SRI VENKATESWARA UNIVERSITY
DEPARTMENT OF INSTRUMENTATION

Syllabus for M. Sc. Instrumentation Course (Choice Based Credit System)

Prospectus cum Syllabus

For

M. Sc. Instrumentation (Choice Based Credit System)

Sri Venkateswara University

Tirupati-517502

Vision

- To inculcate certain specific enabling skill sets to prepare the students to take up challenges in any one or more functional domains viz. (i) Academics; (ii) Basic and Applied Research; (iii) Research & Development; (iv) Engineering & Technology and (v) Industry.

Mission

To bring out professionals having knowledge of basic laws of nature together with strong fundamentals in the core area of physics viz. Classical Mechanics, Quantum Mechanics, Condensed Matter Physics, Electromagnetism, Computational Physics, Statistical Physics, Spectroscopy, Photonics, Thin film Technology and Solar Energy Physics, Electronics, Atomic and Nuclear Physics and advanced level topics such as High Energy Physics, Nanotechnology, Nonlinear Optics, etc.

Programme Specific Outcomes

- Understand the basic and advance concepts of different branches of physics
- Perform and design experiments in the areas of electronics, atomic, nuclear, Condensed matter and computational physics

Apply the concepts of Physics in specialized areas of condensed, nuclear, renewable energies, particle physics etc in industry academia, research and day to day life.

1. BACKGROUND

All over the world the growth of an Industrial society in a Nation is measured by its use of Scientific Instruments. This is because the R & D achievements in research organizations and Industries depend on the availability of advanced instruments. Further the instruments can be utilized to its full capacity only if well trained manpower is available for design, development, usage and timely repair and maintenance. This is possible when the gap between Pure Sciences and Engineering; that is in effect the gap between Academic Society and Industrial Sector is bridged. This is a well-established fact today.

It is the requirement that has led to the emergence of Instrumentation Course – a new discipline of not only Science but technology as well and has become frontline area today. The discipline of Instrumentation Course necessarily needs the understanding of latest trends and achievements in the field of Physical, Chemical and Biological Sciences. The main objective

of Instrumentation Course is to logically translate the proven research ideas into a reliable and effective but simple, elegant and handy instruments and gadgets. This will facilitate not only the development of high technology products in diverse fields but also the teaching of advanced techniques in the frontline research.

To fulfill these goals, Sri Venkateswara University introduced M. Sc. Instrumentation course. This is an Industry / R & D oriented Professional course. It incorporates compulsory one month practical training in an industry / R & D organization and a project therein of three months. This gives exposure to the student to day-to-day life environment. The seminar course develops communication skills. Few expert lectures are organized based on course curriculum. Practicals in workshop techniques and skills are also arranged**.**

2. M. Sc. Instrumentation

(Two Years Master's Course in Instrumentation)

ELIGIBILITY: B.Sc. with Physics / Electronics

DURATION: Two years (Four semester course)

Note: This is Industry oriented TWENTY-FOUR months professional course.

3. COURSE STRUCTURE

SEMESTER-I:	4 Theory Courses	4 Credits each
	2 Laboratory Courses	4 Credits each
SEMESTER-II:	4 Theory Courses	4 Credits each
	2 Laboratory Courses	4 Credits each

After completion of Semester-II, Industrial Training for one month

SEMESTER-III:	4 Theory Courses	4 Credits each
	2 Laboratory Courses	4 Credits each
SEMESTER-IV:	4 Theory Courses	4 Credits each
	1 Project Work	8 Credits
	1 Laboratory Courses	4 Credits

SEMESTER I – OVERVIEW

S.No	Components of Study		Title of the Paper	Instruction hours per week	Credits	Internal Assessment Marks	End Semester Exam Marks	Total
1	Core	INS-101	Electronic devises, linear ICs and Industrial Electronics	4	4	20	80	100
2		INS-102	Digital Techniques and Principles of Communications	4	4	20	80	100
3	Compulsory Foundation	INS-103	Human Values and Professional Ethics-I	4	4	20	80	100
4	Elective Foundation	INS-104	"C" Programming	4	4	20	80	100
5	Labs	INS-105	Analogue Electronics Lab	4	4	--	--	100
		INS-106	Digital Electronics Lab	4	4	--	--	100
Total				**24**	**24**	**80**	**320**	**600**

SEMESTER II – OVERVIEW

S.No	Components of Study			Title of the Paper	Instruction hours per week	Credits	Internal Assessment Marks	End Semester Exam Marks	Total
1	Core	INS-201		Introduction to Instrumentation and Control System	4	4	20	80	100
2		INS-202	a	Sensors, Signal Conditioners and Recorders	4	4	20	80	100
			b	Network Analysis					
			c	Basics of Spectroscopy Instruments					
3	Compulsory Foundation	INS-203		Human Values and Professional Ethics-II	4	4	20	80	100
4	Elective foundation	INS-204		Microprocessors	4	4	20	80	100
5	Labs	INS-205		Microprocessors lab	4	4	-	-	100
		INS-206		Transducers Lab	4	4	-	-	100
Total					**24**	**24**	**80**	**320**	**600**

SEMESTER III – OVERVIEW

S.No	Components of Study			Title of the Paper	Instruction hours per week	Credits	Internal Assessment Marks	End Semester Exam Marks	Total
1	Core	INS-301		Scientific/Analytical Instrumentation	4	4	20	80	100
2		INS-302		Microcontrollers and Digital Signal Processing	4	4	20	80	100
4	Generic Elective	INS-303	a	Electronic Instrumentation	4	4	20	80	100
			b	Optical Instrumentation and Photonics					
			c	Instrumentation for Environmental Engineering					
5	Open Elective	INS-304	a	Computer Architecture and Organization	4	4	20	80	100
			b	Geo Physical Instrumentation					
			c	MEMS					
6	Labs	INS-305		Microcontroller Lab	4	4	-	-	100
		INS-306		Analytical Instrumentation Lab	4	4	-	-	100
Total					**24**	**24**	**80**	**320**	**600**

SEMESTER IV – OVERVIEW

S.No	Components of Study			Title of the Paper	Instruction hours per week	Credits	Internal Assessment Marks	End Semester Exam Marks	Total
1	Core	INS-401		VLSI System Design	4	4	20	80	100
2		INS-402		Industrial and Process Control Instrumentation	4	4	20	80	100
3	Generic Elective	INS-403		Industrial Project Work	8	8	--	--	200
4	Open Elective	INS-404	a	Bio Medical Instrumentation	4	4	20	80	100
			b	Optical Communication					
			c	Electrical Engineering Materials					
5	LAB	INS-405		VLSI Lab	4	4	--	--	100
Total					**24**	**24**	**60**	**240**	**600**

4. Generic Elective Course:

Any one of the theory courses mentioned in the list of Departmental (Specialization) courses will be conducted provided adequate number of students opts for it.

Important Note: Following, other departmental, courses will be offered depending upon availability of the staff and facilities. The detailed syllabi can be made available if required / asked for.

INS-304: Generic Elective Course

1. Electronic Instrumentation
2. Optical Instrumentation and Photonics
3. Instrumentation for Environmental Engineering

INS-403: Generic Elective Course

1. Industrial Project Work

5. Open Elective Course:

This course will be choice of the students. Depending upon the background of maximum number of students (As they are coming from different specializations) one course will be finalized, which will be from the following list, but it is not mandatory that the course should be from the given list. **The course may be any other course related to the field.** The course will be design by the concerned teacher and will be approved by the faculty of the department. The assessment of the course will be done by the concerned teacher by giving assignments and tutorials, open book test, seminar etc. If the student is unable to suggest the course, department will finalize the course in consultation with student from given list.

INS-304: Open Elective Course:

1. Computer Architecture and Organization
2. Geo physical Instrumentation
3. MEMS

INS-404: Open Elective Course:

1. Bio Medical Instrumentation
2. Optical Communication
3. Electrical Engineering Materials

INS-403: Course related to Industrial Project Work

INS-403 courses will not be taught in the class room. However respective mentor/staff will guide the student in the preparation/study of this Course.

The Course related to Industrial Project will be designed by the Department faculty with reference to the list given below:

1. Analytical Instrumentation
2. Bio medical Instrumentation
3. Embedded Systems and Applications
4. Renewable Energy Systems
5. Power Electronic System Design
6. Microprocessor Based Instrumentation
7. Microcontroller Based Instrumentation
8. Soft computing Techniques
9. Advanced process control

Note: The content of the syllabus may be varying according to the concerned project.

6. Rules of Credit System for M. Sc. (Instrumentation Course)

1. M. Sc. Instrumentation course has average 7 modular courses per semester.
2. For earning the degree of M. Sc. Instrumentation Science, every student will have to obtain 100 credits of which a minimum of 75% of the credits will have to be earned from the core / compulsory courses from the syllabus as defined by the Department of Instrumentation Course.
3. A student can opt for remaining 25% of the credits from the courses offered by other departments with proper cross matching. This cross matching can be carried out in consultation with the Departmental committee and concerned Head of Departments.
4. Assessment for each theory course is divided into two parts, internal examination and External term end examination in the ratio of 30:70. Teacher may select any / combinations of the following methods for internal assessment.
    a. Series of internal tests
    b. Seminar presentation

5. The outline of the distribution of maximum marks for various aspects/mechanisms towards continuous assessment of the practical is as follows:
    a) Journals -10 marks
    b) Viva-voce at the time of submission of each practical-20 Marks
    c) Group Discussion of 5/6 students for testing the understanding level of Student-10 marks.
    d) Attendance – 5 marks
    e) Additional practical work of in disciplinary approach – 5 marks
6. At least three experiments should be asked for the full course of 4/5 credits and at least two for 2/3 credits.
7. Certified Journal would be compulsory to appear for the ESE (ETE) practical course.
8. There shall be two experts from the parent Department and two examiners (one of which will be external) per batch.
9. Rules for granting term for theory / practical course consists of minimum 75 % attendance for the theory course and completion of Laboratory Journal for at least 75% practical in all respect.
10. Internal assessment for Industrial Training and Project will be carried out on the basis of assessment by the internal guide / staff during the visits, periodic reporting, presentations by the student and the confidential report from the Industry.
11. Granting of term for Industrial Training and Project will be decided on the basis of attendance, actual work carried out by the student, assessment by the internal guide / staff and confidential report from the Industry.
12. The external term end examination consists of
    a) Theory Course — Written examination
    b) Practical Course — Practical examination and viva-voice
    c) Industrial Project Work — Oral presentation followed by question answers
13. For getting a credit for a particular course, student must obtain minimum 40% marks in total (internal assessment and external examination) for the course. For each course grade and grade points would be awarded as shown in the following table.

