

**GOVT. COLLEGE OF  
ENGINEERING,  
AMRAVATI**



**B. Tech. (Instrumentation)**

**V & VI Semester**

**Department of Instrumentation**

**Engineering**

**2010-11**

# GOVERNMENT COLLEGE OF ENGINEERING AMRAVATI

DEPARTMENT OF INSTRUMENTATION ENGINEERING

**B. Tech. ( Instrumentation Engineering )**

Course Code	Name of the Course	Teaching Scheme				Evaluation Scheme							Credits
		Theory Hrs /week	Tutorial Hrs/week	Practical Hrs/week	Total	Theory				Practical		Total	
						TA	CT1	CT2	ESE	Internal	External		
<b>Sem III</b>													
IN301	Engineering Mathematics III	4	1	---	5	10	15	15	60	---	---	100	5
IN302	Electronic Devices & Circuits	4	---	---	4	10	15	15	60	---	---	100	4
IN303	Signal & System	4	1	---	5	10	15	15	60	---	---	100	5
IN304	Circuit Theory	4	---	---	4	10	15	15	60	---	---	100	4
IN305	Digital Electronics	4	---	---	4	10	15	15	60	---	---	100	4
IN306	Electronic Devices & Circuits Lab	---	---	2	2	---	---	---	---	25	25	50	1
IN307	Circuit Theory Lab	---	---	2	2	---	---	---	---	25	25	50	1
IN308	Digital Electronics Lab	---	---	2	2	---	---	---	---	25	25	50	1
IN309	Computational method lab -I*	---	---	2	2	---	---	---	---	50	50	100	2
<b>Total</b>		<b>20</b>	<b>2</b>	<b>8</b>	<b>30</b>	<b>50</b>	<b>75</b>	<b>75</b>	<b>300</b>	<b>125</b>	<b>125</b>	<b>750</b>	<b>27</b>
<b>Sem IV</b>													
IN401	Engg. Mathematics IV	4	1	---	5	10	15	15	60	---	---	100	5
IN402	Sensors& Transducer	4	---	---	4	10	15	15	60	---	---	100	4
IN403	Control System Component	4	---	---	4	10	15	15	60	---	---	100	4
IN404	Numerical Methods	4	1	---	5	10	15	15	60	---	---	100	5
IN405	Linear Integrated Circuits	4	---	---	4	10	15	15	60	---	---	100	4
IN406	Sensors& Transducer Lab	---	---	2	2	---	---	---	---	25	25	50	1
IN407	Control System Component Lab	---	---	2	2	---	---	---	---	25	25	50	1
IN408	Linear Integrated Circuits Lab	---	---	2	2	---	---	---	---	25	25	50	1
IN409	Computational Method Lab -II**	---	---	2	2	---	---	---	---	50	50	100	2
<b>Total</b>		<b>20</b>	<b>2</b>	<b>8</b>	<b>30</b>	<b>50</b>	<b>75</b>	<b>75</b>	<b>300</b>	<b>125</b>	<b>125</b>	<b>750</b>	<b>27</b>
<b>Sem V</b>													
IN501	Microprocessor Based Instrumentation	4	1	---	5	10	15	15	60	---	---	100	5
IN502	Chemical & Analytical Instrumentation	4	---	---	4	10	15	15	60	---	---	100	4
IN503	Digital Signal Processing	4	---	---	5	10	15	15	60	---	---	100	5
IN504	Electronic Instrumentation	4	1	---	4	10	15	15	60	---	---	100	4

IN505	Material Science & Process	4	---	---	4	10	15	15	60	---	---	100	4
IN506	Microprocessor Based Instrumentation Lab	---	---	2	2	---	---	---	---	25	25	50	1
IN507	Chemical & Analytical Instrumentation Lab	---	---	2	2	---	---	---	---	25	25	50	1
IN508	Electronic Instrumentation Lab	---	---	2	2	---	---	---	---	25	25	50	1
IN509	General Proficiency-I	---	---	2	2	---	---	---	---	50	50	100	2
<b>Total</b>		<b>20</b>	<b>2</b>	<b>8</b>	<b>30</b>	<b>50</b>	<b>75</b>	<b>75</b>	<b>300</b>	<b>125</b>	<b>125</b>	<b>750</b>	<b>27</b>

**Sem VI**

IN601	Distributed Control System	4	---	---	4	10	15	15	60	---	---	100	4
IN602	Microcontroller & It's Application	4	---	---	4	10	15	15	60	---	---	100	4
IN603	Power Electronics	4	---	---	4	10	15	15	60	---	---	100	4
IN604	Power Plant Instrumentation	4	---	---	4	10	15	15	60	---	---	100	4
IN605	Feedback Control System	4	---	---	4	10	15	15	60	---	---	100	4
IN606	Distributed Control System Lab	---	---	2	2	---	---	---	---	25	25	50	1
IN607	Microcontroller & It's Application Lab	---	---	2	2	---	---	---	---	25	25	50	1
IN608	Power Electronics Lab	---	---	2	2	---	---	---	---	25	25	50	1
IN609	General Proficiency-II	---	---	2	2	---	---	---	---	50	---	50	2
IN610	Minor Project	---	---	2	2	---	---	---	---	50	---	25	2
<b>Total</b>		<b>20</b>	<b>---</b>	<b>10</b>	<b>30</b>	<b>50</b>	<b>75</b>	<b>75</b>	<b>300</b>	<b>175</b>	<b>75</b>	<b>750</b>	<b>27</b>

