SRI VENKATESWARA UNIVERSITY :: TIRUPATI

SVU COLLEGE OF SCIENCES

Organising Under USIC

Syllabus for M. Sc. Instrumentation Course

Choice Based Credit System (CBCS)

Amended as per NEP - 2020

(w.e.f. the Academic Year 2021-2022)

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:	6 Theory hours	4 Credits each
	2 Laboratory Courses	4 Credits each
SEMESTER-II:	6 Theory hours	4 Credits each
	2 Laboratory Courses	4 Credits each

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

SEMESTER-III:	6 Theory hours	4 Credits each
	2 Laboratory Courses	4 Credits each
SEMESTER-IV:	6 Theory hours	4 Credits each
	1 Project Work	4 Credits
	1 Laboratory Courses	4 Credits

SRI VENKATESWARA UNIVERSITY::TIRUPATI

DEPARTMENT OF INSTRUMENTATION

TWO YEAR M.Sc. COURSE IN INSTRUMENTATION (2021-2022)

COURSE STRUCTURE AND EXAMINATION SCHEME

Semester -I : OVERVIEW

S.No	Components of Study	Title of the Course	Title of the Paper	Credit Hrs/ Week	No. of Credits	IA Marks	Sem End Marks	Total
1.	**Mandatory Core**	INS – 101	1.Introduction to Instrumentation and Control System	6	4	20	80	100
2.		INS – 102	2. Analog Devices and Industrial Electronics	6	4	20	80	100
3.	**Compulsory Foundation**	INS - 103(a)	1. Digital Techniques and Principles of Communications	6	4	20	80	100
		INS - 103(b)	2. Power Electronics					
		INS - 103(c)	3. Industrial Product Instrumentation					
4.	**Elective Foundation**	INS - 104 (a)	1. Programming in "C"	6	4	20	80	100
		INS - 104 (b)	2. Renewable Sources of Energy					
		INS -104 (c)	3. Opto Electronics					
5.	**Practical –I**	INS - 105	Paper 1& 3 (Analog and Digital Electronics Lab)	6	4	--	100	100
6.	**Practical-II**	INS – 106	Paper 3 &4 (" C " Programs Lab)	6	4	--	100	100
	Total			36	24	80	520	600
7.	Audit Course			0	0	100	0	0

***All core papers are Mandatory**

- Compulsory Foundation choose one paper.
- Elective Foundation – Choose one paper.
- Audit course-100 Marks (Internals) Zero Credits under self-study.
- Interested students may register for MOOC with the approval of the concerned DDC but it will be considered for the award of the grade as open elective only giving extra credits.

Semester – II: OVERVIEW

S.No	Components of Study	Title of the Course	Title of the Paper	Credit Hrs/ Week	No. of Credits	IA Marks	Sem End Marks	Total
1.	**Mandatory Core**	INS – 201	1.Industrial Instrumentation	6	4	20	80	100
2.		INS – 202	2. Electronic Instrumentation	6	4	20	80	100
3.	**Compulsory Foundation**	INS - 203(a)	1. Sensors and Signal Conditioners	6	4	20	80	100
		INS - 203(b)	2.Network Analysis					
		INS - 203(c)	3. Spectroscopic Instrumentation					
4.	**Elective Foundation**	INS - 204(a)	1.Microprocessors and Interfacing	6	4	20	80	100
		INS - 204(b)	2. Robotics					
		INS - 204(c)	3. Electronic Measurement Instruments					
5.	**Practical -I**	INS – 205	Paper 1& 3 (Transducers Lab)	6	4	--	100	100
6.	**Practical-II**	INS – 206	Paper 3 & 4 (Microprocessors Lab)	6	4	--	100	100
	Total			36	24	80	520	600
7.	Audit Course			0	0	100	0	0

***All core papers are Mandatory**

- Compulsory Foundation choose one paper.
- Elective Foundation – Choose one paper.
- Audit course-100 Marks (Internals) Zero Credits under self-study.
- Interested students may register for MOOC with the approval of the concerned DDC but it will be considered for the award of the grade as open elective only giving extra credits.

Semester – III: OVERVIEW

S.No	Components of Study	Title of the Course	Title of the Paper	Credit Hrs/ Week	No. of Credits	IA Marks	Sem End Marks	Total
1.	**Mandatory Core**	INS – 301	1.Analytical Instrumentation	6	4	20	80	100
2.		INS – 302	2.Digital Signal Processing	6	4	20	80	100
3.	**Generic Elective**	INS - 303(a)	1. Biomedical Instrumentation	6	4	20	80	100
		INS - 303(b)	2. Micro Electro Mechanical Systems					
		INS - 303(c)	3. Instrumentation for Environmental Science					
4.	**Practicals**	INS – 304	Analytical Instrumentation Lab	6	4	--	100	100
5.	**Skill Oriented Course**	INS – 305	Microcontrollers and Interfacing	6	4	10	90 (T40 +P50)	100
6.	**Open Elective**	INS - 306(a)	1.Computer Architecture and Organization	6	4	20	80	100
		INS - 306(b)	2.Industrial Organization and Management					
	Total			36	24	90	510	600

***All core papers are Mandatory**

- Generic Elective – Choose one
- Core papers and Generic Electives opted paper held Practical-I
- Skill Oriented Course is Mandatory. Relevant society along with practical (10marks internal 40 final theory & 50 for practicals).
- Open Electives are for the students of other Departments. Minimum one paper should be opted. Extra credits may be earned by opting for more number of open electives depending on the interest of the student through self-study.
- Interested students may register for MOOC with the approval of the concerned DDC.

Semester – IV: OVERVIEW

S.No	Components of study	Title of the Course	Title of the Paper	Credit Hrs/ Week	No. of Credits	IA Marks	Sem End Marks	Total
1.	**Mandatory Core**	INS - 401	1.Introduction to VLSI Circuits	6	4	20	80	100
2.		INS – 402	2.Embedded Systems and Real time Operating Systems	6	4	20	80	100
3.	**Generic Elective**	INS - 403(a)	1. Programmable Logic Controllers	6	4	20	80	100
		INS - 403(b)	2.Computational Mathematics					
		INS - 403(c)	3. Electrical Engineering Materials					
4.	**Practicals**	INS – 404	VLSI Lab	6	4	--	100	100
5.	**Multi Disciplinary Course/ Project Work**	INS – 405	Project Work	6	4	--	100	100
6.	**Open Elective**	INS - 406(a)	1. Agro Based Instrumentation	6	4	20	80	100
		INS - 406(b)	2.Industrial Automation					
	Total			36	24	90	520	600

*All core papers are Mandatory

- Generic Elective – Choose one
- Core papers and Generic Electives opted paper held Practical-II.
- Project Work- Collaboration with various firms/companies/societies.
- Multi-Disciplinary Course is Mandatory. Circle formation with other subjects/Dept. of Arts/Commerce.
- Open Electives are for the students of other Departments. Minimum one paper should be opted. Extra credits may be earned by opting for more number of open electives depending on the interest of the student through self-study.
- Interested students may register for MOOC with the approval of the concerned DDC.

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-303: Generic Elective Course

1. Biomedical Instrumentation
2. Micro Electro Mechanical Systems
3. Instrumentation for Environmental Science

INS-403: Generic Elective Course

1. Programmable Logic Controllers
2. Computational Mathematics
3. Electrical Engineering Materials

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-306: Open Elective Course:

1. Computer Architecture and Organization
2. Industrial Organization and Management

INS-406: Open Elective Course:

1. Agro Based Instrumentation
2. Industrial Automation

INS-405: Course related to Industrial Project Work

INS-405 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.

(Mandatory Core)

Core – 1: INS-101	Introduction to Instrumentation and Control System

UNIT: I

INSTRUMENTS AND THEIR CLASSIFICATION

Typical applications of instrument systems, Functional elements of instrumentationand measuring Systems. Input elements (Transducers and Electrodes), Intermediateelements (Signal conditioning) and Output elements (Data display and storage)

(a) Order of Instruments: Zero, First, Second and nth order Instruments.
(b) Null &Deflection, Manual & Automatic, Self-generating & Power operated. Proximity &Non proximity types.
(c) Analogue and Digital Types.

ERRORS AND UNCERTAINTIES

Introduction to errors and uncertainties in the measurement Performance parameters of Instruments.Propagation of uncertainties in measurement.

STATIC PERFORMANCE PARAMETERS (CHARACTERISTICS)

Accuracy,Precision,Resolution,Threshold, Sensitivity, Linearity, Hysterises, Dead band.Backlash, Drift, Span. Impedance loading and Matching.Specifications of an Instrument.

UNIT –II

INTRODUCTRION TO CONTROL SYSTEMS

(a). Basic components of a control system, Open-loop and closed-loop control system and their differences.
(b). Classifications of control systems. Linear & non-linear time –invariant & time varying continuous & sampled data and digital.
(c). Effects of feedback on overallgain, stability, sensitivity, bandwidth and noise

UNIT – III

TIME RESPONSE ANALASIS AND STABILITY CRITERIA

(a). Standard test signals.Time response of first and second order systems Transient and steady state response. Time domain specifications.Steady state errors and error coefficients.
(b). Concept of stability. Necessary condition for stability. Hurwitz stability Criterion.Routh stability criterion.Relative stability analysis.

UNIT – IV

FREQUENCY RESPONSE ANALYSIS AND STABILITY CRITERIA

Frequency domain specifications. Bode diagrams. Phase margin and gain margains.

Polar plots Nyquist plot. Applications ofNyquist criterion to find the stability.

BOOKS FOR REFERENCE:

1. A course in Electrical and Electronic Measurements and Instrumentation ByA.K. Sawhney
2. Electronic Instrumentation and Measurement Techniques, Cooper and Albert D.Helfriek
3. Principles of Industrial Instrumentation by D. Patranabis

4 Modern control systems engineering by Ogata

5. Instrumentation measurement and Analysis – Nakra&Chaudhry
6. Instrumentation – Devices and systems – Rangan,Sarma& Mani
7. Control Systems Engineering – Nagrath and Gopal
8. Automatic Control Systems – Benjamin C.Kuo
9. Control systems –Nagoorkani.

(Mandatory Core)

Core – 2: INS-102	**Analog Devices and Industrial Electronics**

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,

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. 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. 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.

BOOKS FOR REFERENCE:

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

(Compulsory Foundation)

Compulsory Foundation: INS-103(a)	Digital Techniques and Principles of Communications

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).

UNIT-III

a. Analog Modulation:

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, Pulse Amplitude Modulation and Pulse Code Modulation.

UNIT-IV

a. Satellite Communication Systems :
Line of sight of propagation, Line of sight transmitter and receiver, classification of satellites, Differences between active and passive satellites Geostationary satellite, Transponders,

BOOKS FOR REFERENCE

1. Digital Principles & Applications‖, Tata McGraw-Hill, delhi, 8th Edition, 2015 — Albert P Malvino and leach.
2. Digital Fundamentals‖, Pearson Education, 11th Edition, 2014 — Thomas L Floyd.
3. Digital Electronics – An Introduction to Theroy and Practice – William H. Gothmann
4. Analog and Digital Electronics for Engineers – An introduction – H. Ahmed & P. J. Spreadnury.
5. Analog and Digital Electronics – Charles H. Roth, Jr. Larry L.Kinney, Raghunandan G.H.
6. Text Book of Digital Electronics By Shriram K. Vasudevan, V.Subashri, Jai Vigneshwar J., Sumana Raviganesan.