Marks Obtained	Grade	Grade point
80-100	O: Outstanding	10
70-79	A+: Excellent	09
60-69	A: Very Good	08
55-59	B+: Good	07
50-54	B: Above Average	06
45-49	C: Average	05
40-44	P: Pass	04
0-39	F: Fail	0
-	Ab: Absent	0

14. Final grade w. e. f. the AY 2015-16 (10 point scale):

GPA	Final Grade
9.00 - 10.00	O
8.50 - 08.99	A+
7.50 - 08.49	A
6.50 - 07.49	B+
5.50 - 06.49	B
4.25 - 05.49	C
4.00 - 04.24	P
00.00 - 03.99	F

Remark: B+ is equivalent to 55% marks and B is equivalent to 50% marks

15. Industrial Training**:** Industrial training is for the period of 2½ – 3 months, in an Industry / R & D organization nearby Tirupati.

16. Project**:** The Project work must be carried out in an Industry / R & D organization for a period of three months.

1. Detailed Syllabus

SEMESTER – I

Subject Code	Subject Name	Credits allotted		Total
		Theory	Practical	
INS-101	Electronic Devices, Linear I.Cs And Industrial Electronics	4	--	4
Course Objectives	• To study basic electronic circuits. • To understand the concepts of transistors, UJT,SCR and thyristers • The main objective of this course is to introduce and expose the students to various electronic circuits and design operational amplifiers for various applications			
Course Outcomes	• Understand and describe specifications, features and capabilities of electronic devices. • Understand fundamental of semiconductors • Select appropriate device for circuit operation.			

UNIT-I

a. Electronic Devices:

Introduction to semiconductors. General semiconductor devices -Diodes, Transistor, Field Effect Transistor (FET), MOSFET, Zener diodes Special semi conductor devices - Tunnel diode, Varactor diodes, UJT, SCR, Diac, Triac, Thyristor. Integrated circuits (1C s) -SSL MSI, LSI and VLSI

b. Power supplies and Regulation (DC and AC)

Rectifiers - Half wave, Full wave, Bridge, Voltage Multipliers, Filters -inductance. LC. Pi, and T sections. Basic DC voltage regulation- Two terminal and three terminal voltage regulators,. Switch mode regulated Power supplies (SMPS)- AC voltage regulation- Step voltage regulation and Servo voltage regulation, Constant voltage transformer, UPS.

UNIT-II

a. Analysis of Operational amplifiers:

Introduction to operational amplifiers,. Characteristics of ideal and real operational amplifiers, Op amp configurations - Inverting, Non-inverting, current and voltage-followers, Differential amplifiers and comparators,. Virtual ground and Miller effect.

b. Mathematical operations and applications of Operational amplifiers:

Addition, Subtraction, Scale changing (Multiplication and Division) Integration and Differentiation. Waveform generators: Wein Bridge Oscillator and Multi vibrators, Precision Rectifiers, Instrumentation Amplifiers, Active filters.

UNIT-III

Thyristors and Related Power Devices

Thyristor turn and off methods, Thyristor ratings, SCR half wave rectifier, SCR full wave rectifier, Light activated silicon controlled rectifier (LASCR), Shockley diodes, TRIAC power control circuit, UJT Full wave phase control circuit, Programmable UJT, Silicon controlled switch (SCS), Gate turn off thyristors (GTO), Gate drive Circuits.

UNIT-IV

Industrial Applications

Relays, Reed relay, Solid state relay, UJT/SCR time delay relay, AC time delay relay , Precision long time delay relay, Integrated circuit timers (.555 timers), Electronic resistance welding types of resistance welding, AC welder circuits, Industrial heating, skin effect, High frequency power source for induction heating, Dielectric heating, applications, comparison between dielectric and induction heating, Resistance heating.

REFERENCE BOOKS:

1. Fundamentals of Electronic Devices by David A. Bell
2. Operational Amplifiers and Linear Integrated Circuits by Robert F. Coughlin and Frederick F. Driscoll
3. Operational Amplifiers and Linear Integrated Circuits by Ramakanth Gaekwad
4. Operational Amplifier characteristics and applications by Robert G. Irvine
5. Semiconductor circuits : Linear and Digital by Marlin, Restenbalt
6. An introduction to Operational Amplifiers by SV Subramanyam
7. Industrial electronics by S.Biswas, Dhanpat Rai, India
8. Electronic devices and Circuits by G.K. Mithal
8. Industrial and Power Electronics - G.K. Mithal and Maneesha Gupta, Khanna, 2003.
9. Integrated Electronics - J. Millman and C.C Halkias, McGraw Hill, 1972.
10. Electronic Devices and circuits - Theodore. H.Bogart, Pearson Education, 2003.
11. Thyristors and applications - M. Rammurthy, East-West Press, 1977.

Subject Code	Subject Name	Credits allotted		Total
		Theory	Practical	
INS-102	Digital Techniques and Principles of Communications	4	--	4
Course Objectives	• To teach principles of digital electronics. • To teach topic including Boolean algebra, basic gates, logic circuits, flip-flops, registers, arithmetic circuits, counters, interfacing with analog devices, and computer memory.			
Course Outcomes	• Students will be able to represent numerical values in various number systems and perform number conversions between different number systems • Students will demonstrate the knowledge of operation of logic gates, Boolean algebra, Karnaugh map reduction method. • Students will demonstrate the knowledge of operation of basic types of flip-flops, registers, counter, decoders, encoders, multiplexers, and de-multiplexers. • Students will be able to analyze and design digital combinational circuits including arithmetic circuits half adder, full adder, and multiplier). • Students will be able to analyze sequential digital circuits. Students will demonstrate knowledge of the nomenclature and technology in the area of memory devices: ROM, Ram, PROM, PLD, FPSAs, etc.			

UNIT-I

a. Number systems and codes:

Binary numbers - Binary to decimal conversion, decimal to binary conversion. Binary addition, Subtraction, multiplication and division. Octal numbers: Octal to binary and binary to octal conversions. Octal to decimal and decimal to octal conversions, Hexadecimal numbers - Hexadecimal to binary and binary to hexadecimal Conversions.

b. Logic gates and Boolean algebra

Logic gates AND, OR, NOT, NAND, NOR, XOR and XNOR, Laws of Boolean algebra- Simplification of Boolean functions. De Morgan's theorems, Karnaugh Map simplification.

c. Combinational circuits and flip flops:

Half adder, Full adder, Parallel binary adder, 8421 adder. Half and Full subtracters, Sequential logic: R-S (Delay element). J-K, J-K Master/Slave (race around conditions) flip flops.

UNIT-II

a. Registers, Counters and logic implementation:

Registers - Buffer register, Shift registers, Applications of shift registers- Ring counters, Johnson counter. Counters-Asynchronous/ Ripple counters, Synchronous counters, Mod counters using reset input, Counter application- Digital clock.

b. Combinational logic: Read only Memory (ROM)-Combination logic using ROM, Types of ROMs, Programmable Logic Array (PLA), and Programmable Array Logic (PLA).

c. Analogue to Digital and Digital to Analogue converters:

Introduction, D/A conversion: The R-2R Ladder type DAC, The weighted resistor type DAC, specifications, A/D conversion: Flash type ADC, Dual slope ADC, Successive approximation type ADC.

UNIT-III

a. Modulation (Principles only):

Introduction, Modulation, Need for Modulation, Types of Modulations, Amplitude modulation, Frequency modulation, phase modulation, Comparison between AM, FM and PM Various forms of AM and its comparison, Generation of AM and FM, Demodulation of AM and FM

b. Pulse modulation:

Introduction, Principles of Pulse modulation, Types of Pulse modulations, Sampling theorem, Analog pulse modulation, Digital modulation, Comparison between various types of pulse modulations, Generation and Demodulation of various types of Pulse modulations, Advantages and Applications of PCM

UNIT-IV

a. Introduction to Satellite Communication Systems Principles only):

Line of sight of propagation, Line of sight transmitter and receiver, Microwave repeater, classification of satellites, Differences between active and passive satellites Geostationary satellite, Transponders, Microwave repeater station (block diagram), Satellite repeater (block diagram) , Functioning of a Satellite and earth station, applications of satellite communications, Advantages and disadvantages.

b. Introduction to Wireless Communication Systems (Principles only):

Evolution of mobile radio communication, Mobile radiotelephony, Mobile radio systems, Frequency division Multiplexing , time division multiplexing, Paging systems, Cordless telephone system, Cellular telephone system, Calling through cellular telephone. Comparison of common wireless communication systems, trends in cellular radio and personal communication.

REFERENCES BOOKS:

1. Semiconductor Pulse circuits by Mitchel
2. Digital Principles and Applications by Malvino and Leach
3. Digital Electronics for Scientists by Malmstadt & Enke
4. Integrated Digital Electronics Design by Taub and Schilling
5. Pulse and Digital and Switching waveforms by Millman and Taub
6. Digital computer Electronics: An introduction to Microcomputers by AP Malvino
7. Electronic communication systems by Kennedy
8. Principles of communications by Taub and Schilling
9. Analog and Digital Communications by Gregg.
10. Communication Systems Analog and Digital - R.P. Singh and SDSapre, 2004.
11. Communication Systems Engineering - John. G. Proakis and Masoud Salehi
12. Mobile communications, J. Schiller, Pearson 2008.

Subject Code	Subject Name	Credits allotted		Total
		Theory	Practical	
INS-103	Human Values and Professional Ethics-I	4	-	4
Course Objectives	• To teach principles of Human Values • To teach principles of fundamental of Professional ethics • To teach topics including Bhagavd Gita, Nature of Values, Individual and Society ethics.			
Course Outcomes	• Students will be able to learn Principle Human Values • Students will demonstrate the knowledge of Professional ethics • Students will be able to analyze Bhagavd Gita, Individual and society ethics.			

UNIT-I

Definition and Nature of Ethics – Is relation to Religion, Politics, Business, Law, Medicine and Environment. Need and Importance of Professional Ethics – Goals – Ethical Values in Various Professions.

UNIT- II

Nature of Values – Good and Bad, Ends and Means, Actual and Potential Values, Objective and Subjective Values, Analysis of Basic Moral Concepts – Right, Ought, Duty, Obligation, Justice, Responsibility and Freedom, Good Behavior and Respect for Elders, Character and Conduct.

UNIT- III

Individual and Society: Ahimsa (Non-Violence), Satya (Truth), Brahmacharya (Celibacy), Asteya (Non Possesion) and Aparigraha (Non-stealing). Purusharthas (Cardinal virtues) - Dharma (Righteousness), Artha (Wealth), Kama (Fulfillment Bodily Desires), Moksha (Liberation).

UNIT- IV

Bhagavd Gita – (a) Niskama Karma, (b) Buddhism – The Four Nobel Truths – Arya astanga marga, (c) Jainism - Mahavratas and Anuvratas. Values Embedded in Various Religions, Religious Tolerence, Gandhian Ethics.

UNIT-V

Crime and Theories of Punishment – (a) Reformative, Retributive and Deterrent, (b) Views on Manu and Yajnavalkya.