**Sem VII**

IN701	Modern Control Theory	4	---	---	4	10	15	15	60	---	---	100	4
IN702	Biomedical Instrumentation	3	---	---	4	10	15	15	60	---	---	100	4
IN703	Instrumentation System Design	4	---	---	4	10	15	15	60	---	---	100	4
IN704	Operation Research & Management	4	---	---	4	10	15	15	60	---	---	100	4
IN705	Elective-I	4	---	---	4	10	15	15	60	---	---	100	4
IN706	Biomedical Instrumentation Lab	---	---	2	2	---	---	---	---	25	25	50	1
IN707	Instrumentation System Design Lab	---	---	2	2	---	---	---	---	25	25	50	1
IN708#	Seminar & Project	---	---	6	6	---	---	---	---	50	100	150	5
<b>Total</b>		<b>20</b>	<b>---</b>	<b>10</b>	<b>30</b>	<b>5</b>	<b>75</b>	<b>75</b>	<b>300</b>	<b>100</b>	<b>150</b>	<b>750</b>	<b>27</b>

**Sem VIII**

IN801	Process Instrumentation & Control	4	---	---	4	10	15	15	60	---	---	100	4
IN802	Project Engineering & Management	4	---	---	4	10	15	15	60	---	---	100	4
IN803	Elective -II	4	1	---	5	10	15	15	60	---	---	100	5

IN804	Elective-III	4	1	---	5	10	15	15	60	---	---	100	5
IN805	Process Instrumentation & Control Lab	---	---	2	2	---	---	---	---	25	25	50	1
IN806	Project Engineering & Management Lab	---	---	2	2	---	---	---	---	25	25	50	1
IN807#	Project- II	---	---	8	8	---	---	---	---	100	150	250	7
<b>Total</b>		<b>16</b>	<b>2</b>	<b>12</b>	<b>30</b>	<b>40</b>	<b>60</b>	<b>60</b>	<b>240</b>	<b>150</b>	<b>200</b>	<b>750</b>	<b>27</b>

**Duration of ESE is 2 Hrs 30 Minutes for all courses**

**TA :Teacher Assessment**

**CT: Class Tests**

**ESE: End Sem. Examination**

**# For project there will be 4 students in each batch**

**\* Lab-I has programming based on basic MATLAB**

**\*\* Lab -II has programming based on MATLAB toolbox like neural network, fuzzy logic optimization**

**Electives**

<b>Elective-I (IN705)</b>	<b>Elective-II (IN803)</b>	<b>Elective-III (IN804)</b>
A) Opto- Electronics Instrumentation	A) Advance Sensors	A) Image Processing
B) Instrumentation for agriculture & Food Processing	B) Neural Network and Fuzzy logic control	B) Adaptive Control
C) Embedded Systems	C) Computer Network	C) System Identification
D) Biomedical Signal Processing	D) Digital Control System	D) Nonlinear Control

## IN501 MICROPROCESSOR BASED INSTRUMENTATION

**Teaching Scheme : 04 L + 01 T Total 05**

**Credit : 05**

**Evaluation Scheme : 15 CT1 + 15 CT2 +10 TA+ 60 ESE**

**Total Marks: 100**

**Duration of ESE : 2hrs 30min.**

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**Introduction to 8085:** Architecture and operation, pin out diagram. Assembly language programming for 8085 microprocessor instruction classification, instruction set study in details, addressing modes, writing assembly language programs, stacks subroutines, floating point routines. Instruction set timing diagrams, a minimum configuration for 8085.

**Parallel I/O and Interfacing:-**In Basic interfacing concept, Memory- mapped I/O, I/O mapped concept interfacing memory. Interfacing memories EPROM and RAM with 8085 with exhaustive and partial decoding techniques.

**Interrupt structure of 8085:-** Internal interrupt circuit, hardware and software interrupts, serial data transfer. Following structure programmable peripheral devices are to be studied in details as regards to Introduction , block diagram, Functional pin Configuration Control word format and different mode , software for their interfacing with 8085: 8255, 8253, 8279, 8251, 8259 and 8257.

**Interfacing application:** Interfacing seven segment displays keyboard, A to D and D to A converter.

**Microprocessor based data acquisition and control system:** Temperature control system, Flow control system etc. Introduction to 8086, 80486, and Pentium processors.

### **Text Books:**

1. Microprocessor Architecture, Programming and application with 8085/8085A, by R. S. Gaonkar, Willey Eastern Ltd. Fourth Edition, 1995

### **Reference Books:**

1. Microprocessor and programming logic, by K. L. Short, Prentice-Hall India Pvt.Ltd. Second Edition, 2005
2. Microprocessor Principles and Application by Ajit Pal Mc-Graw Hill, New Delhi.
3. Advanced Microprocessor and Interfacing by B. Ram McGraw-Hill Publishing Company Ltd., New Delhi.

