

VEER NARMAD SOUTH GUJARAT UNIVERSITY, SURAT

**FACULTY OF TECHNOLOGY INCLUDING
ENGINEERING
BOARD OF STUDIES IN INSTRUMENTATION &
CONTROL ENGINEERING**

Proposed Teaching and Examination Scheme and Detailed Syllabus

for

B.E.III (INSTRUMENTATION AND CONTROL ENGINEERING)

1999

Scheme For Teaching and Examination

VEER NARMAD SOUTH GUJARAT UNIVERSITY, SURAT

B.E.-III (Instrumentation & Control)

Semester- V

<u>Course</u>	<u>Course No</u>	<u>Teaching Scheme</u>			<u>Examination Scheme</u>						
		L	T	P	Theory Exam University Exam	Pract/Quiz/Viva/T.W. etc.					
							Hrs	Pract	Int	Tuto	Total
Economics & Business Management	HU 501 EC/ IC	3	0	0	3	100	0	0	0	0	0
Control System Components	IC 502 IC	3	1	2	3	100	3	30	20	25	75
Instrumentation systems	IC 503 IC	3	0	2	3	100	3	30	20	0	50
Microprocessors programming & interfacing.	EC 504 EC/IC	3	0	2	3	100	3	30	20	0	50
Power Electronics	IC 505 IC	3	1	2	3	100	3	30	20	25	75
Linear Integrated Circuits	IC 506 IC	3	0	2	3	100	3	30	20	0	50
		18	2	10		600		150	100	50	300
	(Total)	30						Grand	Total		900

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B.E.-III (Instrumentation & Control)

Semester- V

ECONOMICS & BUSINESS MANAGEMENT : HU 501 EC/IC

	Lecture	Tutorial	Practical
Teaching Hours	3	0	0
Examination Scheme	100	0	Cont. Evaluation 0
Marks			Examination 0

1	<p>OPERATIONS RESEARCH:</p> <ol style="list-style-type: none">1. Introduction: Evolution of OR, team approach, quantitative approach, application.2. Linear Programming: Basic concepts, formulation of models, limitations of LP, LP Methods, Graphical & Simple Method, Degeneracy, multiple optimal solution, unbounded problem, infeasible problem, Transportation problem and transportation models, Assignment problem & assignment method.3. Decision Theory: Decision making under different situation (certainty, uncertainty, under risk), Decision tree model.4. Queuing System: Queuing problem, assumptions, *M/M/1 Model.5. Simulation: Analytical and simulation models, Monte Carlo simulation model and Computer simulation. <p>(* denotes Poisson arrival, Poisson departure, single server, infinite capacity and FIFO service discipline).</p>
2	<p>BUSINESS MANAGEMENT:</p> <ol style="list-style-type: none">1. Introduction: Engineering Management and Organization, Evolution process.2. Business Organization: Types, individual, proprietorship, partnership, joint stock company, Cooperative and State owned organization.3. Management: Definitions, concepts and principles, Management process, Functional (Production, Finance, Marketing, and Personnel) Management, Coordination and its importance.4. Trade Unions and Industrial Relations: Collective bargaining, industrial dispute act and social security measures in India

References:

1. K. V. RAO: Management Science, McGraw Hill Co., New Delhi,Ed.(1990).
2. O. P. KHANNA: Industrial Engg. & Management, Dhanpatrai & Sons, New Delhi,Ed. (1990).
3. R. D. AGRAWAL: Organization & Management, Tata McGraw Hill, New Delhi,Ed. (1993).
4. S. D. SHARMA: Operations Research, Kedarnath Ramnath & Co., Meerut,Ed.(1992).

