GONDWANA UNIVERSITY, GADCHIROLI
Four Year Degree Course in Engineering and Technology
Course and Examination Scheme with Credit Grade System
Fifth Semester B.E. (Instrumentation Engineering)

Subject Code	Subject	Teaching Scheme				Examination Scheme									
		Hours Per Week			Number of Credits	THEORY						PRACTICAL			
		L	T	P		Duration of Paper (Hrs.)	Max. Marks ESE	Max. Marks Sessional		Total	Min . Passing Marks	Max. Marks TW	Max. Marks POE	Total	Min . Passing Marks
								MSE	IE						
IN501	Process Automation	3	1	0	4	3	80	10	10	100	40	--	--	--	--
IN502	Signals & Systems	3	1	0	4	3	80	10	10	100	40	--	--	--	--
IN503	Power Electronics	3	1	0	3	3	80	10	10	100	40	--	--	--	--
IN504	Microprocessors and Interfacing	3	1	0	3	3	80	10	10	100	40	--	--	--	--
IN505	Control System Components	3	1	0	4	3	80	10	10	100	40	--	--	--	--
Laboratories															
IN506	Process Automation	0	0	3	2	--	--	--	--	--	--	25	25	50	25
IN507	Power Electronics	0	0	3	2	--	--	--	--	--	--	25	25	50	25
IN508	Microprocessors and Interfacing	0	0	3	2	--	--	--	--	--	--	25	25	50	25
IN509	Programming Practice III: MATLAB/SCILAB	0	0	2	2	--	--	--	--	--	--	50	--	50	25
Total		**15**	**5**	**11**	**26**	--	--	--	--	**500**	--	--	--	**200**	--
Semester Total		**31**													**700**

Appendix A

GONDWANA UNIVERSITY, GADCHIROLI

FACULTY OF ENGINEERING AND TECHNOLOGY

CONSLIDATED STATEMENT OF VARIOUS PARAMETERS IN TEACHING & EXAMINATION SCHEME OF

B.E. (INSTRUMENTATION ENGINEERING)

SR.NO.	SEMESTER	NO. OF THEORY SUBJECTS	NO OF LABS/PRACT	TEACHING HOURS(TH) (L+T)	TEACHING HOURS (PRACT)	TOTAL CREDIT	MAX. THEORY MARKS	MAX.PRACT MARKS	MAX. MARKS TOTAL
1	I	--	--	--	--	--	--	--	--
2	II	--	--	--	--	--	--	--	--
3	III	5	4	20	11	25	500	200	700
4	IV	5	4	20	11	25	500	200	700
5	VI	5	4	20	11	26	500	200	700
6	VI	5	4	19	13	26	500	200	700
7	VII	4	4	16	13	23	400	250	650
8	VIII	4	4	16	15	25	400	250	650
		28	**24**	**111**	**74**	**150**	**2800**	**1300**	**4100**

***Audit course. It is neither considered as passing head nor considered for earning some credit(s). However, this is mandatory to be taken up at the respective college level**

Subject wise Board of Studies Affiliation

Board of Studies	Subject Codes
APPLIED SCIENCES & HUMANITIES	IN301, IN401, IN601
ELECTRICAL ENGINEERING	IN503
INSTRUMENTATION ENGINEERING	Rest all ,except above enlisted

V Semester B.E.
Instrumentation Engineering

V Semester B.E. Instrumentation Engineering

Course Code : IN501

Title of the Course : Process Automation

Course Scheme					Evaluation Scheme (Theory)				
Lecture	Tutorial	Practical	Periods/week	Credits	Duration of paper, hrs	MSE	IE	ESE	Total
3	1	0	4	4	3	10	10	80	100

