spectrophotometers : single and dual beam, dual wavelength and double monochromator, diode array-rapid scanning, reverse optics technique.

Infra-Red (IR) spectrophotometers : basic components, types, Fourier transform techniques.

Unit II : Emission spectrometry : theoretical concepts, instrumentation : source unit, electrodes.

Direct reading multichannel spectrometers.

Flame photometry : principle, constructional details, fuel gases, atomizer, burner, optical and recording systems.

Atomic absorption spectrometers : theoretical concepts, instrumentation : hollow cathode lamps, burners and flames, plasma excitation sources, optical and electronic systems.

Unit III : Nuclear magnetic resonance (NMR) spectrometry : principle, nuclear spin, nuclear energy levels, resonance condition, NMR absorption spectra, chemical shift, constructional details, spin decoupler, Fourier transform NMR spectroscopy.

Electron spin resonance (ESR) spectrometry : principle and constructional details.

Unit IV : Fluorimeters and phosphorimeters : principle, single and double beam filter fluorimeters, ratio fluorimeters,

spectrofluorimeters, micro-processor based instruments, phosphorescence spectrometer.

Raman spectrometry : Raman effect, components, LASER type.

Photoacoustic and photothermal spectrometers.

Mass spectrometry : basic components, types (magnetic deflection type, time of flight, double focussing, quadrupole, gas chromatograph mass spectrometer (GCMS) system, resolution and applications.

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

Unit V : Radio chemical instrumentation : radio chemical methods, radiation detectors (ionization chamber, Geiger-Muller, proportional and Scintillation counters, semiconductor detectors), pulse height analyser.

X-ray spectrometry : spectrum, instrumentation, diffractometers and absorption meter.

Unit VI : Gas and liquid chromatography : classification, basic parts, carrier gas, sample injection system, chromatographic column, thermal compartment, temperature programming, dual column system, detectors (thermal conductivity, flame ionization, electron capture, Argon ionization), recording instruments, introduction to liquid chromatography.

Methods of gas analysis : oxygen, carbonmonoxide, nitrogen analyzer, gas density analyzers.

Refractometry : principle, Abbe and dipping types.

Interferometry : principle, types-Rayleigh, Jamin and Twyman.

Moir techniques : introduction and its use for length measurement.

BOOKS RECOMMENDED:

- 1) R.S.Khandpur : Handbook of Analytical Instrumentation
- 2) Willard, Merrit and Dean : Instrumental Methods of Analysis

- 3) E.W.Ewing : Instrumental methods of Chemical Analysis
 4) R.D.Braun : Introduction to Instrumental Analysis

PRACTICALS:

Students are expected to perform minimum 8 experiments based on above syllabus.

6 SI 2 BASIC INDUSTRIAL MANAGEMENT

- Unit I : Principles and techniques of management : meaning of and differences among business, management, administration and organisation, Principles of management, functions of management, planning, organisation structure and relationships, direction, co-ordination, control, motivation, delegation and decentralisation, communication, leadership and decision making.
- Unit II : Market and materials management :
- A) Marketing strategy, market research, consumer behaviour, advertising and sales promotion, channels of distribution, pricing of products.
- B) Classes of material, scope of material control, scope of purchasing department, purchasing procedures, order procedures, inventory control, introduction to production, planning and control.
- Unit III : Personnel management :
- Meaning and functions of personnel management, recruitment, selection, promotion, wages and salary administration, training and development, functions and scope of trade unions in Indian industries. Welfare of labour, Problems of labour turn over & retention.
- Unit IV : Project and financial management :
- A) Case studies of project report, preparation of profit and loss statement and balance sheet, ratio analysis.
- B) Principles of costing, cost sheet preparation, variance analysis, meaning and application of various budgets, types of budgets and their importance.
- Unit V : Industrial ownership : types, single partnership, JSC, co-operative, public sector, private sector, merits & demerits.

Entrepreneurial qualities, skills, role of government, financing agencies.

Unit VI : Quality management :

Concepts and applications of Kaizen, quality circle, ISO 9000 series, just-in-time, quality planning and total quality management, elements of TQM, Quality Circles.

BOOKS RECOMMENDED :-

- 1) Koontz H., O'Donnel C. and Whierich : Principles of Management, Tata McGraw Hill Publishing Co. Ltd., New Delhi.
- 2) Khanna O.P. : Industrial Engineering and Management.
- 3) Mody Suresh M. : Total Quality Management, D.L.Shah and Trust, Mumbai
- 4) Sherlekar S.A. : Business, Organisation and Management, Himalaya Pub. House Ltd., Mumbai.
- 5) Gupta P.B. & Sharma P.B. : Industrial Management & Managerial Economics, Ratnasagar Pvt. Ltd., New Delhi.
- 6) Khanka : Entrepreneurial Development, S.Chand & Co., New Delhi.
- 7) Mahajan S.M. : Statistical Quality Control.

6 SI 3 PULSE AND DIGITAL CIRCUITS

- Unit I : Linear wave shaping using RC and RL circuits, Analysis of RC low pass and high pass filters. Analysis of clipping and clamping circuits using diode and switching transistors.
- Unit II : Multivibrators :
- Astable, mono stable and bi stable multivibrators, their triggering mechanism. Sweep generators RC time base, miller time base, bootstrap time base and voltage time base generators.
- Unit III : Combinational logic design using 74XX series devices.
- Multiplexers, demultiplexers, decoder, encoder, comparator and code converter. Counters, types of counters and their design.
- Unit IV : Combinational circuit design :
- Combinational circuit design using ROM array, PLA, 74 adder series, binary adder, BCD adder, carry look ahead adder.

Binary and BCD Subtractor.

- Unit V : Sequential machine:-
Basic model of sequential machine. Minimization, General procedure for analysis and synthesis of synchronous sequential circuits.
- Unit VI : General procedure for analysis and synthesis of asynchronous sequential circuits.

BOOKS RECOMMENDED :-

- 1) Millman and Taub : Pulse, Digital and Switching Waveform ,Tata McGraw Hill Pub.
- 2) Taub and Schilling : Digital Integrated Electronics, Tata McGraw Hill Pub.
- 3) Morris Mano : Digital Design , Eastern Economy Edition.
- 4) Texas Instruments Inc., Designing with TTL Integrated Ckts., McGraw Hill International Edition.
- 5) Digital IC Reference Data Manual.
- 6) Samul Lee Digital Design, PHI Pub.

6 SI 4 ELECTRONIC INSTRUMENTATION

- Unit I : Instrumentation amplifier and its application, active filter design and its application.
Design and use of regulated power supplies, Precision ohmmeter RF power and Voltage measurement, automated voltmeter, digital frequency meter, phase meter, RLC Meter, $\tan \delta$ Meter
- Unit II : Different types of signal generators, cathode ray oscilloscopes : detailed study of various controls, dual beam and trace, storage, sampling, plug in versatility, active and passive probes and their design. Measurement of radio receiver characteristics, sensitivity, selectivity, fidelity.
- Unit III : AD/DA converter; various types and specification sample & hold circuit, features. Architecture and functioning of ADC. 0808, 0809, DAC 0800.
- Unit IV : Multiplexing & de-multiplexing, phase lock loop (PLL), V-f counter, lock in amplifier and its application. Data acquisition

system, (DAS) microprocessor / micro controller based DAS. Digital transducer and signal conditioning, component circuit for amplitude and frequency, telemetry (analog and digital).

- Unit V : Measurement of physical quantities : temperature, water level, flow frequency, pressure, voltage and current using microprocessor, acoustic measurements.
- Unit VI : Electro-cardiograph, electro-encephalograph, electro-myograph : specifications, block diagram, pre-amplifier design, Defibrillators pacemakers, audio-meters : specifications, basic circuit design, patient monitoring systems.