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CONTROL SYSTEM COMPONENTS: IC 502 IC

	Lecture	Tutorial	Practical
Teaching Hours	3	1	2
Examination Scheme Marks	100	25	Cont. Evaluation 20 Examination 30

1	<p>MECHANICAL COMPONENTS FOR POSITION SERVO CONTROL :</p> <ul style="list-style-type: none">-Cams and followers: Types of cams , types of follower and application,-Gears and gear train :construction and comparison of different types of gears : Spur,bevel,helical,rack and pinion worm gear and hearing born gear. Optimization of gear ratio in gear and backlash,gear train.- Gyroscope : construction,operation, types of gyros and it's applications.
2	<p>ELECTRICAL COMPONENTS FOR CONTROL:</p> <ul style="list-style-type: none">-Relay: A/C, DC electro- mechanical, Solid-state etc. and Its construction and operation with characteristic.-Stepper motor : construction, types of motors,design of driver ckt., designing with logic input and applications.- Potential Meters : types : single turn, multi turn wire wound, slide wire etc. functioning of pots. , Application for different modes (Angle transmission, non linear func. generators etc),Balancing, char.,accuracy and resolution- Synchros: Introduction theory of synchros operation, Construction, Transmitter & Receiver system configuration, errors residual Voltage & phase shift, Zeroing effect and Applications.-Tachogenerator: - Mechanical tachometer : types , centrifugal force, resonance tacho., electrical tachometer : eddy current type resonant tacho, electrical generator type, contact less, frequency type, ignition type, stroboscopic type and magnetic pick up type tacho and it's Application .
3	<p>SIGNAL CONVERTING ELEMENTS :</p> <ul style="list-style-type: none">-Amplidyne : principle of operation, construction, T. F. of amplidyne, steady state and transient char., Applications.Magnetic Amplifier : Introduction series connection, magnetic amplifier, time constant, O/p char.,reactor connected in parallel,. gain (power), feedback effect, etc and applications.
4	<p>PNEUMATIC & HYDRAULIC BASED COMPONENTS:</p> <ul style="list-style-type: none">-Air based flapper nozzle construction and Pneumatic relay.-hydraulic Based : Pump based Hydraulic system, (vane pump, ball pump & spool, pitot valve type hydraulic system).
5	<p>BRIEF INTRODUCTION ABOUT CNC MACHINE: Operations & Applications</p>

Tutorials/ practical will be based on theory.

References:

- (1) PANDYA & SHAH: Theory of machine Vol. I ,Charotar Publications, E(1990).
- (2) B. KOREN & BENURI : Numerical control of machine tools, Khanna Publishers, E(1998).
- (3) B GIBSON AND TUTOR: Control system components,Tata McGraw hill Publication,
- (4) B. CHATERJEE : Control System Components, Khanna Publishers,E(1998).
- (5) D. S. KUMAR : Mechanical Measurements and Controls, Metropolitan Book Co.,New Delhi, Ed(1994).
- (6) ATHANI V. V. : Stepper Motor Principle and Application,New Age International, Ed(1997).

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Semester- V

INSTRUMENTATION SYSTEMS : IC 503 IC

	Lecture	Tutorial	Practical
Teaching Hours	3	0	2
Examination Scheme Marks	100	0	Cont. Evaluation 20 Examination 30

1	BASICS OF INSTRUMENTATION : -Introduction . -Instrument Symbols and identification, -P & I diagram,loop wiring diagram, special drawings. -Organization of instrumentation dept.
2	CONTROL ROOM AND CONTROL PANELS: -Control room layout and power design, -Types of panels and It's proper application, -Piping tubing tapping and wiring of panel.
3	INSTRUMENT AIR SYSTEMS : -Air Supply system : Design, and sizing criateria,compressor systems and Its types, -Dryers -Distribution system.
4	INDICATOR RECORDERS AND ANNUNCIATORS : -Indicators :Types of Indicators for various applications, -Recorders : Types of recorders and It's merits and demerits, -Annunciators : Function ,sequences displays , types, -Microprocessor for recording, announcing and indicating purpose.
5	SAFETY AND PROTECTIVE DEVICES IN INSTRUMENTATION: -Hazardous area and Classification, -Intrinsic safety, -Pressure, temperature,level and flow switches.
6	UN INTERRUPTED POWER SUPPLY: -ON line and OFF line UPS.
7	GROUNDING: Different types of grounding methods.

Practicals will be based on theory.