Units	Contents	Hours
1	**Process Dynamics:** Elements of Process dynamics, process variables, types of processes, (dead time, single and multi capacity, self and non self regulating process) dynamics of physical system, The input-output Model, Degrees of freedom, liquid gas and thermal processes, mathematical modeling, process time constant and method for finding time constant, dead time, Introduction and evolution of Automation in industries, Benefits of automation.	07
2	**Control Action and Controllers:** Basic control action, two position, multi-position, floating control modes, Continuous controller modes: proportional, integral, derivative, Composite controller modes: P-I, P-D, P-I-D, Integral wind-up and prevention, Auto/Manual transfer, Bump less transfer, Response of controllers for different test inputs, controller tuning using Cohen-Coon, Ziegler-Nichols, Bode Stability criterion methods, Pneumatic and electronic controllers.	10
3	**Advanced control systems:** Feedback and Feed-forward control, Cascade control ,ratio control, split range control, auto selective control, multivariable process control, adaptive and inferential control, interaction and decoupling ,robust control.	09
4	**Programmable Logic Controller (PLC):** Introduction, Architecture, PLC specifications, input/output modules, power supplies and isolators, PLC programming procedures: programming on-off inputs/outputs, auxiliary commands and functions; PLC Basic Functions, register basics, timer functions, counter functions; PLC intermediate functions: Arithmetic functions, comparison functions, Design of interlocks and alarms using PLC, development of ladder diagram for various processes, Introduction to SCADA and HMI.	11
5	**Distributed Control Systems (DCS):** Definition, Local Control Unit (LCU) architecture, configuration and programming, communication facilities, redundancy concept, Evolution of signal standards – HART communication protocol –	08

	communication modes – HART networks. Introduction – General field bus architecture – basic requirements of field bus standard.	
	Total	**45**

TEXT BOOKS:

1. Process Control and Instrumentation technology by C. D. Jonson.
2. G. Stephanopoulos, "Chemical Process Control: An Introduction to Theory and Practice", Prentice Hall of India, New Delhi, 2001.

REFERENCE BOOKS:

1. Process Control , application , designing and tuning by F.G.Shinsky
2. Handbook of Process Control by Bela G.Liptak
3. Applied Instrumentation in Process Industries by Andrews.
4. Garry Dunning , "Programmable Logic Controllers " PHI Pub, 3/e
5. Distributed Computer Control for Industrial Automation by Poppovik Bhatkar, Dekkar Publications.
6. Automatic Process Control by Donald P. Eckman.
7. John W. Webb Ronald A Reis, "*Programmable Logic Controllers - Principles and Applications*", 4th Edition, Prentice Hall Inc., New Jersey, 1998.
8. Krishna Kant, "*Computer-based Industrial Control*", Prentice Hall, New Delhi, 1997.

V Semester B.E. Instrumentation Engineering

Course Code : IN502

Title of the Course : Signals and Systems (V Semester Electronics/ETC/ECE/Electrical/E&P)

Course Scheme					Evaluation Scheme (Theory)				
Lecture	Tutorial	Practical	Periods/week	Credits	Duration of paper, hrs	MSE	IE	ESE	Total
3	1	0	4	4	3	10	10	80	100

Unit	Contents	Hours
1	Classification of signals: Continuous time and discrete time, even, odd, periodic and non periodic, deterministic and non deterministic, energy and power. Fourier Transform of Elementary signals: exponential, sine, step, impulse, ramp, rectangular, triangular, signum, sinc. Properties of Fourier Transform, Convolution theorem, sampling theorem. Systems: Definition, Classification: linear and non linear, time variant and invariant, causal and non-causal, static and dynamic, stable and unstable, invertible. Introduction to Laplace Transform,	9
2	Linear Time Invariant Systems: Introduction, Discrete Time LTI Systems: The Convolution sum and the convolution Integral , Properties of Linear Time Invariant Systems, Causal LTI Systems described by Differential and Difference equations Singularity functions	9
3	Fourier Transform Analysis: Fourier Series representation of periodic Signals, The continuous time Fourier transform, discrete Fourier Transform and introduction to FFT.	9
4	Z-Transform: Definition, properties of z-transform, z-transform of standard sequences, inverse Z-transform, relationship of z-transform with Fourier transform, applications of Z-transform to solutions of difference equations, Properties and	9

	Applications of Z-transform.	
5	Time and Frequency Characterization of Signals and Systems :-First & Second order Continuous and Discrete time System ,examples of Time and frequency domain Analysis of systems Sampling: Representation of a continuous –Time Signal by its Samples-Sampling Theorem, Reconstruction of a signal from its samples using interpolation, The effect of understanding : Aliasing, Discrete Time Processing of Continuous Time Signal and Sampling of Discrete time Signal.	9
	Total	**45**

Text Books :

1. Signals and Systems by Alan V. Oppenheim, Alan S. Wilsky and S. Hamid Nawab, Publication: Prentice Hall of India Edition: Second Ed., 1997.