PRACTICALS : Students are expected to perform minimum Eight experiments based on above syllabus.

BOOKS RECOMMENDED :-

1. Helfric A.D. and Cooper W.D.- Modern Electronics Instrumentation and Measurement Techniques
2. Rathore T.S. - Digital Measurement Technique
3. Schilling D.L. and Belover C - Electronic Circuits : Discrete and Integrated
4. Gayakwad R. - Op-Amp and Integrated Circuits
5. Webschall D. - Circuit Design for Electronic Instrumentation
6. Chaudhari D.S. - Medical Instruments.

6 SULI 5 LINEAR INTEGRATED CIRCUITS

SECTION-A

- Unit I : Operational Amplifier
Differential amplifier : gain expressions using H parameters, transfer-characteristics, constant current source, level shifting, block diagram of op-amp, frequency response, frequency compensation methods, study of ICs uA741, measurement of parameters of op-amp and off set nulling and their importance.
- Unit II : Linear Applications of Op-Amp
Inverting and non inverting amplifiers, voltage followers (AC-DC), integrator, differentiator, differential amplifier, bridge amplifier, instrumentation amplifiers, precision rectifiers, RMS to DC converter, voltage to current converter, sinusoidal RC

oscillators, constant voltage sources, frequency to voltage and voltage to frequency convertor.

- Unit III : Non Linear Applications of Op-Amp and Filter Circuits
- Clipping and clamping circuits, comparator, astable, monostable and bistable multivibrator, Schmitt trigger, voltage sweep generator, active filters : Butterworth, Chebyshev filters using op-amp, log and antilog amplifiers

SECTION-B

- Unit IV : Voltage Regulator
- Block schematic of regulator IC 723, regulated power supply using IC 723, short circuit protection, switch mode power supply, dual tracking regulators, regulator using 78**, 79**, and LM 317.
- Unit V : 1. Timers :
- Block schematic of IC 555, application of timer 555 as astable, monostable and bistable multivibrators, delayed timer, sawtooth generator, FSK modulator.
2. Sample & hold circuit, basics of analog multiplexer.
- Unit VI : 1. PHASE LOCKED LOOPS
- Operation of phase lock loop system, transfer characteristics, lock range and capture range, study of PLL IC-LM 565 and its applications as AM detector, FM detector and frequency translator.
2. Analog Multiplier : IC 1496

PRACTICALS : Minimum Eight practicals based on the above syllabus, preferably uniformly distributed.

BOOKS RECOMMENDED :-

- 1) Gayakwad R.A. : OP-Amps and Linear Integrated Circuits, Prentice Hall of India Pvt. Ltd., New Delhi (Second Edition), 1980.
- 2) Milliman J. and Grabel A. : Microelectronics, McGraw Hill Book Co., New Delhi, 1985.
- 3) Tobey J.E. and Grame J.E. : Operational Amplifier Design and Applications, International Student Edition, 1983.
- 4) Linear Application Handbook : National Semiconductors.
- 5) Application Note on IC : BEL India.
- 6) Herb Taub and Donald Schilling : Digital Integrated Circuits, McGraw Hill Pub.

6 SULIMETX 6 COMMUNICATION SKILLS

- Unit I : **Comprehension over an unseen passage :-**
- Comprehension - A - word study :-
Synonym, antonym, meanings, matching words, adjectives, adverbs, prefix and suffix, correct forms of commonly misspelled words, understanding of the given passage.
- Comprehension - B - Structure study :-
Simple and compound sentences, types of conjunctions, singular and plural, tenses and their effect on verb forms. Use of - not only - but also, if clause, since, may, can, could, would, too etc.
- Active and passive forms, negative and interrogative, punctuation and capitalization. (10 Hours)
- Unit II : **Principles of Communication :-**
- Theoretical background - importance of communication, its process, model of communication its components & barriers. Verbal communication, its significance, types of written communication and its style, organization of a text (Titles, summaries, headings, sequencing, signaling, cueing etc.), Important text factors (length of paragraph, sentences, words, clarification and text difficulty). Evaluation of written communication for its effectivity and subject content.
- Verbal and non-verbal objectives in interpersonal skills. (10 Hours)
- Unit III : **Aspects in professional communication :-**
- Specific formats for written communication like - business correspondence, formal reports, technical proposals, research papers and articles, advertising and graphics. Format for day-to-day written communication like applications, notices, minutes, quotations, orders, enquiries etc.
- Types of graphics and pictorial devices
- Oral communications - face to face communications, group discussion and personal interviews.
- Methodology of conduction of meetings, seminars, symposia, conference and workshop. (10 Hours)

BOOKS RECOMMENDED :

- 1) Krishna Mohan, Meera Banerjee : Developing Communication Skills, MacMillan India Limited.
- 2) Chrissie Wright (Editor) : Handbook of Practical Communication Skills, Jaico Publishing House.
- 3) Curriculum Development Centre, TTTI WR, Bhopal : A Course in

Technical English, Somaiya Publication Pvt. Ltd.

- 4) F.Frank Candlin : General English for Technical Students, University of London Press Ltd.

COMMUNICATION SKILLS LABORATORY

Objective :

On completion of this laboratory the candidate should be able to demonstrate adequate skills in oral and written communication for technical English language, actively participate in group discussions and interviews and exhibit the evidence of vocabulary building. Candidates should be assessed through continuous monitoring and evaluation.

The sample list of experiments is given below. This list can be used as guideline for problem statements but the scope of the laboratory should not be limited to the same. Aim of the list is to inform about minimum expected outcomes.

1. Assignments and tests for vocabulary building
2. Technical report writing
3. Group discussions
4. Interview techniques
5. Projects and tasks such as class news letter
6. Writing daily diaries and letters
7. Interactive language laboratory experiments.

TEXT BOOK : Norman Lewis : Word Power Made Easy
<http://www.teachingenglish.org.uk>

SEVENTH SEMESTER

7SI 1

UNIT OPERATIONS

UNIT I : Basic concept: Unit operation and unit process concept: Block diagram of Chemical process, Classification of unit operation, Material and Energy balance, Batch and Continuous Process, Endothermic and Exothermic reaction, Reversible and Irreversible Process, Humidification and Dehumidification.

Extraction: Field of Application of liquid Extraction, Selection of solvent, Extraction Equipments (Mixer-settlers , spray column) Leaching Equipment.

UNIT II : Transportation & Systems: Classification, Efficiency, and Characteristics of Pumps, Compressors , Fans, Blowers, and NPSH of Centrifugal Pumps.

Heat Exchangers: Types of Heat Exchangers.

UNIT III : Distillation: Continuous Fractionating Columns, Plate efficiencies.

Influencing plate efficiency, Flash Distillation, and Batch distillation.

Drying : Principle of drying, Classification of dryers, Temperature patterns in dryers , Drying equipment, Selection of drying equipment.

Evaporation : Types of Evaporators , Single effect evaporators , Multiple effect evaporators , forced circulation evaporator.

UNIT IV : Introduction to Process Industries: Nitrogen Industries: Synthesis of Ammonia, Nitric Acid, Urea.

Manufacturing Process of Cement Plant, Paper and Pulp Industries.

UNIT V : Chemical reactors: Classification of chemical reactors, flow dia., effect of Variables such as temperature, Pressure , Reactor concentration, flow pattern & reaction kinetics.

UNIT VI : Filtration: Mechanism of filtration, Rotary drum filter, flow sheet for Continuous vacuum Filtration, suspended batch. Centrifuges, Clarifying filter, cyclone types of industrial filters, Bag filters.

Crystallization : Types

Separation: -Hydro clones, centrifugal decanters, Disk centrifuge.

Size reduction: Crushing law, crushing equipment, types of grinders.

TEXT BOOKS .