(Compulsory Foundation)

Compulsory Foundation: INS-103(b)	**Power Electronics**

UNIT I

Study of switching devices: Frame, Driver and snubber circuit of SCR, TRIAC, BJT, IGBT, MOSFET, Commutation circuits for SCR.

Step-down and step-up chopper, Time ratio control and current limit control Buck, boost, buck- boost converter, concept of Resonant switching - SMPS.

UNIT II

Converters: Half controlled and fully controlled converters, single phase dual converters – power factor Improvements.

Three Phase Converters – Half controlled and fully controlled converters.

Design of SCR based DC power circuits including UJT as triggering device AC power control using SCR-UJT & TRIAC-DIAC like universal speed controller fan regulator.

Design of SCR/TRIAC based AC power control circuits including UJT/DIAC as a triggering device.

UNIT III

AC to AC Controllers: On Off controller, Single phase AC voltage controllers–single and three phase cycloconverters.

Inverters: Single phase and three phase (both 120^0 mode and 180^0 mode) inverters - Series resonant inverter - Current source inverter. UPS

UNIT IV

Motors: Working principle, Types of AC motors and Characteristics of AC motors. DC motors working principle, types and characteristics. Stepper motors.

AC Motor Drives: Concept & requirement of drives, Current fed & Voltage fed drives, rotor resistance control & v/f control of AC motors.

DC Motor Drives: DC Drives for brushed/brushless motors

Industrial Applications: Induction & dielectric heating process block diagram, merits/demerits and applications of power electronics in traction.

<u>BOOKS FOR REFERENCE:</u>

1. M.H. Rashid, ‗Power Electronics: Circuits, Devices and Applications‘, Pearson Education, 4th Edition, 2013.

2. P.S. bimbhra, ―Power Electronics‖, Khanna publishers, 13th reprint, 2004.

3. Alok Jain, ―Power Electronics & its applications‖, PENRAM International Publishing (India) Pvt. Ltd, 2nd Edition, 2008.

(Compulsory Foundation)

Compulsory Foundation: INS-103(c)	Industrial Product Instrumentation

Unit - I:

Introduction: Stages in product design - Market survey, Product Specifications (Electrical, Mechanical, Environmental), R&D and Engineering Prototypes, Pilot Production Batch, Environmental testing, Documentation, Manufacturing. Electronic Products Classification- Consumer, Industrial and Military. Their peculiarities in terms of Cost/performance ratio and Reliability. Reliability- Bath tub curve, Measures taken (at Component and Product level and various soldering techniques including Surface Mount Technology) to improve reliability. Fundamentals of Communication System Design, criteria for selection of frequency bands, requirements of Voice and Multimedia Applications

Unit - II

Hardware designs- Analog

Analog Signal Conditioning- Factors affecting choice of OPAMPs in signal conditioning applications. Need for Instrumentation Amplifiers- Case study. Error budget analysis with Case study. ADCs- Interpretation of ADC specifications from design view point. Considerations in selecting References (Vref for ADC).DACs- Interpretation of DAC specifications from design view point.

Unit – III

Hardware design- Digital

Interface examples for- LED, HB LED, LCD, Keyboard, Touch Screen. Microcontrollers - Comparative study of different Microcontroller Architectures, Factors affecting choice of Microcontroller for particular application with Case study of one application. Introduction to buses and protocols used in Electronic Products- I2C, SPI.

UNIT - IV
PCB design and EMI/EMC

PCB Design practices for Analog and Mixed signal circuits- Ground Loops, Precision circuits, shielding and guarding. PCB Design Practices for High Speed Digital Circuits, Signal integrity and EMC. EMI/EMC testing standards and compliance.

Text Books

1. Bernhard E. Bürdek, ―History,Theory, Practice of Product Design‖, Springer Science, 1st edition, 2005.
2. Paul Horowitz, ―Art of Electronics‖, Cambridge University Press, 3rd edition, 2015.
3. Howard Johnson, Martin Graham, ―High-speed Digital design- A Handbook of Black Magic‖, Prentice Hall Publication, 1st edition, 1993.
4. Proakis and Salehi, ―Contemporary Communication Systems Using Matlab‖, Wadsworth Publishing Co Inc, 3rd edition, 2011.
5. G. PahlandW.Beitz J. Feldhusen and K.-H. Grote, ―Engineering Design - A Systematic Approach‖, Springer, 3rd edition, 2007.
6. Tim Williams, ―EMC for Product Designers‖, Elsevier, 4th edition, 2007.

Reference Books

1. David Bailey, ―Practical Radio Engineering and Telemetry for Industry‖, Elsevier, 1st Edition 2003.
2. Bernard Sklar , ―Digital Communication‖ , Pearson Education, 2nd Edition, 2001.
3. Pressman , ―Software Engineering - A Practitioner's Approach‖ McGraw-Hill Higher Education, 8th Edition, 2014.
4. DomineLeenaerts ,Johan van der Tang , Cicero S. Vaucher , ―Circuit Design for RF Transceivers ‖ Springer, 2001 Edition, 2011.

(Elective Foundation)

Elective Foundation: INS-104(a)	**Programming in "C"**

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.

BOOKS FOR REFERENCE

1. Programming with C" by K.R. Venugopalprasad, Tata McGraw Hill
2. Programming in C by E. Balaguruswamy, Tata McGraw Hill
3. "Data structures through C" by YeshwanthKanitkar, BPB Publications (2003)
4. Programming in ANSI C - E. Balaguruswamy.
5. Let us C - YeshwanthKanitkar.
6. Data Structures using C - A.M. Tanenbaum and others.
7. "C programming "by Dennis Ritche, PHI Publishers.

(Elective Foundation)

Elective Foundation: INS-104(b)	Renewable Sources of Energy

Unit - 1:

INTRODUCTION TO ENERGY STUDIES

Introduction, Energy science and Technology, Forms of Energy, Importance of Energy Consumption as Measure of Prosperity, Per Capita Energy Consumption, Roles and responsibility of Ministry of New and Renewable Energy Sources, Needs of renewable energy, Classification of Energy Resources, Conventional Energy Resources , Non-Conventional Energy Resources, World Energy Scenario, Indian Energy Scenario.

SOLAR ENERGY

Introduction, Solar Radiation, Sun path diagram, Basic Sun-Earth Angles, Solar Radiation Geometry and its relation, Measurement of Solar Radiation on horizontal and tilted surfaces, Principle of Conversion of Solar Radiation into Heat, Collectors, Collector efficiency, Selective surfaces, Solar Water Heating system , Solar Cookers , Solar driers, Solar Still, Solar Furnaces, Solar Greenhouse. Solar Photovoltaic, Solar Cell fundamentals, Characteristics, Classification,

Construction of module, panel and array. Solar PV Systems (stand-alone and grid connected), Solar PV Applications. Government schemes and policies.

Unit - 2:

WIND ENERGY

Introduction, History of Wind Energy, Wind Energy Scenario of World and India. Basic principles of Wind Energy Conversion Systems (WECS), Types and Classification of WECS, Parts of WECS, Power, torque and speed characteristics, Electrical Power Output and Capacity Factor of WECS, Stand alone, grid connected and hybrid applications of WECS, Economics of wind energy utilization, Site selection criteria, Wind farm, Wind rose diagram.

Unit - 3:

BIOMASS ENERGY

Introduction, Biomass energy, Photosynthesis process, Biomass fuels, Biomass energy conversion technologies and applications, Urban waste to Energy Conversion, Biomass Gasification, Types and application of gasifier, Biomass to Ethanol Production, Biogas production from waste biomass, Types of biogas plants, Factors affecting biogas generation, Energy plantation, Environmental impacts and benefits, Future role of biomass , Biomass programs in India.

Unit - 4:

HYDRO POWER AND OTHER RENEWABLE ENERGY SOURCES

Hydropower: Introduction, Capacity and Potential, Small hydro, Environmental and social impacts. Tidal Energy: Introduction, Capacity and Potential, Principle of Tidal Power, Components of Tidal Power Plant, Classification of Tidal Power Plants. Ocean Thermal Energy: Introduction, Ocean Thermal Energy Conversion (OTEC), Principle of OTEC **5** system, Methods of OTEC power generation. Geothermal Energy: Introduction, Capacity and Potential, Resources of geothermal energy.

BOOKS FOR REFERENCE

1. Sukhatme. S.P., Solar Energy, Tata McGraw Hill Publishing Company Ltd., New Delhi, 1997.

2. B. H. Khan, Non-Conventional Energy Resources, , The McGraw Hill

3. Twidell, J.W. & Weir, A. Renewable Energy Sources, EFN Spon Ltd., UK, 2006.

4. S. P. Sukhatme and J.K. Nayak, Solar Energy – Principles of Thermal Collection and Storage, Tata McGraw- Hill, New Delhi.

5. Garg, Prakash, Solar Energy, Fundamentals and Applications, Tata McGraw Hill.

(Elective Foundation)

Elective Foundation: INS-104(b)	**Renewable Sources of Energy**

Unit - 1:

INTRODUCTION TO ENERGY STUDIES

Introduction, Energy science and Technology, Forms of Energy, Importance of Energy Consumption as Measure of Prosperity, Per Capita Energy Consumption, Roles and responsibility of Ministry of New and Renewable Energy Sources, Needs of renewable energy, Classification of Energy Resources, Conventional Energy Resources , Non-Conventional Energy Resources, World Energy Scenario, Indian Energy Scenario.

SOLAR ENERGY

Introduction, Solar Radiation, Sun path diagram, Basic Sun-Earth Angles, Solar Radiation Geometry and its relation, Measurement of Solar Radiation on horizontal and tilted surfaces, Principle of Conversion of Solar Radiation into Heat, Collectors, Collector efficiency, Selective surfaces, Solar Water Heating system , Solar Cookers , Solar driers, Solar Still, Solar Furnaces, Solar Greenhouse. Solar Photovoltaic, Solar Cell fundamentals, Characteristics, Classification, Construction of module, panel and array. Solar PV Systems (stand-alone and grid connected), Solar PV Applications. Government schemes and policies.

Unit - 2:

WIND ENERGY

Introduction, History of Wind Energy, Wind Energy Scenario of World and India. Basic principles of Wind Energy Conversion Systems (WECS), Types and Classification of WECS, Parts of WECS, Power, torque and speed characteristics, Electrical Power Output and Capacity Factor of WECS, Stand alone, grid connected and hybrid applications of WECS, Economics of wind energy utilization, Site selection criteria, Wind farm, Wind rose diagram.

Unit - 3:

BIOMASS ENERGY

Introduction, Biomass energy, Photosynthesis process, Biomass fuels, Biomass energy conversion technologies and applications, Urban waste to Energy Conversion, Biomass Gasification, Types and application of gasifier, Biomass to Ethanol Production, Biogas production from waste biomass, Types of biogas plants, Factors affecting biogas generation, Energy plantation, Environmental impacts and benefits, Future role of biomass , Biomass programs in India.

