VEER NARMAD SOUTH GUJARAT UNIVERSITY

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

Proposed Teaching and Examination Scheme and Detailed Syllabus

for

B.E.IV (INSTRUMENTATION AND CONTROL ENGINEERING)

VEER NARMAD SOUTH GUJARAT UNIVERSITY

B.E. IV (Instrumentation & Control)

Semester - VIII

LIST OF ELECTIVES

Sr. No.	Name of the Subject	Code
	GROUP - I (IC 81X IC)	
1.1	Biomedical Instrumentation	IC 811 IC
1.2	Flight Instrumentation	IC 812 IC
1.3	Parallel Processing & Real Time Operating System	IC 813 IC
1.4	Computer Architecture & PCL card Interfacing	IC 814 IC
	GROUP - II (IC 82X IC)	
2.1	Robotics Engineering	IC 821 IC
2.2	Plant Automation	IC 822 IC
2.3	Process System Analysis	IC 823 IC
2.4	Fuzzy Logic Control & Neural Network	IC 824 IC

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Semester - VIII

Scheme For Teaching and Examination
B.E.-IV (Instrumentation & Control) 8th Semester

B.E.IV (Inst. & Control) - 8th Semester		Teaching Scheme			Examination Scheme						
		L Hrs.	T Hrs.	P Hrs.	Theory Exam		Practical/Quiz/Viva/T.W. etc.				
					University Exam.		University Exam.		Tutorial	Cont. Evalua-tion	Total Marks
Course	Course No.				Dura-tion Hrs.	Marks	Duration Hrs.	Marks			
Modern Digital Control System	IC 801 IC	3	1	0	3	100	0	0	25	0	25
Instrumentation Systems & Interfacing	IC 802 IC	3	1	2	3	100	3	30	25	20	75
Projectplanning estimation & Quality Systems	IC 803 IC	3	0	2	3	100	3	30	0	20	50
Elective - I	IC 81X IC	3	0	0	3	100	3	0	0	0	0
Elective - II	IC 82X IC	3	0	0	3	100	3	0	0	0	0
Project	IC 806 IC	0	0	8	0	0	0	120	0	80	200
Seminar	IC 807 IC	0	2	0	0	0	0	30	0	20	50
	TOTAL	15	4	12		500		210	50	140	400
Total Contact Hours : 31											Total Marks : 900

Note : 1. Students have to opt one subject each from Group-I and Group-II .
2. Seminar is not to be considered as a passing head and evaluation is to be done by the Department.

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MODERN DIGITAL CONTROL SYSTEM : IC 801 IC

	Lecture	Tutorial	Practical
Teaching Hours	3	1	0
Examination Scheme Marks	100	25	Cont. Evaluation : 00 Examination : 00

1	INTRODUCTION OF LINEAR CONTROL SYSTEM:- -Type of control systems , -Servomechanism, -Development of automatic control system, -Sampled & Digital control system, -Multivariable system & It's application.
2	NON-LINEAR SYSTEM: -Types of nonlinearity, -Characteristic, -Piecewise linearisation,-Describing function for nonlinear system & It's application for different systems.
4	SAMPLE DATA SYSTEM: -Principle, -Signal reconstruction, -Pulse transfer function, -Transient response of System (1^{st} & 2^{nd}) for Various Inputs, -Z - Transformation (zee transform) and Its advantages over Laplace transform, -Inverse Z transformation, -Modified Z transform, -Mapping from S plane to Z plane, -Stability criteria in Z transform, -Design of W plane, -Brief Ideas of Designing of PID Controller.
5	STABILITY ANALYSIS FOR NON-LINEAR SYSTEM: -Equilibrium state stability, -Stability approach by Describing function, -Limit Cycle, -Construction of Phase Trajectory, -Analysis by Phase Plane method, -Isocline method, -Delta & Pell's methods, -Liapunov Stability Concepts,
6	- DIGITAL SIGNAL PROCESSING & IT APPLICATION : -DSP processor architectural features, Hardward and modified hardward architecture, Computational units , memory interfacing and brief about ADSP 21 XX Processor. - DSP Application : Digital PID, Adaptive and fuzzy Controller .

References:

(1) Control System Engg. By J.Nagrath & M. Gopal - - New age International, II nd Edition 1997.
(2) Automatic Control System By B.C. Kuo , New Delhi / Prentic hall of india ltd., VII th Editiion 1995.
(3) Modern control Engg. By M. Gopal, New Delhi / New Age International Ltd., IInd Editiion @1996..
(4) Digital & Sample Data Control System By J. T. TON
(5) Digital Control System BY Houpis & Lamont
(6) Theory and application of digital signal processing : by Lawrence R. Rabiner and Bernold Gold , Prentice Hall-1975.
(7) Introduction to digital signal processing : by R. Kuo - McGraw Hill International edi,1988.

