SRI VENKATESWARA UNIVERSITY:: TIRUPATI

SVU COLLEGE OF SCIENCES

DEPARTMENT OF USIC

Syllabus for M.Sc. INSTRUMENTATION

Choice Based Credit System(CBCS)

Amended as per NEP-2020

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

Vision:

To achieve excellence in analytical and electronic instruments through quality education and training and to logically translate the proven research ideas into a reliable and effective, simple, elegant and handy instruments and gadgets

Mission

To enhance the teaching-learning process by implementing innovative practices to create globally competent researchers

To strengthen research culture providing sustainable solutions in the domain of analytical instruments, electronic instruments for the benefit of research and industry.

To inculcate professional ethics and entrepreneurial attitude for addressing needs of industry and society.

PROGRAM EDUCATIONAL OBJECTIVES: At the end of the program, the student will beable to:

PEO1	Apply principles of basic scientific concepts in understanding, analysis, and prediction of Instrumentation and Electronic systems.
PEO2	Develop human resource with specialization in theoretical and experimental Techniques required for career in academic, research and industry.
PEO3	Engage in lifelong learning and adapt to changing professional and societal needs.

PROGRAMOUTCOMES: At the end of the program, the student will be able to:

PO1	Apply principles of basic engineering concepts in understanding and analysis of instruments
PO2	Identify, formulate, and analyze advanced engineering problems reaching substantiated conclusions using first principles of mathematics and basics of engineering.
PO3	Design solutions for advanced engineering problems and design system components to meet the specified needs with appropriate attention to health and safety risks, applicable standards, and economic, environmental, cultural and societal consideration.
PO4	Use research based knowledge and methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions
PO5	Create, select, and apply appropriate techniques, resources, and modern scientific Tools to complex physics problems with an understanding of the limitations
PO6	Apply reasoning informed by the contextual knowledge to assess societal, health, safety, legal and cultural issues, and the consequent responsibilities relevant to the professional scientific practice.

PO7	Understand the impact of the scientific solutions in societal and environmental contexts, and demonstrate the knowledge of, and need for sustainable development
PO8	Apply ethical principles and commit to the norms of scientific practice.
PO9	Function effectively as an individual, and as a member or leader in diverse teams, And in multidisciplinary settings
PO10	Communicate effectively on scientific activities with the scientific/Engineering community and with society at large, such as, being able to comprehend and write effective reports and design documentation, make effective representations, and give and receive clear instructions
PO11	Demonstrate knowledge and understanding of the scientific principles and apply these to one's own work, as a member and leader in a team, to manage projects and in multidisciplinary environments
PO12	Recognize the need for, and have the preparation and ability to engage in independent And life-long learning in the broadest context of scientific and technological change

PROGRAM SPECIFIC OUTCOMES: At the end of the program, the student will be able to:

PSO1	Understand the basic and advance concepts of different branches of Instrumentation, Industrial and Electronics.
PSO2	Perform and design experiments in the areas of Instrumentation, electronics, atomic and Controlling Circuits
PSO3	Apply the concepts of Instrumentation in specialized areas of Sugar Industries, Irrigation methods in Agriculture, renewable energies, Controlling Circuits etc. in industry, academia, research and day to day life.

SRI VENKATESWARAUNIVERSITY::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 butit 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 butit 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)	1. Industrial Organization and Management					
	Total			36	24	90	510	600

*All core papers are Mandatory

- Generic Elective – Choose two
- 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 practical's).
- 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
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	510	600

*All core papers are Mandatory

- Generic Elective – Choose two
- 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. ofArts/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.

(MandatoryCore)

INS-101	INTRODUCTION TO INSTRUMENTATION AND CONTROL SYSTEM	L-5,T-1,P-0	4Credits

Pre-requisite: Understanding of graduate level Instrumentation

Course Objectives:

- To study the basic principles of Instrumentation System
- To study the basic concepts of Control System
- To study the time response analysis
- Root Locus, Frequency Response Analysis, Routh stability

Course Outcomes: At the end of the course, the student will be able to

CO1	• Understand fundamentals of Instrumentation system
CO2	• Understand and design open loop and closed loop control system
CO3	• Understand time response analysis
CO4	• Design and Analysis of Root Locus ,Frequency Response Systems

Mapping of course outcomes with the program outcomes

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	3	2	2	-	1	1	-	2	2	-	1
CO2	3	2	1	2	-	1	1	-	2	2	1	2
CO3	3	3	2	-	2	1	1	-	2	2	-	-
CO4	3	2	1	2	-	1	1	-	2	2	1	-

(MandatoryCore)

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: T IME 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 of Nyquist criterion to find the stability.