References:

- (1) D. P. ECKMAN : Industrial Instrumentation,Wiley Eastern Publication,E(1991).
- (2) ANDREWS: Applied instrumentation in process industry Vol. II,III ,Gulf Book Co.,P(1994).
- (3) LIPTAK : Process instrumentation hand book ,Chilton Book Co.,Pensilvenia,P(1994).
- (4) C.D. JOHNSON: Process control instrumentation, PH,USA, Vth Ed. (1996).
- (5) R. K. JAIN.: Industrial measurements, Khanna Publishers,Ed(1998).

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Semester- V

MICROPROCESSOR PROGRAMMING & INTERFACING : EC 504 EC/IC

	Lecture	Tutorial	Practical
Teaching Hours	3	0	2
Examination Scheme Marks	100	0	Cont. Evaluation : 20 Examination : 30

1	Microprocessor Architecture: Introduction, operation, memory, input/output and Interfacing Devices
2	Instructions and Timings: Instruction classification, timings and operation status, overview of 8085 instruction set.
3	Programming Methods and Techniques: Assembly language programming using different programming techniques like looping, counting and indexing, subroutines parameter passing, time delay programs.
4	Interrupts:8085 Interrupts, restart as software instruction, Additional I/O concepts
5	Parallel Input /Output and Interfacing Applications: Basic interfacing concepts, 8255 Programmable Peripheral Interface, Interfacing displays, keyboards, 8279 Programmable Keyboard/Display Interface, Interfacing memory, Memory, mapped I/O.
6	General Purpose Programmable Peripheral Devices: 8253 Programmable Timer 8257 DMA controller, 8259 Interrupt controller.

Practical work shall be based upon the theory course.

References:

1. GAONKAR R S: Microprocessor Architecture, Programming and Applications with 8085 , Wiley Eastern Limited, New Delhi, Ed(1998).
2. LEVENTHAL LANCE: Introduction to Microprocessor: Software, Hardware and Programming, PHI,Ed(1992).
3. MATHUR A. P.: Introduction to Microprocessor. Tata McGrawHill ,3/e, 1996
4. SHORT K. L.: Microprocessors and Programmed Logic, PHI, Ed(1992).

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POWER ELECTRONICS : IC 505 IC

	Lecture	Tutorial	Practical
Teaching Hours	3	1	2
Examination Scheme Marks	100	25	Cont. Evaluation 20 Examination 30

1	INTRODUCTION: History,scope and application of power electronics.
2	THYRISTORS : -Two transistor model of SCR.Turn on and turn off methods for SCR.,Series and parallel operation of SCR. -Thyristor families,SCR, Diac, Triac - construction, V-I characteristics, applications, -Requirement of gate triggering and various firing techniques. - Triac, GTO, diac, Sources of thyristor triggering. -Thyristor types like phase control type,fast switching type, GTO, LASCR,FET and MOS controlled thyristor. -di/dt and dv/dt protection.
3	POWER TRANSISTOR DEVICES: Basic structure and V-I characteristics of power MOSFET, IGBT, SIT, Switching characteristics, Gate/Base drive circuits, Safe operation area, di/dt dv/dt limitation, series/parallel operation, ratings.
4	RECTIFIERS AND CONVERTORS: Uncontrolled rectifier : Single phase central taped transformer connection, half wave and full wave bridge configuration, three phase half and full bridge converters, Concept of flywheeling diode, operation with resistive, inductive and back EMF load, - Controlled rectifiers : Single phase semi-dual- full converters, three phase half wave converter and semi converter,dual and full converter,Power factor improvement, operation of all converters with resistive, inductive and back EMF load, - effect of source inductance on converter performance, power factor, ripple factor calculation.
5	THYRISTOR COMMUTATION TECHNIQUES : - Natural commutation & Force commutation, - Voltage/Current commutation, - DC chopper, Principle of voltage control, analysis of morgan chopper circuit, Johns chopper circuit, regenerative chopper circuit.
6	POWER DEVICES PROTECTION: Protective measure, types of Snubber circuits and their functions, Snubber circuits for transistors and thyristors, thermal protection, design of heat sinks.