Reference Books :

1. Signals and Linear Systems by Gabel R.A. and Robert R.A, John Wiley and Sons, New York, 1987,Edition: 3rd Edition
2. Systems and Signal Analysis by C. T. Chen Publication: Oxford University Press, India, 3rd Edition, 2004
3. Introduction to Signals and Systems by Michael J. Robert, Publication: Tata Mc-Graw Hill, Edition: Second, 2003.
4. Signals and Systems by S. Haykin and B. V. Veen, Publications: John Wiley and Sons, Inc., Editions: Second Edition, 1999.
5. Signals and Systems Analysis using, Transform Methods and MATLAB by M. J. Roberts Tata McGraw-Hill Publishing Company Limited, Second Edition, 2003.

V Semester B.E. Instrumentation Engineering

Course Code : IN503

Title of the Course : **POWER ELECTRONICS**

FIFTH SEMESTER B.E. (Electronics / Electronics & (Tele) Communication/Instrumentation)

SUBJECT : POWER ELECTRONICS

Lectures	Tutorial(s)	Practical	Total periods/week (each of 60 minutes duration)	Credits
04	01	02	07	05

Unit	Contents	Hours
I	**Basics in Power Electronics Engineering** Development of Power Controllers, Working Principle & Characteristics of different Power Controllers, Thyristor Family, Two Transistor model of SCR, Gate Characteristic, Turn On , Turn Off Mechanisms & other ratings of SCRs , Relaxation Oscillators using UJT, Basic Firing Circuits for SCR, Application of SCR in obtaining Logic Gates, Flip Flop and Circuit Breaker, AC Power control using TRIAC- DIAC, Basic Firing Circuits for SCR Power Transistor, Power MOSFET & IGBT (Basic properties, characteristics, comparison & applications)	12
II	**Phase Controlled Rectification** Principle of Phase Control, Line Commutation, Single phase half wave, Full wave mid –point, Fully controlled with & without freewheeling diode with different types of Loads, Effect of Source inductance, Half Controlled Bridge configurations, Development of expressions for mean current & voltage for different loads, Dual Converter Three Phase fully controlled & half controlled bridge circuits , Development of expressions for mean voltage	10

III	**Inverters** Principle of Inversion, Various Techniques of Forced Commutation & their designs, Single phase & Three phase series Inverter, Single Phase Parallel Inverter, Single phase bridge Inverter (All with commutation Circuits), Design of Filter Three phase fully controlled bridge inverters in different modes (without commutation Circuit), Design of complete firing circuit for Three phase Power Control Circuits	12
IV	**Choppers & Cycloconverter** Principle of Working ,Types of Choppers, Oscillating Chopper, Jones & Morgan's Chopper, Multi Phase Chopper, Step Up Chopper, AC Chopper, Need & Principle of Working of Cycloconverter using single phase bridge circuits	08
V	**Multiple Connection & Protection** Need & methods of multiple connections of SCRs, Design of Equalizing Circuits, Firing Circuits during multiple connection, Gate protection, Over current & over voltage protections of SCR, Design of Snubber Circuit, Converter Faults	08
	Total	**50**

Text Books :

(1) M.H. Rashid, "Power Electronics Circuits, Devives & Applications", Pearson Education
(2) C.W. Lander, "Power Electronics", McGraw Hill
(3) M. Ramamoorthy, " Thyristors & their Applications"
(4) GK Dubey, Doradla, Singh, Joshi " Thyristorstorized Power Controllers", New Age International
(5) Singh, Khanchandani, " Power Electronics", Tata McGraw Hill
(6) SCR Manaual by General Electric

Reference Books :

(1) Philip T. Krein, "Elements of Power Electronics", Oxford University Press
(2) Vedam Subrahmanyam, "Power Electronics", New Age International
(3) MS Jamil Asghar, "Power Electronics", Prentice Hall of India
(4) PC Sen, 'Modern Power Electronics", S. Chand Publishers
(5) PS Bhimra, "Power Electronics", Khanna Publishers