Books For Study:

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.

MODEL QUESTION PAPER

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?

(MandatoryCore)

INS-102	Analog Devices and Industrial Electronics	L-3,T-1,P-2	4Credits

Pre-requisite: Understanding of graduate level Analog Devices and Industrial Electronics

Course Objectives:

- To study basic electronic circuits.
- To study the basics of operational amplifiers
- To understand the concepts of transistors, UJT,SCR and thyristers
- The main objective of this course is to introduce and expose the students to various electronic circuits and design operational amplifiers for various applications.

Course Outcomes: At the end of the course, the student will be able to

CO1	• Understand and describe specifications, features and capabilities of electronic devices.
CO2	• Understand the basics of operational amplifiers and their applications
CO3	• Understand fundamental of semiconductors and power devices
CO4	• Select appropriate device for circuit operation.

Mapping of course outcomes with the program outcomes

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	3	2	2	1	2	1	-	2	-	1	-
CO2	3	3	2	1	2	2	2	-	-	-	1	-
CO3	3	3	2	2	1	2	2	-	1	-	1	-
CO4	3	3	2	1	2	2	1	-	-	-	1	-

(MandatoryCore)

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 Study:

1. Fundamentals of Electronic Devices by David A. Bell
2. Operational Amplifiers and Linear Integrated Circuits by RamakanthGaekwad
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.

MODEL QUESTION PAPER

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.

INS-103(a)	Digital Techniques and Principles of Communications	L-5,T-1,P-6	4Credits

Pre-requisite: Basic knowledge about Digital Techniques

Course Objectives:

- To teach theory and working of FET and MOSFET
- To teach Op-amp basics
- To teach flip-flops, registers, counters, interfacing with analog devices
- To teach communication electronics

Course Outcomes: At the end of the course, the student will be able to

CO1	• Learn working and applications of FET and MOSFET.
CO2	• Learn the basics of op-amps.
CO3	• Learn the importance of digital electronics.
CO4	• Learn the process of communication and its importance.

Mapping of course outcomes with the program outcomes

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	3	2	2	2	2	1	-	1	-	1	-
CO2	3	3	2	1	2	-	1	-	-	2	1	-
CO3	2	2	3	2	2	-	1	-	1	-	1	-
CO4	3	3	2	2	2	-	1	-		2	1	-

(Compulsory Foundation)

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

UNIT–I: Introduction to ElectronicDevices:

Field Effect Transistor (FET): Structure and working of JFET, Characteristics, and parameters of JFET.AdvantagesofFEToverBJT.FETasswitchandAmplifier-ApplicationofFETasvoltage variable resistor. Structure of MOSFET, depletion type and enhancement type, MOSFETCharacteristics,MOSFET as variable resistor,Conceptof CMOS.Structure,working and Characteristics of UJT. Application of UJT as a Relaxation oscillator.

UNIT–II: Operational Amplifiers:

Block diagram of a typical Op-Amp, differential Amplifier, Comparator open loop configuration,invertingandnon-invertingamplifiers.Op-ampwithnegativefeedback,voltageshuntfeedback, effect of feedback on closed loop gain, input resistance, output resistance, CMRR, frequency response, slew rate. InstrumentationAmplifier,integratoranddifferentiator.Waveformgenerators(Squareandtriangle). Filters (Low pass, high pass and Band pass). Analog to Digital data converters (ADC)andDigital to Analog conversion (DAC).

UNIT–III: Digital Electronics

Combinational Logic: Multiplexers, Decoder,Demultiplexer,Dataselector,Multiplexer,Encoder. Sequential Logic: Flip–Flops, A1-bit memory, The RS Flip-Flop, JK Flip – Flop, JKMaster Slave Flip–Flops, T Flip-Flop, D Flip-Flop, Shift Registers, Serial-in Serial-out, Serial-inParallel-out,Parallel-inSerial-out,Parallel-inParallel-outRegisters.AsynchronousandSynchronousCounters.