Practicals will be based on theory.

References:

1. N. MOHAN : Power Electronics : Converters, Applications and Design. Wiley Publication,Ed(1995).
2. M.H. RASHID: Power Electronics: Circuits, Devices and Applications. PHI, Ed(1994).
3. G.K. DUBEY: Thyristorized Power Controllers. Wiley Eastern, Ed(1990).
4. S. B. DOWAY: Power Semiconductors Circuits. John,WileyPublication,ED(1994).
5. P. C. SEN : Power Electonics,TMH Publication, 1/e, 11th reprint ,1997.
6. P. S. BIMBHRA : Power Electronics, Khanna Publishers, 2/e,1998.

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Semester- V

LINEAR INTEGRATED CIRCUITS : IC 506 IC

	Lecture	Tutorial	Practical
Teaching Hours	3	0	2
Examination Scheme Marks	100	0	Cont. Evaluation 20 Examination 30

1	BASIC OPERATIONAL AMPLIFIER - Differential OP Amplifier model on transistor based and Its characteristics,- IC Based different types of op- Amplifier - Characteristic & Specifications of op amp - Feed back configuration, Parameter Measurement, Frequency Response, effect of temp, i/p impedance, Other parameters etc, Gain (O/L & C/L), Offset nullifying etc
2	APPLICATIONS OF OP AMP : - Negative Feed back. Appn.: - As a Adder, Multiplier, Integrator, differentiator, Constant Voltage & Current Source. - Analog simulation for Solving different equations.- Positive feed back. Appn. : - Oscillators, Phase shift, Wein bridge, Hartlay,Colpitt, Crystal etc. - Multivibrators. - Half & Full Rectifier, - Non. linear Appn. - pick detector, - Schmitt trigger, - Comparator, - Sample & Hold Ckt. , - Basic concepts of ADC & DAC on op. amp. etc.
3	BASIC INTRODUCTION OF 555 : Timer IC with working, operation and its application as Multivibrator.
4	POWER REGULATOR IC: 78xx & 79xx Series and Ideas for DC low power Voltage regulators Ckt; negative and variable voltage regulators, too.
5	FILTERS : - Butter worth, Chebychev, Elliptic filters, - Design and evaluation of Second order filters (low pass, high pass, Band pass & Band reject) and Cascading of pt.

Practicals will be based on theory.

References:

- (1) JACOB MILLMAN & CHRISTOS C. HALKIAS: Integrated electronics: Analog & digital ckts & systems , Tata McGRAW - HILL Ed.(1991).
- (2) RAMAKANT GAYKWAD: Op-Amps and linear integrated circuits. Prentice Hall of India, IIIrd Ed. (1997).
- (3) MALVINO A.P :Electronic principles,TATA McGraw Hill pub.co. IIIrd Ed.(1995).
- (4) COUGHLIN & DRISCOLL : OP AMP & Linear Integrated ckts. PHI, 5th Ed.(1998).

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Semester- VI

Scheme For Teaching and Examination

B.E.-III (Instrumentation & Control) 6th Semester

<u>Course</u>	<u>Course No</u>	<u>Teaching Scheme</u>			<u>Examination Scheme</u>						
		L	T	P	Theory Exam University Exam		Pract/Quiz/Viva/T.W. etc. Hrs Pract Int Tuto Total				
Process Equipment Design	IC 601 IC	3	0	0	3	100	0	0	0	0	0
Measurement Techniques	IC 602 IC	3	1	2	3	100	3	30	20	25	75
Industrial Control System	IC 603 IC	3	0	2	3	100	3	30	20	0	50
Analog & Digital Communication	EC 604 EC/IC	3	1	2	3	100	3	30	20	25	75
Analytical Instrumentation	IC 605 IC	3	0	2	3	100	3	30	20	0	50
Microprocessors Systems & Applications	EC 606 EC/IC	3	0	2	3	100	3	30	20	0	50
		18	2	10		600		150	100	50	300
	(Total)	30						Grand	Total		900