REFERENCES BOOKS:

1. Johns S Mackenjie: A Manual of ethics
2. "The Ethics of Management" by Larue Tone Hosmer, Richard D. Irwin Inc.
3. Management Ethics – Integrity at work by Joseph A. Petrick and John F. Quinn, Response Books, New Delhi.
4. "Ethics in Management" by S.A. Shelekar, Himalaya Publishing House.
5. Harold H. Titus: Ethics for Today
6. Maitra, S.K: Hindu Ethics
7. William Lilly: Introduction to Ethics
8. Sinha: A Manual of Ethics

9. Manu: Manava Dharma Sastra or the Institute of Manu: Comprising the Indian System of Duties: Religious and Civil (ed) G.C. Haughton.
10. Sasruta Samhita: Tr. KavirajKunjanlal, KunjanlalBrishagratha, Chowkamba Sanskrit Series, Vol I,II and III, Varanasi, Vol I PP, 16-20, 21-32 and 74-77 only.
11. Charaka Samhita: Tr. Dr. Ram Karan Sarma and Vaidya Bhagavan Dash, Chowkambha Sanskrit Series Office. Varanasi I, II, III Vol I PP 183-191.
12. Ethics, Theory and Contemporary Issues. Barbara Mackinnon, Wadsworth/Thomson Learning, 2001.

Subject Code	Subject Name	Credits allotted		Total
		Theory	Practical	
INS-104	C Programming	4	-	4
Course Objectives	• To teach principles basics of C language. • To teach basics of C programming.			
Course Outcomes	• Students will be able to solve programs. • Students will able to know the use of C Programming			

UNIT-1

a. Overview of computers: Overview of computer system, people, procedures, data, information, hardware-operations of computing, hardware categories, software application software and system software, developments in computer technology, types of programming languages, algorithms, flow charts.

B. Overview of C: History of C, importance of C, basic structure of C programs, programming style.

UNIT-II

a. Constants, Variables and Data Types: Character set, C tokens, keywords and identifiers, constants, variables, data types, declaration of variables, declaration storage classes, assigning values to variables, defining symbolic constants, declaring a variable as Constant and volatile, Overflow and underflow of data.

b. Operators and Expressions: Introduction to operators, arithmetic operators, relational operators, logical operators, assignment operators, increment and decrement operators, conditional operators, bit wise operators, special operators, arithmetic expressions, reading and writing a character, formatted input and output.

c. Decision Making and Looping: IF and Else IF statements, SWITCH statements, WHILE, DO-WHILE and FOR statements. C programs covering all the above aspects.

UNIT-III

a. Arrays and Strings: Introduction to arrays, initialization of One dimensional array and two dimensional arrays, declaring and initializing string variables, reading and writing strings, string handling functions.

b. User Defined Functions: need for user-defined functions, definition of functions, return values and their types, function calls and declarations, arguments but no return values, no arguments no return values, nesting of functions, passing arrays to functions, passing strings to functions.

UNIT- IV

a. Structures and Pointers: Defining a structure, declaring structure variables, structure initialization, copying and comparing structure variables, arrays of structures, understanding pointers, declaring pointer variables, initialization of pointer variables, pointer expressions.

b. File Management and Linked Lists: Defining and opening a file, closing a file, input/output operations on files, and concepts of Single Linked Lists.

REFERENCE BOOKS:

1. Programming in ANSI C - E. Balaguruswamy.
2. Let us C - Yeshwanth Kanitkar.
3. Data Structures using C - A.M. Tanenbaum and others.

Subject Code	Subject Name	Credits allotted		Total
		Theory	Practical	
INS-105	Analogue Electronic Lab	--	4	4

List of Laboratory Experiments:

1. Study the Characteristics of Inverting configuration by using IC-741 op-amp
2. Study the Characteristics of Inverting Non-inverting configuration by using IC- 741
3. Study the Characteristics of Summing Amplifier by using IC-741 op-amp
4. Study the Characteristics of Voltage Follower by using IC-741 op-amp
5. Study the Characteristics of Current follower by using IC-741 op-amp
6. Study the Characteristics of Voltage Regulator using IC-7805.

7. Study of Characteristics of Characteristics of pn-junction diode
8. Study of Characteristics of Characteristics of Zener diode
9. Study the Characteristics of Transistor C-E configuration
10. Study the Characteristics of SCR
11. Study the Characteristics of Wien bridge oscillator by using IC-741 op-amp
12. Study the Characteristics of Astable Mulivibrator using IC-555

Note: The concerned faculty may conduct any other experiment based on the course apart from the given list. The number of experiments conducted must not be less than 10.

Subject Code	Subject Name	Credits allotted		Total
		Theory	Practical	
INS-106	Digital electronics Lab	--	4	4

List of Laboratory Experiments:

1. Design and verification of Logic gates
2. Design and Realization of OR-gate
3. Design and Realization of AND-gate
4. Design and Realization of NOT-gate
5. Design and verification of Half-Adder
6. Design and verification of Full-Adder
7. Design and verification of Half-Subtractor
8. Design and verification of Full- Subtractor
9. Design and verification of J-K flip flop
10. Design and verification of R-S flip flop
11. Designing a 2-4 Decoder
12. Design and verification of R-2R Ladder

Note: The concerned faculty may conduct any other experiment based on the course apart from the given list. The number of experiments conducted must not be less than 10.

SEMESTER – II

Subject Code	Subject Name	Credits allotted		Total
		Theory	Practical	
INS-201	Introduction to instrumentation and control system	4	-	4
Course Objectives	• To study the basic principles of Instrumentation System • To study the basic concepts of Control System • Root Locus, Frequency Response Analysis, Routh stability			
Course Outcomes	• Understand fundamentals of Instrumentation system • Understand and design open loop and closed loop control systems • Design and Analysis of Root Locus ,Frequency Response Systems			

UNIT-I

a. Introduction to instruments and their representation:

Typical applications of Instrument systems, Functional elements of Instrumentation and Measuring systems i.e. Input elements (Transducers and Electrodes), intermediate elements (signal conditioning) and output elements (Data display and storage).

b. Errors and uncertainties in Measurements and Static performance characteristics of instruments:

Introduction to errors and uncertainties in the measurement of performance parameters of instruments. Static performance parameters: Accuracy, Precision, Resolution, Threshold, Sensitivity, Linearity, Hysteresis, Dead band, Backlash, Drift, Span. Impedance loading and matching.

UNIT-II

a. Introduction to Control Systems

Historical development of control systems Components of control system – Open loop and closed loop control systems - Modeling in frequency domain - Mechanical and electromechanical systems. State – space representation – Converting transfer function to state space and state space to transfer function.

b. Signal Flow Graphs and Time Response Systems

Design process - Signal flow graphs - Mason‘s rule formula. Standard test signals, natural frequency and damping ratio, time response specifications. Time response of first and second order systems - Steady state and dynamic error coefficients.

UNIT-III

a. Mathematical modeling of Physical systems

Effects of Feedback on overall gain, Stability, Sensitivity, Bandwidth and Noise. Differential equation approach to Mechanical, Thermal, Hydraulic and Pneumatic Systems (simple treatment). Block diagram algebra.

b. Stability criteria

Necessary condition for stability. Hurwitz stability criterion. Routh stability criteria Relative stability Analysis. Basic control action. Proportional (P), Proportional Derivative (PD), Proportional Integral (PI) and Proportional Integral Derivative (PID) controllers and their effect on the system performance.

UNIT-IV

a. Root locus concept and Design problem: Construction of Root-loci. Rules for constructing Root-loci. Determination of roots from root locus. Design and Compensation technique: Preliminary design considerations. Realization of basic lead and lag compensation, cascaded and feedback compensation.

b. Frequency response Analysis and Stability criteria

Introduction, correlation between time and frequency responses. Polar plots, Bode plots Log-Magnitude versus Frequency and Phase versus Frequency Plots. Nyquest stability criterion. Assessment of relative stability. Stability Analysis Gain Margin M_p and Phase Margin P , Nicholas chart.

REFERENCES BOOKS:

1. Instrumentation Measurement and Analysis by Nakra and Choudary
2. Instrumentation- Devices and Systems by Rangan, Sarma and Mani
3. Measurement of Systems Applications and Design by Earnest O. Doeblin
4. A course in Electrical and Electronic Measurements and Instrumentation ByA.K. Sawhney
5. Electronic Instrumentation and Measurement Techniques, Cooper and Albert D.Helfriek
6. Applied Electronics By G.K. Mithal
7. Principles of Industrial Instrumentation by D. Patranabis
8. Control Systems Engineering by Nagarath and Gopal
9. Automatic control systems by Benjamin C. Kuo
10. Modern control systems engineering by Ogata

Subject Code	Subject Name	Credits allotted		Total
		Theory	Practical	
INS-202.a	Sensors, Signal Conditioners and Recorders	4	--	4
Course Objectives	• To study the basic principles sensors and transducers • To study the basic concepts of Signal Conditioners and Recorders • Topics including Temperature Sensors, Pressure Transducers, Opto-electronic Transducers and Bio Medical Electrodes.			
Course Outcomes	• Understand fundamentals of sensors • Understand and design various Transducers like Temperature, pressure, Displacement and Strain. • Understand the concepts of opto electronic devices and \Recorders			

UNIT-I

a. General Introduction to sensors / transducers.

Definition of a transducer/sensor Role of a transducer in a generalized measurement system. Classification of transducers. Characteristics of transducers. Significant parameters of a transducer.

b. Temperature sensors:

Temperature scales. Mechanical temperature sensors. Resistance type temperature sensors. Platinum resistance thermometer. Thermisters. Thermocouples. Solid state sensors. Quartz thermometer. Radiation type sensors - Optical pyrometers. Calibration of thermometers

UNIT-II

a. Displacement and Strain Transducers: Displacement transducers - Variable resistance, inductance and capacitance. Linear voltage differential Transformer (LVDT) Strain -Definition, Principle of working of strain gauges. Gauge factor.Types of strain gauges. Materials for strain gauges. Temperature compensation. Application

b. Pressure transducers:

Manometers, Elastic transducers - Diaphragms, Bellows, Bourdon or helical tubes. Electrical pressure transducers - Variable resistance, inductance and capacitance. Piezoelectric pressure transducer. Vibrating element pressure sensors. Pressure calibration.

UNIT-III

a. Opto -Electronic Transducers:

Photoemission tube. Photomultiplier tube, Photoconductive cell. Photovoltaic cell (solar cell). Photodiode, Photo-transistor, Photo FET, Light emitting diode. Liquid crystal display. Optoelectronic couplers. Laser diode

b. Electrochemical cells and Biomedical Electrodes:

Electrochemical cells — types. Electrode potential - cell potential. Reference electrodes. Ion selective electrodes. Indicator or working electrodes. Dropping mercury electrodes. Biomedical electrodes -Unipolar, bipolar, non-polar macro and microelectrodes. Surface" electrodes. Microelectrodes - Glass capillary and metal capillary electrodes.