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INSTRUMENTATION SYSTEMS AND INTERFACING : IC 802 IC

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

1.	LANGUAGE OF ELECTRICAL MEASUREMENTS: Charge, voltage and current, Electrical units- sinewaves, frequency and phase, Average and RMS values-Language of Digital Measuring systems.
2.	ELECTRICAL LABORATORY PRACTICE: Safety, Grounds, Circuit protection devices- cables, connectors, switches and relays, Input impedance and loading, power transfer and impedance matching.
3.	INTERFERENCE SIGNALS & THEIR ELIMINATION OR REDUCTION: Capacitive interference, Inductive interference and shielding, Electromagnetic interference and shielding, Conductively coupled interference, Group-loop (common mode) interference, Input guarding to reduce around loop interference, Internal noise.
4.	INTERFACING OF ANALOG TO ANALOG INSTRUMENTS, ANALOG TO DIGITAL INSTRUMENTS: Analog systems, Miscellaneous aspects of Analog Signal conditioning, Analog signal transmission, Analog to Digital systems, Sample and hold circuits, Multiplexers, Analog to Digital, Data Acquisition System configuration.
5.	DIGITAL TO DIGITAL INTERFACING: Language of Digital data transmission, Binary coded decimal interface, IEEE-488 bus, CAMAC interface, Serial, Asynchronous interfacing, Data line monitors, RS-232c standards , 20mA current loop, Universal Asynchronous Receiver-transmitter, Pre-assembled Interface sub-systems, Long -distance Data transmission.
6.	HART PROTOCOL: Method of operation, protocol structure, operating conditions.

(1) “Distributed Computer Control System” by Popovic and Bhatkar, Marcel Dekker
(2) Distributed Control System Manual : By H.L. Wade,1993.
(3) Automation System for Control Data Acquisition : By L.T. Amy, 1992
(4)Student Reference manual for Electronic Instrumentation Labortories : by Stanely wolf & Richard F. M. Smith, Prentice Hall (I) pvt. ltd., 1999

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PROJECT PLANNING ESTIMATION & QUALITY SYSTEMS : IC 803 IC

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

1	PROJECT IMPLEMENTATION AND COST ESTIMATION : Activity V/s documents, manpower planning, project time schedule, cost heads and estimation.
2	PROJECT ENGINEERING AND DOCUMENTATION : Document system, standard symbols and legends, process flow sheet, P &I diagrams, control schematics, instrument list, interlock diagrams, plant G.A. diagram, power/ air distribution, cable engineering, loop schematics and termination diagrams, installation sketches and bill of material, control system documentation.
3	SPECIFICATIONS, CONFIGURATION, AND DESIGN CRITERIA : Degree of automation, manpower matching, instrument specification sheets, area classification and instrument selection, control system specification including control panel, PLC and DCS, subsystem and integration, configuration diagrams.
4	PROJECT MONITORING AND CONTROL : PERT/ CPM techniques, project bar chart, tendering procedure, bid evaluation and procurement procedures, project coordination, multi - agency interaction.
5	TEST PROCEDURES, INSTALLATION AND COMMISSIONING : Factory acceptance and site acceptance test, inspection reports and check list, installation and commissioning, control schedule and site activities upto handover, post installation maintenance, spares management, annual maintenance contract.
6	QUALITY SYSTEMS : Introduction to International quality systems, Quality system requirements, Procedures and Quality system documentation , Implementation and certifying agencies.

References :

(1) Applied Instrumentation in Process Industries, Vol.iii ,by Andrew and Williams, Gulf pub ., 2nd edition, 1979

(2) Process control hand book by Liptak, 3 rd edition, 1999

(3) Practical Process Instrumentation and Control, Vol II by Jay Mal.

(4) Batch Control System (ISA) by T. G. Fisher.

(5) ISO- 9000 Concepts, Methods & Implementation : By Tapan B. Bagchi - Wheeler pub.

(6) ISO- 9000 Guidelines for the chemical & process industries : By ASQC (American Society of Quality Control) - Ben Johnson pub.