Unit - 4:

HYDRO POWER AND OTHER RENEWABLE ENERGY SOURCES

Hydropower: Introduction, Capacity and Potential, Small hydro, Environmental and social impacts. Tidal Energy: Introduction, Capacity and Potential, Principle of Tidal Power, Components of Tidal Power Plant, Classification of Tidal Power Plants. Ocean Thermal Energy: Introduction, Ocean Thermal Energy Conversion (OTEC), Principle of OTEC **5** system, Methods of OTEC power generation. Geothermal Energy: Introduction, Capacity and Potential, Resources of geothermal energy.

BOOKS FOR REFERENCE

1. Sukhatme. S.P., Solar Energy, Tata McGraw Hill Publishing Company Ltd., New Delhi, 1997.
2. B. H. Khan, Non-Conventional Energy Resources, , The McGraw Hill
3. Twidell, J.W. & Weir, A. Renewable Energy Sources, EFN Spon Ltd., UK, 2006.
4. S. P. Sukhatme and J.K. Nayak, Solar Energy – Principles of Thermal Collection and Storage, Tata McGraw-
Hill, New Delhi.
5. Garg, Prakash, Solar Energy, Fundamentals and Applications, Tata McGraw Hill.

(Elective Foundation)

Elective Foundation: INS-104(c)	**Opto Electronics**

Unit I:

Laser Fundamentals: Properties of laser, Laser modes- axial and transverse, single mode operation. Frequency stabilization.Mode locking, Mode hopping, Q-switching techniques.
Laser Types: Doped insulator lasers, Semiconductor lasers, Gas lasers, Liquid Dye lasers.
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.
Applications of Laser: Biomedical, process, etc

Unit II:

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.

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

Unit III:

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 IV:

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, nonlinear phenomena

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.

BOOKS FOR REFERENCE

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. Opto Electronic Devices – Li, Xun-Hardback-374.
4. Optical Electronics – Ajoy Ghatak, K.Thyagarajan.

Semester – II:

(Mandatory Core)

Core – 1: INS-201	Industrial Instrumentation

UNIT – I

Introduction to Process Instrumentation: Elements of Process Instrumentation - Switches, Valves, Gauges, Converters, transmitters, actuators, relays. Process Instrumentation Diagrams - Familiarization.

Instrumentation in Iron & Steel Industries: Description of the process, Measurement hardware, Valves, Controllers and displays, Computer Applications and Typical control systems as applied to the iron and steel industries.

UNIT – II

Instrumentation in Petrochemical Industries: Control of Distillation Towers, Refrigeration units, Steam boilers, Furnaces, Centrifuges, Crystallizers, Heat exchangers, Pumps, Compressors, and Evaporators as applied to the petrochemical industry.

UNIT – III

Instrumentation in Pharmaceutical Industries : Description of the process, Measurement hardware, Valves, Controllers and displays, Computer Applications and Typical control systems as applied to the Pharmaceutical industries.

UNIT – IV

Instrumentation in Thermal Power Stations : Description of the process, Measurement hardware, Valves, Controllers and displays, Computer Applications and Typical control systems as applied to the Thermal Power Stations.

BOOKS FOR REFERENCE

1. Industrial Instrumentation – K. Krishnaswamy.
2. Industrial Instrumentation – Donald P. Eckman.
3. Industrial Instrumentation – Umesh Rathore.
4. Industrial Instrumentation – K. Krishnaswamy, S. Vijaychitra.
6. Process Instrumentation — Liptak

7. Process Instrumentation & control Handbook - Mithal
8. Instrumentation in Industries - H.E. Soison
9. Programmable Logic Controllers – John Webb – Maxwell Macmillan International

(Mandatory Core)

Core – 2: INS-202	Electronic Instrumentation

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.

(b). Cathod Ray Oscilloscopes, D.C. and A.C. Millie/Micro voltmeters Precision rectifier types. Nano ammeter (usingop.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: (Basic principle, design and working with suitable block/circuit diagrams)

(a) Spectrum Analyzers

(b) Frequency Synthesizers

(c) Digital tachometer

(d) Digital watt meter

(e) Digital Capacitance meter

BOOKS FOR REFERENCE

1. Principle of Electronic Instrumentation – De Sa, Elsevier Science
2. Electronic Instrumentation and Measurements – H. S. Kalsi
3. Electrical and Electronic Measurements and Instrumentation – J. K. Gupta.
4. Electronic Instruments and Instrumentation Technology – M.M.S. Anand.
5. Electronic Instrumentation and Measuring Techniques. — Cooper
6. Electronic Instrumentation — Kalsi
7. Electronic Measurements and Instrumentation. — Oliver & Cage
8. Instrumentation Devices and Systems. — Rangan, Sarma and Mani
9. A Course in Electrical and Electronic Measurements and Instrumentation. by AK Sawhney

(Compulsory Foundation)

Compulsory Foundation: INS-203(a)	**Sensors and Signal Conditioners**

UNIT-I: INTRODUCTION TO SENSORS \ TRANSDUCERS.

Definition of a transducers\sensor.Role of transducers.Characteristics of transducers.Significant parameters of a transducer.Selection of a transducer.Classification of transducers.Linearization of transducers.

UNIT-II: SIGNAL CONDITIONERS:

Precision Rectifier, Logarithmic Amplifier, Anti Logarithmic Amplifier, Active filters, DC to DC converters, Chopper Stabilized Amplifier, Phase Sensitive detector.

OPTO-ELECTRONIC TRANSDUCERS

Photoelectric effect.Photo emissive tube and photomultiplier tubes.Photoconductive and photovoltaic cells.Photo diodes and photo transistor. Light Dependent Resistors.

UNIT – III:

(a) TEMPERATURE TRANSDUCERS

Mechanical Temperature sensors.Resistance type temperature sensors.Platinum resistance thermometer.Thermocouples.Solid state sensors.Radiation type sensors – optical pyrometers.Calibration of thermometers.

(b) FLOW TRANSDUCERS

Flow characteristics. Obstruction meters-Venturi meter and orifice meters.Turbine flow measuring devices.

(c) LEVEL SENSORS

Diaphragm level sensor.Differential pressure level sensor.Laser level sensor. Level gauges.

UNIT-IV: DISPLACEMENT, STRAIN AND PREESSURE 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.Applications.

Manometers.Elastic transducers - Diaphragms, Bellows, Bourdon or helical tubes.Electrical pressure transducers – variable resistance, inductance and capacitance.Piezoelectric pressure transducer.Pressure calibration.

BOOKS FOR REFERENCE

1. Sensors and Transducers – D.Patranabis
2. Inteligent Sensor Systems 1996 Edition by John Bringnell, Neil White, Taylor & Francis.
3. Sensors and Transducers – Principle and Applications – R. Y. Borse
4. Modern Sensors Handbook 2007 Edition by Pavel Ripka, Aloisk Tipek, ISTE LTD.
5. Instrumentation Measurement Analysis – Nakra and Chaudhry
6. Instrumentation – Devices and Systems – Rangan, Mani and Sharma

7. A Course in Electrical and Electronic Measurements and Instrumentation A.K.Sahany
8. Hand Book of Bio-Medical Instrumentation – R.S. Khandpur (TMH)
9. 9.Process Measurement and Analysis – B.G. Liptak

(Compulsory Foundation)

Compulsory Foundation: INS-203(b)	**Network Analysis**

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.

BOOKS FOR REFERENCE

1. Circuits and Network Analysis,3/e, TMH: Sudhakar and S. P. Shyam Mohan
2. Network Analysis – M.E.Van Valkenburg, T.S.Rathore
3. Network Analysis And Synthesis – B.Somanathan Nair, S.R.Deepa.
4. Network Analysis and Synthesis – Ravish R. Singh.

(Compulsory Foundation)

Compulsory Foundation: INS-203(c)	**Spectroscopic Instrumentation**

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.

BOOKS FOR REFERENCE

1. Principles of Fluorescence Spectroscopy, Joseph R.Lakowicz - Plenum Press, 1983
2. Molecular Spectroscopy, N.C.Crabb and P.W.B.King
3. Light Scattering in Solids, M Cardona, G Guntherodt - 1975 - Springer-Verlag
4. Noble Lecture of SirC.V.Raman
5. Elements of Spectroscopy, Gupta, Kumar and Sharma
6. Elements of Diatomic Molecular Spectra, H. Dunford
7. Problems in Spectroscopy, S.V.J. Lakshman
8. Basic Principles of Spectroscopy, R. Chang

(Elective Foundation)

Elective Foundation: INS-204(a)	Microprocessors and Interfacing

UNIT-I

Introduction to Microprocessor: Overview of a basic microcomputer structure and operation, Ideal microprocessor, Microprocessor technology-Bipolar and MOS, Microprocessor evolution and types

UNIT-II

8086 / 8088 Microprocessor Family: Overview of 8086 Microprocessor family.

Architecture of 8086/8088 Microprocessor - Architecture of Intel 8086/8088, Addressing modes. Detailed instruction set of Intel 8086/8088. Interrupts, Assembler Directives.

UNIT- III

Interfacing of data converts, memory and I/O Devices: Interfacing 8-bit D/A converter and A/D converts, Software controlled successive approximation A/D converter using ADC, Memory interfacing, DMA data transfer, serial data transfer, interfacing to Alphanumeric display.

UNIT-IV

Programmable peripheral Interfacing Device: programmable Keyboard/display interface(8279), Programmable Peripheral Interface(8255), Programmable Interval Timer(8253), Programmable Interrupt Controller(8259), Synchronous Data Communication Device(8251).

BOOKS FOR REFERENCE

1. Microprocessors and Interfacing Programming and Hardware --- Douglas V Hall
2. The Intel Microprocessors 8086/8088. 80186/80187. 80286. 80386. 80486. Pentium Processors - Architecture. Programming and interfacing. PHI, B.B. Brey
3. Advanced Microprocessors and Interfacing – Badri Ram.
4. Microprocessors and Interfacing Devices - Rupender Singh, Sarika Jain.
5. Introduction to Microprocessor/Microcontrollers-B.RAM.
6. The 8086/8088 Microprocessors : Programming. Interfacing Software. Hardware and

Applications -
Walter A. Triebel. Avatar Singh. PHI Edition.
7. Microprocessors, PC Hardware and Interfacing – N.Mathivannan, PHI
8. Advanced Microprocessor & Peripherals – Architecture, Programming & Interfacing – A.K.Ray&K.M.Bhurchandi , TMH.

(Elective Foundation)

Elective Foundation: INS-204(b)	**Robotics**

UNIT-I

Brief History, Types of robots, Overview of robot subsystems, resolution, repeatability and accuracy, Degrees of freedom of robots, Robot configurations and concept of workspace, Mechanisms and transmission, End effectors and Different types of grippers, vacuum and other methods of gripping. Pneumatic, hydraulic and electrical actuators, applications of robots, specifications of different industrial robots.

UNIT-II

Rotation matrices, Euler angle and RPY representation, Homogeneous transformation matrices, Denavit-Hartenbergnotation,representation of absolute position and orientation in terms of joint parameters, direct kinematics.

Inverse Kinematics, inverse orientation, inverse locations, Singularities, Jacobian, Trajectory Planning: joint interpolation, task space interpolation, executing user specified tasks.

UNIT-III

Static force analysis of RP type and RR type planar robots, Dynamic analysis using Lagrangian and Newton-Euler formulations of RR and RP type planar robots, , Independent joint control, PD and PID feedback, actuator models, nonlinearity of manipulator models, Computed torque control, force control, hybrid control.