V Semester B.E. Instrumentation Engineering

Course Code : IN504

Title of the Course : Microprocessors and Interfacing

Course Scheme					Evaluation Scheme (Theory)				
Lecture	Tutorial	Practical	Periods/week	Credits	Duration of paper, hrs	MSE	IE	ESE	Total
3	1	0	4	3	3	10	10	80	100

Units	Contents	Hours
1	**Introduction of Microcomputer System**: CPU, I/O devices, clock, memory, bussed architecture, tri-state logic, address bus, data bus and control bus. **Semiconductor Memories**: Development of semiconductor memory, internal structure and decoding, memory read and write timing diagrams, RAM, ROM, EPROM, EEPROM, DRAM.	7
2	**Architecture of 8-bit Microprocessor:** Intel 8085A microprocessor, Pin description and internal architecture. **Operation and Control of Microprocessor:** Timing and control unit, op-code fetch machine cycle, memory read/write machine cycles, I/O read/write machine Cycles, interrupt acknowledge machine cycle, state transition diagram.	10
3	**Instruction Set:** Addressing modes; Data transfer, arithmetic, logical, branch, stack and machine control groups of instruction set. **Assembly Language Programming:** simple examples, Subroutines, parameter passing to subroutines.	10
4	**Interfacing:** Interfacing of memory chips, address allocation technique and decoding; Interfacing of I/O devices, LEDs, and toggle-switches as examples, memory mapped and isolated I/O structure. **Programmable Peripheral Interface:** Intel 8255, pin configuration and block diagram, modes of operation, programming; ADC and DAC chips, stepper motor their interfacing. and programming. **Interrupts:** Interrupt structure of 8085A microprocessor, processing of vectored and non-vectored interrupts, Handling multiple interrupts, and programming **Programmable Interrupt controller:** Intel 8259, Block diagram, Interrupt operation, programming	10
5	**Programmable Interval Timer:** Intel 8253/8254, pin configuration, internal block	8

	diagram of counter and modes of operation, counter read methods, programming, READ-BACK command of Intel 8254. **Serial I/o and Data communication:** RS232, Intel 8251A programmable communication Interface, pin configuration, internal block diagram, 8237 DMA controller and programming. **Programmable keyboard/display interface:** 8279 pin configuration, internal block diagram and programming. **Introduction of 8086 microprocessor and its architecture.**	
	Total	**45**

TEXT BOOKS:

1. Microprocessor Architecture, programming, and Applications with the 8085 by Ramesh Gaonkar, Penram ISBN-81-87972-09-2
2. Fundamentals of Microprocessor and Microcomputers by B. Ram, Dhanpat Rai and Co.

REFERENCE BOOKS:

1. Stewart J, "Microprocessor Systems- Hardware, Software and Programming", Prentice Hall International Edition,1990
2. Short K. L., "Microprocessors and Programmed Logic", Pearson Education

V Semester B.E. Instrumentation Engineering

Course Code : IN505

Title of the Course : Control System Components

Course Scheme					Evaluation Scheme (Theory)				
Lecture	Tutorial	Practical	Periods/week	Credits	Duration of paper, hrs	MSE	IE	ESE	Total
3	1	0	4	4	3	10	10	80	100