UNIT–IV: Communication Electronics

Introduction to Modulation (AM & FM), Sampling Theorem, Low pass and Band pass signals, PAM, Channel BW for a PAM signal. Natural sampling, Flat-top sampling. Signal recovery through holding. Quantization of signals, PCM transmission, Quantization of noise, Differential PCM, Delta Modulation, Adaptive Delta modulation CVSD. Signal to noise ratio in PCM and Delta Modulations.

Books for Study

1. Micro Electronics by Milliman and Halkias.TMH Publications
2. OP-Amps&LinearIntegratedCircuits,byRamakanthA.Gayakwad,PHI,2ndEdition,1991.
3. DigitalSystems byRonald J. Tocci,6th Edition,PHI, 1999.
4. DigitalPrinciplesandApplicationsbyA.P.MalvinoandDonaldP.Leach,TataMcGraw-Hill, New Delhi, 1993.
5. PrinciplesofCommunications byTaub andSchilling,Mc-GrawHillPublication.
6. ElectronicDevicesandCircuitTheorybyRobertBoylestedandLouisNashdsky–JoseKanedy&Division.PHI,New Delhi, 1991
7. ElectronicPrinciples byMalvino, 6th Ed.TMH, 2017
8. Linear Integrated circuitsbyRoyChoudhry, Pearson,2018
9. Op-Amps – D.K. Mahesh, PHI

MODEL QUESTION PAPER

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

NS-103(b)	Power Electronics	L-5,T-1,P-0	4Credits

Pre-requisite: Understanding of graduate level Power Electronics

Course Objectives:

- To understand the operation, characteristics and performance parameters of
- Single phase and three phase controlled rectifiers.
- To study the operation, switching techniques and basic topologies of DC-DC
- Switching regulators.
- To learn the different inverter to understand the harmonic reduction methods.

Course Outcomes: At the end of the course, the student will be able to

CO1	• Students will be able to understand the working of FET, JFET, MOSFET.
CO2	• Understand working of Controlled Rectifiers, Inverters and DC to DC converters.
CO3	• Understand the inverters
CO4	• Understand the Working of AC/DC Drives.

Mapping of course outcomes with the program outcomes

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	3	3	2	2	1	1	-	-	2	-	1
CO2	3	3	3	1	2	1	-	-	-	2	-	1
CO3	3	3	3	2	2	1	1	-	-	2	-	1
CO4	3	3	3	-	-	2	-	-	-	2	-	1

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.

Books For Study:

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.

INS-103©	Industrial Product Instrumentation	L-3,T-1,P-2	4Credits

Pre-requisite: Understanding of graduate level Industrial Product Instrumentation

Course Objectives:

- Learn the basics of instrumentation design
- Lear the hardware design
- Learn the digital design
- Learn the PCB design

Course Outcomes: At the end of the course, the Student will be able to

CO1	Design the instruments
CO2	Learn the hardware design
CO3	Learn the digital design
CO4	Learn the PCB design

Mapping of course outcomes with the program outcomes

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	3	2	2	2	1	1	-	1	2	1	1
CO2	3	3	3	1	2			-	-	-	1	1
CO3	3	3	3	2	2			-	-	-	1	1
CO4	3	3	3					-	2	-	1	1

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.

Books For Study

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.

INS-104(a)	Programming in "C"	L-5,T-1,P-0	4Credits

Pre-requisite: Understanding of graduate level Programming in "C"

Course Objectives:

- To teach basic principles of 'C' language.
- To teach basic Programs in 'C' Language.
- To teach simple Array Programs in 'C' Language.
- To teach file management using 'C' language

Course Outcomes: At the end of the course, the student will be able to

CO1	• Understand the basic principles of C language.
CO2	• Understand To teach basic Programs in C Language.
CO3	• Understand the simple Array Programs in C Language.
CO4	• Understand the File management and Linked List Programs.

Mapping of course outcomes with the program outcomes

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	2	3	2	2	2	-	-	2	1	-	1
CO2	3	2	3	3	-		2	-	2	1	-	1
CO3	3	2	3	3	2		-	-	2	-	-	1
CO4	3	2	3	3	-	2		-	2	-	-	1

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 Study

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.

MODEL QUESTION PAPER

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.