UNIT-IV

Sensors and controllers: Internal and external sensors, position, velocity and acceleration sensors, proximity sensors, force sensors, laser range finder. Robot vision: image processing fundamentals for robotic applications, image acquisition and preprocessing. Segmentation and region characterization object recognition by image matching and based on features

BOOKS FOR REFERENCE

1. Introduction to Robotics – Analysis, Control, Applications – Saeed B. Niku.
2. Introduction to Robotics – Mechanics and Control - John J. Craig.
3. Robotics and Control – R.K. Mittal, I.J.Nagrath.
4. Robotics for Engineers – Kailash Chandra Mahajan, Prashant Kumar Pattnaik, Raghvendra Kumar.

(Elective Foundation)

Elective Foundation: INS-204(c)	Electronic Measurement Instruments

Unit - I :

Static and Dynamic characteristics of instruments, dead zone, hysteresis, threshold, resolution, input & output impedance, loading effects, fundamentals of measurements, Types of Error, Statistical Analysis, Probability of Errors, Limiting Errors , calibration of instruments, traceability, calibration report & certification.

DC bridges: Wheatstone bridge and Kelvin bridge design, bridge sensitivity, errors in bridge circuits, null type and deflection type bridges, current sensitive and voltage sensitive bridges, applications of DC bridges

Unit - II:

Signal Converters: I To P / P To I Converter, Temperature to Voltage Converter, Conversion To Frequency, Period, or Time Duration, Measurement of Phase Difference Using X-OR and SR Flip-Flop Method, Measurement of Active And Reactive Power of Supply Line, Lock-in Amplifiers, Variable Oscillators, Direct Sensor Microcontroller Interfacing.

Isolation Techniques: Transformer Isolation, Optical Isolation, Digital Techniques For Optical Isolation, Hall-Effect Principle and Measurement of Displacement, Current And Power Using Hall Sensors, Amplifications of Low Level Signals, Guarding, Shielding.

Unit - III:

Electronic Instruments for Measuring Basic Parameters: Amplified DC meter, AC Voltmeter, True- RMS responding Voltmeter, Electronic multi-meter, Digital voltmeter, Vector Voltmeter.

Digital Instruments: Block diagram, principle of operation, Accuracy of Measurement Digital Multimeter, Kilo Watt Hour meter, Phase meter, Digital Tachometer, Ultrasonic Distance meter, Digital Thermometer, DSO, Frequency meter.

Unit - IV:

Instrument for Generation and Analysis of Waveforms: Introduction, The Sine Wave Generator, Frequency Synthesized Signal Generator, Frequency Divider Generator, Signal Generator Modulation, Sweep Frequency Generator, Pulse and Square Wave Generator, Function Generator, Wave Analyzers, Harmonic Distortion Analyzer, Spectrum Analyzer.

BOOKS FOR REFERENCE

1. Helfrick Albert D., Cooper W. D., "Modern Electronic Instrumentation and Measurement Techniques", Prentice Hall India, 2nd Edition, 2008.

2. Sawhney A. K., "A Course in Electrical and Electronics Measurements and Instrumentation", DhanpatRai& Sons, 11th Edition, 2005.

3. Kalsi H. S., "Electronic Instrumentation", Tata McGraw-Hill Education, 3rd Edition, 2010.

4. Bell David A., "Electronic Instrumentation and Measurements", Pearson Education, 3rd Edition, 2013.

Labs	**Practical – I: INS-205**	**Transducers Lab**
	Practical – II: INS-206	**Microprocessors Lab**

Semester – III:

(Mandatory Core)

Core – 1: INS-301	**Analytical Instrumentation**

UNIT –I:

COLORIMETERS AND SPECTROPHOTOMETERS

(a) 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.

(b) 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.

ATOMIC ABSORPTION AND RAMAN SPECTROMETERS

a) Atomic absorption spectrometer – Principle and working with a block diagram. Salient features of individual blocks. Applications.

b) Raman Spectrometer – Principle and working with a block diagram. Salient features of individual blocks. Applications of Raman spectrometer.

UNIT –II

CONDUCTIVITY BRIDGES, PH METERS AND POLAROGRAPHS

a) Conductivity bridge – Principle and working of a conductivity bridge with a block diagram. Salient features of individual blocks. Applications of conductivity bridges.

b) pH Meters – Principle and working with a block diagram. Salient features of individual blocks. Types of pH meters. Applications of pH meters in chemical and industrial fields.

c) Polarograph – Principle and working with a block diagram. Salient features of individual blocks. Characteristics of dropping mercury electrode. Polarogram. Pulse polarograph. Application of Polographs in chemical and Industrial fields.

UNIT – III

RESONANCE AND MASS SPECTROMETERS

a) Nuclear magnetic resonance spectrometer – Principle and working with suitable schematic/block diagrams. Experimental arrangement. Salient features of individual blocks. NMR spectrum. Applications of NMR spectrometer.
b) Electron spins resonance spectrometer – Principle and working with a block diagram. Experimental arrangement. Salient features of individual blocks. Applications of ESR spectrometer.
c) Mossbauer Spectrometer – Experimental arrangement. Salient features of individual blocks. Sources, absorbers and detectors. Mossbauer spectrum. Applications of Mossbauer spectrometer.
d) Mass spectrometer – Principle and working. Description of individual blocks of experimental arrangement. Applications of Mass spectrometer.

UNIT – IV

ELECTRON MICROSCOPES

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

THERMAL ANALYSERS

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

CHROMATOGRAPHS

Chromatographs – Gas and liquid chromatographs: Principle and working with a block diagram. Applications.

BOOKS FOR REFERENCE

1. Hand Book of Analytical Instruments – R.S.Khandpur
2. Instrumental Methods of - Dr.S.Ravi Sankar
3. Advanced Instrumentation Techniques – Dr.S.Ravichandran, Dr.Naredndra Mulchand Gowekar
4. A Hand Book of Instrumental Methods of Analysis – Dr.Gokul S. Talele, Prof. Hitesh V. Shahare.
5. .Instrumental Methods of Analysis – Willard, Merrit& Dean
6. .Instrumental Methods of Analysis – Chatwal & Anand
7. .Principles of Instrumental Analysis – Skoog
8. .Industrial Instrumentation – Soisson

(Mandatory Core)

Core – 2: INS-302	Digital Signal Processing

Unit - I:

Introduction, signals and systems

Basic elements of Digital Signal Processing (DSP), analog to digital conversion (ADC), comparison between DSP and Analog Signal Processing (ASP) with applications of DSP. Discrete-time signals and systems. Classification of signals, sampling process/theorem, aliasing effect and reconstruction, classification of systems, input-output description of systems, Block-digram representation of discrete-time systems.

Unit - II:

Analysis of discrete-time systems

Linear convolution, causality and stability of discrete time systems, autocorrelation, crosscorrelation, z-transform and its properties, solving difference equations and analysis of discrete-time systems in zdomain, transfer function, pole-zero plot. Implementation of discrete-time systems: Structures for the realization, Finite Impulse Response (FIR) and Infinite Impulse Response (IIR) structures.

Unit – III :

Discrete Fourier Transform (DFT)

Discrete Fourier transform (DFT), properties of DFT, symmetry properties, circular convolution, linear filtering methods based on DFT, Frequency analysis of signals using DFT, Efficient computation of DFT, Fast Fourier Transform (FFT) algorithms: radix-2 decimation-in-time (DIT) and decimation-infrequency (DIF)FFT algorithms.

Unit – IV :

Design of digital IIR filters:

IIR filter design by Approximation of Derivatives, IIR filter design by impulse invariance, IIR filter design by bilinear transformation, Characteristics of commonly used analog filters (Butter worth and Chebyshev), Frequency transformations, comparison of IIR & FIR filters.

Design of dital FIR filters:

Symmetric and antisymmeric FIR filters, Design of linear phase FIR Digital Filters using Windows, Design of linear phase FIR Digital Filters by Frequency Sampling method.

BOOKS FOR REFERENCE

1. A. V. Oppenheim and R. W. Schafer, "Discrete Time Signal Processing", Pearson Education.
2. J. G. Proakis and D. J. Manolakis, "Digital Signal Processing: Principles, Algorithms and Applications", PHI, 2000.
3. P. Ramesh Babu, "Digital Signal Processing", Sci- Tech Publications.
4. A. Nagoor Kani, " Digital Signal Processing", Mc Graw Hill Publications, 2nd Edition.
5. B. Porat, "A Course in Digital Signal Processing", J. Wiley and Sons.
6. J. R. Johnson, "Introduction to Digital Signal Processing", PHI.
7. Rabiner, Gold, "Theory and Applications of Digital Signal Processing", TMH.
8. S. K. Mitra, "Digital Signal Processing-A Computer Based Approach", MGH

(Generic Elective)

Generic Elective : INS-303(a)	Biomedical Instrumentation

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 a Biotelemetry 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.

BOOKS FOR REFERENCE

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

(Generic Elective)

Generic Elective : INS-303(b)	Micro Electro Mechanical Systems

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.

BOOKS FOR REFERENCE

1. Micro Electro Mechanical System Design – James J. Allen
2. MICRO ELECTRO MECHANICAL SYSTEMS – DR.P.ELAMURUGAN.
3. Micro Electro Mechanical Systems – Dr. T. Kamatchi, Dr. G. Veera Senthil Kumar, K. Meenakshi Sundar, R. Karthick.
4. Micro Electronic and Mechanical Systems – Zheng Yun Man

(Generic Elective)

Generic Elective: INS-303(c)	**Instrumentation for Environmental Science**

UNIT - I

a.Introduction: Necessity of instrumentation & control for environment, sensor requirementfor 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 naturalquality, 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 watersampling 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.

BOOKS FOR REFERENCE

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.

Practicals : INS: 304	**Analytical Instrumentation Lab**
kill Oriented: INS-305	**Microcontrollers and Interfacing**

(Skill Oriented Course)

Skill Oriented: INS-305	**Microcontrollers and Interfacing**

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 Newman 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, . Serial communication and Parallel Communication

Interrupts - Interrupts in MCS-51 -Timers and counters – Communications – Seri and Parallel.

UNIT- III

a. 8051 Memory and I/O device Interfacing:

Memory Interfacing – Program and data memory, I/O Interfacing – LED, relays, Keyboard, LCD, Seven Segment Display, Stepper Motor.

b. Interfacing DAC / ADC with 8051 Microcontroller:

Interfacing DAC – 0808 with 8051 and its simple programming.

Interfacing ADC – 0809 with 8051 and its simple Programming.

BOOKS FOR REFERENCE

1. Microcontrollers Architecture, Programming, Interfacing and System Design- Raj
2. The 8051 Microcontroller and Embedded Systems – Mazidi and Mazidi, 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. Programming and Customizing the PIC Microcontroller – Myke Predko.
7. The 8051 Microcontroller and Embedded Systems – Muhammad Ali Mazidi, Janice Gillispie Mazidi, Rolin D. Mokinlay.
8. Microcontroller(ARM) and Embedded Systems – Raghunandan G. H.
9. MicroProcessors and Microcontrollers – Sunil Mathur, Jeebananda Panda.

(Open Elective)

Open Elective: INS – 306 (a)	**Computer Architecture and Organization**

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, Virtual 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.