UNIT-IV

a. Signal conditioners (Filters, Detectors *&* Amplifiers)

Filters - Integrators, Differentiators and active filters. Detectors Peak Detectors sample and hold circuits. Phase sensitive detector and precision rectifiers, Amplifiers- chopper stabilized DC amplifiers. Instrumentation amplifiers. Logarithmic and anti logarithmic amplifiers Isolation amplifiers, Lock in amplifiers.

b. Recorders, Displays and Storage Devices

Recorders- Basic recording systems. Strip chart recorders. Galvanometer and Potentiometer type recorders (direct and null type). Indicators and display Devices - Nixie, LED, LCD and seven segment and dot matrix displays. Magnetic tape and disc recorders. Data loggers, Dot matrix and laser printers. Compact disc/Optical disc recorders

REFERENCES BOOKS:

1. Instrumentation Measurement Analysis by Nakra and Chaudary
2. Instrumentation - Devices and Systems by Rangan, Mani and Sharma
3. A course in Electrical and Electronic Measurements and Instrumentation by AK Sawhney
4. Instrumental Methods of Analysis by Willard, Meritt, Dean and Seattle
5. Hand Book of Biomedical Instrumentation by RS Khandpur
6. Fundamentals of Electronic Devices by David A. Bell
7. An introduction to Operational amplifiers by SV Subramanyam

Subject Code	Subject Name	Credits allotted		Total
		Theory	Practical	
INS 202.b	Network Analysis	4	-	4
Course Objectives	• To teach principles of Network Theorems • To teach topics including Network Analysis of Laplace transform, two port networks, and Resonance Circuits.			
Course Outcomes	• Students will be able to learn Principle of Network Theorems • Students will be able to analyze and design Network Theorems and Resonance Circuits • Students will be able to analyze Frequency Plots			

UNIT-I

Network theorems: Thevenin‘s theorem, Norton‘s theorem, Super position theorem, Reciprocity theorem, Millman theorem, Maximum Power Transfer theorem.

Signal representation - Impulse, step, pulse and ramp function, waveform synthesis.

UNIT-II

Laplace Transform in the Network Analysis: Initial and Final conditions, Transformed impedance and circuits, Transform of signal waveform. Transient analysis of RL, RC, and RLC networks with impulse, step, exponential, pulse and sinusoidal inputs, use of initial and final value theorems. Networks with transformed impedance and dependent sources.

UNIT-III

The concept of complex frequency - Network functions for the one port and two port - driving point and transfer functions - Poles and Zeros of network functions and their locations and effects on the time and frequency domain. Restriction of poles and zeros in the driving point and transfer function. Time domain behavior from the pole - zero plot.Frequency response plots - Magnitude and phase plots, Plots from s-plane phasors, Bode plots - phase margin and gain margin.Parameters of two-port network – impedance, admittance, transmission and hybrid - Conversion formulae.Attenuators – propagation constant, types of attenuators – T, π and Balanced.

UNIT-IV

Resonance in series and parallel circuits- resonant frequency- bandwidth - Q factor, Selectivity. Coupled circuits, single tuned and double tuned circuits, coefficient of

coupling, Image Impedance, Characteristic impedance and propagation constant.Introduction to filters- Filter approximations - poles of the Butterworth, Chebyshev and inverse Chebyshev functions, expression for transfer function of Butterworth Low pass filter, design for 2nd order and 3rd order low pass Butterworth filters, Bessel-Thomson response.

REFERENCE BOOKS:

1. Franklin F. Kuo: Network Analysis and Synthesis, **2/e**, Wiley India.
2. M.E. Van Valkenburg: Analog Filter Design, Saunder's College Publishing,1982.
3. V. K. Aatre: Network Theory and Filter Design, Wiley Eastern.
4. Smarajit Ghosh, Network Theory – Analysis & Synthesis, PHI, 2008
5. Sudhakar and S. P. Shyam Mohan: Circuits and Network Analysis,3/e, TMH.

Subject Code	Subject Name	Credits allotted		Total
		Theory	Practical	
INS - 202.c	Basic of Spectroscopic Instruments	4	--	4
Course Objectives	• To objective of the course is to make the student familiar with various Spectroscopic instrumentation techniques. • To make the students understand the fundamentals of Molecular spectroscopy, Raman spectroscopy			
Course Outcomes	• Understand Fundamentals of spectroscopic Instrumentation techniques • The students will be able to learn molecular and Raman spectroscopy • The students will be able analyze Florescence and phosphorescence			

UNIT-I

Molecular Spectroscopy:

Introduction, Rotational structure of electronic bands of diatomic molecules, Fortrat diagram, General relations, Combination relations for $^1\Sigma$ - 1Σ and $^1\Sigma$ – $^1\pi$ bands Evaluation of rotational constants with reference to above transition.SSIsotope effect in electronic spectra of diatomic molecules. Potential energy curves and dissociation energy and pre-dissociation energy.

UNIT-II

Raman Spectroscopy:

Introduction, Theory of Raman Scattering, Rotational Raman Spectra, Vibrational Raman Spectra, Mutual Exclusion Principle, Laser Raman Spectroscopy, Schematic diagram of Laser Raman Spectrometer, description, Applications, Sample Handling Techniques, Polarization of Raman Scattered Light, Single Crystal Raman Spectra Raman Investigation of Phase Transitions, Resonance Raman Scattering, Structure Determination.

UNIT-III

Spectrophotometry :

Introduction – Beer's law, Absorptivity, UV and visible absorption, Instrumentation, Essential parts of spectrophotometer, Gratings and prisms, Radiant energy sources, Filters, Photosensitive detectors, Barrier layer cells, Photo emissive cells Photomultiplier tubes, Relationship between absorption in the visible and UV region and molecular structure, IR spectrophotometry, Fourier Transform Infrared (FTIR) Spectrometer, Principle, description of the Spectrophotometer, Advantages of FTIR over convention IR spectrophotometer, Applications.

UNIT - IV

Fluorescence and Phosphorescence Spectroscopy:

Introduction – Normal and Resonance Fluorescence, Intensities of Transitions, Non-radiative decay of fluorescent molecules, Phosphorescence and the nature of the triplet state, Population of the triplet state, Delayed Fluorescence, Excitation spectra Schematic diagram of Fluorescence Spectrometer description, Applications of Fluorescence and Phosphorescence.

REFERENCE BOOKS:

1. Elements of Spectroscopy, Gupta, Kumar and Sharma
2. Elements of Diatomic Molecular Spectra, H. Dunford
3. Problems in Spectroscopy, S.V.J. Lakshman
4. Basic Principles of Spectroscopy, R. Chang
5. Principles of Fluorescence Spectroscopy, Joseph R.Lakowicz - Plenum Press, 1983
6. Molecular Spectroscopy, N.C.Crabb and P.W.B.King

7. Light Scattering in Solids, M Cardona, G Guntherodt - 1975 - Springer-Verlag
8. Noble Lecture of Sir C.V.Raman

Subject Code	Subject Name	Credits allotted		Total
		Theory	Practical	
INS-203	Human Values and Professional Ethics-II	4	-	4
Course Objectives	• To teach principles of Human Values • To teach principles of fundamental of Professional ethics • To teach topics including medical ethics, business ethics, Environmental ethics, Social ethics.			
Course Outcomes	• Students will be able to learn Principle of medical ethics and business ethics. • Students will demonstrate the knowledge of Environmental ethics and social ethics. • Students will be able to analyze ethical theory, man and nature, climate change and justice.			

UNIT I

Value Education – Definition – Relevance to present day – Concept of human values - Self introspection – Self esteem. Family values-Components, Structure and responsibilities of family Neutralization of anger – Adjustability – Threats of family life – Status of women in family and society – Caring for needy and elderly – Time allotment for sharing ideas and concerns.

UNIT II

Medical ethics – Views of Charaka, Sushruta and Hippocratus on moral responsibility of medical practitioners. Code of ethics for medical and healthcare professionals. Euthanasia, Ethical obligation to animals, Ethical issues in relation to health care professionals and patients. Social justice in health care, human cloning, problem of abortion. Ethical issues in genetic engineering and Ethical issues raised by new biological technology or knowledge.

UNIT III

Business ethics – Ethical standards of business – Immoral and illegal practices and their solutions. Characteristics of ethical problems in management, ethical theories, causes of unethical behavior, Ethical abuses and work ethics.

UNIT IV

Environmental ethics – Ethical theory, man and nature - Ecological crisis, Pest control, Pollution and waste, Climate change, Energy and pollution, Justice and environmental health.

UNIT V

Social ethics – Organ trade, Human trafficking, Human rights violation and social disparities, Feminist ethics, Surrogacy/pregnancy. Ethics of media – Impact of Newspapers, Television, Movies and Internet.

REFERENCE BOOKS:

1. Johns S Mackenjie: A Manual of ethics
2. "The Ethics of Management" by Larue Tone Hosmer, Richard D. Irwin Inc.
3. Management Ethics – Integrity at work by Joseph A. Petrick and John
4. F. Quinn, Response Books, New Delhi.
5. "Ethics in Management" by S.A. Shelekar, Himalaya Publishing House.
6. Harold H. Titus: Ethics for Today
7. Maitra, S.K: Hindu Ethics
8. William Lilly: Introduction to Ethics
9. Sinha: A Manual of Ethics
10. Manu: Manava Dharma Sastra or the Institute of Manu: Comprising the Indian System of Duties: Religious and Civil (ed) G.C. Haughton.
11. Sasruta Samhita: Tr. KavirajKunjanlal, KunjanlalBrishagratha, Chowkamba Sanskrit Series, Vol I,II and III, Varanasi, Vol I PP, 16-20, 21-32 and 74-77 only.
12. Charaka Samhita: Tr. Dr. Ram Karan Sarma and Vaidya Bhagavan Dash, Chowkambha Sanskrit Series Office. Varanasi I, II, III Vol I PP 183-191.
13. Ethics, Theory and Contemporary Issues. Barbara Mackinnon, Wadsworth/Thomson Learning, 2001.
14. Analyzing Moral Issues, Judith A. Boss, Mayfield Publishing Company, 1999.
15. An Introduction to Applied Ethics (Ed.,) John H. Piet and Ayodya Prasad, Cosmo Publications.
16. Text Book for Intermediate First Year Ethics and Human Values, Board of Intermediate Eduction – Telugu Academy, Hyderabad.
17. I.C. Sharma Ethical Philosophy of India. Nagin& Co Julundhar.