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Semester - VIII

ELECTIVE GROUP - I

1.1 IC 811 IC : BIOMEDICAL INSTRUMENTATION

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

1	BIOSIGNALS AND RECORDING **:** - Source of bioelectric signal, Resting & action potential potential , ECG leads Placement, Einthoven angle, Electrocardiogram, Vector, phono cardiography, Electromyogram, Electroencephalograph, Electrodes for ECG ,EEG,EMG,Basic requirements of Amplifier, interference reduction ckt., Active filters, noise rejection technique.
2	BIOMEDICAL EQUIPMENT **:** - ECG, EEG, EMG, X-Ray machine, Cardiac pacemaker, Hemodialysis machine, Diathermy unit, LASER in surgery, Blood gas analyzer, Blood cell counter.
3	RESPIRATORY SYSTEM & ELECTRICAL SAFETY **:** -Physiology, Tests and instrumentation for breathing mechanics, Artificial respiration - Electric shock hazard, Leakage current, Physiological effect of electric current safety codes for medical equipment, Accident prevention method, Test instruments.
4	BIOMEDICAL TELEMETRY**:** -Single & multi channel wireless telemetry, Telephone telemetry.
5	ULTRASONIC IMAGING SYSTEM **:** **-** Generation and detection of ultrasonic waves, ultrasonic scanner, Biological effect.
6	COMPUTERS IN BIOMEDICAL **:** **-**Interfacing with medical equipments, Analysis of ECG, Patientmonitoring system, Catheterisation laboratory, Clinical laboratory automation.

References:

(1) Hand book of Biomedical Instrumentation - R.S. Khandpur, Tata Mcgrawhill, 1999.

(2) Introduction to Biomedical Equipment Technology - J.J. Carr and J.M. Brown John Wiley & Sons.

(3) Medical Instrumentation, Application & Design by John Webster, John Wiley & sons, 3rd edi., 1999

(4) Biological Control System Analysis - J.H. Milseum McGraw Hill.

(5) Principles of Applied Biomedical Instrumentation - Geddes and Backer John Wiley & Sons. 3rd edi., 1989.

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1.2 IC 812 IC : FLIGHT INSTRUMENTATION

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

1	Atmosphere, aerospace transducers for measurement of flight parameters, aircraft instruments to measure speed, altitude outside air temperature and pressure, various types of manometers, pitot and static tubes, yaw and pitch meters, anemometers, measurement of velocity field, pressure field, lift, drag and moments.
2	Automatic flight control system, various types of active control applications, flight test instrumentation, gyroscopic principle and instruments, wind tunnels and their utility to aeronautical and other fields, flow visualization techniques in wind tunnels.
3	Flight data acquisition and recording systems, general layouts and operation block diagrams of power plant, study of typical fuel control systems, hydraulic servo systems.
4	Microprocessor/computer based flight control and instrumentation systems, autopilot, fly-by-wire, determination of flight characteristics such as maximum speed, best climb rate.

References:

(1) Modern Aviation Electronics. By A.Helpfric, Prentice Hall, 1984.
(2) Avionics Navigation System. By M.Kaytorm and W.R.Fried, Wiley 1964.
(3) Air-craft Instruments. By M.Coulthard, Pitman, 1952.
(4) Control of Aircraft and Rocket Power Plants. By Sobby and Sugg. Wiley. 1963.
(5) Control system Components. By Gibson and Tutor, McGraw Hill.

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1.3 IC 813 IC : PARALLEL PROCESSING AND REAL TIME OPERATING SYSTEM

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

1.	Definition of parallel computer, evolution of parallel computers. Types of parallelism, intertask dependencies.
2	Structure of parallel computers, pipeline, array, shared memory multiprocessor, message passing multiprocessor, performance of parallel computers, features of parallel computers, data flow concepts, computing language, parallel processor applications.
3	Real time operating system : Introduction, types of operating systems, requirements of general RTOS, input output management, task scheduler, storage management and kernel structure of RTOS.
4	Neural networks and computing.
5	Introduction to expert systems and applications.

References:

(1) Digital Control System. By Houpis and Lamont, McGraw Hill, 1985.
(2) Operating Systems Principles. By Hansen P.B., Prentice Hall, 1973.
(3) Elements of Parallel Computing. By V.Rajaraman, PHI, 1990.
(4) Computer Architecture and Parallel processing. By Hwang Kai, McGraw Hill, 1985.
(5) Introduction to Parallel Processor and Distributed Control. By Sharp.