Units	Contents	Hours
1	**Industrial Control Devices** - **Switches:** Toggle switch, Slide switch, DIP switch, Rotary switch, Thumbwheel switch, Selector switch, Push button, Drum switch, Limit switch, Emergency switch, Micro-switches, Review of process switches, Switch specifications. **Relays & Contactors:** Electro-mechanical relay, Reed relay, hermetically sealed relay, Solid-state relays, contactors, Comparison between relay and contactor. Development of wiring diagram for given application using above components.	06
2	**Sequencing & Interlocking for motors**: Concept of sequencing & Interlocking, Standard symbols used for Electrical Wiring Diagram, Electrical Wiring diagrams for Starting, Stopping, Emergency shutdown, (Direct on line, star delta, soft starter), Reversing direction of rotation, Braking, Starting with variable speeds, Jogging/Inching	10
3	**Auxiliary Components and Control valves** Synchros, Feeders, Dampers, Alarm annunciator, High/low selectors, P to I and I to P converter. Circuit Breaker: Need of Circuit Breaker, Operating Principle, and Types. Control Valves: Introduction, Types based on design and characteristics, components of control valve, Valve sizing, Typical applications.	08
4	**Hydraulic Components** Hydraulic Fluid, Hydraulic Power Pack, Hydraulic Filters, Piping, Heat Exchangers, Hydraulic Pumps, Actuator (cylinders & motors), Hydraulic valves. Hydraulic Circuits**:** Development of hydraulic circuits using Standard Symbols. Hydraulic Circuits like Meter in, Meter out Reciprocating, speed control, Sequencing of cylinders, Direction control, Deceleration, Regenerative circuit, etc Troubleshooting in Hydraulic circuits. Introduction to circuit design.	08
5	**Pneumatic Components** Compressed Air theory, Air treatment and distribution, Pneumatic Power Supply, Types of Pneumatic Relay, FRL unit, Pneumatic Actuator (cylinders and Air motors), Pneumatic valves, Fluidic Elements and its applications. Pneumatic Circuits**:** Development of Pneumatic circuits using Standard Symbols. Sequence diagram (step-displacement) for implementing pneumatic circuits. Different Pneumatic Circuits like Reciprocating, Sequencing, Anti-cycle repetition, Block	08

	transfer, Speed regulation, Job sorting, Electro-pneumatic circuits, etc. Troubleshooting in Pneumatic circuits.	
	Total	**45**

TEXT-BOOKS:

1. Industrial Hydraulics, Pippenger, Tyler Gregory Hicks, Mcgraw Hill.
2. Pneumatic Systems: Principles and Maintenance, S.R. Majumdar, TMH Publication

REFERENCE BOOKS:

1. Modern Control Technology: Components and Systems' C. T. Kilian , Thompson Learning Publication.
2. Industrial Electronics, F.D. Petruzella, McGraw-Hill
3. Electrical Technology, B. L. Theraja, S. Chand Company and Limited

V Semester B.E. Instrumentation Engineering

Course Code : IN506

Title of the Course : Process Automation Laboratory

Course Scheme				Evaluation Scheme (Laboratory)		
Lecture	Tutorial	Practical	Credits	TW	POE	Total
0	0	3	2	25	25	50

Course Objectives:

1. To understand and analyze the theoretical concepts in Process Automation through experimentation.
2. To learn and use the proper methods while gathering experimental data.
3. To get familiar with the proper use of process control and automation instruments and equipments in Process Control laboratory.

Suggested list of Experiments:

1. Determine the time-constant of RTD for given step-input.

2. Design of an electronic ON-OFF controller and plot the characteristics of neutral zone of controller
3. Design an electronic PID controller and study its response for step input.
4. Study of Cascade Control trainer (Flow & Level control)
5. Study of flow control trainer
6. Control valve characteristics
7. Study of basic logic operations, timer, counter, arithmetic operations in PLC.
8. Study of analog operations in PLC.
9. PLC programming for bottle filling, logic relays etc.
10. Study of DCS and programming in FBD

Outcomes by the end of the session:

- Students will be able to do experiments based on syllabus using proper methodology and derive scientific conclusion/s based on experiments conducted.

V Semester B.E. Instrumentation Engineering

Course Code : IN507

Title of the Course : Power Electronics Laboratory

Common for B. E. Electronics/Electrical /Instrumentation Engineering

Course Scheme				Evaluation Scheme (Laboratory)		
Lecture	Tutorial	Practical	Credits	TW	POE	Total
0	0	3	2	25	25	50

Course Objectives:

1. To become familiarize and explain the physical principles, operations, structural details and their characteristics of power semiconductor devices.
2. To understand the various techniques of turning on & turning off of the thyristors.
3. To describe the operation of different rectifiers, cycloconverters, inverters and choppers with their applications.

Suggested list of Experiments:

1. Study of SCR characteristic.
2. Study of DIAC/TRIAC characteristics.
3. Study of SCR firing circuits.
4. Study of SCR commutations.
5. Study of half wave controlled rectifier.
6. Study of full wave controlled rectifier.
7. Study of cycloconverters.
8. Study of SCR series / parallel inverter.
9. Study of PWM inverter.
10. Study of step up/down chopper.