4. Microprocessors and Interfacing programming and Hardware by Douglas V.Hall  
Mc Graw Hill. 2nd Edition 2003
5. The 8086 microprocessor, programming and Interfacing the PC by Kenneth j.  
Ayala Penram International

## IN502 CHEMICAL AND ANALYTICAL INSTRUMENTATION

**Teaching Scheme: 04 L+00T Total 04**

**Credit: 04**

**Evaluation Scheme: 15 CT1 + 15 CT2 +10 TA+ 60 ESE**

**Total Marks: 100**

**Duration of ESE : 2hrs 30min.**

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**Introduction** to Chemical Instrumental Analysis, Advantages over classical (gravimetric and volumetric analysis) methods. Ultraviolet (UV) and visible absorption instruments components. Beer-Lambert Law, monochromator: design and associated equipment. UV and visible instruments, Colorimeter, Spectrophotometer: Single and Dual Beam.

**Infra Red (IR) Spectrophotometers:** Basic components and types.

**Emission Spectrometry:** Theoretical concept, Instrumentation: Source unit, Electrodes.

**Flame Photometry:** Principle, Constructional details, Fuel gases, Atomizer, Burner, Optical and Recording System.

**Atomic absorption Spectrometer:** Theoretical concept. Instrumentation, hollow cathode lamp, Burner and flames, Plasma excitation sources.

**Nuclear magnetic Resonance (NMR) Spectrometry:** Principle, Nuclear spin, Chemical shift, constructional details, Spin decoupler, Fourier transform NMR Spectroscopy.

**Electron Spin Resonance (ESR) Spectrometry:** Principle and constructional details. Fluorimeter and Phosphorimeter: Principle, Single and Double beam filter fluorimeter, Spectrofluorimeter.

**Raman Spectrometry:** Raman Effect, Components, Laser types. Photoacoustic and photo thermal spectrometers.

**Mass Spectrometry:** Basic components, Gas Chromatograph Mass Spectrometer (GCMS) System, Applications.

**Electron and Ion Spectroscopy:** Electron Spectroscopy for chemical analysis (ESCA), Auger Electron Spectroscopy (AES), Secondary Ion Mass Spectrometry (SIMS).

**Radio Chemical Instrumentation:** Radio chemical methods (Ionization chamber, Geiger Muller, Proportional counters).

**X-Ray Spectrometry:** Spectrum, Instrumentation, Diffractometers.

**Gas & Liquid Chromatography:** Classification, Basic parts, Carrier gas, Simple Injection System, Chromatographic column, thermal compartment, Dual column system, Detectors (thermal conductivity, flame ionization, electron capture). Introduction to Liquid Chromatography.

**Methods of Gas Analysis:** Oxygen, Carbon monoxide, Nitrogen analyzer, gas density analyzer.

**Refractometry:** Principle, Abbe & Dipping types.

**Text Books:**

1. Hand Book of Analytical Instrumentation by R. S. Khandpur McGraw Hill Publication 1989

**Reference Books:**

1. Instrumental Methods of Analysis by Willard, Merrit & Dean , CBS Publication, Sixth Edition 1986
2. Instrumental Methods of Chemical Analysis by G. W. Ewing ,McGraw Hill Fifth Edition 1985
3. Instrumental Methods of Chemical Analysis By Chatwal G.R.and Anand S,Himalya Publishing House 1998

**IN503 DIGITAL SIGNAL PROCESSING**

**Teaching Scheme : 04 L + 01 T Total 05**

**Credit : 05**

**Evaluation Scheme : 15 CT1 + 15 CT2 +10 TA+ 60 ESE**

**Total Marks : 100**

**Duration of ESE : 2hrs 30min.**

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**Matlab should be used while imparting the instructions.**

**Introduction to DSP:** Signals, Systems and Processing, Basic element of a Digital Signal Processing System, Advantages of Digital over Analog Signal Processing.

**Digital filter structure:** Block diagram representation, equivalent structures, Basic FIR structures, Basic IIR structures, All pass filters, IIR tapped cascaded lattice structures, FIR cascaded lattice structures.

**Digital Filter design:** IIR filter design – Bilinear transformation, Impulse invariant transformation, Low pass IIR digital filters, Spectral transformations, FIR filter design using windowing techniques, Frequency sampling technique, and Computer aided design.

**DSP algorithm implementation:** Computation of DFT, FFT algorithms, Decimation in time, Decimation in Frequency, Different algorithms of FFT such as DIT and DIF where input and output is in order, radix-n algorithms.

### **Introduction to Multirate Filter Banks and Wavelets**

### **Introduction to DSP processors**

**Applications of DSP:** Biometrics and Applications of DSP processors in control Systems (one application of each).

### **Text Books:**

1. Digital signal processing- A computer based approach, by Mitra S. K., McGraw Hill, 2002

### **Reference Books:**

1. Digital Signal Processing- A Practical Approach, by Ifeachor E. C., B. W. Jarvis, Pearson Education, New Delhi, Second Edition, 2002.
2. Discrete time signal processing, by Oppenheim A. V. , Schafer R.W., Prentice-Hall of India, 2001.
3. Digital signal processing –Principles, algorithms and applications by Proakis J. G. , Manolakis D.G. , Prentice Hall of India, 2002.
4. Understanding Digital Signal Processing, by R. G. Lyons, Pearson Education New Delhi, 1999
5. Introduction to Wavelets and Wavelet Transform” by Burrus C. S. , Ramesh and Gopinath A., Prentice Hall India.