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Semester- VI

PROCESS EQUIPMENT DESIGN : IC 601 IC

	Lecture	Tutorial	Practical
Teaching Hours	3	0	0
Examination Scheme Marks	100	0	Cont. Evaluation 00 Examination 00

1.	<p>DESIGN ENGG. CRITERIA:</p> <ul style="list-style-type: none">-Pneumatic v/s electronic systems : cost,safety,dependability,maintenance and process requirements.-Specification of Flow,Temp.,Pressure,level and analytical instruments.-Future and spare capacity.- Control centers, Transmission systems, process connections.- Miscellaneous design criteria : Mounting,selection of charts,unit ranges.
2.	<p>SELECTING MEASUREMENT METHODS :</p> <ul style="list-style-type: none">-Selection and specification standards for various flow ,temp.,level and pressure instruments.
3.	<p>CONTROL VALVE :</p> <ul style="list-style-type: none">-types, characteristics , rangeability Cv.-Actuators,-positioners.-accessories.
4.	<p>CONTROL VALVE SIZING :</p> <ul style="list-style-type: none">- Designing of control valves for gas, vapor, liquid etc.,-Effect and remedies cavitation, flashing condition, noise on control valve, pressure drop across a valve, Sequenced valve arrangement, Valve linearizer,- Testing procedure of control valve ,-Flow characteristics of linear & equal percentage,quick opening control valves on load changes,-High pressure & temp. service control valve, Installed ranges and viscosity correction for control valve.
5.	<p>SPC IN PROCESS INDUSTRIES: - Introduction of SPC (statistical Process Control), Graphic treatment for data collection, presentation and problem solving, - Descriptive measures, The normal distribution and its application, process capability, - Basics of control charting, Control charts for individual measurements averages and ranges, - Evaluation of control charts</p>

Tutorials will be based on theory.

References:

- (1) MERIT :Hydraulic control system ,Wiley Publication,reprint,Ed(1965).
- (2) CONSIDINE: Industrial Automation.(Process/Industrial Instrumentation &controls) Hand Book,Ahuja book company, Vth Ed.(1993).
- (3) HAW. D. BAUMANN: Control Valve Premier A Users' Guide,2/e,ISA Publication,1998.
- (4) PHILIP L. SKONSEN : Valve Handbook,Mc Graw Hill,Ed(1998).
- (5) HARRISON M. WADSWORTH : Handbook of Statistical Methods for engg. and scientists,McGraw Hill Publication, 2/e,1998.

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MEASUREMENT TECHNIQUES : IC 602 IC

	Lecture	Tutorial	Practical
Teaching Hours	3	1	2
Examination Scheme Marks	100	25	Cont. Evaluation 20 Examination 30

1	INTRODUCTION OF MEASUREMENTS : - Definition of Instrumentation. - Static char. : - Accuracy, precision, resolution, Sensitivity, Scale, threshold, Hysteresis, Drift, deadzone, repeatability, Linearity, etc. - Dynamic characteristics: Speed of Response, lag, errors, fidelity, Response of 1st & 2nd order system. - Types of errors etc., - Terminology and Specifications of instruments, - Measurement standards :- Time, frequency, Voltage, Current, 3-15 psi etc., ANSI, ASME, ADA, BS, DIN, CSMR, FCI, API, ISI, and introduction Reliability and safety.
2	Temperature measurements : Selection of device, installation, Calibration etc for followings : (1) Thermocouples. (2) Thermometers. (3) Temp . gages. (4) RTD and μ . wire Tech. (5) Thermisters. (6) Radiation type pyrometers and optical pyrometers etc.
3	Flow Measuring devices and it's installation, Calibration.: (1) Differential pressure types : - Principle, Types of Measuring devices like as Orifice, Venturi, Pitot tube etc. (2) Differential Area types: - Principle, - Types of Measuring devices like as Rotameter, open channel , close channel etc., Magnetic meter, Turbine meter, Ultrasonic, Vortex, Positive displacement type, Mass flow, Anemometer, flow totalizer etc. (3) Flow quantity meters : - Reciprocating meter, Tilt etc.,
4	Level Measuring Tech.: (1) for Liquids and Solids : Float type displace, Air purge method, Capacitor Diaphragm box level gauges, DP cell, Load cell, Bicolour direct reading, Vibrating, Ultrasonic Radio active traducers, Read switches etc. (2) Interacting and Non-interacting system for level.
5	Pressure measuring devices and it's installation, calibration etc. (1) Pressure sales and standard and it's conversion. (2) Devices : - Manometer (different types), - Burden type, - Bellows & Diaphragm, - Dead weight Testers,- Vacuum gages Testers, - Load cell, - Piezo-electrical, - Strain gauge types, - Force Balance, - Mc Lead gauges. - Thermal conductivity, - Re ionization type, - Sensors for high pressure, - Pressure switches etc.