INS - 104(b))	Renewable Sources of Energy	L-3,T-1,P-2	4Credits

Pre-requisite: Understanding of graduate level in Renewable Sources of Energy

Course Objectives:

- To teach the different energy sources
- To teach the importance of Solar energy
- To teach the usage of wind energy
- To teach the importance of bio-mass energy

Course Outcomes: At the end of the course, the student will be able to

CO1	• Understand about different energy sources
CO2	• Learn the importance of Solar energy
CO3	• Learn the usage of wind energy
CO4	• Learn the importance of bio-mass energy

Mapping of course outcomes with the program outcomes

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	3	3	2	2	1	1	-	2	-	-	-
CO2	3	3	3	3	-	1	2	-	1	2	-	-
CO3	3	3	3	3	-	1	2	-	1	-	-	-
CO4	3	3	3	3	-	1	2	-	2	2	-	-

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 Study

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.

INS-104(C)	Opto Electronics	L-5,T-1,P-0	4Credits
Pre-requisite: Understanding of graduate level Basic Opto Electronics			

Course Objectives:

- To teach the fundamentals of laser and their applications
- To teach the different optical sources and detectors
- To teach the oprtical components and instruments
- To teach the basics of optical fibres and its applications

Course Outcomes: At the end of the course, the student will be able to

CO1	• Learn fundamentals of laser and their applications
CO2	• Know the different optical sources and detectors
CO3	• Understand the oprtical components and instruments
CO4	• Learn the basics of optical fibres and its applications

Mapping of course outcomes with the program outcomes

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	2	-	2	2	1	1	-	2	1	-	-
CO2	3	2	-	3	2	1	2	-	2	1	-	-
CO3	3	2	-	3	2	1	2	-	2	1	-	-
CO4	3	2	-	3	2	1	2	-	2	1	-	-

(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 Study

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.

(MandatoryCore)

INS-201	**Industrial Instrumentation**	**L-5,T-1,P-0**	**4Credits**
Pre-requisite: Understanding of graduate level Industrial Instrumentation			

Course Objectives:

- To teach the introduction in Process Instrumentation .
- To teach the Instrumentation in Iron and Steel Industries.
- To teach the Instrumentation in Petrochemical, Pharmacy
- To teach Thermal Power Stations.

Course Outcomes: At the end of the course, the student will be able to

CO1	• learn the introduction in Process Instrumentation .
CO2	• learn To teach the Instrumentation in Iron and Steel Industries.
CO3	• learn the Instrumentation in Petrochemical.
CO4	• know the Instrumentation in Pharmacy and Thermal Power Stations.

Mapping of course outcomes with the program outcomes

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	2	2	-	3	2	1	1	1	-	1	-
CO2	3	3	3	1	3	-	1	1	-	1	-	-
CO3	3	3	3	-	2	-	1	-	-	-	-	-
CO4	3	3	3	-	2	2	1	1	-	-	1	-

(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 Study

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

MODEL QUESTION PAPER

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?

(MandatoryCore)

INS- 202	Electronic Instrumentation	L-3,T-1,P-2	4Credits

Pre-requisite: Understanding of graduate level Electronic Instrumentation

Course Objectives:

- To teach Analogue Measuring Instruments
- To teach. Principle, operation and construction and details of analog and digital measuring instrumentation
- To teach designof function generator, square wave generator and digital multi meter
- To teach Spectrum Analyzers, Frequency Synthesizers, Digital tachometer, Digital watt meter Digital Capacitance meter

Course Outcomes: At the end of the course, the student will be able to

CO1	• Learn about analogue Measuring Instruments
CO2	• Learn • Principle, operation and construction and details of analog and digital measuring instrumentation.
CO3	• analyze and design function generator, square wave generator and digital multi meter.
CO4	• Learn Spectrum Analyzers, Frequency Synthesizers, Digital tachometer, Digital watt meter Digital Capacitance meter

Mapping of course outcomes with the program outcomes

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	3	2	-	2	1	1	-	**1**	1	**-**	-
CO2	3	2	2	1	2	1	-	-	**1**	1	**-**	-
CO3	3	3	3	-	2	1	2	-	**1**	1	-	-

CO4	3	2	3	2	3	-	2	-	**1**	1	-	-

(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 Study:
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

MODEL QUESTION PAPER

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.