## IN 504 ELECTRONICS INSTRUMENTATION

**Teaching Scheme : 04 L+00T Total 04**

**Credit : 04**

**Evaluation Scheme : 15 CT1 + 15 CT2 +10 TA+ 60 ESE**

**Total Marks: 100**

**Duration of ESE : 2hrs 30min.**

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**Experimental data and errors:** Measurement recording and reporting, graphical presentation of data, precision and accuracy, resolution and sensitivity, errors in measurement, statistical evaluation of measurement data and errors.

**Electrical laboratory practice:** Safety, grounds, circuit protection devices, cables, connectors, switches and relays, input impedance, output impedance and loading power transfer and impedance matching.

**Analog DC and AC meters:** Electromechanical meter movements, analog ac ammeters and voltmeters, analog multimeters.

**Digital electronic meters:** Counting and encoding, display devices, digital voltmeters, digital multimeters.

**D.C and A.C bridges and applications:** Whetstone Bridge, Kelvin bridge, Schering and Maxwell bridge, Wein bridge, Q meter.

**The oscilloscope:** Oscilloscope subsystems, display (cathode-ray tube), vertical deflection subsystem, dual –trace feature, horizontal deflection sub system, oscilloscope probes, oscilloscope controls, special purpose oscilloscope.

**Recorders and potentiometer:** Potentiometer, recorder, machine-interpretable recorders.

**Time and frequency measurements:** Time, frequency and phase measurement  
**Interference signals and their elimination or reduction:** Capacitive interference, inductive interference, input shielding, electromagnetic interference and shielding, input guarding to reduce ground-loop interference, internal noise.

### **Text Books:**

1. Electronic Instrumentation, by H. S. Kalsi McGraw- Hill, New Delhi Third Edition, 2005

### **Reference Books:**

1. Modern electronic instrumentation and measurement techniques, by Helfric A, D and Cooper W. D Prentice Hall of India 2005

2. Electronic measurements, by Kantrowitz, Kousourou, and Zucker Prentice Hall, New Jersey
3. A course in electrical and Electronic measurements and Instrumentation, by K. Sawhney Dhanpat Rai and Sons, New Delhi. 17th Edition 2001
4. Digital Measurement Techniques By T.S. Rathore, Narosa Publishing House, Second Edition 2004
5. Student reference manual, by Stanley wolf, Richard I. M. Smith Prentice Hall of India.

### **IN505 MATERIAL SCIENCE AND PROCESSES**

**Teaching Scheme : 04 L+00T Total 04**

**Credit : 04**

**Evaluation Scheme : 15 CT1 + 15 CT2 +10 TA+ 60 ESE**

**Total Marks: 100**

**Duration of ESE : 2hrs 30min.**

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**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 and shear test, compression test, impact test, hardness test, fatigue test, S-N diagram, creep of materials, Erichsen test.

**Introduction To Manufacturing Processes**, Casting, cold working and hard working processes like rolling, forging, extrusion, etc Crystal structure of metals and alloys: FCC , BCC , HCP.

**Materials and their applications** for electrical and electronic component, Materials for resistors, properties and applications, Superconducting materials, Transducers materials, Semiconductors-commonly used type working applications. Thermistors, Piezoelectric, ferro electric and Ferro ceramic materials, die electric materials and dielectric constant, capacitor insulating materials, properties of fibrous material , ceramic, mica glass, rubber, plastics, thermosetting and thermoplastic resins, insulating waxes, varnishes and coolants. Effects of carbon composition and applications.

**Magnetic materials:** soft material and hard magnetic materials ferrites and Di para antiferro, ferromagnetism.

**Thermocouple materials:** soldering materials, Fuse materials, contact materials, fluorescent and phosphorescent materials, processing of electronic materials, crystal growth , purification junction IC fabrication processes of galvanizing and impregnation.

**Text Books:**

1. Electrical Engineering Materials by Alagappan W., Kumar N.T. McGraw Hill 1998.

**Reference Books:**

1. Material For Engineering Technician by Raymond A. Higgins 2nd Edition, ELBS, 1998
2. The structure and Properties of Materials, Vol. IV “by R. M.Rose, L.A.Shepard, John Wulff, John Wily and Son Inc.198
3. Engineering Material by Agrawal B. K., , Mc-Graw Hill Publishing company, 2000
4. Material science and Metallurgy by Dr. Kodgire, Everest V. D., Publishing House, 12th Edition 2002

**IN 506 MICROPROCESSOR BASED INSTRUMENTATION LABORATORY**

**Teaching Scheme : 02 P Total 02**

**Credit : 01**

**Evaluation Scheme : 25 Internal + 25 External**

**Total Marks: 50**

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Minimum 8 Experiments should be conducted from the sample list given below.

However experiment beyond the list and based on curriculum of IN501 may be conducted.

1. To study the architecture of 8085 microprocessor.
2. Addition and subtraction of 8/16/32 bit numbers
1. (Number should be placed in memory).
2. Multiplication and division of 8 bit numbers using add and shift method.
3. Write an assembly language program to handle RST7.5 interrupt
4. Block transfer
5. Searching and Sorting
6. BCD binary Arithmetic
7. Number system conversion
8. Interfacing 7-segment displays with 8255.

9. Interfacing Keyboard matrix with 8255.
10. Interfacing DAC
11. Interfacing ADC
12. Programming for 8253.
13. Software implementation of ADC
14. Observing timing diagram on CRO.
15. Study of interrupts.
16. Interfacing programs must be based on applications used in process industries.