Course Outcomes:

Students will be able to design and explain different types of power electronics circuits and able to choose particular circuits for controlling and protecting the industrial applications.

V Semester B.E. Instrumentation Engineering

Course Code : IN508

Title of the Course : Microprocessors and Interfacing Laboratory

Course Scheme				Evaluation Scheme (Laboratory)		
Lecture	Tutorial	Practical	Credits	TW	POE	Total
0	0	3	2	25	25	50

Course Prerequisites: Digital Electronics

Course Objective:

- To develop an in-depth understanding of the operation of microprocessors, assembly language programming & interfacing techniques.

Suggested list of experiments:

1. Programs illustrating immediate, direct & register addressing mode
2. Programs illustrating register indirect addressing mode
3. Programs illustrating arithmetic operations
4. Programs illustrating logical operations
5. Program to Find the square of given number
6. Programs illustrating different code conversions
7. Program to arrange array in descending/ascending order
8. Programs illustrating Conditional CALL & RETURN instructions
9. Program illustrating the interfacing of 8255 with 8085A
10. Program illustrating Seven Segment Display Interface
11. Program illustrating the interfacing of 8279 with keyboard and display using 8085A
12. Transmit message using 8251

Course Outcome:

- An ability to understand the basic functioning of 8085 and do programs
- An ability to design memory systems, and do programs for communication and peripheral

Interfacing

- An ability to get aware of hardware and software interaction and integration
- An ability to understand the basic functioning of multiprocessor systems.

V Semester B.E. Instrumentation Engineering

Course Code : IN509

Title of the Course : Programming Practice-III

MATLAB/SCILAB Laboratory

Course Scheme				Evaluation Scheme (Laboratory)		
Lecture	Tutorial	Practical	Credits	TW	POE	Total
0	0	2	2	50	0	50

Course objective:

- Understand the MATLAB/SCILAB Desktop, Command and Graph Window.
- Be able to do simple and complex calculation using MATLAB/SCILAB
- Be able to carry out numerical computations and analysis
- Understand the mathematical concepts upon which numerical methods rely
- Understand the tools that are essential in solving engineering problems

Units	Content	Hours
1	Starting with MATLAB/SCILAB, Creating Arrays, Mathematical operations with Array, Script files, Two-dimensional plots, Functions and Function files, Programming in MATLAB/SCILAB.	12
2	Introduction to various MATLAB/SCILAB tool boxes like measurement, Control system, Signal/image processing, Signals and systems etc. and SIMULINK.	12
	Total	**24**

Term work (TW):

Term work shall consist of at least ten exercises/programs based on suggested list and above syllabus

Suggested list of experiments:

1. Study of 1st & 2nd order control system using MATLAB/SCILAB.
2. Study of effect of different values of Zeta on 2nd order response.

3. Study of bode & root locus using MATLAB/SCILAB.
4. Study of lead, lag, lag-lead compensators using MATLAB/SCILAB.
5. State variable modeling using MATLAB/SCILAB.
6. Pole placement using linear state variable feedback using MATLAB/SCILAB
7. Pole placement using Ackermann's formula
8. Solve the problems on the methods of isoclines method, nonlinear system analysis by phase plane method.
9. Derive the DF for nonlinearities. Relay with saturation, relay with dead-zone, dead-zone and saturation, relay with Hysteresis etc.
10. Investigate the stability of system with nonlinearities relay, saturation, dead-zone, hysteresis and existence of limit cycle using DF technique.
11. Study the behavior of Limit Cycle with the help of Vendor Pols equation.

Course Outcomes:

Students will be able to write programs based on above syllabus using proper methodology and derive scientific conclusion/s based on above MATLAB concepts.

TEXT BOOKS:

1. Getting started with MATLAB by Rudra Pratap, Oxford University Press Publisher.
2. Programming in Scilab 4.1 by Das Vinu V. New Age International Reference website: http://www.scilab.in/

REFERENCE BOOKS:

1. Mastering MATLAB7 by Duane Hanselman, Bruce Littlefield, Pearson Education, Fourth Edition.
2. Essential MATLAB for Engineers and Scientists by Brian H. Hahn, Daniel T. Valentine , Academic Press, Fourth Edition.
3. Analysis and Design of control systems using MATLAB by Rao V. Dukkipatti, New Age International.