(CompulsoryFoundation)

INS-203(a)	Sensors and Signal Conditioners	L-5,T-1,P-0	4Credits

Pre-requisite: Understanding of graduate level in Sensors and Signal Conditioners

Course Objectives:

- To study the basic principles sensors and transducers
- To study the basic concepts of Signal Conditioners and Recorders
- To study Temperature transducer , flow transducer and level sensors
- To teach Pressure Transducers,d Manometers and Elastic transducers

Course Outcomes: At the end of the course, the student will be able to

CO1	• Understand fundamentals of sensor/Transducers
CO2	• Understand the concept of Signal Conditioners.
CO3	• Understand the concepts Temperature transducer , flow transducer and level sensors
CO4	• Learn Pressure Transducers, Manometers and Elastic transducers

Mapping of course outcomes with the program outcomes

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	3	2	1	2	1	2	-	-	2	2	-
CO2	3	3	2	1	2	1	1	-	1	-	2	-
CO3	3	3	2	1	2	1	2	-	-	-	2	-
CO4	3	3	2	1	2	1	1	-	-	2	2	-

(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 Study:

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

MODEL QUESTION PAPER

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.

INS-203(b)	Network Analysis	L-5,T-1,P-0	4Credits

Pre-requisite: Understanding of graduate level

Course Objectives:

- To teach different Network theorems
- To teach Laplace Transform in the Network Analysis
- To teach The concept of complex frequency
- To teach Resonance in series and parallel circuits

CourseOutcomes: At the end of the course, the student will be able to

CO1	• Under stand different Network theorems
CO2	• Lear the use of Laplace Transform in the Network Analysis
CO3	• Under stand the concept of complex frequency
CO4	• Learn the concepts in Resonance in series and parallel circuits

Mapping of course outcomes with the program outcomes

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	3	2	-	2	1	1	-	-	2	2	-
CO2	3	3	2	1	2	1	1	-	1	2	2	1
CO3	3	3	2	-	-	1	1	-	-	2	2	-
CO4	3	3	2	1	2	1	1	-	1	2	2	1

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 Study:

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.

INS-203(c)	Spectroscopic Instrumentation	L-3,T-1,P-2	4Credits

Pre-requisite: Understanding of graduate level in Spectroscopy

Course Objectives:

- To study the basics of Molecular Spectroscopy
- To study the basics of RAMAN Spectroscopy
- To study the basics of Spectrophotometry
- To study the basics of Fluorescence and Phosphorescence Spectroscopy

Course Outcomes: At the end of the course, the student will be able to

CO1	• Understand the basics of Molecular Spectroscopy
CO2	• Understand the basics of RAMAN Spectroscopy
CO3	• Understand the basics of Spectrophotometry
CO4	• Understand the basics of Fluorescence and Phosphorescence Spectroscopy

Mapping of course outcomes with the program outcomes

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	3	2	2	2	1	1	-	1	2	-	-
CO2	3	3	-	2	2	1	1	-	-	2	2	-
CO3	3	3	2	1	2	1	1	-	-	2	-	-
CO4	3	3	1	-	2	1	1	-	1	2	2	-

(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.

TEXT BOOKS:

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

Books For Study:

1. Elements of Spectroscopy, Gupta, Kumar and Sharma
2. Elements of Diatomic Molecular Spectra, H. Dunford
3. Problems in Spectroscopy, S.V.J. Lakshman
4. Basic Principles of Spectroscopy, R. Chang

INS-204(a)	**Microprocessors and Interfacing**	**L-5,T-1,P-0**	**4Credits**

Pre-requisite: Understanding of graduate level Microprocessors

Course Objectives:

- To teach principles of Microprocessor.
- To teach topics including internal architecture of microprocessor 8085 and 8086, their memory organization.
- Interfacing of data converts, memory and I/O Devices
- Programmable peripheral Interfacing Device

Course Outcomes: At the end of the course, the student will able to

CO1	• learn assembly programming language
CO2	• demonstrate the knowledge of addressing modes, instruction sets.
CO3	• able to analyze and design assembly level programmes and timing diagrams.
CO4	• able to analyze programmable peripheral devices, 8255, 8257/8237, 8259.

Mapping of course outcomes with the program outcomes

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9		PO11	PO12
CO1	3	3	2	2	-	-	-	-	2	-	1	1
CO2	3	3	2	2	-1	-	1	-	2	-	1	-
CO3	3	3	2	-	1	1	1-	-	2	-	1	-
CO4	3	3	2	2	2	1	1	-	2	-	1	2

(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 Study:

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.