Subject Code	Subject Name	Credits allotted		Total
		Theory	Practical	
INS-204	Microprocessor	4	--	4
Course Objectives	• To teach principles of Microprocessor. • To teach topics including internal architecture of microprocessor 8085 and 8086, their memory organization.			
Course Outcomes	• Students will be able to learn assembly programming language. • Students will demonstrate the knowledge of addressing modes, instruction sets. • Students will be able to analyze and design assembly level programmes and timing diagrams. • Students will be able to analyze programmable peripheral devices, 8255, 8257/8237, 8259.			

UNIT-I

a. Introduction to the microprocessors and computer

Historical background, developments, modern microprocessors, the microprocessor based personal computer system, memory and I/O systems, computer data formats, microprocessor controlled temperature system.

b. Architecture and organization of microprocessor 8085

MPU architecture and its operations, pin description, memory organization, I/O devices, register organization, data bus, address bus and control bus.

UNIT-II

a. Introduction to 8085 Assemble language programming

Assembly language programming, Instruction format and addressing modes, Assembly language format, Data transfer, data manipulation & control instructions

b. Interrupts, stack and data transfer schemes

Stack and subroutine, interrupts of 8085, serial and parallel data transfer schemes, I/O and memory interfacing

UNIT-III

a. Non- programmable and programmable interfacing devices

Non-programmable I/O interfacing chip 8212, multifunctional programmable chip 8155, PPI chip 8255

b. Timer, DMA controller and USART

8253/54 programmable timer, DMA controller 8257/8237, 8259A programmable interrupt controller (PIC), 8251 universal synchronous asynchronous receiver transmitter (USART)

UNIT-IV

a. Introduction to 8086 microprocessor

Architecture of 8086, type of addressing modes 8086, segmented memory cycles, read/write cycle in min/max mode. Reset operation, wait state, Halt state, Hold state, Lock operation and interrupt processing. Addressing modes and their features.

b. The Pentium II, III, Pentium 4 core 2 microprocessor

Introduction to Pentium to microprocessor, memory system and I/O system, the Pentium III pinout, Bus, Chip sets, Pentium 4 and core, memory interface hyper threading technology, register set, Bit extension technology, multi core technology.

REFERENCES BOOKS:

1. Microprocessor Architecture, Programming and Applications – R. S. Gaonkar
2. Microprocessor and Digital Systems – D. Hall
3. Microprocessor – S. I. Ahson
4. The Intel Microprocessor, Architecture, Programming and Interfacing – Barry B. Brey
5. Microprocessor 8085 and its Interfacing – Sunil Mathur

Subject Code	Subject Name	Credits allotted		Total
		Theory	Practical	
INS-205	Microprocessors Lab	--	4	4

List of Laboratory Experiments:

1. Write a assemble language programming for verification of addition of two numbers
2. Write a assemble language programming for verification of Subtraction of two numbers
3. Write a assemble language programming for verification of Multiplication of two numbers
4. Write a assemble language programming for verification of Division

of two numbers

5. Write a assemble language programming for verification of Decoder
6. Write a assemble language programming for verification of filling memory area
7. Write a assemble language programming for verification of largest number of array
8. Write a Assemble language programming for verification of smallest Num sber of array
9. Write a assemble language programming for verification of Factorial of given number
10. Write a assemble language programming for verification of addition of three numbers

Note: The concerned faculty may conduct any other experiment based on the course apart from the given list. The number of experiments conducted must not be less than 10.

Subject Code	Subject Name	Credits allotted		Total
		Theory	Practical	
INS-206	Transducers Lab	--	4	4

List of Laboratory Experiments:

1. Study the characteristics of NTC Type thermistor
2. Study the characteristics of Load Cell / strain gauge – 1
3. Study the characteristics of Load Cell / strain gauge – 2
4. Study the characteristics of linear variable differential transducer
5. Study the characteristics of Energy gap of semiconductor
6. Study the characteristics of UJT as relaxation oscillator
7. Study the characteristics of Function generator
8. Study the characteristics of Cathode ray oscilloscope
9. Study the characteristics of Data logger
10. Study the characteristics of Sound sensor

Note: The concerned faculty may conduct any other experiment based on the course apart from the given list. The number of experiments conducted must not be less than 10.

SEMESTER – III

Subject Code	Subject Name	Credits allotted		Total
		Theory	Practical	
INS-301	Scientific / Analytical Instrumentation	4	--	4
Course Objectives	• To introduce the basic concept of qualitative and quantitative analysis of given sample. • To study various spectroscopic techniques and its instrumentation. • To study the concept of separation science and its applications. • To study the concept of industrial analyzers and its application.			
Course Outcomes	• The Students get will be versed with the principles, construction and working of various analytical instruments.. • Students get details information about the applications of analytical techniques in medicine, industry etc.			

UNIT-I

a. Colorimeters and Spectrophotometers:

Colorimeter - Principle and working with a block diagram. Salient features of individual blocks. Specifications of a colorimeter. Applications of colorimeters to analytical and biomedical purposes. Spectrophotometer - Principle and working with a block diagram. Salient features of individual blocks. Specifications and operation , of Spectrophotometer. Types of spectrophotometers - Ultraviolet, Visible and Infrared. Applications of spectrophotometers to chemical analysis

b. Electron Microscopes

Transmission electron microscope - Principle and working with a block diagram. Salient features of individual blocks. Scanning electron microscope - Principle and working with a block diagram. Description of g individual blocks. Applications of electron microscopes.

UNIT- II

a. p^H meters and Conductivity Bridges

p^H meters: Principle and working with a block diagram. Salient features of individual blocks. Types of p^H meters Applications of p^H meters in chemical and industrial fields. Conductivity bridges: Principle and working of a conductivity bridge with block diagram. Salient features of individual blocks. Applications of conductivity bridges.

b. Polarographs and Nuclear radiation detectors

Polarographs: Principle and working with a block diagram. Salient features of individual blocks. Characteristics of dropping mercury electrode. Polarogram. Pulse polarograph. Application of Polarographs in chemical and Industrial fields. Nuclear radiation detectors: Ionization chamber, GM Counter, Proportional Counter, Solid state detectors.

UNIT-III

a. Resonance Spectrometers

Nuclear Magnetic Resonance spectrophotometer - Principle and working with suitable schematic/block diagrams. Experimental arrangement. Salient features of individual blocks. NMR spectrum . Applications of NMR spectrometer. Electron spin resonance spectrometer - Principle and working with a block diagram. Experimental arrangement. Salient features of individual blocks. Applications

b. Mass Spectrometers

Mossbauer spectrometer - Experimental* arrangement. Salient features of individual blocks. Sources, absorbers and detectors. Mossbauer spectrum. Applications of Mossbauer spectrometer. Mass spectrometer - Principle and working. Description of individual blocks of experimental arrangement. Applications n of Mass spectrometer.

UNIT-IV

a. Thermal Analyzers and chromatography

Thermo gravimetric and Differential Thermal analyzers – Principle and working with schematic diagram. Description of individual blocks. Applications

b. Chromatographs

Chromatographs - Gas and liquid (HPLC) chromatographs : Principle and working with a block diagram. Applications.

REFERENCES BOOKS:

1. Instrumental Methods of Analysis by Willard, Merrit , Dean and Seattle
2. Instrumental Methods of Analysis by Chatwal and Anand
3. Principles of Instrumental Analysis by Skoog
4. Industrial Instrumentation by Soisson
5. Molecular spectroscopy by Singh and Dikshit
6. Instrumental Analysis by Mann, Wickers and Gulick
7. Instrumental Methods of Chemical Analysis by B K Sharma

Subject Code	Subject Name	Credits allotted		Total
		Theory	Practical	
INS 302	Microcontroller and Digital Signal Processing	4	-	4
Course Objectives	• To make the student understand the fundamentals of microcontroller. • To introduced students to the idea of digital signal processing and characterization in time and frequency domain. • To understand these systems and should be able to determine hardware and software Interfacing with real time systems. • To understand the interfacing of the devices.			
Course Outcomes	• Understand the concept of Interfacing with Real time System. • Understanding of functional building blocks of an embedded system for developing a real time system application. • Students will able to understand significance of digital signal processing system.			

UNIT-I

a. Introduction to Microcontrollers

Introduction, Microcontrollers and Microprocessors Embedded versus external Memory devices, 8 bit and!6 bit micro controllers,CISC and RISC processors, Harvard and Von Newmann Architectures, commercial microcontroller devices

b.8051 Microcontroller

Introduction, MCS-51 architecture, Registers in MCS 51 , Pin description, connections, I/O ports and Memory Organization

UNIT –II

a. Addressing modes, Instructions and programming in 8051

Addressing modes, Instruction set, Instructions and simple programs, Assembly language programming, Development systems and tools

b. Interrupts, Timer/counters and serial communications, Interfacing

Interrupts - Interrupts in MCS-51 -Timers and counters - serial. communications - Interfacing - LEDs -Push buttons, Relays and Latch connections- Keyboard interfacing - Interfacing 7 segment displays - ADC and DAC interfacing

UNIT III

a. Introduction to DSP: Examples Of Signals, Classification Of Signals, System, Mathematical Modeling Of Continuous Systems, Signal Processing, Advantage And Disadvantage Of Signal Processing.

b.Signals: Elementary Continuous Time Signals, Continuous Time Periodic Signals, Representation. Of Periodic Signals, Elementary Discrete Time Signals, Classification Of Discrete Time Signals, Operation On Signals, Sampling And Aliasing, Discrete Time System

c. Filters: Ideal Filters, Simple ER Digital Filters, Simple FIR Filters , Comb Filter, All Pass Filter, Analogue And Digital Conversion, Reconstruction Of Analogue Signal, Types Of A/D and D/A Converters

UNIT IV

a. Digital Signal Processors: Overview Of Digital Signal Processors, Selecting Digital Signal Processors, Applications Of PDSPS, Vonnemann Architecture, Harvard Architectures, VLIW Architecture, Multiply Accumulate Unit (MAC), Pipe Lining, Architecture Of TMS320C50

b. Applications Of Digital Signal Processing: Introduction, Speech Processing, Speech Analysis, Speech Coding, Sub-band 'Coding, Channel Vocoder, Homomorphic Vocoder, Digital Processing Of Audio Signals, Radar Signal Processing, DSP Based Measurement System.

REFERENCES BOOKS:

1. Microcontrollers Architecture, Programming, Interfacing and System Design- Raj
2. The 8051 Microcontroller and Embedded Systems - Mazidi andMazidi, PHI,2000.
3. The 8 051 Microcontroller, Kenneth Ayala
4. Microcontrollers (Theory & Applications)-A. V. Deshmuk, WTMH, 2005.
5. Design with PIC Microcontrollers - John B. Peatman, Pearson Education, 2005.
6. Discrete Time Signal Processing - A.V. Oppenheim and R.W. Schaffer, PHI,
7. Fundamentals of Digital Signal Processing - Loney Luderman.