Tutorials/practicals will be based on theory.

References:

- (1) DONALD P. ECKMAN :Automatic process control (Industrial instrumentation), Wiley Eastern ltd, Ed (1991)
- (2) LIPTAK : Instrument Engg. Handbook, Chilton Book Co. ,Pensilvenia,P(1994).
(3) RANGAN MANI SHARMA: Instrument Devices and Systems,TMH Publication,2/e,1997.
- (4) R.K.JAIN: Mech. and Ind. Instrumentation ,Khanna Publishers,10/e,1996.
- (5) DOEBELIN : Measurement systems : Application and design, TMH publication,4/e, 1990
- (6) W.G.ANDREWS: Applied Instrumentation in process industry Vol. I & II ,Gulf Book Co.,1994
- (7) J.P.HOLMAN: Experimental Methods for Engineers,TMH publicaition,6/e,1994.
- (8) B.E.JONES: Instrument Technology (Instrumentation feedback & measurement) TATA McGraw Hill,E (1997)
- (9) PATRANABIS: Principle of Industrial Instrumentation, TMH publication,2/e,1998.

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Semester- VI

INDUSTRIAL CONTROL SYSTEM : IC 603 IC

	Lecture	Tutorial	Practical
Teaching Hours	3	0	2
Examination Scheme Marks	100	0	Cont. Evaluation 20 Examination 30

1.	BOILER INSTRUMENTATION AND CONTROL : - Combustion Control, Three level drum Control Steam, Lamp and pressure control, Flow of steam to Control.
2.	TURBINE INSTRUMENTATION & CONTROL: - Speed Measurement of turbine shaft & Maintain constant to control, - Vibration, axial moment and other parameter Measurement.
3.	CONTROL OF HEAT EXCHANGERS : - Types of heat Exchangers, - Dynamics of steam, - Heat Exchanges, - Response of charge in temp. -Types of Control Scheme and tuning, - Calculation and reduction of process lag.
4.	DISTILLATION COLUMN CONTROL : - Basic features of composition, - Control scheme, - Control of overhead and bottom composition, - Distillation model equation, - process and control equation, - Temp. & Pressure Control, - Floating pressure Control, - Reflex Control.
5.	REACTOR CONTROLLING : - Controlling Scheme for different types of reactor, - Operations, Stability and Safety devices.
6.	DESECRATE STATE PROCESS CONTROL : - Architecture, Discrete input, output System, I/o Modular, - Analog & Digital I/O Modules, - intelligent, Communication and Designing I/O Modules. - Memory & Storage : Memory Map, - Hardware to Software and visevers an interface. - Programming Languages : * Development of ladder diagram from flow chart for complex System. * Advance Programming of PLC (Like as cascading timer, Counters, MCS-MCB shift Reg. sequential process, arithmetic functions) * PLC Simulator, * PLC to PC and pc through Control on process with graphical display.