- 1) Unit Operation of Chemical Engg. By Maccabe Smith Harriott, McGraw-Hill.
- 2) Chemical Engineer's Handbook by Perry, 6/c McGraw Hill, 1984
- 3) Outline of Chemical Technology by M. Gopala Rao, Marshall Sittig (3/e)

REFERENCE BOKS:

- 1) Outline of Chemical Technology by M.G.Rao & Misting, 2/e, East west, 1973
- 2) Designing of Thermal System by Stoker, 3/e

7SI 2 PROCESSEQUIPMENT DESIGN

UNIT I : Design aspects and selection criteria for flow, temp., pressure and level Transducers, Transmitter, Designing Analog and Digital Signal Conditioners. (mV-5 v to 4-20 mA, 0-5 V to 0-FFH), Relay controlled Cards, Stepper motor Control cards, PC based Add-on cards for process control.

UNIT II : Control valve Design : Designing control valve for gas, Vapor and liquid. Effects and remedies of cavitation , flashing condition, valve noise, calculation and reduction method, valve auxiliary parts, control valve linearizer, High pressure and high temperature service control valve, installed range ability and viscosity correction for control valve.

Design consideration for actuators, (Solenoid, Pneumatic, Hydraulic)

UNIT III : Architecture of DCS, Various displays, DCS element , Introduction to DCS Cards, DCS system integration with PLC and PC, Overview of Honey Well TDC-3000 DCS, Communication links and overview of protocols.

UNIT IV : Configuration and performance characteristics of virtual instrumentation Systems. (Lab view) Faultfinding and Trouble shooting techniques of instruments and Systems, causes and remedy of faults.

UNIT V : Specification of advanced PLC, input speed modules (analog, digital, discrete modular). Modular controller, high speed counter, remote input output scanner, communication modules, limit switches, scan time, PLC programmer and its Features. Programming instruction: Input / Output , timer counter, bit, comparison, file move & logical, input output message, data handling, branch instruction, Conversion, Skip and by pass I/O.

UNIT VI : Development of ladder diagram & flow chart or sequence map (table, slot).

System configuration:- Hardware, system, Sizing & selection, Wiring diagram, PLC installation, Safely enclosure, temperature noise, hook up Consideration, operator interrupts, interfacing of PC & field bus, PLC Simulator.

(52)

TEXT BOOKS

- 1) Process Control Instrumentation Technology, by C.D. Johnson, (7e)
- 2) Distributed computer control for industrial automation by Popovic and Bhatkar.
- 3) Programmable Logic Controller by J. D. Otter (PHI)
- 4) Computer Based Industrial Control by Krishnakant.

REFERENCE BOOK

- 1) Hand Book : Process Control by B.G. Liptak.

Practicals: Student are expected to perform minimum 8 experiments based on the above topics

7 SI 3 BIOMEDICALINSTRUMENTATION

Unit I : Introduction to Biomedical Instrumentation : sources of biomedical potentials. Different bioelectric signals like ECG, EMG & EEG.

Biopotential electrodes : basic electrode theory, nearest equation, electrical conductivity of electrode jellies & creams, skin contact impedance & its measurement. Electrods for ECG, EEE & EMG.

- Unit II : Cardiovascular system : physiology of heart & cardiovascular system, ECG lead configuration, ECG recorders, Vectorcardiograph, Phonocardiograph, measurement of cardiac output, blood flow & blood pressure.
- Unit III : Central Nervous System : anatomy of nervous system, neuronal communication, neuronal receptors. The somatic & autonomic nervous system & spinal reflexes. Neuronal firing measurements, EEG measurements, Recorder for EEG & EMG.
- Unit IV : Therapeutic equipments : cardiac pacemakers, cardiac defibrillators, nerve & muscle stimulators, Diathermy : shortwave, uw & ultrasonic.
- Unit V : Medical Imaging System : instrumentation for diagnostics
X-Ray : properties, X-ray units, X-ray machines & generation process, special imaging techniques for X-rays.

Ultrasonic Imaging System : Physics of ultrasound, basic modes of transmission, ultrasonic display modes : A scan, B scan & M scan with applications. Biological effects of ultrasound.
- Unit VI : Electrical safety: general consideration for biomedical recorder amplifiers, sources of noise in zero level recording circuits, physiological effects of electrical currents, electric shock hazards, leakage currents, methods of accident prevention. Test instruments for checking safety parameters of biomedical equipments.

Practicals: Student are expected to perform minimum 8 experiments based on the above topics

TEXT BOOKS :

- 1) Handbook of Biomedical Instrumentation by R.S.Khandpur, TMH Pub.
- 2) Biomedical Instrumentation & Measurements by L.Cromwell, F.Weibell, E.A. Pfciffer, PHI Pub.

REFERENCE BOOKS :

- 1) Introduction to Biomedical Equipment by Carr & Brown.
- 2) Medical Instrumentation by J.G.Webster, 3rd edition, John Wiley.

7SI 4 PROJECT PLANNING ESTIMATION AND ASSESSMENT

- Unit I : Definition of Project, Purpose, Scope, Organization Structure, Project implementation and Cost estimation, Documentation, Manpower Planning, Project time Schedule, Cost and estimation. Documentation Software to create, modify, add, revise and update I & C document.
- Unit II : Project monitoring and control: PERT/CPM techniques, Project Bar Chart, Tendering procedure, Bid evaluation and procurement procedure, project coordination, multi-agency interaction.
- Unit III : Specification, Configuration and Design Criteria : Degree of automation, Manpower matching, instrument Specification sheet, area classification and Instrument selection, control system specification, PLC and DCS, subsystem.

Control console, centers and panels: Types, Design, Inspection, and specification. Intelligent operator interface (IOI).
- Unit IV : Test Procedure, Installation and Commissioning: Factory acceptance and Site acceptance test inspection reports and check list, installation and Commissioning, control schedule and site activities up to hand over, post Installation maintenance spares management, annual maintenance contract.
- Unit V : Project Engineering and documentation, standard symbols and legends, process flow sheet, P and I diagrams, control schematics, instrument list, interlock diagrams, plant G. A. diagrams, power/air distribution, loop schematics and termination diagram, installation sketches and bill of material, control system documentation.

Cable Engineering: Different classes of conductors, NEMA Standards. Types and specifications of cables, cable schedule, routing of cables, types of glands, ferruling and terminations.
- Unit VI : Discrete State control system: Two state control system, non-interactive Variables, sequential system, Time sequence

system, and composite sequential system.

Field bus Wiring: Terminator, Power Conditioners, Spurs, Segments, and repeaters. Networking: Hubs, routers, LAN cards, and Cat cables. (52)

Text Books

1. Applied Instrumentation in Process Industries, Vol. I & II by Andrew & William.
2. Batch Control System By T. G. Fisher.
3. Management System by John Bacon.

Practicals: Student are expected to perform minimum 8 experiments based on the above topics.

7SI 5/7SU5/7SL5 ELECTIVE-I

(1) FUZZY LOGIC AND NEURAL NETWORKS

- UNIT-I Introduction : Biological Neurons and their artificial models introduction to neural computing, Components of neuron, input and output weight, threshold, weight factors, transfer functions, concepts of supervised and unsupervised learning. (8)
- UNIT-II Supervised Learning : Single layer network, perceptron, Linear separability, Training algorithm and limitations.
Multilayer Network : Architecture of feed forward network, Learning rule, generalized delta rule, learning function. Back propagation algorithm. (9)
- UNIT-III Unsupervised Learning : Introduction, Counter propagation networks, Kohonen's self organizing maps.
Hopfield networks. (8)
- UNIT-IV Introduction : Uncertainty in information, basic concepts of Fuzzy sets, operations on fuzzy sets, properties.
Fuzzy relations : operations, properties, value assignments. (8)
- UNIT-V Membership functions : Features, fuzzification, membership value assignments, Fuzzy Rule based systems, Graphical technique of inference.
Defuzzification : Lambda-cuts for Fuzzy sets and Fuzzy relations, Defuzzification methods. (9)

UNIT-VI Applications:

1. Fuzzy pattern Recognition - feature analysis, partitioning of feature space, single sample identification multifeature pattern recognition.
2. Simple Fuzzy logic controller - Control system design stages, Assumptions in a Fuzzy control system design, general fuzzy logic controllers, simple examples. (8)

TEXT BOOKS :

1. J.M. Zurada : "Introduction to Artificial Neural Systems", Jaico Publishing House.
2. Meherotra Kishan, Mohan C.K., Ranka Sanjay : "Elements of artificial neural networks", Penram Int. Pub., Mumbai
3. Timothy Koss : "Fuzzy Logic with Engineering Applications", McGraw Hill International Edition.