**Practical Examination:**

It consists of performance of experiment based on file/journal/report submitted by students and oral based on curriculum of course IN501.

**IN 507 CHEMICAL AND ANALYTICAL INSTRUMENTATION LABORATORY**

**Teaching Scheme : 02 P Total 02**

**Credit : 01**

**Evaluation Scheme : 25 Internal + 25 External**

**Total Marks: 50**

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Minimum 8 Experiments should be conducted from the sample list given below.

However experiment beyond the list and based on curriculum of IN502 may be conducted.

1. To find pH of given solution.
2. To study conductivity measurement.
3. Analysis of colour by using colorimeter.
4. To study spectro-photometer
5. To Study Fluorimeter.
6. To study flame photometer.
7. To determine the Refractive index by using refractometer.
8. Use of gas chromatography for analyzing components of gas mixtures.
9. To study Nuclear Magnetic Resonance(NMR)
10. To study Atomic absorption spectrometer(AAS)

**Practical Examination:**

It consists of performance of experiment based on file/journal submitted by students and oral based on curriculum of course IN502.

## IN 508 ELECTRONICS INSTRUMENTATION LABORATORY

**Teaching Scheme : 02 P Total 02**

**Credit : 01**

**Evaluation Scheme : 25 Internal + 25 External**

**Total Marks: 50**

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Minimum 8 Experiments should be conducted from the sample list given below.

However experiment beyond the list and based on curriculum of IN504 may be conducted.

1. Measurement of resistance (high, medium, low)
2. Measurement of inductance.
3. Measurement of capacitance.
4. Phase and frequency measurement on CRO using Lissajous pattern
5. Study of digital storage oscilloscope
6. Study of digital voltmeter, digital multimeter.
7. Study of recorders.
8. Digital measurement of phase and frequency.
9. Study of AC and DC meters.

### **Practical Examination:-**

It consists of performance of experiment based on file/journal submitted by students and oral based on curriculum of course IN504.

## IN 509 GENERAL PROFICIENCY-I

**Teaching Scheme : 02 P Total 02**

**Credit : 02**

**Evaluation Scheme : 50 Internal + 50 External**

**Total Marks: 100**

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After completing this course the student should be able to get proficiency in Reading, Writing and Speaking Skills

**Style and Structure:** Art of writing, Elements of prose, aspects of effective style, patterning the text, editing the own writing, the mechanism of writing Comprehension.

**Writing at work, home:** Writing letters at work, how to write reports, writing for meeting, job application, writing letters from home, invitation and announcement, modes of address, coping with exams, studied techniques, essay writing and research,

**The skill of good speaking:** improving your voice and speech, the art of conversation, public speaking, using visual aids, being interviewed by media, job interview, dealing with the boss, dealing with the subordinates, how to run a meeting, negotiating and selling

**Thinking skill.:** How to think, critical thinking and lateral thinking. Memorizing and memorizing skills

**Reference Books:**

1. Orient communication in English for technical students, by Longman, TTTI Calcutta.
2. How to write and speak better, Reader's digest, By John Ellison Kahn, Touchan Books Limited.
3. Six Hat thinking, by Bono E.D., Pengwin Books
4. English Grammar by Wren and Martin.
5. Word Power Made easy by Norman Lewis, Goyal Saab, W.R.Goyal Publishers

Minimum 8 tutorials/assignments/group discussions based on above curriculum,

following list will be considered as a guideline.

1. Vocabulary building. (words/week)
2. Demonstration of audio, video CDs.(LRs)
3. Reading, orating and writing paragraphs from English daily.
  - a. Precise writing and comprehension.
  - b. Enriching communication with use of idioms and phrases.
  - c. Learning read/write/speak by listening to learning recourses
4. Supervised one to one, one to many and many to many communication (letter, extempore, board writing, telephonic conversation, debate, elocution etc.)
5. Demonstration of Audio, Video CDs of interviews, speeches etc.
6. Audio recording of the conversations and analysing it offline.
7. Pronunciation of foreign language words commonly practiced. (French, Greek, Latin etc)
8. Six thinking hats/lateral thinking.
9. Practice of memorizing

**Practical Examination:**

The examination consists of oral based on tutorial/assignments/reports

## IN601 DISTRIBUTED CONTROL SYSTEM

**Teaching Scheme : 04 L +00T Total 04**

**Credit : 04**

**Evaluation Scheme: 15 CT1 + 15 CT2 +10 TA+ 60 ESE**

**Total Marks: 100**

**Duration of ESE : 2hrs 30min.**

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**Introduction:** To programmable logic controllers, PLC architecture, operation, definition of discrete process control, ladder diagrams, ladder diagram elements, ladder programming and its features, programming examples of typical processes.

**Hierarchical control:** Hierarchical control, overall tasks of the system, task listing, lower and higher level computer tasks. The centralized control and its features Personal computers in process control, direct digital control, distributed process control

**Introduction:** to supervisory control and data acquisition (SCADA) as applied to process control systems.

**DCS Configurations:** Functional block diagram of DCS, supervisory computer displays, Software configurations in DCS, control technique, Communication between components of DCS, DCS algorithm, attributes. Study of any one DCS such as TDC-3000.