8. Digital Signal Processing - S. Salivahanan et al, TMH, 2000.
9. Digital Signal Processing - Thomas J. Cavicchi, WSE, John Wiley, 2004.
10. Digital Signal Processors, Architecture, Programming & Applications, - B.Venkata Ramani, M. Bhaskar, TMH , 4th reprint, 2004
11. Digital Signal Processing, P. Rameshbabu, Scitech, India 2009

INS-304 Syllabus for Generic Elective Courses

Subject Code	Subject Name	Credits allotted		Total
		Theory	Practical	
INS-303.a	Electronic Instrumentation	4	-	4
Course Objectives	• To teach principles of Electronic Instrumentation • To teach topics including analog measure instruments, CRO, Wave form generators and special instruments.			
Course Outcomes	• Students will be able to learn Principle, operation and construction and details of analog and digital measuring instrumentation. • Students will demonstrate the knowledge of spectrum analyzers and digital watt meter. • Students will be able to analyze and design function generator, square wave generator and digital multi meter. • Students will be able to analyze wave forms in CRO.			

UNIT-I

Analogue Measuring Instruments

a. Principle, Operation and constructional details of moving coil moving iron - induction type dynamometer type of DC meters Thermal type and rectifier type of meters. Errors and their compensation - extension of ranges of DC and AC meters - Ohmmeters - series type - shunt type meters - Meggers. Design and constructional details of multi meters.

(Basic principle, design and working with suitable block/circuit diagrams)

b. Cathode Ray Oscilloscope - Single beam. Dual trace, dual beam., Electronic-voltmeters (Transistor, FET & 1C versions). , D.C. and A.C. Millie/Micro voltmeters Precision rectifier types. Nano ammeter (using op.amp). Analogue frequency meter. Analogue phase meter, impedance, L, C, R Bridges, Q meters and Distortion factor meters

UNIT-II

Digital Measuring Instruments

(Basic principle, design and working with suitable block/ circuit diagrams)

a) Digital frequency meter.

b) Digital volt meter.

c) Digital multimeters.

d) Digital phase meter.

e) Digitizing Oscilloscopes, Storage oscilloscope and Sampling Oscilloscopes.

UNIT-III

Waveform Generators

(Basic principle, design and working with suitable block/circuit diagrams)

(a) A.F. Sine/Square wave Generator.

(b) R.F. Signal Generator.

(c) Standard signal Generator.

(d) Function Generator.

UNIT - IV

Special Instruments

(a) Spectrum Analyzers

(b) Frequency Synthesizers

(c) Digital tachometer

(d) Digital watt meter

(e) Digital Capacitance meter

REFERENCE BOOKS:

1. Electronic Instrumentation and Measuring Techniques. — Cooper
2. Electronic Instrumentation — Kalsi
3. Electronic Measurements and Instrumentation. — Oliver & Cage
4. Instrumentation Devices and Systems. — Rangan, Sarma and Mani
5. A Course in Electrical and Electronic Measurements and Instrumentation. by AK Sawhney

Subject Code	Subject Name	Credits allotted		Total
		Theory	Practical	
INS-303.b	Optical Instrumentation and Photonics	4	--	4
Course Objectives	• To expose the students to the basic concepts of optical fibers and their properties. • To provide adequate knowledge about the industrial applications of optical fibers			
Course Outcomes	• Identify various sensors, fiber optic and their applications • Understand the principle of working of fiber optic used to measure temperature, Displacement, level, and various miscellaneous other applications. • Understand application of fiber optics in industry			

UNIT I

a.Introduction: Fundamentals of light Nature of light, electromagnetic optics spectrum, propagation of light, electromagnetic waves in dielectric media, polarization and coherence, interactions of light with matter, absorption, scattering, dispersion, polarization, diffraction and interference.

b.Optical sources: Electromagnetic spectrum, types of spectra- line, band and continuous light sources, radiometry and photometry, natural sources, incandescent lamp, gas discharge lamp. Light-emitting diodes electroluminescent process, choice of LED materials, LED structures, infrared sources, semiconductor laser.

c.Optical detectors: Thermal detectors and Quantum detectors, bolometer, Photodiodes-PIN and avalanche photodiodes, phototransistors, photo multipliers, photovoltaic, IR detectors, Solar cells, CCD devices.

UNIT II:

Optical components Filters: absorption filters and interference filter, gratings-equation of diffraction grating, resolving power, concave grating, volume diffraction grating, holographic grating. Lenses, Polarizer and Beam splitters, Monochromator

Optical instruments: Eye, telescopes, microscopes, optical projection systems, cameras, basic principles of Holography, OTDR, polarimeter.

UNIT III:

a. Optical Fiber and Their properties: Ray theory, wave guiding principles, Theory of optical wave propagation, Types and classification of optical fibers, optical fiber mode, single mode fiber, special fiber, fiber materials, fiber fabrication, transmission characteristics of fiber, absorption losses, scattering losses, dispersion, polarization, non-linear phenomena

b.Optical Fiber Measurements: Measurement of attenuation, dispersion, refractive index profile of fiber and cut off wavelength, numerical aperture, OTDR, Measurement of flow, pressure, Temperature, displacement, acceleration and fluid level vibration measurement.

c.Fiber Optic Sensing Principles and Techniques: Classification and principle of fiber optic sensors, fiber grating and fiber Bragg grating technology and distributed optical fiber sensing.

UNIT IV:

a.Laser Fundamentals: Properties of laser, Laser modes- axial and transverse, single mode operation. Frequency stabilization. Mode locking, Mode hopping, Q-switching techniques.

b. Laser Types: Doped insulator lasers, Semiconductor lasers, Gas lasers, Liquid Dye lasers.

c.Laser safety: Biological effects, safety standards, risk of exposure, laser hazard classification and assessment, laser safety system, safe industrial laser laboratory, laser eye protection, laser accidents.

REFERNCE BOOKS:

1. J. Wilson, ―Optoelectronics‖, Prentice-Hall of India.3rd Edition, 1988.
2. Electro-Optical Instrumentation: Sensing and Measuring with Lasers‖, Pearson Education, Inc., 1st Edition, 2004.
3. Charles M. Vest, ―Holographic Interferometer, John Wiley & sons, 1st Edition, 1979.
4. Joseph T Verdeyen, ―Laser electronics‖, Prentice Hall of India , 3rd Edition, 1995.
5. J.M. Senior, ―Optical fiber communications principles and practice‖, Prentice Hall of India, 3rd Edition, 2010.
6. H. Zanger and C. Zanger, ―Fiber optics - communication and other application‖, McGraw Hill, 1st Edition, 1992.

7. Kao C.K., ―Optical fiber systems, Technology, Design & Application‖, McGraw Hill, 1st Edition, 1982.
8. Allen H. Cherin, ―Introduction to optical fibers‖, McGraw Hill., 1st Edition, 1983.
9. S.C.Gupta, ―Text book on optical fiber Communication & other application‖, Prenticehall of India, 2nd Edition, 2012.
10. Dr. S. Kumar, ―Basics of Remote Sensing & GIS‖, Laxmi publications, 1st edition, 2005.

Subject Code	Subject Name	Credits allotted		Total
		Theory	Practical	
INS-303.c	Instrumentation for Environmental Engineering	4	-	4
Course Objectives	• To create awareness of sensor environment • To study the sensors used in quality analysis of water and air			
Course Outcomes	• The students get well versed with all sensors required for regulating environmental conditions • Students also get through knowledge of instrumentation involved in environmental management.			

UNIT I

a.Introduction: Necessity of instrumentation & control for environment, sensor requirement for environment. Instrumentation methodologies: Ultraviolet analyzers, total hydrocarbon analyzers using flame ionization detector, Gas chromatography in environmental analysis, photo ionization, portable & stationary analytical instruments.

b.Quality of water: Standards of raw & treated water, sources of water & their natural quality, effects of water quality. Water quality parameters: Thermal conductivity, detectors, Opacity monitors, pH analyzers & their application, conductivity analyzers & their application. Water treatment: Requirement of water treatment facilities, process design.

UNIT II

a.Ground water monitoring: Level measurement in ground water monitoring wells, laboratory analysis of ground water samples, instrumentation in ground water monitoring, instrumentation in assessment of soil & ground water pollution.

b.Waste water monitoring: Automatic waste water sampling, optimum waste water sampling locations, and waste water measurement techniques. Instrumentation set up for waste water treatment plant. Latest methods of waste water treatment plants.

UNIT III

Air pollution: definitions, energy environment relationship, importance of air pollution, air pollution from thermal power plant, their characteristics & control. Air sampling methods & equipments, analytical methods for air pollution studies. Control of air pollution.

UNIT IV

a. Air monitoring: measurement of ambient air quality.

b. Flow monitoring: Air flow measurement, gas flow, non-open channel flow measurement, open channel waste water flow measurement.

c. Rain water harvesting: necessity, methods, rate of NGOs municipal corporation, Govt., limitations. Quality assurance of storage water.

REFERENCES BOOKS:

1. Walter J. Weber (Jr.), ―Physicochemical Processes: For Water Quality Control John Wiley & Sons, 1st Edition, 1972.
2. M. N. Rao & H. V. N. Rao, ―Air pollution engineering‖ McGraw Hill Higher Education, 1st Edition, 1989.
3. Wark & Warner, **"**Air pollution control technology‖, Pearson, 3rd Edition, 1997.
4. Randy D. Down, ―Environmental Instrumentation & Analysis Handbook‖,Wiley, 1st Edition, 2004.

INS-305: Syllabus for Open Course

Subject Code	Subject Name	Credits allotted		Total
		Theory	Practical	
INS-304.a	Computer Architecture and Organization	4	--	4
Course Objectives	• To teach basics of Computer Architecture and block diagram • To teach how to organize the computer hardware and software			
Course Outcomes	• Students will be able to understand internal block diagram of computer • Students will be able to know the organization of computer and their specifications.			

UNIT I

a. Basic structure of Computers: Computer Types, Functional unit, Basic Operational concepts, Bus structures, Performance, multiprocessors and multi computers.

b. Register Transfer Language And Micro operations: Register Transfer language. Register Transfer Bus and memory transfers, Arithmetic Micro-operations, logic micro operations, shift micro operations, Arithmetic logic shift unit. Instruction codes. Computer Registers Computer instructions - Instruction cycle. Memory -Reference Instructions. Input - Output and Interrupt. STACK organization. Instruction formats. Addressing modes

UNIT II

a. Micro Programmed Control: Control memory, Address sequencing, microprogram example, design of control unit Hard wired control. Micro programmed control

b. Computer Arithmetic: Addition and subtraction, multiplication Algorithms, Division Algorithms, Floating - point Arithmetic operations. Decimal Arithmetic unit Decimal Arithmetic operations.