REFERENCE BOOKS

1. N. K. Bose and P. Liang : "Neural Network Fundamental with Graphs, Algorithms and Applications", Tata McGraw Hill Edition.
2. G.J. Klir and T.A. Folger : Fuzzy sets, Uncertainty and Information", PHI Publication
3. Kosko Bart : "Neural Networks & Fuzzy systems", Prentice Hall of India Pvt.Ltd., New Delhi

7SI 5/7SU5 Elective-I

(2) / (5) ROBOTICS & AUTOMATION

- UNIT-I Definition of a Robot, A brief introduction to Robot Technology, Sensory perception, Intelligence, End Effectors, Sensory feedback, Robot Vision / Computer Vision and its fundamental components, Tactile Sensing, Range finding and real world navigation Speech synthesis and recognition.
Robot control fundamentals : The Artificial intelligence view point, comparison of human brain and computer in the context of intelligent behaviour, problem representation in A.I. system problem solving technique in A.I. (12)
- UNIT-II Definition of knowledge, Domain and logic : Elements of logic, proportional calculus, predicate calculus, pros and cons of logic, production system and their basis elements, sementic Nets and their characteristics, Frames, A Brief

about Expert system comparison of various methods of knowledge representation. (10)

- UNIT-III Elements of speech, Time Domain Analysis / Synthesis of speech and waveform digitization, frequency Domain Analysis / Synthesis of speech phoneme Speech Synthesis, various type of speech recognition Systems and their basics ideas, Isolated word Recognition, Connected Speech understanding. (12)
- UNIT-IV Elements of vision, Image Transformation, Image Analysis, Image Understanding of Machine perception, Industrial Vision System. (9)
- UNIT-V Triangulation Method, Time of Flight (TOF), Ranging Method, Robot Position and Proximity Sensing, Tactile-Sensing System, Sensing Joint Forces and their importance in Robot programming, sensing touch and slip. (9)
- UNIT-VI Various Robot Programming Languages and their characteristics, characteristics of Robot Task Level language, comparison of Robot programming language, features of the high level languages used in conventional programming language, featuring with the high level language used in conventional programming. (12)

BOOKS RECOMMENDED

1. Staugard A.C. : "Robotic and AI", Prentice Hall, Engle Wood Cliff N.J. 1987.
2. Lee C.S.G., Fu K. S., Gonzalez R.C. : "Robotic-Control, Sensing and Intelligence", Mc-Graw Hill, Singapore, 1987.
3. Klafferetal : "Robotics"
4. Parent M. and Laugreau C. : "Robot Technology (Vol.4 : Logic and programming)", Kogan Page, London, 1985.
5. Aleksander I., Farreny H. and Ghallab M. : "Robot Technology " (Vol-1).
6. Decision and Intelligence "Kogan Page, 1986.

7SI 5

Elective-I

(3) DIGITAL SIGNAL PROCESSING

- UNIT-I Introduction to DSP, Frequency domain description of signals & systems, Discrete time sequences systems, Linearity unit sample response, Convolution, Time invariant

system, Stability criteria for discrete time systems, Solutions of linear difference equations. (9)

- UNIT-II Introduction to Fourier transform of Discrete Time Signal and its properties, Inverse Fourier transform, Sampling of continuous time signal, Reconstruction of continuous time signal from sequences, Z-Transform and its properties, complex Z-plane, ROC Determination of filter Coefficients, relationship between Fourier Transform and Z-Transform, Inverse Z-Transform. (12)
- UNIT-III DFT and its properties, Circular convolution, Linear convolution from DFT, FFT, Decimation in time and frequency algorithm. Introduction to wavelet transform. (10)
- UNIT-IV Filter categories, Direct form I, Direct form II, Cascade and parallel structure for IIR and FIR Filter, Frequency sampling structures for F.I.R. filter, Steps in Filter Design, Design by Pole Zero Placements, FIR filter design by Windowing method, Rectangular, Triangular and Blackman window. (8)
- UNIT-V Analog filter types, Butterworth, Elliptic filter, Specification and formulae to decide to filter order, Methods to convert analog filter into IIR digital, Mapping of differential, Impulse invariant, Bilinear, Matched Z transformation. (8)
- UNIT-VI Multi rate DSP, Introductory concept of multi rate signal processing, Design of Practical sampler, Rate converters, Decimators and Interpolator, Filter Bank application and examples. (8)

TEXT BOOKS :

1. Oppenham & Scheffer : Discrete time Processing (PHI)
2. Proakis & Monolakis D.G. : Digital Signal Processing (PHI)
3. Mitra S.K. : Digital Signal Processing (PHI)

REFERENCES

1. Roman Kuc : Digital Signal Processing (MCW)
2. Ifeacher E.C., Jervis B. W. : Digital Signal Processing (Addison Wesley)
3. P. P. Vaidyanathan : DSP and Multirate Systems (PHI)
4. Rabiner and Chrocherie : Multirate DSP (PHI)

7SI 5

ELECTIVE I

(4) OPTOELECTRONIC INSTRUMENTATION

- UNIT I Light and Elements of solid state physics, nature of light, wave nature of light, light sources black body radiation, units

of light, Energy bands in solids, semiconductor types, works function.

- UNIT II DISPLAY DEVICES : Luminescence, Insestion Luminescence and the light emitting diode, Radiative recombination processes, LED materials, Commercial LED materials, LED construction, response time of LEDs, LED drive circuitry plasma display liquid crystal displays.
- LASERS : Emission population inversion, optical feedback classes of laser, doped insulator lasers. Semiconductor lasers, gas lasers, liquid dye lasers, laser applications, measurement of distance holography.
- UNIT III OPTICAL FIBERS : -
- Classification of optical fiber, priciple of light transmission through a fiber, fabrication of optical fibers, material consideration loss and band width limiting mechanism, perform fabrication technique, fiber drawing, fiber optic communication system.
- UNIT IV Fiber optic sensors, intensity modulated sensors, microben strain intensity modulated sensor, liquid level types hybrid sensor, internal effect intensity modulated sensor, phase sensor, diffraction grating sensors, sensors using single mode fiber, interferometric temperature sensor, distributed fiber optic sensors, polarization problem in interferometric sensors using single mode fiber.
- UNIT V Medical applications of fiber sensors, Fabry-Perot fiber optic sensors, Electric field and voltage sensors, Chemical fiber optic gyroscopes, magnetic field and current fiber sensor, military and aerospace applications, important applications of integrated optic fiber technology, Local area networks.
- UNIT VI Special applications, ADM, video link, satellite link, computer link, nuclear reactor link, digital video transmission in optical fiber networks, video compression, N.A. measurement, working of OTDR, microprocessor based OTDR, applications of OTDR, dispersion measurements, Bit Error Rate (BER) measurement, attenuation measurement using OTDR, cut-off wavelength measurement, microbending loss measurement. (52)

TEXT BOOK :-

- 1) Subir Kumar Sarkar : Optical Fibers & Fiber Optic Communication Systems”, S. Chand & Co., 2001.