BOOKS FOR REFERENCE

1. Computer Systems Architecture -'M.Moris Mano, Illrd Edition, PHI/Pearson.
2. Computer Organization - Car Hamacher, ZvonksVranesic, 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, -SivaraamaDandamudi
6. Computer Organization and Architecture (Designing for Performance) – William Stallings.

7. Computer Organization and Architecture – A.P.Godse, Dr.D.A.Godse.
8. Computer Organization and Architecture – R. Senthilnathan, A.Pagalavan, R.Vijayabaskar.
9. computer architecture and organization – Nicholas p carter

(Open Elective)

Open Elective: INS – 306(b)	**Industrial Organization and Management**

Unit – I :

Industrial Management and Business organization:

Definition of business, characteristics and classifications, objectives, types of business organizationscharacteristics,
levels of management, characteristics and objectives. Hierarchical structure and organization of group, Functions of management- *forecasting, organizing, directing, motivating, planning, co-ordinating, controlling, communication, leadership etc.*
Developing Business environment: SWOT analysis, BCG Matrix, Porter's 5 forces of competition.
Management techniques for developing strategy viz., Balanced score card, Performance Management
and analysis techniques viz. Ishikawa diagrams, Business process Re-engineering

Unit II:

Quality, Inspection and Environment Management :

Quality Circles/ Forums, Quality Objectives, use of Statistical Process Control, Introduction to ISO 9000
Inspection: objectives, Principles, standards, Qualities of inspector, Role of R & D, Innovation, Business
expansion, Diversion, Mergers and Takeovers

Environmental pollution:- ecology, factors causing pollution, effect of pollution on human health, Air
pollution control, sources of pollution water pollution and control, solid waste management
Environmental norms: ISO 14000

Unit III:

Production Planning, Inventory Control and Supply Chain Management:

Manufacturing Excellence, Outsourcing, Production planning techniques, Purchase and Inventory
Management, inventory control using Economic Order Quantity, Minimum Order Quantity, Ordering
T. E. Instrumentation Syllabus 2015 Course (Credit Base)
Level, store keeping, Finished goods, semi finished goods, raw material handling and storage, Value
Addition, Supply Chain concepts and management for leveraging profit

Unit IV:

Human Resources Management:

Manpower planning, Human Resources: exploiting true potential, Staff training and development,
Motivation, Selection and training of manpower, Appraisal and increments management, Leadership
skills, Delegation and development for growth. Objectives and Job Descriptions/ Role Summary

BOOKS FOR REFERENCE

1. Business Poly – Azar Kazmi
2. Resisting Intellectual property – Halbert, Taylor & Francis – 2007 – PHI
3. Management in Engineering- Gail Freeman- Bell and James Balkwill (PHI).
4. The New Era of Management – R. L. Daft, THOMSON (India Edition)
6. Modern Economic Theory- Dewett K. K.
7. Elementary Economic Theory- Dr. R. D. Gupta.
8. Business organization and Management- M.C. Shukla.T.E.

Semester – IV:

(Mandatory Core)

Core – 1: INS-401	INTRODUCTION TO VLSI CIRCUITS

UNIT-I

An Overview of VLSI and logic and Design with MOSFETs: Complexity and Design, Basic concepts, Ideal switches and Boolean operations, MOSFETs as switches, Basic logic gates in CMOS, Complex logic gates in CMOS.

UNIT-II

Physical Structure and Fabrication of CMOS ICs: Integrated circuit layers, MOSFETs, CMOS layers, Designing FET arrays, Overview of silicon processing, Material growth and deposition, Lithography.

UNIT-III

Elements of Physical Design and Electrical Characteristics of MOSFETs: Basic Concepts, Layout of basic structures, cell concepts, FET sizing and the unit transistor, Physical design of logic gates, Design hierarchies, MOS physics, nFET current-voltage equations, pFET characteristics.

UNIT-IV:

Electronic analysis of CMOS logic gates: DC characteristics of the CMOS inverts, inverter switching characteristics, power dissipation, DC characteristics: NAND and NOR gates, NAND and NOR transient response, Transmission gates and pass transistor.

BOOKS FOR REFERENCE

1. John P. Uyemura, “Introduction to VLSI circuits and Systems”,Johnwiley and sons.
2. VLSI - W. Wolf.
3. VLSI Fabrication Principles (Sillicon and Gallium Arsenide) – Sorab K Ghandhi
4. VLSI Design – K.Lal Kishore, V.S.V.Prabhakar
5. S.K.Ghandhi,”VLSI Fabriction principles”, 2/e, John Wiley and sons.

6. S.M.Sze,"VLSI Technology",2/e mcGraW-Hill,1988.
7. VLSI Physical Design Automation – Sadiq M Sait, Habib Youssef.
8. VLSI Technology & Design – V.S.Bagad.

(Mandatory Core)

Core – 2: INS-402	**Embedded Systems and Real time Operating Systems**

UNIT-I: Introduction to Embedded systems: Introduction, Application areas, Categories of embedded systems, Overview of embedded systems architecture, Specialities of embedded systems, Recent trends, Hardware architecture, Software architecture, Application software, Communication software, core platform development, development tools.

The PIC Microcontroller : Introduction: PIC microcontroller features, PIC Architecture, rogram memory, Addressing Modes, Instruction set, Instruction Format, Byte-Oriented Instructions, Bit-Oriented Instructions, Literal Instructions,Control Instructions (CALL and GOTO),Destination Designator

UNIT-II: Introduction to ARM processors, architecture of ARM 7, registers, current program status register, pipeline, exceptions, interrupts and vector table. Instruction set: Data processing instructions, arithmetic, Logic, branch, load-store instructions, software interrupt instructions, PSR instructions, loading constants.

Applications: Programming the flash memory using JTAG, working with audio codec (AC97), JPEG encoder, MP3 decoder, ADC, DAC, LCD, Stepper motor, seven segment displays, Relays and Opto- isolators.

UNIT-III: Real Time Operating Systems and Concepts: Introduction,Types of operating systems, Typical real time applications, Hard Vs Soft real-time systems, Real time operating systems(RTOS),Architecture of the kernel, Task and task scheduler, Interrupt service routines, Management Function calls of Semaphores, Mutex, , Message Queues, Event registers, Pipes, Signals, Timers. Memory management, Priority inversion problem. Embedded Operating

Systems: Real time operating systems, hand held operating systems.

UNIT-IV: RTOS APPLICATION DOMAINS

RTOS for Image Processing - Embedded RTOS for voice over IP - RTOS for fault Tolerant Applications - RTOS for Control Systems.

RFID systems:RFID system, RFID applications RFID Tag, RFID Reader, applications development using RFID

BOOKS FOR REFERENCE:

1. Real Time systems-black book, Dr.K.V.K.K. Prasad, Dreamtech Publishers
2. ARM system Developer's Guide-Andrew N.SLOSS, Domic Symes and Chris Wright, Morgan Kaufman Pubs.
3. J B Peatman, Design with PIC Microcontrollers, Prentice Hall.
4. RTOS Designing embedded systems-J.Ganssle, Newnes, 1999
5. Real Time Systems, C.M. Krishna, Kang, G.Shin, McGraw Hill, 1997
6. PIC Microcontroller by H.W Huang, Delmar CENGAGE Learning, 2007.

Core – 2: INS-402	**Embedded Systems and Real time Operating Systems**

UNIT-I: Introduction to Embedded systems: Introduction, Application areas, Categories of embedded systems, Overview of embedded systems architecture, Specialities of embedded systems, Recent trends, Hardware architecture, Software architecture, Application software, Communication software, core platform development, development tools.

The PIC Microcontroller : Introduction: PIC microcontroller features, PIC Architecture, Program memory, Addressing Modes, Instruction set, Instruction Format, Byte-Oriented Instructions, Bit-Oriented Instructions, Literal Instructions,Control Instructions (CALL and GOTO),Destination Designator

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Applications: Programming the flash memory using JTAG, working with audio codec (AC97), JPEG encoder, MP3 decoder, ADC, DAC, LCD, Stepper motor, seven segment displays, Relays and Opto- isolators..

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UNIT-IV: RTOS APPLICATION DOMAINS

RTOS for Image Processing - Embedded RTOS for voice over IP - RTOS for fault Tolerant Applications - RTOS for Control Systems.

RFID systems:RFID system, RFID applications RFID Tag, RFID Reader, applications development using RFID

BOOKS FOR REFERENCE:

1. Real Time systems-black book, Dr.K.V.K.K. Prasad, Dreamtech Publishers
2. ARM system Developer's Guide-Andrew N.SLOSS, Domic Symes and Chris Wright, Morgan Kaufman Pubs.
3. J B Peatman, Design with PIC Microcontrollers, Prentice Hall.
4. RTOS Designing embedded systems-J.Ganssle, Newnes, 1999
5. Real Time Systems, C.M. Krishna, Kang, G.Shin, McGraw Hill, 1997
6. PIC Microcontroller by H.W Huang, Delmar CENGAGE Learning, 2007.

(Generic Elective)

Generic Elective: INS-403(a)	**Programmable Logic Controllers**

Unit - I

a.Process Dynamics: Dynamic elements in a control loop, Dead time processes and smith predictor compensator. Inverse response behavior of processes and compensator. Dynamic behavior of first and second order systems. Interacting and non-interacting systems.

b.Process Control Action: Elements of process control, Controller Principle, Process Characteristics, Control system parameters, discontinuous, continuous and composite controller modes/actions (P,I,D,PI,PD and PID).

Unit - II

a.Process Controllers and Tuning: General features, construction and working of Pneumatic, Hydraulic and Electronic controller. Process reaction curve method, Zigler-Nichols method, Cohencoon correction for quarter amplitude, Frequency response method,Relay based tuning.

b.Control Schemes: Feedback, feedforward, cascade, ratio, split range, selective control, adaptive control, and model based control.

Unit - III

a.Analysis of Control Loop: Steady state gain, Process gain, Valve gain, Process time constant, Variable time Constant, Transmitter gain, Linearisinga equal percentage valve, Variable pressure drop. Analysis of Flow Control, Pressure Control, Liquid level Control, Temperature control, SLPC-features, faceplate, functions, MLPC- features, faceplate, functions, SLPC and MLPC comparison.

b.Scaling: Types of scaling, examples of Scaling.

Unit – IV

a.Multivariable Control: Block diagram analysis of multivariable systems, Interaction, Tuning of Multivariable controllers, relative gain analysis, Decoupler design.

b.Intelligent Controllers:

Step analysis method for finding first, second and multiple time constants and deadtime. Model Based controllers: Internal Model control, Smith predictor, optimal controller, Model Predictive controller, Dynamic matrix controller (DMC).Self Tunning Controller. Basic concept Fuzzy logic systems – Artificial Neural networks

BOOKS FOR REFERENCE:

1. Donald Eckman, ―Automatic Process Control‖, Wiley Eastern Limited, 1st Edition, 1966
2. Thomas E Marlin, ―Process Control- Designing processes and Control Systems for Dynamic Performance‖, McGraw-Hill International Editions, 1st Edition , 1995.
3. F.G.Shinskey, ―Process control Systems‖, TATA MCGRAW HILL, 3rd Edition, 1988.
4. Krishna Kant, ―Computer Based Industrial Control‖, Prentice hall of India, 2nd Edition, 2010.
5. B Liptek, ―Instrument engineers handbook‖, Chilton book Co, 1st Edition, 1969.
6. P.W.Murrill, ―Fundamentals of Process Control‖, International Society of Automation, 1st Edition, 2000.
7. Considine, ―Process/Industrial Instruments and Controls Handbook‖, McGraw-Hill Professional, 5th Edition, 1999.
8. T.J.Ross, Fuzzy Logic with Engineering Applications, Wiley, 3rd Edition, 2011.
9. P.W.Murrill, ―Applications concepts of Process control‖, International Society of Automation, 3rd edition, 2012.