UNIT III

a. The Memory System: Basic concepts semiconductor RAM memories. Read only memories Cache memories performance considerations, VirtWual memories secondary storage. Introduction to RAID.

b. Input-Output Organization: Peripheral Devices, Input-Output Interface, Asynchronous data transfer Modes of Transfer, Priority Interrupt Direct memory Access, Input -Output Processor (IOP) Serial communication; Introduction to peripheral component, Interconnect (PCI) bus. Introduction to standard serial communication protocols like RS232, USB, and IEEE1394.

UNIT IV

a. Pipeline And Vector Processing: Parallel Processing, Pipelining, Arithmetic Pipeline, Instruction Pipeline, RISC Pipeline Vector Processing, Array Processors.

b. Multi Processors: Characteristics or Multiprocessors, Interconnection Structures, Inter processor Arbitration. Inter Processor Communication and Synchronization Cache Coherence. Shared Memory Multiprocessors.

REFERENCES BOOKS:

1. Computer Systems Architecture -'M.Moris Mano, Illrd Edition, PHI/Pearson.
2. Computer Organization - Car Hamacher, Zvonks Vranesic, SafeaZaky, McGraw Hill.

3. Computer Organization and Architecture - William Stallings Sixth Edition, Pearson.
4. Structured Computer Organization - Andrew S. Tanenbaum, 4th Edition Pearson.
5. Fundamentals or Computer Organization and Design, -Sivaraama Dandamudi

Subject Code	Subject Name	Credits allotted		Total
		Theory	Practical	
INS-304.b	Geophysical Instrumentation	4	--	4
Course Objectives	• To objective of the course is to make the student familiar with different Geo physical instrumentation techniques. • To make the students understand the fundamentals of signal processing, field theory ,gravity and magnetic field of the earth			
Course Outcomes	• Understand Fundamentals of Geo Physical Instrumentation • The students will be able to learn electrical and electromagnetic methods • The students will be able analyze seismic methods of Geo Physical Instrumentation			

UNIT-I

a.Signal Processing:

Continuous and discrete signals; Fourier series; linear time invariant systems with deterministic and random inputs; band limited signal and sampling theorem; discrete and Fast Fourier transform; Z-transform; convolution; Filters: discrete and continuous, recursive, non-recursive, optimal and inverse filters; deconvolution.

b.Field theory:

Newtonian potential; Laplace and Poisson's equations; Green's Theorem; Gauss' law; Continuation integral; equivalent stratum; Maxwell's equations and electromagnetic theory; Displacement potential, Helmhotz's theorem and seismic wave propagation.

UNIT-II

a. Gravity and Magnetic fields of the earth:

Normal gravity field; Clairaut's theorem; Shape of the earth; deflection of the vertical, geoid, free-air, Bouguer and isostatic anomalies, isostatic models for local and regional compensation. Geomagnetic field, secular and transient variations and their theories; palaeomagnetism, construction of polar wandering curves.

b. Gravity and Magnetic Methods:

Gravimeters and magnetometers; data acquisition from land, air and ship; corrections and reduction of anomalies; ambiguity; regional and residual separation; continuation and derivative calculations; interpretation of anomalies of simple geometric bodies, single pole, sphere, horizontal cylinder, sheet, dyke and fault. Forward modelling and inversion of arbitrary shaped bodies and 2-D, 3-D interfaces. Interpretations in frequency domain.

UNIT-III

Electrical and Electromagnetic Methods:

Electrical profiling and sounding, typical sounding curves, pseudo-sections; resistivity transform and direct interpretation; induced polarization methods. Electromagnetic field techniques; elliptic polarization, in-phase and out of phase components, horizontal and vertical loop methods; interpretation; VLF (very low frequency); AFMAG (Audio frequency magnetic) methods; and central frequency sounding; transient electromagnetic methods; magneto-telluric method; geomagnetic depth sounding.

UNIT-IV

Seismic Methods:

Generalized Snell's Law; Ray theory; reflection, refraction, diffraction; Zoeppritz's equation; seismic energy sources; detectors; seismic noises and noise profile analysis; seismic data recording and telemetry devices; reduction to a datum and weathering corrections; Interpretation of a refraction seismic data by graphical and analytical techniques; CDP/CMP; seismic reflection data processing, velocity analysis, F-K filtering, stacking, deconvolution, migration before and after stack; bright spot analysis; wavelet processing; attenuation studies, shear waves, AVO; VSP; introduction to 3D seismic; seismic stratigrapy.

REFERENCE BOOKS:

1. Fundamentals of Geophysics by William Lowreie
2. Basic Exploration Geophysics by E. S. Robinson and C. Coruh
3. Applied Geophysics by W.M. Telford, L.P.Geldart, and R.E.Sheriff

Subject Code	Subject Name	Credits allotted		Total
		Theory	Practical	
INS 304.c	MEMS	4	-	4
Course Objectives	• To teach the fundamentals of MEMS • To teach topics including Micro system Fabrication and design			
Course Outcomes	• Students will be able to learn Principle MEMS of spectrum • Students will be able to analyze Microsystems fabrication and design • Students will be able to analyze applications of MEMS			

UNIT-I

MEMS and Microsystems – Applications – Multidisciplinary nature of MEMS – principles and examples of Micro sensors and micro actuators – micro accelerometer - meters Micro grippers – micro motors - micro valves – micro pumps – Shape Memory Alloys.

UNIT-II

Scaling laws in miniaturization - scaling in geometry, scaling in rigid body dynamics, the trimmer force scaling vector, scaling in electrostatic and electromagnetic forces, scaling in electricity and fluidic dynamics, scaling in heat conducting and heat convection.

UNIT-III

Micro System fabrication – photo lithography – Ion implantation- Diffusion – Oxidation – Chemical vapour deposition – Etching- Overview of Micro manufacturing – Bulk micro manufacturing – Surface micro machining – LIGA process – Materials for MEMS – silicon – silicon compounds – silicon piezo resistors – GaAs – polymers.

UNIT-IV

Microsystem Design - Design considerations – Selection of signal transduction – Process design – Design of a silicon die for a micro pressure sensor – Microsystem packaging - three levels of micro system packaging – interfaces in micro system packaging.

REFERENCES BOOKS:

1. Mark Madou, "Fundamentals of Micro fabrication", CRC Press, New York, 1997.
2. Julian W Gardner, "Microsensors: Principles and Applications", John Wiley & Sons,
3. Sze S M, "Semiconductor Sensors", McGraw-Hill, New Delhi, 1994.
4. Chang C Y and Sze S M, "VLSI Technology", McGraw-Hill, New York, 2000.

Subject Code	Subject Name	Credits allotted		Total
		Theory	Practical	
INS-305	Microcontrollers Lab	--	4	4

List of Laboratory Experiments:

1. Write a assemble language programming for verification of addition of two numbers
2. Write a assemble language programming of Subtraction of two numbers
3. Write a assemble language programming for verification of Multiplication of two numbers
4. Write a assemble language programming of Division of two numbers
5. Write a Assemble language programming for verification of Decoder
6. Write a assemble language programming for verification of filling memory area
7. Write a assemble language programming for verification of largest number of array
8. Write a assemble language programming for verification of smallest number of array
9. Write a assemble language programming for verification of Factorial of given number
10. Write a assemble language programming for verification of addition of three numbers
11. Write a assemble language programming for verification of key code display
12. Write a assemble language programming for verification of previous digits of the number

Note: The concerned faculty may conduct any other experiment based on the course apart from the given list. The number of experiments conducted must not be less than 10.

Subject Code	Subject Name	Credits allotted		Total
		Theory	Practical	
INS-306	Analytical Instrumentation Lab	--	4	4

List of Laboratory Experiments:

01. Study the characteristics of Electron spins resonance of Mn^{2+} seashell
02. Structural determination of thin-film XRD
03. Study the characteristics of Instrumentation Amplifier
04. Study the characteristics of Photo transistor
05. Study the characteristics of Anderson's bridge
06. Study the characteristics of LCR Impedance circuit
07. Study the characteristics of Photodiode
08. Study the characteristics of Analogue frequency meter
09. Study the characteristics of Frequency modulation & demodulation
10. Study the characteristics of Light emitting diode

Note: The concerned faculty may conduct any other experiment based on the course apart from the given list. The number of experiments conducted must not be less than 10.

SEMESTER - IV

Subject Code	Subject Name	Credits allotted		Total
		Theory	Practical	
INS-401	VLSI Systems Design	4	--	4
Course Objectives	• To objective of the course is to make the student familiar with VLSI system design aspects • To make the students understand the fundamentals of Integrates circuit fabrication techniques and sequential logic design.			
Course Outcomes	• Understand the fundamentals of VLSI systems • The students will be able to learn transistor and gates, combinational and sequential circuit design • The students will be able understand CAD systems.			

UNIT-I

a. Introduction to Digital system and VLSI

Design significance of Integrated circuits, Integrated Circuit manufacturing technology and economics, CMOS Technology, 1C Design techniques

b. Transistors and gates

Transistors And Layout, Fabrication Processes, Transistors, Wires and Vias, Design Rules, Layout Design Tools. Logic Gates, Combinational Logic Functions, Static Complementary Gates, Wires and Delay, Switch Logic, Alternative Gate Circuits

UNIT-II

Combinational Networks and Sequential Machines:

Combinational Logic Networks, Layout Design Method, Simulation, Combinational Network Delay, Crosstalk, Power Optimization, Switch Logic Networks, Combinational Logic Testing Sequential Machines, Latches And Flip-Flops Sequential Systems And Clocking Disciplines. Sequential System Design, Power Optimization, Design Validation, Sequential Testing

UNIT-III

Sub system Design, Floor Planning And Architecture Design:

Sub system Design Principles, Combinational Shifters, Adders, Alus, Multipliers, High Density Memory, Field Programmable Gate Arrays, Programmable Logic Arrays Floor Planning Methods, Off-Chip Connections. Architecture Design, Register-Transfer Design, High Level Synthesis Architecture For Low Power Architectural Testing.

UNIT-IV

Chip Design and CAD Systems And Algorithms

Design Methodologies For Chip Design, Case Studies, Timer Chip and PDF 8 Data Path, CAD Systems, Simulation, Layout Synthesis, Layout Analysis, Timing Analysis and Optimization, Logic Synthesis, Test Generation, Sequential Machine Optimizations, Scheduling And Binding, Hardware/Software Co-Design

REFERENCES BOOKS:

1. Essentials of VLSI circuits and systems - Kamran Eshraghian, Eshraghian Dougles and A. Pucknell, PHI, 2005 Edition.
2. Modern VLSI Design - Wayne Wolf, Pearson Education, 3rd Edition, 1997.
3. Principles of CMOS VLSI Design - Weste and Eshraghian, Pearson Education, 1999.
4. Introduction to VLSI Circuits and Systems - John .P. Uyemura, JohnWiley,2003.
5. Digital Integrated Circuits - John M. Rabaey, PHI, EEE, 1997.
6. VLSI Technology, Sujata Pandey and Manoj Pandey, Dhanpat Rai, 2009

Subject Code	Subject Name	Credits allotted		Total
		Theory	Practical	
INS-402	Industrial and Process Control Instrumentation	4	--	4
Course Objectives	• To objective of the course is to make the student familiar with different process dynamics in Process industries and different control schemes generally used to get best output. It also makes students aware of various analysis and design methods for multivariable systems. In addition, the subject about discrete state process control and Batch process. • To make the students understand the fundamentals of automation and various automation systems used in industry such as PLC, DCS and SCADS.			
Course Outcomes	• Understand evolution and architecture o DCS, hierarchical control in DCS, programming DCS through function Block Diagram (FBD) method. SCADS architecture, communication in SCADS, develop any application based on SCADS along with GUI using SCADA software. • The students will be able to handle any kind of process by framing it in block diagram, mathematical model and different process variables. • The students will be able to handle different types of controller like electronics, pneumatic and hydraulic.			