References:

- (1) Applied Instrumentation in process Industries Volume: II : By Andrews.
- (2) Automatic Control for power and process : By Matifold.
- (3) Programmable Logic Controller : By J.D.Otter.
- (4) Process Control Instrumentation Technology : By C.D.Johson.
- (5) Applied Instrumentation : By Andrews, Gulf.
- (6) Programmable Controllers : By T.A.Hughes

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Semester- VI

ANALOG AND DIGITAL COMMUNICATION: EC 604 EC/IC

	Lecture	Tutorial	Practical
Teaching Hours	3	1	2
Examination Scheme Marks	100	25	Cont. Evaluation : 20 Examination : 30

1.	Spectral Analysis Parameters: Fourier Series, Power Spectral Density, Convolution, Correlation between waveforms, Auto and Cross correlation, Sampling Theorem.
2.	Analog Input Analog Output Schemes: Amplitude Modulation: Equation for AM, modulation index, spectrum of AM, DSB and SSB transmission with and without carriers, VSB transmission, DSB,C amplitude modulators, Envelope detectors, Balanced Modulator, SSB signal generation and Demodulation schemes.
3.	Frequency modulation: Equations for FM, modulation Index, spectrum calculation for sinusoidal waveform and Bessels function table, phase modulation, relationship between FM and PM, NBFM and WBFM, frequency modulators and demodulators (Armstrong method) Types of noise : Noise in AM and FM systems.
4.	Digital Input Analog Output Schemes: ASK, FSK,QAM, BPSK, QPSK, Transmitter and receiver block diagrams.
5.	Analog Input Digital Output Schemes: Various pulse modulation methods, Pulse code modulation PCM, Delta modulation DM. Comparison between PCM and DM, Compounding method, Noise In digital systems
6.	Digital Input Digital Output Schemes: Line encoding methods : NRZ, RZ, Manchester, and multilevel encoding methods and comparison of these schemes
7.	Source coding : Linear predictive coding, Huffman coding
8.	Multiplexing : FDM and TDM systems, examples and comparison

Practical work shall be based upon the theory course.

References :

1. B.P.LATHI: Modern digital and analog communication systems. Holt,Sounders (HRW Series) Publication. 1998.
2. DENNIS RODDY AND JOHN COOLEN : Electronic communications. Fourth Edition,PHI 1995
3. TAUB AND SCHILLING : Principles of communication. Systems. Mc Graw Hill Publication, 1992.
4. P. CHAKRABARTY : Analog Communication Systems, Dhanpatray and Sons Publication, 1/e,1998.

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Semester- VI

ANALYTICAL INSTRUMENTATION : IC 605 IC

	Lecture	Tutorial	Practical
Teaching Hours	3	0	2
Examination Scheme Marks	100	0	Cont. Evaluation 20 Examination 30

1	<p>U.V. AND VIS ABSORPTION METHODS :</p> <ul style="list-style-type: none">- Law of photometry (Beer and Lambert's), - U.V. & VIS absorption instruments components, - Monochromator design and associated equipment, Monochromator performance. <p>U.V. and VIS instruments : Color meters, Single & Double beam Spectra meters, Dual wavelength and double monochromator Systems, IR Spectro photo meters, Fourier transformation.</p>
2	<p>MASS SPECTROMETRY : - Basic mass Spectrometer components,</p> <ul style="list-style-type: none">-Types of meters : Magnetic deflection type, time of flight, radio frequency, double focusing, Quadruple type - Gas Chromatography. mass spectra meter - GCMS System, resolution of Mass Spectra meters and Its applications.
3	<p>RADIO CHEMICAL INSTRUMENTS : - Radio chemical Methods,</p> <ul style="list-style-type: none">- Radiation detectors - Ionization chamber, - Geiger Mueller Counter,- Proportional Counter, - Scintillation Counter, - Semiconductor detector,- Pulse height analyzer.
4	<p>GAS AND LIQUID CHROMATOGRAPHY : - Classification, basic parts of gas chromatography-carrier gas, Sample injection System, chromatographic Column, - Thermal compartment, temp. programming, dual Column System, - Detector-thermal Conductivity, Flame ionization,</p> <ul style="list-style-type: none">- electron Capture : Argon ionization detector etc.,- Other methods of gas analysis : <p>(1) Oxygen Analyzer. (2) Carbon monoxide Analyzer. (3) Carbon dioxide Analyzer. (4) Nitrogen. (5) Gas density Analyzer. (6) Smoke detector etc.</p>
5	<p>OPTO-ELECTRONIC DEVICES :</p> <p>(1) Characterization and application of LED, photo-diode, photo-transistor, LDR, thermistor Bar graph display, Opto isolator and photo coupler with it's different types.</p> <p>(2) Types of LCD, dynamic, Scattering, Principle and Characteristics.</p> <ul style="list-style-type: none">- Ultrasonic generation and Applications, - Light Spectrums and it's Analysis.
6	<p>MISCELLANEOUS MEASUREMENTS :</p> <ul style="list-style-type: none">- pH measurement,- Conductivity measurement-Humidity and moisture measurement-Flume detector, Lock detector flame detector, Smoke detector etc.- Density Measurements-Dissolve oxygen measurement.