10. B.Waynebequette, ―Process Control:Modeling, Design and Simulation‖, Prentice hall of india, 1st Edition, 2002.

11. Stephanopoulos George, ―Chemical Process Control‖, Prentice hall of India, United States Edition, 1983.

(Generic Elective)

Generic Elective: INS-403(b)	**Computational Mathematics**

UNIT - I: Special Functions

Beta and Gamma Functions – Definitions and properties – Evaluation of integrals, Legendre, Bessel and Hermite differential equations – Solutions – Generating functions – Orthogonal properties of Legendre, Bessel and Hermite Functions (Proof not necessary) – Recurrence relations – (Proof for Legendre polynomials only).

UNIT - II: Integral Transforms

Fouriers Transforms: Properties of Fourier transforms – Fourier sine and cosine transforms-
Power in Fourier series – Modulation theorem, Fourier transform of impulse function, Constants,
Unit step function and Periodic functions.

Laplace Transforms: Definition and notation – Properties of Laplace transforms – Laplace transforms of Dirac delta function and periodic functions (Square wave, sawtooth wave and triangular wave) – Inverse Laplace transforms – properties – Solution of linear differential equations with constant coefficients - Applications to LCR circuits and resonance of simple pendulum.

UNIT - III: Numerical techniques

Solution of an equation – Bisection method, Regular False method, Newton - Rhapson method - Solutions of simultaneous – Gauss elimination method and Gauss-Seidel method -

Interpolations - Newton's interpolation and Lagrange's interpolation, Curve fitting – Method of Least squares. Numerical differentiation and integration – Trapezoidal rule and Simpson's 1/3 rule – Solutions of differential equations - Euler's method and Runga-Kutta Methods.

UNIT – IV: Complex Variables

Functions – Complex differentiation - Analytic function - Cauchy – Reimann equations – Derivatives of elementary functions – Singular points and classification. Complex integration - Cauchy's theorem – Integrals of special functions – Cauchy's integral formula – Taylor's and Lorentz theorem (statements only) – Residues, calculations of residues - Residue theorem – evaluation of definite integrals.

BOOKS FOR REFERENCE:

1. Functions for Scientists and Engineers, W.W. Bell, D.Van Nostrand Company, London (1968)
2. Fourier Analysis, Hsu P Jewi, Unitech Division
3. Laplace Transforms by Murray Spiegle, Schaum's outline series, McGraw Hill, International Book Company, New York.
4. Applied Mathematics for Engineers, Pipes and Harval, Third Edition, McGraw Hill Books Co.

(Generic Elective)

Generic Elective: INS-403(c)	**Electrical Engineering Materials**

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.

BOOKS FOR REFERENCE:

1. Ian P. Hones, 'Material Science for Electrical & Electronics Engineers', Oxford University Press

2. K. M. Gupta – Electrical Engineering Materials, Umesh Publication, 2nd edition 20

Practicals: INS : 404	**VLSI Lab**

Project Work : INS - 405	**Project Work**

(Open Elective)

Open Elective: INS-406(a)	Agro Based Instrumentation

Unit – I :

Necessity of instrumentation & control for agriculture, engineering properties of soil: fundamental definitions & relationships, index properties of soil, permeability & seepage analysis, shear strength, Mohr‘s circle of stress, active & passive earth pressures, stability & slopes, Sensors: introduction to sonic anemometers, hygrometers, fine wire thermocouples, open & close path gas analyzers, brief introduction to various bio-sensors.

Unit – II

Flow Diagrams: Flow diagram of sugar plant & instrumentation set up for it, flow diagram of fermenter & control(batch process),flow diagram of dairy industry & instrumentation set up for it, juice extraction- control process - instrumentation set up.

Unit – III

Irrigation systems: necessity, irrigation methods: overhead, centre pivot, lateral move, micro irrigation systems & it‘s performance, comparison of different irrigation systems, soil moisture measurement methods: resistance based method, voltage based method, thermal based method, details of gypsum block soil moisture sensor, irrigation scheduling, irrigation efficiencies, design considerations in irrigation channels.

Unit - IV:

Application of SCADA for DMA

Application of SCADA for DAM parameters & control, irrigation control management upstream & down - stream control systems, green houses & instrumentation: ventilation, cooling & heating, wind speed, temperature & humidity, rain gauge carbon dioxide enrichment measurement & control.

Automation in earth moving equipments & farm equipments

Application of SCADA & PLC in packing industry and cold storage systems, implementation of hydraulic, pneumatic & electronics control circuits in harvesters cotton pickers, tractor etc. classification of

BOOKS FOR REFERENCE:

1. Patranabis, ―Principles of Industrial Instrumentation‖, Tata McGraw-Hill, 2nd Edition 2005.
2. Bella Liptek, ―Instrument engineers handbook‖, Chilton book Co., NY, 1st Edition, 1969.
3. C. D. Johnson, ―Process Control Instrumentation Technology‖, Prentice hall of India, 8th Edition, 2009.
4. B.A.Wills, "Wills' Mineral Processing Technology‖, Butterworth-Heinemann, 8th Edition, 2015.
5. Microprocessor – Based Agri Instrumentation – Krishna Kant.
6. Advanced Agricultural Instrumentation – William G. Gensler

(Open Elective)

Open Elective: INS-406(b)	**Industrial Automation**

Unit -I:

Introduction: Overview, OSI reference model, Transmission media : Copper cable,Coaxial cables, Twisted-pair cable, Connector standards, Earthing/grounding, Fiber-optic cable components, Fiber-optic cable parameters

Open control network: RS-232 overview, RS-232 interface standard, RS-232 troubleshooting, Typical RS-232 problems, RS-485 overview, The RS-485 interface standard, RS-485 troubleshooting Current loop and RS-485 converters overview, TCP/IP overview, Internet layer protocols (packet transport), Modbus overview, Modbus protocol structure, Modbus troubleshooting

Unit - II:

Network at different level: AS-I, CAN, Devicenet, Industrial Ethernet overview, Profibus PA/DP/FMS overview, Foundation Fieldbus overview, The physical layer and wiring rules, HART overview, Introduction to HART and smart instrumentation.

Safety Instrumented System (SIS): Need for safety instrumentation- risk and risk eduction methods, hazards analysis. Process control systems and SIS. Safety Integrity Levels (SIL) and availability. Introduction to the international functional safety standard IEC61508

Unit - III:

Automation Fundamentals: Automation and its importance, automation applications, expectations of automation. Process and factory automation. Types of plant and control – categories in industry, open loop and close loop control functions, continuous processes, discrete processes, and mixed processes. Automation hierarchy – large control system hierarchy, data quantity & quality and hierarchical control. Control system architecture – evolution and current trends, comparison of different architectures.

Unit - IV:

Distributed Control System (DCS): Introduction to DCS. Evolution of DCS, DCS flow sheet symbols, architecture of DCS. Controller, Input and output modules, Communication module, data highway, local I/O bus, Workstations, Specifications of DCS. Introduction of Hierarchical control of memory: Task listing, Higher and Lower computer level task. Supervisory computer tasks DCS configuration. Supervisory computer functions, Control techniques, Supervisory Control Algorithm. DCS & Supervisory computer displays, advanced control Strategies, computer interface with DCS. DCS. System integration with PLCs computer: HMI, Man machine interface sequencing, Supervisory control, and integration with PLC, personal computers and direct I/O, serial linkages, network linkages, link between networks. Introduction to DCS Programming, Function Block Diagram method for DCS programming.

BOOKS FOR REFERENCE:

1 Samuel M. Herb, ―Understanding Distributed Processor Systems for Control‖, International Society of Automation Publication, 1st Edition, 1999.

2 Thomas Hughes, ―Programmable Logic Controller‖, International Society of Automation Publication, 4th Edition, 2004

3 Stuart A. Boyer, ―SCADA supervisory control and data acquisition‖, International Society of Automation Publication, 4th Edtion, 2009.

4 Gruhn and Cheddie, ―Safety Shutdown Systems‖, International Society of Automation,

MODEL QUESTION PAPERS FOR ALL SEMESTERS

M.Sc., DEGREE EXAMINATIONS- 2022
Branch: INSTRUMENTATION FIRST SEMESTER
Paper : I: INS -101:Introduction to Instrumentation and Control System

TIME:3 Hours **Max.Marks:80**

SECTION - A

Answer any **FOUR** of the following. Each Question carries 5 marks. **(4x5=20)**

1. Explain the typical applications of Instrument systems?

2.Write a brief note on the performance parameters of instruments i.e.

i) Accuracy ii) Precision

3. Explain the basic components of a control system?.

4. Explain the classification of control systems

5. Discuss in detail transient response

6.What is meant by stability explain about relative and absolute stability of a control system.

7. Write a brief note on Bode plot?.

8.Discuss about Polar plot?

SECTION – B

Answer **ALL** questions. Each Question carries 15 marks **(4x15 = 60)**

9.a) Explain the Functional elements of Instrumentation and Measuring Systems with neat block diagram.

(OR)

b) Discuss about errors and uncertainties in the measurement of performance parameter of instruments.

10. a) Write about open loop and closed loop systems with neat diagram and explain it with suitable Examples? .

(**OR)**

b) Write briefly about effect of feed back on Overall gain, Stability, Sensitivity, Bandwidth and noise.

11. a) Discuss about Time response of first order systems with neat block diagram?

(OR)

b) Explain about concept of stability and necessary condition for stability?

12. a) Explain about Phase margin and Gain margin with neat sketch?

(OR)

b) Write about Nyquist criterion to find stability with suitable example?

M.Sc., DEGREE EXAMINATIONS- 2022
Branch: INSTRUMENTATION FIRST SEMESTER
Paper : I: INS -102:Analog Devices and Industrial Electronics

TIME:3 Hours **Max.Marks:80**

SECTION - A

Answer any **FOUR** of the following. Each Question carries 5 marks. **(4x5=20)**

1. Write a brief note on Semi conductor materials.

2. Explain the working of a two pin and a three pin voltage regulators.

3. Write about differential amplifier and a comparator with circuits?

4. Describe the constructional features of a Wein Bridge Oscillator with neat sketch.

5. Explain the working of Gate Turn Off Thyristors (GTO) and its salient features.

6. Write a short note on Shockley diodes.

7. State and explain the AC time delay relay and solid state relays with neat circuit diagram.

8. State and explain the Sink effect?

SECTION – B

Answer **ALL** questions. Each Question carries 15 marks **(4x15 = 60)**

9. a) Discuss the inversion layer formation in MOSFET and explain its characteristics
.

(OR)

b) Explain the working principle of SMPS unit using relevant sketches. Write down some of its salient features.

10. a) Write down the characteristics idal and real amplifier. Discuss about the working of voltage and current follower with neat sketeches.

(**OR)**

b) Explain the various mathematical operations that can be performed using operational amplifier with the help of relevant sketches.

11. a) Draw the circuit diagram of SCR full wave rectifier. Explain the operation with wave forms.