REFERENCE BOOKS :

- 1) Morris Tischler : “Optoeeltronics : Fiber Optics and Lasers”, A Lab Text Manual, 2nd Edition, McGraw Hill, 1992.
- 2) Frederick C.Allard : “Fiber Optics Handbook for Engineers & Scientist (Optical & Electro-optical Engineering Series)”, McGraw Hill, 1990.
- 3) John M.Senior : Optical Fiber Communications, Principles & Practice”, 2nd edition, Prentice Hall of India, 1996.

EIGHTH SEMESTER

8SI 1

INSTRUMENT AND SYSTEM DESIGN

- UNIT I Basic concept of instrument Design: Functional requirements and Specification. Operational environment: - commercial, industrial, military. NEMA, DIN, BIS, ANSI , CENELEC standards.
- UNIT II Printed Circuit board Design: General components, layout scheme, grid system, PCB size, mechanical stress, Design rules for digital circuit PCB and analog circuit PCBS. Single and multilayer boards Designing technique for small signal ckt.
- UNIT III Automation and computer use in PCB design artwork , CAD packages and tools, soldering techniques, component assembly, testing. (Softwares like express PCB and Protel)
- UNIT IV Reliability, MTTR, MTBF, concepts of availability, component screening, infant mortality and bath tube curve, Component ageing. Failure rate analysis, Statistical-sampling criteria. Sampling for units with low failure rates, Redundancy.
- UNIT V Electronic design guidelines : Noise in electronics circuit, the design of low noise circuits, Components limits, sensitive device, sensitive inputs, input Filtering, damping, suppressors.
- UNIT VI Enclosure Design guidelines: Grounding and shielding techniques, protection against electromagnetic interference and electrostatic discharge. Packaging for various operational environment including IP-51 & IP-54.

TEXT BOOKS :

- (1) The Art of Electronics (Second edition 1989), Hill & Horowitz, Cambridge University Press.

- (2) Electronics, Discharge & Electronics Equipments by Warren.
- (3) Reliability Engineering by E. Balguruswamy.
- (4) Printed Circuit Boards by Walter Bosshart.

REFERENCE BOOK:

- (1) Electronics Instrument Handbook, 1999 – by Coombs.

Practicals: Student are expected to design miniproject considering following points.

1. Basic concept of instrument Design.
2. PC Based PCB design .
3. Electronic design guidelines.
4. Enclosure Design guidelines.

Oral : Basic criteria for design of instrument suitable for laboratory field control room environment.

8SI 2 PROCESS MODELLING & OPTIMIZATION

UNIT I Classification of models, major activity in model building ,use of mathematical models ,scope of coverage ,principles of formulation .

Fundamental laws: Continuity equations, energy equations, equations of Motions, Transport equations, Equations of state equilibrium, Chemical kinetics.

UNIT II Solving the mathematical models for dynamic system, heat transfer system, tanks types reactor systems, vaporizer, flashdrum, batch reactors , continuous distillation in multi - tray columns , dynamic modelling of process controlling loop .

UNIT III Computer simulation; Newton Raphson method ,False position , Euler method , Runge-Kutta (fourth –order), Adams –Bashforth method.

UNIT IV Process Identification: Purpose, Time domain “Eyeball” fitting of step test data, direct sine, pulse, and step signal testing. ATV identification.

UNIT V The nature & organization of optimization problems, formulation of objective function, cost, time, value of money, measure of probability, methods of least squares.

UNIT VI Single & multivariable optimization, linear programming and simplex method, sequential quadratic programming & reduced gradient optimization technique, Introduction to geometric programming & dynamic programming. (52)

TEXT BOOKS :—

- 1) Process Modeling & Simulation Control for Chemical Engineers by W.L. Luben, McGraw Hill.
- 2) Optimization of Chemical Process by Edger.

8SI 3 PROCESS INSTRUMENTATION

UNIT I Introduction to Process control & process characteristics:

Types of processes, process characteristics and controllability, step analysis method of finding time constant, self regulating and nonself regulating. Processes, interacting & non-interacting processes.

UNIT II Multiloop & multivariable process control systems, Feedback control, feed forward control, Cascade control, ratio control, auto selective control, adaptive control system, Coupling & decoupling control system, scaling the instruments.

Analysis of flow, level, temperature loops.

UNIT III Boiler instrumentation: combustion control, Air to fuel ratio control, 3-element drum level control, steam pressure, temp control, burner management and control, safely interlocks.

Furnace control, FB-FF-CS of heat exchanger, Evaporator control.

UNIT IV Distillation column control: Flow control of distillate and bottoms products, reflux control, composition control, pressure & Temperature control.

Reactor control:- Flow, temp, Pressure, endpoint controls , Reactor safety interlocks. Dryer control, pumps & compressor control, cooling Tower control ,water treatment control.

UNIT V Application of DCS: Distillation columns, power plants, Iron and steel plants, cement plants, oil and gas fields, paper and pulp industries.

Introduction to SCADA System and its Application.

UNIT VI Introduction to Intelligent controllers: optimal controller, predictive controller, Expert system and controllers, Artificial Neural networks controllers, fuzzy logic & Neurofuzzy control system, linear and non linear controllers, Single loop and multiloop controllers., model based PID controllers. (52)

TEXT BOOKS :

- 1) Process Control Handbook by Bela G. Liptak
- 2) Process Control System 3/e by F.G.Shinsky, McGraw Hill.
- 3) Computer Based Industrial Control by—Krishnakant. (PHI)
- 4) Process Instrumentation & Control Handbook by Considine .

Practicals:- Students are expected to perform minimum 8 experiments based on the above topics.

8SI 4**ELECTIVE-II****(1) ENVIRONMENTAL INSTRUMENTATION**

UNIT I Environmental definition, Constituents, biochemical cycle, causes of pollution, types of pollution and their measurement, effects of pollution, different sensors for measurement of pollution, difference between off –line measurement and continuous monitoring.

Environmental toxicology and hazards. Common toxic agents, their analysis and safety measures. Environmental regulation and standards.

UNIT II Review of standard methods of pollution analysis, sampling operation, Devices and techniques as related to environmental engineering.

Air pollution Analysis: Analysis of aerosols and Monitoring of gaseous pollutants like SO₂, H₂S, NO-NO_x, CO-CO₂, ozone, NH₃, and organic gases , Vapor Analysis Monitoring of suspended particulate matter and trace matter and trace metal pollutants.

UNIT III Water pollution Analysis Physical Examination-colour, conductivity, temp, odour , turbidity, hardness. Chemical Characterization-Ca²⁺, Mg²⁺, Na⁺, K⁺, Cl⁻, SO₄²⁻, HCO₃⁻, Al³⁺, Ba²⁺, Boron, F⁻, NO₃⁻, PO₄³⁻, Fe³⁺, Mn²⁺, SiO₂, Biological investigation-DO,BOD, bacteriological examination, water quality monitoring instrumentation. (pH meters, conductivity meters etc.) Water hardness testing & its removal, Water purification methods.

UNIT IV Effluent Analysis, Physical Methods of characterization density, viscosity, temperature, conductivity, turbidity, volatile, and dissolved solids, oil and immiscible liquids, colour odour, radioactivity, analysis of organic pollutants,

BOD, COD, TOC Specific analysis of Organic pollutants. Analysis of metal pollutants, Analysis of anion and dissolved gases dissolved oxygen , PH, dissolved chlorides, suspended Solids, nitrogen, sludge index.

UNIT V Soil pollution and pesticide Analysis : Analysis of Micronutrients, trace elements pesticides, Chromatographic Characterization. Polarographic and Spectroscopy Analysis of pesticides.