Practicals will be based on theory.

References:

- (1) R.S.KHANDPUR: Hand book of Analytical Instrumentation ,Tata McGraw Hill,p(1996).
- (2) DONALD P.ECKMAN :Instrumentation,Wiley eastern India,Ed(1991).
- (3) MOTTERSHEAD ALLEN : Electronic Devices & Circuits: An introduction, PHI, New Delhi,19th Ed.(1997).
- (4) LIPTAK : Analytical Instrumentation, Chilton Book Co.,Pensilveniya,P(1996)

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Semester- VI

MICROPROCESSOR SYSTEMS AND APPLICATIONS: EC 606 EC/IC B. E. III (IC) 6th Semester.

	Lecture	Tutorial	Practical
Teaching Hours	3	0	2
Examination Scheme Marks	100	0	Cont. Evaluation : 20 Examination : 30

1.	Introduction to 16 bit Microprocessor: 8086/8088 Architecture, Machine language instructions, Internal execution and timing
2.	8086/8088 Family Assembly Language Programming: Data transfer instructions, Arithmetic instructions, Logical, shift and rotate instructions, Branch instructions, Loop instructions, NOP,HLT and flag manipulation instructions, Assembler directives.
3.	8086 System Connections And Timings: 8086 Hardware overview, Basic signal flow on 8086 buses, Analyzing a minimum mode system, 8086 addressing and address decoding, 8086 timing parameters.
4.	Interrupts And Interrupt Service Procedures: 8086 interrupts and interrupt responses, 8086 Interrupt types, Hardware and software considerations for using interrupts.
5.	I/O Programming: Fundamental I/O considerations, Programmed and Interrupt I/O, Block transfers and DMA, I/O design example.
6.	Interfacing: Programmable parallel ports and handshake input/output, Interfacing microprocessors to keyboard and displays, D/A converter operation, Interfacing and applications, A/D converter types, Specifications and interfacing, Serial communication interfaces.
7.	Introduction to Microcontrollers: Basics of 8031 and 8051 architecture and programming, introduction to 16 bit micro controllers
8.	Applications: Temperature , Pressure, Level & Traffic Control.

Practical work shall be based upon the theory course.

Reference:

1. HALL DOUGLAS V: Microprocessors and Interfacing, Programming and Hardware (Tata McGraw Hill Publishing Company Limited 1991)
2. GIBSON GLENN A. and Liu Yu Cheng: Microcomputer Systems: The 8086/8088 Family, Architecture, Programming and Design (Prentice Hall of India Private Limited, New Delhi, Second Edition,1994)
3. MCS 86 User's Manual (Santa Clara, Calif.: Intel Corporation,1993)
4. MORSE, STEPHEN P. :The 8086 Premier: An Introduction to It's Architecture, System Design and Programming (Rochelle Park,N.J.: Hayden Book Company, Inc., 1989)
5. TRIEBEL AND SINGH:The 8088 and 8086 Microprocessor Programming, Interfacing, Software, Hardware and Applications, PHI, 1991

TITLES GIVEN IN BRACES REPRESENT SIMILAR BOOKS BY THE SAME AUTHOR.