(OR)

b) Describe the construnction of programmable UJT and explain its operational Mechanism with neat diagrams.

12. a) Draw the characteristics and explain the operations of UJT / SCR time delay relays.

(OR)

b) Explain the working of a 555 timer with block diagram and also mention some of its applications with relevant sketeches.

M.Sc., DEGREE EXAMINATIONS- 2022
Branch: INSTRUMENTATION FIRST SEMESTER
Paper : I: INS -103(a):Digital Techniques and Principles of Communications

TIME:3 Hours **Max.Marks:80**

SECTION - A

Answer any **FOUR** of the following. Each Question carries 5 marks. **(4x5=20)**

1. Give various number systems used in Digital Electronics?
2. What is a Logic Gate? Give a brief account of AND, OR and NOT logic gates?
3. Draw a circuit diagram of a 4 bit Ripple Counter?
4. Explain programme array logic
5. How can frequency modulation be generated from phase modulation?
6. What is quantization? Write PCM system?
7. What is a Satellite? Write the differences between Active and Passive Satellites?
8. Write a note on transponders

SECTION – B

Answer **ALL** questions. Each Question carries 15 marks **(4x15 = 60)**

9. (a). State De Morgan's Theorems of Boolean Algebra and prove them?

(OR)

(b). Illustrate and describe the working of J-K Master/Slave Flip Flop Circuit? Give its Truth Table?

10. (a). Discuss the applications of shift registers

(OR)

(b). Draw the circuit diagram of a Programmable Logic Array and explain its operation?

11. (a). Write the comparison between amplitude modulation, frequency modulation and phase modulation

(OR)

(b). Write in detail sampling theorem

12. (a). Write the advantages of Geostationary satellite

(OR)

(b). Explain the classification of satellites

M.Sc., DEGREE EXAMINATIONS- 2022
Branch: INSTRUMENTATION FIRST SEMESTER
Paper : I: INS -104(a):Programming in "C"

TIME:3 Hours **Max.Marks:80**

SECTION - A

Answer any **FOUR** of the following. Each Question carries 5 marks. **(4x5=20)**

1. Discuss about the significance of flow charts in Computer Programming?
2. Explain briefly about constants and varaibles and write a C program for finding the Sum of the Squares of the natural numbers using for statement?
3. What is the difference between Over flow and Under flow of Data?
4. Write about bitwise and conditional operators in "C" with examples?
5. Write a brief note on string handling functions?
6. Explain the importance of user – defined functions?
7. What is structure in C? Explain the structure initialization?
8. Write about the concepts of single linked lists

SECTION – B

Answer **ALL** questions. Each Question carries 15 marks **(4x15 = 60)**

9. (a). Explain the organization of a computer system with relevant examples?

(OR)

(b). Discuss about the basic structure of "C" program with examples and also its key words?

10. (a). What is an operator? Explain briefly about the different type of operators with examples and also mention the their hierarchy in "C" program.

(OR)

(b).Example briefly about the different type of Decision making and looping statements with examples?

11. (a). What is an array? How to initialize 1 D and 2 D arrays? Write a C program for computing two given

(3×3) matrix multiplication?

(OR)

(b). What is pointer? Explain about user defined functions and how they are different from library functions?

12. (a). Write a program in C for declaration of pointers and structures in “C”

(OR)

(b). Discuss about the file management and I/O operation on files in “C” language with examples.

M.Sc., DEGREE EXAMINATIONS- 2022
Branch: INSTRUMENTATION SECOND SEMESTER
Paper : I: INS -201:INDUSTRIAL INSTRUMENTATION

TIME:3 Hours **Max.Marks:80**

SECTION - A

Answer any **FOUR** of the following. Each Question carries 5 marks. **(4x5=20)**

1. Write a brief note on Elements of Transmitters in Process Instrumentation ?
2. Discuss about the valves and controllers in Iron and Steel Industry?
3. Write a brief note Steam Boilers in Petrochemical Industry?
4. Give a detailed note Heat Exchangers in Petrochemical Industry?
5. Briefly discuss about Measurement Heard ware in Pharmaceutical Industry?
6. Give a detailed note on Controllers and Displays in Pharmaceutical Industry?
7. Write a short note on Valves and Controllers in Thermal Power Stations?
8. Explain Computer Applications in Thermal Power Stations?

SECTION – B

Answer **ALL** questions. Each Question carries 15 marks **(4x15 = 60)**

9. a)Write in detail about the Valves, Guages, Converters, actuators and relays

(OR)

b) Explain the Instrumentation process in Iron and Steel Industry?

10. a) Explain the Instrumentation process in Petrochemical Industry ?

(**OR)**

b) Explain in detailed about the Furnaces in and Centrifuges in Petrochemical Industry with neat
sketch.

11. a) Explain the Instrumentation process in Pharmaceutical Industry?

(OR)

b) Explain briefly about the Measurement Heard ware and Valves in Pharmaceutical Industry with neat sketch?

12. a) Explain in detailed about Instrumentation in Thermal Power Station?

(OR)

b) Explain briefly about controller and Displays in Thermal Power Station with neat sketch?

M.Sc., DEGREE EXAMINATIONS- 2022
Branch: INSTRUMENTATION SECOND SEMESTER
Paper :II: INS -202:ELECTRONIC INSTRUMENTATION

TIME:3 Hours **Max.Marks:80**

SECTION - A

Answer any **FOUR** of the following. Each Question carries 5 marks. **(4x5=20)**

1. Discuss the extension of ranges in DC meter
2. Write the working of analog phase meter
3. What are the types of digital measuring instruments? Describe them briefly?
4. Discuss the principle and working of Digital voltmeter?
5. Write theworking of square wave generator
6. Write the various elements and their working in function generator
7.Explain the functioning of digital watt meter
8.Explain briefly Digital Capacitance meter with a diagram?

SECTION – B

Answer **ALL** questions. Each Question carries 15 marks **(4x15 = 60)**

9. a) What are Analog and Digital Measuring Instruments? Explain the principle and construction and operation of dynamometer type of DC meter?

(OR)

b) What are the types of Cathode Ray Oscilloscope (CRO)? Explain the working principle of dual beam CRO with a neat block diagram?

10. a) Illustrate Digital Phase Meter with a neat diagram and write its applications.

(OR)

b) Draw a neat sketch of digital storage Oscilloscope (DSO) and explain its working in details.

11. a) Design a RF signal generator and explain its principle and working.

(OR)

b) Explain signal generator with neat diagram and write its working principle. What are the applications of signal generator?

12.a) Illustrate the principle and working of a spectrum analyzer. Discuss two important applications.

(OR)

b) Explain the working principle and functioning of Digital tachometer with a neat circuit diagram.

M.Sc., DEGREE EXAMINATIONS- 2022
Branch: INSTRUMENTATION SECOND SEMESTER
Paper :III: INS -203(a):Sensors and Signal Conditioners

TIME:3 Hours **Max.Marks:80**

SECTION - A

Answer any **FOUR** of the following. Each Question carries 5 marks. **(4x5=20)**

1. Define "Passive" and "Active" Transducer and give an example of each?
2. Write the importance of transducer
3. Discuss the functioning of logarithmic transducer
4. Write the difference between photo conductive and photo voltaic cell.
5. What is Thermocouple? How Thermocouple can be used to measure temperature?
6. Write the working of differential pressure level sensor
7. Describe the functioning of variable resistance transducer
8. Write the various elements and their working in electrical transducer

SECTION – B

Answer **ALL** questions. Each Question carries 15 marks **(4x15 = 60)**

9. a). What is a Transducer? Classify the transducers according to their characteristics and applications?

(OR)

b). Discuss the linearization of transducers

10. (a). Describe in detail the working of phase sensitive detector

(OR)

(b).Discuss the principle and working of photomultiplier tube

11. a) Write a working and importance of Platinum Resistance Thermometer.

(OR)

b) Write the differences between the Venturi meter and Orifice meter?

12. a) With neat diagram explain the principle and working of linear voltage differential transformer (LVDT).

(OR)

b) Discuss the functioning of various elements in Strain Gauge with neat diagram and explain its uses.

M.Sc., DEGREE EXAMINATIONS- 2022
Branch: INSTRUMENTATION SECOND SEMESTER
Paper : IV: INS -204(a):MICROPROCESSORS AND INTERFACING

TIME:3 Hours **Max.Marks:80**

SECTION - A

Answer any **FOUR** of the following. Each Question carries 5 marks. **(4x5=20)**

1. Discuss briefly about Overview of a basic microcomputer structure?
2.Write the microprocessor technology in bipolar junction trnsistor
3.Discuss about Addressing Modes in 8086 Microprocessor?
4. Write about Instruction Sets in 8086 Microprocessor?
5. Explain about Successive approximation A/D Converter?
6. Discuss about Serial Data Transfer?
7. Write about Programmable Peripheral Interface (8255)?
8. Discuss about Programmable Interrupt Controller (8259)?

SECTION – B

Answer **ALL** questions. Each Question carries 15 marks **(4x15 = 60)**

09. (a) Give a detailed account on the Microprocessor technology in MOS
(OR)
(b) Describe about detailed Microprocessor Evolution and types?

10. (a) Explain about the Architecture of 8086 Microprocessor?
(**OR)**
(b) Explain in detailed about the Interrupts in 8086 Microprocessor?

11. (a) Describe in detail about Interfacing 8 bit D/A converter?
(OR)
(b) Write about DMA data transfer with suitable example?

12. (a) Give a detailed account on Programmable Keyboard/ Display Interface (8279) with neat sketch?

(OR)
(b) Describe about Programmable Interval Timer (8253) with neat sketch?

M.Sc., DEGREE EXAMINATIONS- 2022
Branch: INSTRUMENTATION THIRD SEMESTER
Paper : I: INS -301:Analytical Instrumentation

TIME: 3 Hours **Max.Marks:80**

SECTION - A

Answer any **FOUR** of the following. Each Question carries 5 marks. **(4x5=20)**

1. Discuss the principle of calorimeter
2. Write the applications of atomic absorption spectrometer
3. Write a brief note on applications of Conductivity bridges?
4. Write some applications of Polarographs in chemical and industrial fields?
5. Write the principle of NMR and its importance .
6. Write the salient features of individual blocks in electron spin resonance spectrometer
7. Sketch the block diagram of transmission electron microscope and name the various elements
8. Discuss the applications of gas chromatography

SECTION – B

Answer **ALL** questions. Each Question carries 15 marks **(4x15 = 60)**

9. (a). Explain the working of UV – Visible Spectrophotometer with a neat block diagram and also mention its applications?

(OR)

(b).Write the principle and working of Raman spectrometer and discuss its applications

10. (a). Explain the principle and working of Conductivity bridge with block diagram?

(OR)

(b). Discuss the salient features of various blocks in a polarograph and write the working of polorograph with diagram?

11. (a). Draw the block diagram of nuclear magnetic resonance spectrometer and explain its working?

(OR)

(b). Explain the principle and working of Mass Spectrometer with relevant block diagrams and write its applications

12. (a). with neat diagram write the principle and working of scanning electron microscope and discuss its applications

(OR)

(b). Describe the working principle of Thermo Gravimetric Analyzers with the help of relevant diagrams?