**Introduction:** To data highways, Field buses, Multiplexers and remote sensing terminal units.

**System integration:** With PLC and computer (Hybrid control system), I/O hardware, set point stations, Network protocols, MAP/TOP.

**Computer integrating process,** communication hierarchy, ISO/OSI reference model, MAP, TOP application. Study of YOKOGAWA, Rosemount Distributed Control Systems.

### **Text Book:**

1. Process Control Instrument Engineers Handbook by Bela G. Liptak third edition, Butterworth Heinemann Company.1999

### **Reference Books:**

1. Introduction to Programmable Logic Controllers by Gary Dunning, Second Edition, Thomson Delmar learning, 2002.

2. Process Control Instrumentation Technology by C. D. Johnson, Seventh Edition, Pearson Education, New Delhi 2003.
3. Instrument Engineers handbook – by Liptak B. G. (Ed) Vol-II and III, Chilton book Company.
4. Programmable Controllers: Principles and Applications, by Webb J. W. Mergy/publishing co. 1988
5. Computer Based Industrial Control By Krishankant, PHI, 2005,7th Edition

## **IN602 MICROCONTROLLERS AND ITS APPLICATIONS**

**Teaching Scheme : 04 L +00T Total 04**

**Credit : 04**

**Evaluation Scheme: 15 CT1 + 15 CT2 +10 TA+ 60 ESe**

**Total Marks: 100**

**Duration of ESE : 2hrs 30min.**

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**Introduction to microcontrollers:** Evaluation of Microcontroller , Classification families, manufacturer and applications, Comparison of microprocessor and microcontrollers 4-bit, 8-bit, and 16-bit microcontrollers 89C5I and other 8-bit microcontroller chips, System Development tools, assembler Simulator, Emulator, EPROM programmers.

**8051 Architecture:** Pin out diagram, 8051 oscillator and clock, Program counter and Data Pointer, A and B CPU registers, Flags and Program Status Word, internal memory, stack and stack pointer, Special Function Registers, internal ROM, i/p and o/p ports.

Assembly language programming for 8051 microcontroller instruction classification, instruction set Arithmetic and logical operations, jump and call instructions etc., Writing assembly language programming based on instruction set, stacks and subroutines.

**Interrupts of 8051:** Serial data input and output, serial data transmission and communication counters and timers, timer modes timer/counter programming. 8051 microcontroller interfacing with: 8255, Keyboard and Display, A/D and D/A chips external memories (RAM and EPROM).

**Design of dedicated systems** using 8051 for temperature indication OR/AND control, Flow indication OR/AND control stepper motor control Embedded control systems, Smart transmitters.

**Bus interfacing standards:** RS 232, IEEE 488.



**Microcontroller Selection:** Features, architectures and instruction set comparison of 8051 ATMEL, MOTOROLA, DALLAS Devices data sheets.

**Text Books:**

1. 8051 Microcontroller: Architecture, Programming and applications by Ayala K.J. Penram international 2nd Edition

**Reference Books:**

1. Programming and customizing the 8051 Microcontroller by Myke Predko, McGraw-Hill, New Delhi. Edition-2005.
2. The 8051 Microcontroller and Embedded System By Mazidi M.A., Pearson Education 2004
3. Intel's PIC AVR, Motorola Manual.

### IN603 POWER ELECTRONICS

**Teaching Scheme : 04 L+00T Total 04**

**Credit : 04**

**Evaluation Scheme : 15 CT1 + 15 CT2 +10 TA+ 60 ESE**

**Total Marks: 100**

**Duration of ESE : 2hrs 30min.**

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**Introduction:** Modern power semiconductor devices and their characteristics, gate drive specifications, ratings, applications, Design of gate triggering circuits using UJT, PUT, IGBT ,Diac, Triac, Thyristor and Thyristor protection circuits.

**Thyristor Commutation Techniques:** Principles of Natural commutation, Design of Forced commutation circuits: Self commutation, Impulse commutation, Resonant pulse commutation, Complementary commutation, External pulse commutation.

**Phase Controlled Rectifiers:** Single phase rectifiers: Half wave, Center tapped, Bridge (half controlled and fully controlled) with R and RL load.

**Three phase rectifiers:** Half wave, Bridge with R and RL load. Effect of source inductance, voltage and current harmonics analysis, dual converters. Power factor improvement methods.

**DC Chopper:** Basic chopper, continuous and discontinuous current conduction; TRC, CLC methods, classification of choppers, step-up chopper.

**AC Voltage Controller:** Types of ac voltage controllers, single-phase ac voltage controllers with R and RL load, transformer tap changers.

**Inverters:** Single phase inverters: series, parallel and bridge configurations with R load, PWM inverters. Three phase inverters with  $120^\circ$  and  $180^\circ$  conduction with R and load RL, voltage control and harmonics reduction.

**Cycloconverters:** The basic principle of operations of single phase to single phase, three phase to single phase, three phase to three phase with circulating and non-circulating mode.

**Speed control of DC motors:** Using different rectifiers, principles of regenerative braking, principles of two/ four quadrant chopper drives, control using multiphase choppers, microprocessor control of DC drives.

**Speed control of AC motors:** Stator voltage control, rotor voltage control, frequency control, voltage and frequency control, microprocessor control of AC drives.