Noise Pollution and its Measurement: Units Devices and Maps Noise Control System.

Radiation Pollution and its Measurement and Control.

UNIT VI Instrumentation setup for different type of pollution control like Wastewater treatment, HVAC control etc.

Environmental testing, Dry heat, Dry cold, Damp Heat, Salt Spray, Dust, Altitude bump, Vibration drop/Topple, free fall, and study of ISO 14001. (52)

TEXT BOOKS :

- 1) Environmental Pollution Analysis by S. M. Khopkar 1st ed, Wiley Eastern 1993.
- 2) Basic Concepts of Analytical Chemistry by S. M. Khopkar.
- 3) Environmental Engineering by Peary H. S. and others.
- 4) Sensor Systems for Environmental Monitoring by Campbell.
- 5) Basic Environmental Technology-(Ed-1997) by J. A. Nathanson.
- 6) Environmental Tech. Series, V,I,II,III,IV by Neal K. Ustler.

8SI 4**ELECTIVE-II****(2) ADVANCED BIOMEDICAL INSTRUMENTATION**

UNIT I Patient monitoring system : system concept, bedside patient monitors, central monitors, average reading heart monitor, intensive care monitoring, ambulatory monitoring. Biotelemetry : single channel & multichannel telemetry, telephone & computer based telemetry.

UNIT II Magnetic resonance imaging system : principles of NMR imaging system, image reconstruction techniques, basic NMR components, applications, advantages & disadvantages of NMR, imaging techniques, Biological effects of NMR imaging.

UNIT III Computer applications in medical field : biomedical computer applications, computerised patient monitoring system,

computer aided ECG analysis, computerised catheterisation laboratory, basics of Computer Axial Tomography (CAT).

UNIT IV Laser applications in biomedical field : principle of operation of Laser, types of Lasers, applications of lasers in endoscopy, angiography, ophthalmology & removal of kidney stone.

UNIT V Regulation of water & electrolyte balance, kidney structure, filtration & reabsorption, renal acid base control, artificial kidney, dialysis system.

UNIT VI Biosignal conversions & averaging : sampling basics, simple conversion systems, conversion requirements for biomedical signals, signal conversion ckts., basics of signal averaging, signal averaging as a digital filter, software for signal averaging, limitations of signal averaging.

TEXT BOOKS :

- 1) R.S.Khandpur : Handbook of Biomedical Instrumentation (TMH)
- 2) L.Cromwell & F. Weibell : Biomedical Instrumentation & Measurements (PHI)
- 3) W.J.Tmpkins : Biomedical Digital Signal Processing (Eastern Economy Education)
- 4) Cass & Brown : Introduction to Biomedical Equipment Technology.
- 5) J.G.Webster : Medical Instrumentation, 3rd edition, John Wiley.

8SI 4

ELECTIVE-II

(3) POWER PLANT INSTRUMENTATION

UNIT I Thermal power plant : unit overview, types of biolers, turbine generators, condensers, variable speed pumps and fans, material handling system.

UNIT II Comparison of thermal, hydro, nuclear power plant, boiler safety standards, boiler inspection procedures.

UNIT III Boiler instrumentation : control and optimization, combustion control, air to fuel ratio control, 3-element drum level control, steam temperature and pressure control, Oxygen/CO/CO₂ in flue gases, furnace draft, electrical megawatt controls, boiler interlocks, sequence event recorder, supervisory control, data acquisition systems, burner management systems and controllers.

UNIT IV Automation strategy of thermal power plant (PLC, DCS, SCADA) and open system application, block schematic, control equipment, boiler automation, diagnostic functions and protection, digital electro-hydraulic governor, man-machine interface, software system, graphic display of automated power plant, application functions, variable pressure control.

UNIT V Turbine instrumentation : speed calculation, valve actuation, auto-start-up, thermal stress control, condition monitoring and power distribution instrumentation.

UNIT VI Hydroelectric power generation, regulation and monitoring of voltage and frequency, pollution and effluent monitoring and control.
Nuclear power generation and control station.

TEXT BOOKS :

- 1) Payne and Thompson : Efficient Boiler Operation Source Book
- 2) Popovic & Bhatkar : Distributed Computer Control for Industrial Automation, Dekker.
- 3) Dickinson and Cheremisnoff : Solar Energy Technology, Vol. I and II, Dekker.
- 4) Krishna Kant : Computer Based Industrial Control, PHI.
- 5) W.C.Turner : Energy Management Handbook.

REFERENCE BOOKS :

- 1) D.M.Considine : Energy Technology Handbook (MAH)
- 2) B.G.Liptak : Process Control, (Chilton)

8SI 4

ELECTIVE-II

(4) INSTRUMENTATION FOR AGRICULTURE AND FOOD PROCESSING

UNIT I Introduction, necessity of Instrumentation and control for Food processing and Agriculture, Sensor Requirements; Remote Sensing, Biosensors in agriculture, Standards for food quality.

Soil science and sensors; pH conductivity, resistivity, temperature ,soil moisture and salinity, ion concentration, measurements, methods of soil analysis.

- Instrumentation for environmental conditioning of seed germination and growth.
- UNIT II Flow Diagram of Sugar Plant. Sensors and Instrumentation set-up for it.
- Flow Diagram of Fermenter and Control (Batch process).
- Oil Extraction Plant and Instrumentation Set-up.
- Pesticides Manufacturing Process and Control.
- Flow Diagram of Dairy and Confectionery industry and Instrumentation set-up, Juice Extraction control set-up.
- UNIT III Application of SCADA for Dam parameters and control.
- Water Distribution and Management Control, Auto-drip Irrigation Systems. Irrigation Canal Management, upstream and downstream control concept, Supervisory control.
- UNIT IV Green Houses and Instrumentation; Ventilation Cooling and Heating, Wind speed, temp. And humidity, rain gauge, carbon and dioxide enrichment measurement and control.
- UNIT V Automation in Earth Moving Equipment and Farm Implements, Pneumatic, Hydraulic and Electronic Control Circuits in Harvesters, cotton pickers, tractors etc.
- Application of SCADA and PLC in packaging industry.
- UNIT VI Leaf Area, length, Evapotranspiration, Temperature, wetness and respiration measurements and data logging. Electromagnetic, radiation, photosynthesis, infrared and UV, Biosensors methods in agriculture.
- Agrometeorological Instrumentation Weather Stations.

TEXT BOOKS

- 1) Industrial Instrumentation – Patranabis, TMH.
- 2) Instrumentation Handbook – Process Control by B.G.Liptak
- 3) Process Control and Instrumentation Technology by C.D. Johnson.
- 4) Outline of Chemical Technology By M. Gopala Rao, Marshall Sittig (3/e)

8SI 5

PROJECT & SEMINAR

APPENDIX-C
FOUR YEAR B.E. DEGREE COURSE
SEMESTER PATTERN
SEMESTER : FIFTH
BRANCH : INSTRUMENTATION

L : Theory Lecture
T : Tutorial
P : Practical
D : Drawing / Design

ABBREVIATIONS :-
S - SEMESTER PATTERN
U - ELECTRONICS & TELE.
L - INDUSTRIAL ELECTRONICS
I - INSTRUMENTATION
E - ELECTRICAL

| Sr. No. | Sub. Code No. | SUBJECT | Teaching Scheme | | | Examination Scheme | | | | | | | | | |
|------------|---------------------|--|-----------------|---|-----|-------------------------|--------------------------|------------------|-------------------|-----------|-----------------------|------------------|----------|----------------|-----------------------------|
| | | | L | T | P/D | Theory | | | | Practical | | | | | |
| | | | | | | Total Hours/ Week | Duration of Papers | Maximum Marks | | Total | Min. Pass Marks | Maximum Marks | | Total Marks | Minimum Passing Marks |
| | | | | | | | | Theory (Hrs) | College Papers | | | External | Internal | | |
| 1. | 5SI1 | Microprocessor and Microcontrollers | 4 | 1 | 2 | 7 | 3 | 80 | 20 | 100 | 40 | 25 | 25 | 50 | 25 |
| 2. | 5SUI2 | Power Electronics | 4 | 1 | 2 | 7 | 3 | 80 | 20 | 100 | 40 | 25 | 25 | 50 | 25 |
| 3. | 5SI3 | Control System Components | 4 | 1 | 2 | 7 | 3 | 80 | 20 | 100 | 40 | 25 | 25 | 50 | 25 |
| 4. | 5SI4 | Material and Process | 4 | - | - | 4 | 3 | 80 | 20 | 100 | 40 | -- | -- | -- | -- |
| 5. | 5SULI5 | Control System Engineering | 4 | 1 | - | 5 | 3 | 80 | 20 | 100 | 40 | -- | -- | -- | -- |
| TOTAL | | | 20 | 4 | 6 | 30 | | | | 500 | | | | 150 | |