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1.4 IC 814 IC : COMPUTER ARCHITECTURE AND PCL CARD INTERFACING

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

1	INTRODUCTION OF DIGITAL COMPUTER : - Basic ideas about Mother Board and I/O cards.
2	ARCHITECTURE OF 8086 AND ITS PROGRAMMING : - Basic elements of 8086 : ALU, Stack, Addressing Mode, Operating Mode, Pipelining process, Flopy & hard disc driver card, Display card - other controllers, interfacing port. (Serial & Parallel) etc., - Arithmetic logical Assembly level programming of 8086. - Memory I/O, Brief introduction about 80186,80286,80386 etc. Ethernet card, other cord interfacing with CPU.
3	ARCHITECTURE OF 6800 AND ITS FAMILY : - Basic elements of 6800 : ALU, Stack, Addressing Mode, Operating Mode, Pipelining process - other controllers, interfacing port. (Serial & Parallel) etc., - Arithmetic logical Assembly level programming of 6800. - Memory I/O, Brief introduction about 68000 , Zilog-80 etc.
4	LOCAL AREA N/W COMMUNICATION TECHNIQUES : - Concept, topologies, transmission Media, Basis of queuing theory for LAN, Network interconnection, reliability, Security and Applications.
5	TYPES OF PLC CARDS AND IT'S RELEVANT APPLICATIONS : - 8 - channel multiplexing and demultiplexing card., - High performance DAS (Data Acquisition card) , - EPROM programmer card, Motor driver card , - 8 channel isolated thermocouple cards etc..

References:

(1) Microprocessor and Interfacing, Programming and Hardware By Douglas V. Hall, Tata Mcgrawhill, 2nd edi., 1999.

(2) Microprocessor System : The 8086/8088 Family, Architecture, Programming and Designing By Glen A. Gibson & Yu Cheng Liu., Prentice Hall of India, 2nd edi., 1996.

(3) The 8088 and 8086 microprocessor programming, Interfacing, Software, Hardware Application By Triebel and Avtarsingh., Prentice Hall of India, 1995.

(4) Local Area Network : By Gred E Keiser., Tata Mcgrawhill, 1999

(5) The 8086/ 8088 Family : Design, Programming & Interfacing by John Uffenback, Prentice Hall of India, 1995.

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ELECTIVE GROUP - II

2.1 IC 821 IC : ROBOTICS ENGINEERING

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

1	INTRODUCTION ABOUT ROBOTICS & ITS TECHNOLOGY : - Automation and Robotics, - Robotics in science Fiction, - Brief history of robotics, - Robotics market and future prospects, - Robot anatomy, - Work Volume, -Robot drive System, - Control System & dynamic performance, - Precision of Movement, - End effectors, - Sensors.
2	ROBOT MOTION ANALYSIS AND CONTROL : - Introduction to manipulator Kinematics, - Homogeneous Transformations & Kinematics, - Manipulator path control, - Dynamics, - Control Configuration.
3	ROBOT END EFFECTORS : - Types of end effectors, - Mechanical & other Grippers, - Tools as end effectors, - End effector interface, - Selection of gripper and design.
4	SENSORS IN ROBOTICS : - Transducers and sensors in robotics, - Tactile Sensors, - Proximity and range sensors - Miscellaneous Sensors , - Use of Sensors in Robotics.
5	ROBOT PROGRAMMING & LANGUAGE : - Method of robot programming, -Leadthriough programming method, - Robot program as path of space, -Motion interpolation , WAIT SIGNAL, DELAY and branching command, -Limitations and capacities of lead through method, -Robot language structure and textual language, -Motion ,end effector and sensors commands.
6	APPLICATION OF ROBOTICS : - Processing Operation ,- Material transfer and machine loading and unloading.

References:

(1) Industrial Robotics : by Mikell P. Groover , Mitchell Weiss, Roger N. Nagel and Nicholas G. Odrey Mc Graw - Hill., 1986.

(2) Fundental of Robotics Analysis and control : by Robet J. Schilling - Prentice Hall,1996.

(3) Robotics and Image processing : P.A. Janakiraman - Mc Graw - Hill. 1995.

(4) Robotics (Control , Sensing , Vision & Intelligence) : K.Sfu, R.C.Gonzaler, C.G.Glee Mc Graw - Hill. 1995.

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2.2 IC 822 IC : PLANT AUTOMATION

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

1.	INTRODUCTION: Automation- Basic functions, Historical development, current trends in process plants.
2.	MODELLING AND SIMULATION FOR PLANT AUTOMATION: Requirement, uses of systems simulation and modelling, mathematical model building, evaluation and improvement, modern tools, application and future perspectives.
3.	INDUSTRIAL CONTROL APPLICATIONS: Objectives, Automation strategy and control of: Cement plant, power plant, water treatment plant, irrigation canal management, steel plant, petrochemical plant.