**Text Books:**

1. An Introduction to Thyristor and Their Application, by Ramamurty M., Affiliated East-West Press Private Limited, New Delhi-110 020 (India), 2nd Edition, 1991.

**Reference Books:**

1. Power Electronics: Circuits, Devices, and Applications, by Rashid M. H., Prentice Hall of India Private Limited, New Delhi-110 001(India), Second Edition, 1994.
2. Power Electronics, by Singh M. D., Khanchandani K. B., McGraw-Hill Publishing Company Limited, New Delhi (India), 1998.
3. Power Electronics by. Bimbhra P. S., Khanna Publishers, Delhi-110 006 (India), 2nd Edition, 1998.
4. Electric Drives, by. De N. K., Sen P. K., Prentice Hall of India Private Limited, New Delhi-110 001(India), 1999.
5. Principles of Thyristorised Converters, by. De G., Oxford and IBH Publications.

## IN604 POWER PLANT INSTRUMENTATION & UNIT OPERATION

**Teaching Scheme : 04 L +00T Total 04**

**Credit : 04**

**Evaluation Scheme : 15 CT1 + 15 CT2 +10 TA+ 60 ESE**

**Total Marks: 100**

**Duration of ESE: 2hrs 30min.**

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**Basic concept:** Unit operation & unit process, block diagram of chemical process, classification of unit operation, material and energy balance, batch and continuous process, endothermic and exothermic reactions, 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.

**Transportation & Systems:** Classification, efficiency and characteristics of pumps, compressors, fans, blowers and NPSH of centrifugal pumps.

**Heat Exchangers:** Types of heat exchangers.

**Distillation:** Continuous, Fractionating columns, plate efficiencies, flash distillation and batch distillation.

**Drying:** Principle of drying, classification of dryers, drying equipments, selection of drying equipment.

**Evaporation:** Types of evaporators, single effect evaporators, multiple effect evaporators, forced circulation evaporator.

**Thermal Power plant:** Unit overview, types of boilers, turbine generators, condensers, material handling systems. Introduction to Hydroelectric power plant & Nuclear Power plant. Automation strategy for power plant.

**Boiler Instrumentation:** Control and optimization, combustion control air to fuel ratio control, three element drum level control, steam temperature and pressure control, O<sub>2</sub>/CO/CO<sub>2</sub> in flue gases, furnace draft, boiler interlocks.

**Filtration:** Mechanism of filtration, rotary drum filter, suspended batch centrifuge, clarifying filter, cyclone, bag filter.

**Separation:** Hydroclone, Centrifugal decanter, disk centrifuge.

**Size Reduction:** Crushing laws, crushing equipments.

**Text Books:**

1. “Unit Operations of Chemical Engineering” by McCabe, Smith G.C. , Harriot P. McGraw Hill Publication Sixth Edition 2001

**Reference Books:**

1. Chemical Engineers Handbook by Perry .J.H., McGraw Hill 1984
2. Computer Based Industrial Control by Krishan Kant Prentice Hall of India 7th Edition 2005
3. Process Control Volume II by Liptak B. G. , Butterworth Third Edition 1999

**IN605 FEEDBACK CONTROL SYSTEM****Teaching Scheme: 04L+00T Total 04****Credit :04****Evaluation Scheme : 15 CT1 + 15 CT2 +10 TA+ 60 ESE****Total Marks: 100****Duration of ESE : 2hrs 30min.**

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**Introduction:** Basic definition of control system and related terms, historical development of automatic control system, basic control action, classification of control system, open loop and closed loop system, examples.

**Mathematical modeling of physical systems:** Definition of physical system, linear, non linear, time varying, time invariant systems, differential equation of physical systems- mechanical system, electrical system, thermal system, pneumatic system, Analogy between electrical and mechanical system.

**Transfer functions:** Transfer function of physical system, Block dig. Algebra, reduction rules, signal flow graph- definition, construction properties, Masons gain formula, Application of gain formula to block diagrams.

**Time response analysis:** Standard test signals, Analysis of first order and second order systems, time response specifications, steady state error, system types and error constants.

**Stability analysis and root locus:** Concept of stability, Necessary condition for stability, Bounded Input Bounded Output stability ,Hurwitz criterion, Routh stability criterion, Relative stability analysis, Root locus technique concepts, General rules for construction of root locus, Root locus plots, effect of addition of poles and zeros to system, Root locus analysis of control systems.(Use MATLAB)

**Frequency response analysis:** General response of closed loop system, introduction to frequency response, Bode plots, stability margins for the Bode plot, stability analysis of system using bode plots, polar plots, Nyquist stability (Use MATLAB)

**Introduction to Compensation technique** in frequency and time domain

**Text Books:**

1. Control system Engg. By I. J.Nagrath, M. Gopal, New Age Intern.(P) Ltd. Fifth Edition
2. Control system Engg. By Ogata K.

**Reference Books:**

1. Control system principles and design by Gopal M., McGraw Hill Publishing Company Limited, New Delhi, 2nd edition
2. Feedback and control systems Joseph J. Distefano, Stubberud, Ivan Williams, Tata McGraw hill publishing Co. Ltd Second edition
3. Control systems by Ashok Kumar McGraw Hill Publishing co. Ltd. 1st edition
4. Automatic control system by Benjamin C. Kuo, PHI, New Delhi 6th edition.
5. Modern control systems by Ogata K., PHI publication 4<sup>th</sup> edition

**IN 606 DISTRIBUTED CONTROL SYSTEM LABORATORY**

**Teaching Scheme : 02 P Total 02**

**Credit : 01**

**Evaluation Scheme : 25 Internal + 25 External**

**Total Marks: 50**

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Minimum 8 Experiments should be conducted from the sample list given below.