M.Sc., DEGREE EXAMINATIONS- 2022
Branch: INSTRUMENTATION THIRD SEMESTER
Paper : II: INS -302:Digital Signal Processing

TIME:3 Hours **Max.Marks:80**

SECTION - A

Answer any **FOUR** of the following. Each Question carries 5 marks. **(4x5=20)**

1. What are the differences between DSP and ASP?
2. write and prove the sampling process theorem?
3. Give a short note on causality and stability of the discrete time signals?
4. Explain the Z – transfer function and its properties?
5. Explain circular convolution and its properties?
6. What is decimation in frequency. Explain it?
7. Comparison of IIR and FIR filters?
8. Difference between symmetric and Anti - symmetric FIR filters?

SECTION – B

Answer **ALL** questions. Each Question carries 15 marks **(4x15 = 60)**

09. (a) Draw the block diagram of a typical DSP system. Explain the function of each block?

(OR)

(b) Describe the advantages and disadvantages of DSP? Write the applications of DSP?

10. (a) Construct the block diagram of discreate time system and Explain it in detailed?

(OR)

(b) Determine the Z transform of unit step sequence?

11. (a) Find the 4 – point DFT of the sequence $x(n) = \cos(n\pi) / 4$?

(OR)

(b) Derive the relation between DFT and Z transform?

12.(a) Describe the matched Z transform technique for IIR filter design?

(OR)

(b) Design the linear phase FIR digital filter by frequency sampling method?

M.Sc., DEGREE EXAMINATIONS- 2022
Branch: INSTRUMENTATION THIRD SEMESTER
Paper :III: INS -303(a):BIOMEDICAL INSTRUMENTATION

TIME:3 Hours **Max.Marks:80**

SECTION - A

Answer any **FOUR** of the following. Each Question carries 5 marks. **(4x5=20)**

1. What are the basic bioelectrical signals/parameters and mention each of its frequency range?
2. Write a note on electroencephalography
3. What is a pacemaker? What are the different modes of operation of Cardiac Pacemakers?
4. Write the working of blood cell counter
5. Discuss the working of anaesthesiamechine
6.Write the operation of oxymeter
7. Write about dosimeter
8. Discuss the advantages of ultrasonic image forming systems

SECTION – B

Answer ALL questions. Each Question carries 15 marks (4x15 = 60)

9.(a) With neat sketch explain the Physiological Systems of Human Body?

(OR)

(b) What are the Characteristics of EMG signal? Compare the signal characteristics of ECG and EMG with neat sketches?

10.(a) Explain the Nerve and Muscle Stimulators with the help of a neat sketch?

(OR)

(b) Explain the working of X- Ray Machine with the help of a neat diagram?

11.(a).Write the design of biotelemetry system and radio telemetry system

(OR)

(b) Write the working of pulmonary analyzer

12. (a) With neat sketch explain the Computer Tomography Scanner (CT)

(OR)

(b) Explain the working of Magnetic Resonance Imaging (MRI) with the help of a neat diagram?

M.Sc., DEGREE EXAMINATIONS- 2022
Branch: INSTRUMENTATION THIRD SEMESTER
Paper : V: INS -305:MICROCONTROLLERS AND INTERFACING

TIME:2 Hours **Max.Marks:40**

SECTION - A

Answer any four of the following. Each Question carries 4 marks. **(4x4=16)**

1. Write the differences between embedded versus external memory devices
2. Explain 8 bit and 6 bit micro controllers
3. Discuss the addressing modes in 8051 micro controller
4. Write about interrupts in MCS-51 timers
5. Discuss memory interfacing in 8051
6. Write the interfacing of 0809 with 8051

SECTION – B

Answer **ALL** questions. Each Question carries 8 marks **(3x8 =24)**

7. (a) Write about Harvard and Von Newmann architectures in microcontroller devices

(OR)

(b) Explain the pin structure and memory organization in 8051 Microcontroller?

8. **(**a) Write the instructions and programming in 8051 microcontroller

(OR)

(b) Explain in detail serial and parallel communication

9 (a) What is stepper motor in Microcontroller? Discuss the interfacing of stepper motor to 8051 Microcontroller with neat diagram?

(**OR)**

(b) Draw circuit diagram and explain the interfacing of 8 bit ADC to 8051 Microcontroller?

M.Sc., DEGREE EXAMINATIONS- 2022
Branch: INSTRUMENTATION THIRD SEMESTER
Paper :VI: INS -306:COMPUTER ARCHITECTURE AND ORGANIZATION

TIME:3 Hours **Max.Marks:80**

SECTION - A

Answer any **FOUR** of the following. Each Question carries 5 marks. **(4x5=20)**

1. Briefly explain the processor function with block diagram?
2. Define Micro-Operation with example and Give the Micro instruction format?
3. What are the differences between the hardwired control organization and micro programmed control organization?
4. Briefly explain about Algorithms and Flowcharts with exaples?
5.Write a short note on I / O control method?
6. What is meant by Virtual memory and explain it with diagram?
7. Describe the concept of pipelining and give the basic structure of the pipeline processor?
8. Write the importance of shared memory multiprocessors

SECTION – B

Answer **ALL** questions. Each Question carries 15 marks **(4x15 = 60)**

09**.** (a)Discuss in detail multiprocessors and multi computers

(OR)

(b) Write in detail with examples logic micro operations and shift micro operations

10 **.**(a)What is micro programming? What are the advantages and disadvantages of micro programming?

(OR)

(b) Briefly explain about Arithmetic operations with suitable example?

11. (a) Discuss in detail read only memories and cache memories performances in computers

(OR)

(b) Write the input and output organization in computer

12. (a)Discuss with suitable examples: RISC pipe line Vector processing and Array processing?

(OR)

(b) Discuss in detail aboutmulti processor with block diagram and write it's characteristics?

Model Question Paper

M.Sc. DEGREE EXAMINATION - APRIL/DECEMBER
FOURTH SEMESTER
Branch - Instrumentation
Paper 1 –INS -401: INTRODUCTION TO VLSI CIRCUITS
(Under NEP w.e.f.2021-2022)

Time: 3 hours Max Marks: 80

SECTION -A

Answer any FOUR questions. Each question carries 5 Marks. (Marks: 4 x 5 = 20)

1. Explain the overview of design steps involved in the fabrication of VLSI circuits.
2. Explain the design and applications logic gates in circuits.
3. What is a MOSFET? Explain the working of MOSFET?
4. Explain the concept of Lithography.
5. Write a note on FET sizing and unit Transistors.
6. Explain in detail the FET RC model.
7. Write a brief note on power dissipation.
8. Give the working of pass transistor

SECTION -B

Answer ALL questions. Each question carries 15 Marks. (Marks: 4 x 15 =60)

9. (a) Explain MOSFETs as switches with a neat diagram.

(Or)

(b) Draw a neat sketch and explain basic logic gates in CMOS.

10. (a) Discuss briefly the concept of CMOS layers in detail.

(Or)

(b) Explain the overview of materials growth and their deposition in VLSI Technology.

11. (a) Write briefly on layout basic structured sequences.

(Or)

(b) Explain briefly the n – FET current and voltage equation with a neat diagram.

12. (a) Draw a neat diagram and explain briefly the DC characteristics of the CMOS inverter.

(Or)

(b) Discuss briefly the Designing of High Speed CMOS logic Networks.

M.Sc., DEGREE EXAMINATIONS- 2022
Branch: INSTRUMENTATION FOURTH SEMESTER
Paper : II: INS -402:EMBEDDED SYSTEMS AND REAL TIME OPERATING SYSTEMS

TIME:3 Hours **Max.Marks:80**

SECTION - A

Answer any **FOUR** of the following. Each Question carries 5 marks. **(4x5=20)**

1. What is general purpose system and embedded system. Explain it with block diagram?
2. What are the differences between microprocessor and PIC microcontroller?
3. Write the evaluation of ARM processors?
4. Explain the applications of relays with ARM processor?
5. Explain about hard and soft real time systems?
6. What is the need of Task communication?
7. What are the differences between GPOS and RTOS?
8. What is image processing. Explain it with the help of a neat sketch ?

SECTION – B

Answer **ALL** questions. Each Question carries 15 marks **(4x15 = 60)**

09. (a) Explain the difference between Embedded Systems and General Computing Systems with the help of a neat block diagram?

(OR)

(b) Explain the PIC microcontroller architecture with neat block diagram

10. (a) Explain the instruction set of ARM 7 with suitable block diagram?

(OR)

(b) What is meant by Flash memory and write its applications?

11. (a) What is kernel and describe it's architecture with neat block diagram?

(OR)

(b) Write a detailed note on interrupt service routines in RTOS with suitable block diagram?

12. (a) Write the role of RTOS for fault tolerant applications

(OR)

(b) Discuss in detail RFID systems and their applications development using these systems

M.Sc., DEGREE EXAMINATIONS- 2022
Branch: INSTRUMENTATION FOURTH SEMESTER
Paper :III: INS -403(a):PROGRAMMABLE LOGIC CONTROLLERS

TIME:3 Hours **Max.Marks:80**

SECTION - A

Answer any **FOUR** of the following. Each Question carries 5 marks. **(4x5=20)**

1. Write the functioning of dynamic elements in control loop
2. Briefly explain composite controller modes
3. Write the general features of process contoller
4. Give a brief account of model based control
5.Write about steady state gain
6.Discuss in detail Liquid level control
7.Write the design of decoupler
8.Write in brief about artificial neural networks

SECTION – B

Answer **ALL** questions. Each Question carries 15 marks **(4x15 = 60)**

9. (a) Write the working of interacting and non- interacting systems
(OR)
(b) Write the characteristics of process control

10. (a) Discuss in detail Zingler and Nichols method
(OR)
(b) Write the overview of control schemes

11. **(**a) Write in detail the analysis of flow control and pressure control
(OR)
(b) Explain the comparison of SLPC and MLPC

12. (a) Give the overview of multivariable systems

(OR)
(b) Write about model based controller and optimal controller

M.Sc., DEGREE EXAMINATIONS- 2022
Branch: INSTRUMENTATION FOURTH SEMESTER
Paper : VI: INS -406(a):AGRO BASED INSTRUMENTATION

TIME:3 Hours **Max.Marks:80**

SECTION - A

Answer any **FOUR** of the following. Each Question carries 5 marks. **(4x5=20)**

1. List the properties of soil and explain any two properties of soil in detail?
2. Write in brief about bio sensor
3. List out any 4 equipment's used in sugar industry/ Explain in detail about any one of it?
4. Explain the working of fermenter in sugar industry
5. Explain soil moisture measurement method?
6. What are the factors affecting the selection of irrigation system?
7. List out the different sensors & instruments used for monitoring green house environment?
8. Write a short notes on ventilation systems used in green house environment?

SECTION – B

Answer **ALL** questions. Each Question carries 15 marks **(4x15 = 60)**

09. (a) Write in detail the working of sonic anemometer and hygrometer and its usage in agriculture

(OR)

(b) Discuss in detail, Open and Close path gas analyzers with a neat sketch?

10. (a) Draw the flow diagram of a diary industry and instrumentation set up and Explain it?

(OR)

(b) Write in detail juice extraction process and instrumentation

11. (a) Compare surface and micro methods of irrigation based on their advantages and disadvantages?

(OR)

(b) Discuss in detail soil moisture methods

12.(a) Explain the application of SCADA for DAM control?

(OR)

(b) Explain the application of PLC and SCADA in packing industry with neat sketch?