GRAND TOTAL : 650

SEMESTER : SIXTH
BRANCH : INSTRUMENTATION

| Sr. No. | Sub. Code No. | SUBJECT | Teaching Scheme | | | Examination Scheme | | | | | | | | | |
|------------|---------------------|-----------------------------|-----------------|---|-----|-------------------------|--------------------------|------------------|-------------------|-----------|-----------------------|---------------|----------|----------------|-----------------------------|
| | | | L | T | P/D | Theory | | | | Practical | | | | | |
| | | | | | | Total Hours/ Week | Duration of Papers | Maximum Marks | | Total | Min. Pass Marks | Max. Marks | | Total Marks | Minimum Passing Marks |
| | | | | | | | | Theory (Hrs) | College Papers | | | External | Internal | | |
| 1. | 6SI1 | Analytical Instrumentation | 4 | 1 | 2 | 7 | 3 | 80 | 20 | 100 | 40 | 25 | 25 | 50 | 25 |
| 2. | 6SI2 | Basic Industrial Management | 4 | - | - | 4 | 3 | 80 | 20 | 100 | 40 | — | — | — | — |
| 3. | 6SI3 | Pulse & Digital Circuits | 4 | 1 | - | 5 | 3 | 80 | 20 | 100 | 40 | — | — | — | — |
| 4. | 6SI4 | Electronic Instrumentation | 4 | 1 | 2 | 7 | 3 | 80 | 20 | 100 | 40 | 25 | 25 | 50 | 25 |
| 5. | 6SULI5 | Linear Integrated Circuits | 4 | 1 | 2 | 7 | 3 | 80 | 20 | 100 | 40 | 25 | 25 | 50 | 25 |
| 6. | 6SULIMTX6 | Communication Skills | 2 | 1 | - | 3 | 2 | 40 | 10 | 50 | 20 | 15 | 10 | 25 | 12 |
| TOTAL | | | 22 | 5 | 6 | 33 | | | | 550 | | | | 175 | |

GRAND TOTAL : 725

APPENDIX-D
FOUR YEAR B.E. DEGREE COURSE
SEMESTER PATTERN
SEMESTER : SEVENTH
BRANCH : INSTRUMENTATION

L : Theory Lecture
T : Tutorial
P : Practical
D : Drawing / Design

ABBREVIATIONS :-
S - SEMESTER PATTERN
U - ELECTRONICS & TELE.
L - INDUSTRIAL ELECTRONICS
I - INSTRUMENTATION
E - ELECTRICAL

| Sr. No. | Sub. Code | SUBJECT | Teaching Scheme | | | Examination Scheme | | | | | | | | | |
|---------|-----------|--------------------------|-----------------|---|-----|--------------------|--------------------|---------------|----------------|-----------|-----------------|---------------|----------|----------|-------------|
| | | | L | T | P/D | Theory | | | | Practical | | | | | |
| | | | | | | Total Hours/Week | Duration of Papers | Maximum Marks | College Papers | Total | Min. Pass Marks | Maximum Marks | External | Internal | Total Marks |
| 1. | 7SI1 | Unit Operation | 4 | - | - | 4 | 3 | 80 | 20 | 100 | 40 | -- | -- | -- | -- |
| 2. | 7SI2 | Process Equipment Design | 4 | 1 | 2 | 7 | 3 | 80 | 20 | 100 | 40 | 25 | 25 | 50 | 25 |
| 3. | 7SI3 | Opto Electronics | 4 | - | 2 | 6 | 3 | 80 | 20 | 100 | 40 | 25 | 25 | 50 | 25 |
| 4. | 7SI4 | Process Instrumentation | 4 | 1 | 2 | 7 | 3 | 80 | 20 | 100 | 40 | 25 | 25 | 50 | 25 |
| 5. | 7SI5 | Elective-I | 4 | - | - | 4 | 3 | 80 | 20 | 100 | 40 | -- | -- | -- | -- |
| 6. | 8SI5 | Project & Seminar | - | - | 2 | 2 | -- | --- | --- | ---- | --- | -- | -- | -- | -- |
| TOTAL | | | 20 | 2 | 8 | 30 | | | | 500 | | | | 150 | |

GRAND TOTAL : 650

Elective- I : 1) Biomedical Instrumentation 2) Robotics & Automotion
3) Digital Signal Processing

SEMESTER : EIGHTH
BRANCH : INSTRUMENTATION

| Sr. No. | Sub. Code | SUBJECT | Teaching Scheme | | | Examination Scheme | | | | | | | | | |
|---------|-----------|------------------------------------|-----------------|---|-----|--------------------|--------------------|---------------|----------------|-----------|-----------------|------------|----------|----------|-------------|
| | | | L | T | P/D | Theory | | | | Practical | | | | | |
| | | | | | | Total Hours/Week | Duration of Papers | Maximum Marks | College Papers | Total | Min. Pass Marks | Max. Marks | External | Internal | Total Marks |
| 1. | 8SI1 | Instrument & System Design | 4 | 1 | - | 5 | 3 | 80 | 20 | 100 | 40 | -- | -- | -- | -- |
| 2. | 8SI2 | Process Modelling and Optimization | 4 | 1 | 2 | 7 | 3 | 80 | 20 | 100 | 40 | 25 | 25 | 50 | 25 |
| 3. | 8SI3 | Project Planning | 4 | - | 2 | 6 | 3 | 80 | 20 | 100 | 40 | 25 | 25 | 50 | 25 |
| 4. | 8SI4 | Elective-II | 4 | - | 2 | 6 | 3 | 80 | 20 | 100 | 40 | 25 | 25 | 50 | 25 |
| 5. | 8SI5 | *Project & Seminar | - | - | 6 | 6 | -- | --- | --- | ---- | --- | 75 | 75 | 150 | 75 |
| TOTAL | | | 16 | 2 | 12 | 30 | | | | 400 | | | | 300 | |

GRAND TOTAL : 700

Elective-II : 1) Fuzzy Logic & Neural Network 2) Biomedical Instrumentation-II 3) Computer Graphics
* 8SI5
1. College Assessment
a) Project 50}
b) Seminar 25} 75} 150
2. University Oral Exam. 75}

Examination in Environmental Studies leading to Bachelor Degree, Ordinance, 2005

Whereas it is expedient to frame an Ordinance relating to Examination in Environmental Studies leading to Bachelor Degree level, hereinafter appearing, the Management Council is hereby pleased to make the following Ordinance.