UNIT-I:

a. Process Dynamics : Process variables - Load variables -Dynamics of simple pressure, flow level and temperature process -interacting and non-interacting systems - continuous and batch process - self-regulation - Servo and Regulator operation **b. Control Actions and Controllers:** Basic control actions-characteristics of two position, three position, Proportional, Single speed floating, Integral and Derivative

control modes - PI, PD, PID control modes - Pneumatic, Hydraulic and Electronic Controllers to realize various control actions.

UNIT-II

a. Programmable Logical Controllers

Introduction - Advantages of Programmable logic controllers in comparison to relay based system - Configuration of Programmable Logic controllers

b. Distributed Control Systems

Introduction - Overall control configuration- Block diagram of a Generalized control system- Relationship of hierarchy to plant structure - Single loop controllers and Double loop controllers.

UNIT-III

a. Velocity and Acceleration measurement Relative velocity - Translational and Rotational velocity measurement - Revolution counters and Timers - Magnetic and Photoelectric pulse counting stroboscopic methods - Accelerometers of different types - Gyroscopes.

b. Force and Torque measurement

Force measurement - Different methods -Torque measurement -Dynamometers- Gyroscopic Force and Torque Measurement -Vibrating wire Force transducer

UNIT-IV

a. Density Measurement: Volume Flow meter Plus Density measurement - Strain Gauge load cell method - Buoyancy method - Air pressure balance method - Gamma ray method — Vibrating probe method. Direct Mass Flow meters. __

b. Radiation And other Measurements : Radiation Fundamentals. GM counter, Scintillation counter, Radio dating, Sound-Level Meter. Microphones. Time, Frequency, and Phase-Angle measurement. Liquid Level. Humidity. Particle Instruments and Clean-Room Technology.

REFERENCES BOOKS:

1. Chemical Process Control : An introduction to Theory and Practice -Stephanopoulos
2. Process Control - Harriott P.
3. Measurement Systems -Applications and Design - by Doeblin ,Int. 1990.

4. Principles of Industrial Instrumentation - Patranabis D. TMH. End edition 1997
5. Process Control, Third Edition - Liptak E.G., Chilton Book Company, Pennsylvania, 1995
6. Process control - by Pollard A., Heinemann Educational Books, London, 1971.
7. Automatic Process Control - by Eckman D.P., Wiley Eastern Ltd., New Delhi, 993.
8. Process Control - by Patranabis.
9. Process System Analysis and Control - Coughanowr, McGraw Hill, Singapore, 1991
10.Process Instruments and Control Handbook - by Considine D.M., McGraw Hill Int.1993.
11. Mechanical and Industrial Measurements - by Jain R.K., Khanna Publishers, 1986

INS-403: Syllabus for Generic Elective Corse

Subject Code	Subject Name	Credits allotted		Total
		Theory	Practical	
INS-403	Industrial Project Work	--	--	8

INS-404: Syllabus for open Elective Corse

Subject Code	Subject Name	Credits allotted		Total
		Theory	Practical	
INS-404.a	Bio Medical Instrumentation	4	-	4
Course Objectives	• To make student understand the identification, classification, and working principle of various Biomedical Instruments used for Bio-potential measurement and application of these instruments in diagnosis, therapeutic treatment and imaging fields.			
Course Outcomes	• Identify various Bio-potential and their specification in terms of amplitude and frequency. • Understand principle and working of various Biomedical Instruments for diagnosis applications. • Decide the applications of therapeutic instruments for treatment purpose. • Understand applications of imaging instruments and the modalities involved in each technique.			

UNIT-I

a. Human Physiological Systems, Bio Potentials and Electrodes:

Introductions, Cells And their Structure, Transport of ions Through Cell Membrane, Resting and Action Potentials, Bioelectric Potentials, Physiological Systems of Human Body, Electrodes Biomedical Instrumentation System.

b. Bio Signal Acquisition and Recording:

Physiological Signal Amplifiers, Isolation Amplifiers, Pre Amplifiers, Line Driving Amplifiers, Characteristics of Recording System, Electrocardiography (ECG), Electroencephalography (EEG), Electromyography (EMG), Electro- Retinography (ERG), Electro Oculography (EOG), Accuracy in Recording

UNIT - II

a. Physiological Assist Devices:

Introduction, Pacemakers, Defibrillators, Nerve and Muscle Stimulators, Heart Lung Machine, Kidney Machine

b. Special Equipment:

Blood Cell Counter, Audiometer, Digital Thermometer, X Ray. Machine, Radiography and Fluoroscopy, Image Intensifies, Angiography

UNIT - III

a. Bio Telemetry:

Elements of Biotelemetry Systems, Design of aBiotelemetry System Radio telemetry System, Uses Of Biotelemetry

b. Operation Theatre Equipment:

Introduction, Surgical Diathermy Ventillators, Anaesthesia Machine, Cardiac Output Measurement, Pulmonary Function Analyzer, Oxymeters.

UNIT-IV

a. Safety Instrumentation:

Radiation Safety Instrumentation: Dosimeters, Radiation Alarm, Physiological Effects due to 50 Hz Frequency, Micro Shock and Macro Shock, Hospital Architecture.

b. Advanced Biomedical Instrumentation:

Lasers iln Biomedical Instrumentation, Endoscopes, Cryogenic Surgery, Computer Tomography Scanner (CT), Applications, Thermography, Applications, Ultrasonic Image Forming Systems, Applications, Magnetic Resonance Imaging (MRI), Positron Emission Tomography.

REFERENCES BOOKS:

1. Biomedical Instrumentation and Measurement by Harry E. Thomas
2. Hand book of Biomedical Instrumentation by R.S. Khandpur
3. Biomedical Instrumentation & Measurements by Leslie Cromwell, Fred J. Waibell, Erich A.Pfeiffer
4. Hand Book of Bio medical Engineering by Jacob Klime
5. Bio Medical Electronics by Joseph Duboy
6. Transducers for Bio medical Measurements by Richards SC Cobbold
7. Bio medical Instrumentation by M. Arumugam
8. Biomedical Instruments, Theory and Practice by Welkowitz and Dentsch
9. Biological Engineering by Schwan
10. Biomedical Engineering systems by Clines and Mulism

Subject Code	Subject Name	Credits allotted		Total
		Theory	Practical	
INS-404.b	Optical Communication	4	--	4

UNIT – I

a.Introduction:

Measurement of Information, Channel Capacity, Communication System Architecture, Basic Optical Communication System, Advantage of Optical Communication System.

b.**Propagation in Dielectric Waveguides:**

Introduction, Step-index Fibers, Graded Index Fibers, Modes & Rays, Stab Wave Guide.

UNIT – II

a.Attenuation in Optical Fibers:

Introduction, Absorption, Scattering, Very Low Loss Materials, All Plastic & Polymer-Clad-Silica Fibers.

b.Wave Propagation:

Wave propagation in Step-Index & Graded Index Fiber, Overall Fiber Dispersion-Single Mode Fibers, Multimode Fibers, Dispersion-Shifted Fiber, Dispersion, Flattened Fiber, Polarization.

UNIT – III

Source & Detectors:

Design & LED's for Optical Communication, Semiconductor Lasers for Optical Fiber Communication System, Semiconductor Photodiode Detectors, Avalanche Photodiode Detector & Photo multiplier Tubes

UNIT – IV

Optical Fiber Communication System:

Telecommunication, Local Distribution Series, Computer Networks Local Data Transmission & Telemetry, Digital Optical Fiber Communication System-First Generation, System-Second Generation Future System. Data Communication Networks – Network Topologies, Mac Protocols, Analog System. Advanced Multiplexing Strategies – Optical TDM, Sub carrier Multiplexing, WDM Network.

REFERENCE BOOKS:

1. Optical Electronics – A. Yariv – SBS College Publishing, Newyork 1985
2. Optical Information Processing – F. T. S. Yu – Wiley, Newyork, 1983

Subject Code	Subject Name	Credits allotted		Total
		Theory	Practical	
INS-403.c	Electrical Engineering Materials	4	--	4

UNIT I

Atomic bonding, crystallinity, Miller Indices, X-ray crystallorgraphy, structural imperfections, crystal growth.Free electron theory of metals, factors affecting electric conductivity of metals, thermal conductivity of metals, heat developed in current Carrying conductors, thermoelectric effect, super conductivity.

UNIT II

Polarization mechanism and dielectric constant, behavior of polarization under impulse and frequency switching, dielectric loss, spontaneous polarization, piezoelectric effect. Origin of permanent magnetic dipoles in materials, classifications of magnetism.

UNIT III

Energy band theory, classification of materials using energy band theory, Hall effect, drift and diffusion currents, continuity equation, P-N diode, volt-amp equation and its temperature dependence.

UNIT IV

Special purpose materials, Nickel iron alloys, high frequency materials, permanent magnet materials, Feebly magnetic materials, Ageing of a permanent magnet, Effect of impurities.

REFERENCE BOOKS:

1. Ian P. Hones, 'Material Science for Electrical & Electronics Engineers', Oxford University Press
2. K. M. Gupta – Electrical Engineering Materials, Umesh Publication, 2nd edition 2003

Subject Code	Subject Name	Credits allotted		Total
		Theory	Practical	
INS-405	VLSI Lab	--	4	4

List of Laboratory Experiments:

1. Write a VLSI program for verification of Logic Gates
2. Write a VLSI program for verification of T flip flop
3. Write a VLSI program for verification of Full Adder
4. Write a VLSI program for verification of Half Adder
5. Write a VLSI program for verification of Decoder
6. Write a VLSI program for verification of Encoder
7. Write a VLSI program for verification of Demultiplexer
8. Write a VLSI program for verification of Multiplexer
9. Write a VLSI program for verification of R-S flip flop
10. Write a VLSI program for verification of J-K flip flop

Note: The concerned faculty may conduct any other experiment based on the course apart from the given list. The number of experiments conducted must not be less than 10.