However experiment beyond the list and based on curriculum of IN601 may be conducted.

1. Architectural study of Allen bradly PLC.
2. Study of any one PLC software package.
3. Developments of Ladder diagram for the controlling motor operation
4. Development of ladder diagram for temperature control system.
5. Development of Ladder diagram for bottling plant.
6. Study of Software package for SCADA
7. Development of mimic diagram for a particular process using SCADA software
8. Comparative Study of SIMATIC range of products(S7-200,300,400 PLC)

9. Study of any one DCS software package.
10. Comparative study of DCS systems.

**Practical Examination:**

It consists of oral based on file/journal/report submitted by students based on curriculum of course IN601.

**IN 607 MICROCONTROLLERS AND ITS APPLICATIONS LABORATORY**

**Teaching Scheme : 02 P Total 02**

**Credit : 01**

**Evaluation Scheme : 25 Internal + 25 External**

**Total Marks: 50**

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Minimum 8 Experiments should be conducted from the sample list given below.

However experiment beyond the list and based on curriculum of IN602 may be conducted.

1. At least 4 software programs from the following list
  - a. Block transfer
  - b. Searching Sorting
  - c. BCD binary Arithmetic
  - d. Number system conversion etc.
  
2. Block operational
  - a. Moving
  - b. Exchange
  - c. Search
  - d. Sum
  - e. Avg.
  
3. Interfacing Keys and LED's with microcontroller.
4. Interrupts timers serial communication.
5. Interfacing ADC with microcontroller.
6. Interfacing DAC with microcontroller.
7. Interfacing 7 segment display and keyboard with microcontroller
8. Study of interrupts.
9. Interfacing of stepper motor with microcontroller
10. PC downloads experiment

**Practical Examination:**

It consist of performance of experiment based on file/journal/report submitted by students and oral based on curriculum of course IN602

## IN 608 POWER ELECTRONICS LABORATORY

**Teaching Scheme : 02 P Total 02**

**Credit : 01**

**Evaluation Scheme : 25 Internal + 25 External**

**Total Marks: 50**

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Minimum 8 Experiments should be conducted from the sample list given below.

However experiment beyond the list and based on curriculum of IN603 may be conducted.

1. UJT Relaxation oscillator.
2. SCR characteristics.
3. Triac characteristics.
4. Power control using SCR.
5. Power control using Triac.
6. Single phase controlled Rectifiers.
7. Half controlled full wave.
8. Fully controlled full wave.
9. Single phase inverter using transistor.
10. Basic transistor chopper.
11. Study of D.C. motor control using controlled rectifiers.
12. Study of D.C. motor control using choppers.
13. Study of A.C. motor control using inverter.

### **Practical Examination:-**

It consist of performance of experiment based on file/journal/report submitted by students and oral based on curriculum of course IN603

## IN 609 GENERAL PROFICIENCY-II

**Teaching Scheme : 02 P Total 02**

**Credit : 02**

**Evaluation Scheme : 50 Internal**

**Total Marks: 50**

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Memorizing and memorizing technique

**Verbal communication:** Interpersonal skills, Group Discussion Face to Face

Communication, Interview Techniques, Ways of conducting meeting Seminars and

Conferences, Workshops etc

**Written Communication:** Format for Business Correspondence Technical Proposals, Research Papers, Articles, Advertising and Graphics, Notices minutes of meetings Quotations, Order, Enquiry

**Reference Books:**

1. Orient communication in English for technical students, By Longman, TTTI Calcutta (for first topic)
2. How to write and speak better, Reader's digest, By John Ellison Kahn, Touchan Books Limited.
3. Body language, By Allan Pease, Sheldon press

The sample list is given below as a guideline. The list is to inform about minimum expected outcome.

1. Live observation of the conversation/communication, body language.
2. Learning conversation by listening to guidelines.(with learning recourses)
3. Supervised one to one, one to many and many to many conversation can be practiced.
4. Demonstration of Audio, Video CDs of well known personalities.
5. Audio recording of the conversations and analyzing it offline.
6. Video recording of the conversations and analyzing it offline.
7. Talking in front of mirror in the laboratory in presence of observers like other batch mates, group leaders and/or teachers

The internal assessment is based on submission of Tutorials/assignments/group discussion and oral based on Curriculum of course IN609.

**IN 610 MINOR PROJECT**

**Teaching Scheme : 02 P Total 02**

**Credit : 02**

**Evaluation Scheme : 50 Internal**

**Total Marks: 50**

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The Minor Project consist of Design and fabrication of Instrumentation oriented projects such as

1. Process Instrumentation & Automation
2. Biomedical Instrumentation
3. Electronic Instrumentation
4. Microprocessor based Instrumentation.



The minor project work should be carried out in laboratory only. The topic may be given to the individual student or group of not more than three students. The evaluation will be based on the quality of work, report, presentation and demonstration by the students in front of the Expert committee from the department.