References:

(1) Computer Based Industrial Control By Krishna Kant - by Prentice Hall of India, 1998

(2) Process Control : by Liptak , Oxford/Butterwork/ Heinmann ltd., 3rd. edi., 1999

(3) Principal of Process Control : by D. Patranabis, Tata Mcgrahill

(4) Shreve's Chemical Process industries : by George T. Austin , Mcgrawhill international, 3rd ed.

(5) Outlines of chemical technology for the 21st century. : by .gopala rao, marshall sitting, East west pub. 3rd edi.

(6) Advanced Process Control and Information Systems for the Process Industries : by Les A. Kane , Gulf pub., 1st edi. , 1999.

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2.3 IC 823 IC : PROCESS SYSTEM ANALYSIS

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

1	FUNDAMENTALS OF MATHEMATICAL MODELING: - Introduction : Role of Process dynamics & Control, Historical background, Use of mathematical models, Scope of Coverage, Principles of formulation. - Fundamentals Laws : Continuity equation , Energy equation , Equation of motion , Transport equation, Equation of State, Chemical Kinematics
2	MATHEMATICAL MODELS OF CHEMICAL SYSTEM: - Series of Isothermal, Constant -holdup CSTRs . - CSTR with variable holdups. - Two heated tanks, - Gas phase pressurised CSTR, - Non isotheramal CSTR, - - Single Componenet Vaporizer, - Multi Componenet flash drum, - Batch reactor , - Ideal binary distillation column, - Multi component non ideal distillation column.
3	LINEAR OPEN LOOP SYSTEM: - Response of firs-order system and first order system in series - Physical examples of first order system - Higher order system (Second Order) and transportation lag.
4	LINEAR CLOSED LOOP SYSTEM: - Control Sysytem, - Controllers and final control elements,
5	COMPUTER IN PROCESS CONTROL : - Digital Computer simulation of control system, - Microprocessor based controlling & distribution control schem.

References:

(1) Process system analysis and control : By Donald R. Coughanowr.- Mcgrawhill international , II nd Edition ,

(2) Process Control : By Thomas E. Malin (Designing and control system for dynamics performances)

(3) Process Control : By Peter Harriot - Mcgrawhill international , 1st edition ,

(4) Process Modeling, Simulation & Control for Chemical Engg. : By William L. Luyben – Mcgrawhill international, II nd Edition

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2.4 IC 824 IC : FUZZY LOGIC CONTROL & NEURAL NETWORK

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

1	INTRODUCTION OF FUZZY LOGIC: - Review of crisp set theory, - Basic concept of fuzzy sets, - fuzzy operation on sets.
2	FUZZY LOGIC CONTROL PRINCIPLE: - Definition and terminology , -Fuzzy relations, -Fuzzy conditional statement, -Fuzzy rules , -Fuzzy Algorithm, -Functional Diagram
3	FUZZY LOGIC CONTROL SYSTEM : -Fuzzy logic controller, -Fuzzification interface, -Knowledge base, -Decision Making Logic,-Defuzzification interface , -Design of fuzzy logic controller, -Functional diagram approach, -Developing fuzzy model, -performance comparison with conventional controller, -Stability analysis of fuzzy control system.
4	FUNDAMENTAL CONCEPTS OF ARTIFICIAL NEURAL NETWORK: - Biological neurons and their artificial models,-Models of artificial neural network, -Neural network learning rules and overview, - Neural processing, Single layer perception Classifiers.

References :

(1) Fuzzy Control and Fuzzy System : by John Wiley, 1989.

(2) Fuzzy Set theory and application : by H.Z. Zimmermann - 2nd Edition.

(3) An Introduction to Fuzzy Control : by D. Drainbor, H. Hellendoor , M. Reinfrank -2nd edition.

(4) Fuzzy sets, Uncertainty and Infrormation : by George J. Klir , Prentice Hall of India, 1991

(5) Neural Networks & Fuzzy systems by Bart Kosko, Prentice Hall of India, 1997

(6) Fuzzy - Neural control principles, algorithms & application by John Nie & Derek Linkens by Prentice Hall of India, 1998.

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PROJECT: IC 806 IC

	Lecture	Tutorial	Practical
Teaching Hours	0	0	8
Examination Scheme Marks	-	-	Cont. Evaluation 80 Examination 120

Under the subject, student is supposed to carry out project assembly, final testing , take result and draw conclusion of the project started in Part-I and complete the detailed report about the whole project including the application aspect.

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SEMINAR : IC 807 IC

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

Student is required to go to library and search the material from journals and reference books to prepare comprehencive report under the guidance of faculty on a particular recent development in the field of instrumentation & control.

The term work will consist of a report prepared by every student on the seminar topic alloted to them and oral presentation.