1. This Ordinance may be called "Examination in Environmental Studies leading to Bachelor Degree, Ordinance, 2005."
2. This Ordinance shall come into force from the Academic session 2005-06.
3. In this Ordinance and in other ordinances relating to the examination, unless there is anything repugnant in the subject or context :-
 - (i) "Academic session" means a session commencing on such date and ending with such date of the year following as may be appointed by the Management Council.
 - (ii) "Admission to an examination" means the issuance of an admission card to a candidate in token of his having complied with all the conditions laid down in the relevant ordinance, by a competent officer of the University.
 - (iii) "Applicant" means a person who has submitted an application to the University in the form prescribed for admission to an examination.
 - (iv) "Candidate" means a person who has been admitted to an examination by the University.
 - (v) "Regular Candidate" means an applicant who has applied for admission to a University examination through an affiliated college, Department or Institute in which he/she has prosecuting a regular course of study.
 - (vi) "Examinee" means a person who present himself/herself for an examination to which he/she has been admitted.
 - (vii) "Examination" means an examination prescribed by the University under the relevant Ordinance.
 - (viii) "External Candidate" means a candidate who is allowed to take a University examination in accordance with the provision of Original Ordinance No. 151.

- (ix) "Non-Collegiate Candidate" means a candidate who is not a collegiate candidate.
 - (x) An "Ex-student" is a person who having once been admitted to an examination of this University, is again required to take the same examination by reason of his failure or absence thereat and shall include a student who may have joined a college, Department or Institute again in the same class.
 - (xi) "Bachelor Degree Examination" means a examination leading to Bachelor Degree of the University.
 - (xii) "Previous Year" means a year following by final year of Bachelor Degree.
4. Save as otherwise specifically provided, the conditions prescribed for admission to the examination under this Ordinance shall apply to all persons who wish to take the examination to the Degrees of the University mentioned in para 5 below.
 5. The conditions prescribed for admission to examination under this Ordinance shall apply to following degrees of the University :-
 - 1) Bachelor of Arts
 - 2) Bachelor of Performing Arts
 - 3) Bachelor of Fine Arts
 - 4) Bachelor of Mass Communication
 - 5) Bachelor of Social Work
 - 6) Bachelor of Commerce
 - 7) Bachelor of Business Administration
 - 8) Bachelor of Science
 - 9) Bachelor of Computer Science
 - 10) Bachelor of Computer Applications
 - 11) Bachelor of Pharmacy
 - 12) Bachelor of Science (Home Science)
 - 13) Bachelor of Technology (Cosmetics)
 - 14) Bachelor of Engineering
 - 15) Bachelor of Engineering (Part Time) (Civil)
 - 16) Bachelor of Textile
 - 17) Bachelor of Technology (Chemical Technology)
 - 18) Bachelor of Technology (Chemical Engg.)
 - 19) Bachelor of Architecture, and
 - 20) Bachelor of Laws (Five Year Course)
 6. i) Environmental Studies shall be a compulsory subject for a previous year examination of the following Bachelor Degrees of the University,
 - 1) Bachelor of Arts

- 2) Bachelor of Performing Arts
 - 3) Bachelor of Fine Arts
 - 4) Bachelor of Mass Communication
 - 5) Bachelor of Social Work
 - 6) Bachelor of Commerce
 - 7) Bachelor of Business Administration
 - 8) Bachelor of Science
 - 9) Bachelor of Computer Science
 - 10) Bachelor of Computer Applications
 - 11) Bachelor of Pharmacy
 - 12) Bachelor of Science (Home Science)
 - 13) Bachelor of Technology (Cosmetics)
 - 14) Bachelor of Engineering (Part Time) (Civil)
- ii) Environmental Studies shall be a compulsory subject for IIIrd & IVth Semester of the following Bachelor Degrees of the University,
- 1) Bachelor of Engineering
 - 2) Bachelor of Textile
 - 3) Bachelor of Technology (Chemical Technology)
 - 4) Bachelor of Technology (Chemical Engineering)
 - 5) Bachelor of Architecture, and
- iii) Environmental Studies shall be a compulsory subject for Vth & VIth Semester of the Degree of Bachelor of Laws (Five Year Course)
- iv) Students admitted to Second Year/Third Year/IVth Semester/ VIth Semester of various degree examination courses in different Faculties in the academic session 2005-06 or thereafter shall have to appear for examination in the subject Environmental Studies.
7. The main examination leading to Environmental Studies shall be held in Summer and supplementary examination in Winter every year, at such places and on such dates as may be appointed by Board of Examinations.
Explanation:- Examination shall be conducted on the basis of one common question paper for all Bachelor Degree Examination courses irrespective of annual or semester pattern.
8. Scope of the subject for annual pattern examination and or semester pattern examination shall be as provided under the syllabus.
9. Common question paper for all courses covered under this Ordinance alongwith answer books shall be supplied by the University to the Colleges, Departments and Institutes for conducting the examination of the subject.

10. Valuation of the answer books relating to this subject shall be done at College/Department/Institution level only. Remuneration for valuation of answer books shall not be paid by the University.
Provided that prescribed evaluation fee for evaluation of each answer book/s of an external examinee/s appeared from the examination centre shall be paid to each examination centre.
11. It shall be obligatory on the part of the College/Department/Institute to submit candidate wise following information to the University on or before the date as may be prescribed by the University :-

| Sr. No. | Grade/Category | Marks secured |
|---------|----------------|----------------|
| 1. | “A” | - 60 and above |
| 2. | “B” | - 45 to 59 |
| 3. | “C” | - 35 to 44 |
| 4. | “D” | - 25 to 34 |
| 5. | “Fail” | - 24 and below |
| 6. | “Absent” | |

12. For the purposes of teaching, learning and examination, the Committee consisting of three teachers shall be appointed by the Principal/ Head of the Department/Head of the Institution under his/her Chairmanship/ Chairpersonship. While appointing three teachers on the said committee, the Principal shall take care that the teachers to be appointed on the committee, if necessary, shall be from different faculty.
13. i) Duration of theory examination of this subject shall be three hour.
ii) For all Bachelor Degree examinations, common question paper of 100 marks shall be provided by the University.
iii) Distribution of these 100 marks shall be as follows :-
- | | | |
|---|---|----------|
| a) Part-A, Short Answer Pattern | - | 25 Marks |
| b) Part-B, Essay type with inbuilt choice | - | 50 Marks |
| c) Part-C, Essay on Field Work | - | 25 Marks |
14. Medium of instruction shall be English or Marathi or Hindi. Question paper shall be supplied in English and Marathi and Hindi. A candidate shall have option to write answers in English or Marathi or Hindi.
15. Examination for the subject Environmental Studies shall be compulsory for external candidates appearing as a fresh candidate at Winter and/or summer examination.

16. For teaching of the subject, there shall be atleast two hour per week.
For teaching the subject to the regular candidates, a full time approved teacher of the University and or a person having Postgraduate Degree in any faculty with second class shall be considered elligible.
17. For teaching of the subject, additional fee to be charged to regular candidate shall be as prescribed by the University.
18. Every College/ University Teaching Department shall charge additional fee of Rs. 100/- to every Student of the subject Environmental studies.
Out of this Rs. 100/-, the College/University Teaching Department shall have to pay Rs. 25/- to the University as an examination fee of each candidate for the subject environmental studies.
19. The Grade secured by an examinee in the examination of this subject shall not be considered for providing the facility of A.T.K.T. in next higher class.
20. The provisions of Ordinance No. 18/2001 shall not be applicable for securing a grade or higher grade in the examination of this subject.
21. Result of the Final Year of the respective Degree shall not be declared of an examinee unless he/she secures any one of the grade in the examination of subject.

Provided an examinee admitted to Five Year LL.B. course desiring not to continue his/her education beyond Sixth Semester of the said course shall have to secure any one of the grade in the examination of the subject otherwise his/her result of Sixth Semester for awarding B.A. degree shall not be declared.

22. Certificate shall be issued, to the successful examinees in the subject Environmental Studies, after the examination.