MODEL QUESTION PAPER

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?

INS-204(b)	**Robotics**	**L-5,T-1,P-0**	**4Credits**

Pre-requisite: Understanding of graduate level in Robotics

Course Objectives:

The goal of the Robotics course is to familiarize the students with the concepts and techniques in robot manipulator control, enough to evaluate, chose, and incorporate robots in engineering systems

Course Outcomes: At the end of the course, the student will able to

CO1	• To develop the student's knowledge in various robot structures and their workspace.
CO2	• To develop student's skills in performing spatial transformations associated with rigid body motions.
CO3	• To develop student's skills in perform kinematics analysis of robot systems.
CO4	• To provide the student with knowledge of the singularity issues associated with the operation

Mapping of course outcomes with the program outcomes

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	3	2	2	2	1	1	-	2	1	-	-
CO2	3	3	2	2	2	1	1	-	2	1	-	-
CO3	3	3	2	2	2	1	1	-	2	1	-	-
CO4	3	3	2	2	2	1	1	-	2	1	-	-

(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 Study:

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)

INS -204 (c)	Electronic Measurement Instrumentation	L-5,T-1,P-0	4Credits

Pre-requisite: Understanding of graduate level Electronic Measurement Instrumentation

Course Objectives:

- To teach Static and Dynamic characteristics of instruments,
- To teach Signal Converters: I To P / P To I Converter
- To teach Electronic Instruments for Measuring Basic Parameters
- To teach Instrument for Generation and Analysis of Waveforms

CourseOutcomes: At the end of the course, the student will be able to

CO1	• Learn the static and Dynamic characteristics of instruments,
CO2	• Learn the signal Converters: I To P / P To I Converter
CO3	• Understand the electronic Instruments for Measuring Basic Parameters
CO4	• Understand the Instrument for Generation and Analysis of Waveforms

Mapping of course outcomes with the program outcomes

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	2	2	2	1	-	-	-	-	1	1	-
CO2	3	2	2	3	2	-	-	-	1	-	1	-
CO3	3	2	1	2	3	-	1	-	2	2	-	-
CO4	3	2	1	3	3	1	1	-	2	-	2	-

(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 Study:

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.

INS-301	Analytical Instrumentation	L-5,T-1,P-0	4Credits

Pre-requisite: Basic knowledge of Analytical Instrumentation

Course Objectives:

- To introduce the basic concept of qualitative and quantitative analysis of given sample.
- To study various spectroscopic techniques and its instrumentation.
- To study the concept of separation science and its applications.
- To study the concept of industrial analyzers and its application.

Course Outcomes: At the end of the course, the student will be able to

CO1	• The Students get will be versed with the principles, construction and working of various analytical instruments..
CO2	• Students get details information about the applications of analytical techniques in medicine, industry etc.
CO3	• Understand the Polarographs
CO4	• Understand the NMR and ESR Spectrometers

Mapping of course outcomes with the program outcomes

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	2	2	2	2	2	1	-	2	1	-	-
CO2	3	2	2	2	2	2	1	-	-	2	2	-
CO3	3	2	2	2	2	2	1	-	-	-	-	-
CO4	3	2	2	2	2	2	2	-	2	2	-	1

(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 Study:

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

MODEL QUESTION PAPER

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?

INS -302	**Digital Signal Processing**	**L-5,T-1,P-0**	**4Credits**
Pre-requisite: Basic knowledge of Digital Signal Processing			

Course Objectives:

- To teach the basic elements of Digital Signal Processing
- To teach the analysis of discrete-time systems
- To teach discrete Fourier Transform
- To teach design of digital IIR filters:

Course Outcomes: At the end of the course, the student will be able to

CO1	• Gain knowledge on the basic elements of Digital Signal Processing
CO2	• Learn the analysis of discrete-time systems
CO3	• Understand the discrete Fourier Transform
CO4	• Learn design of digital IIR filters:

Mapping of course outcomes with the program outcomes

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	2	2	2	1	2	2	-	1	1	1	-
CO2	3	2	1	3	2	1	-	-	1	1	-	1
CO3	3	2	1	2	3	2	1	-	2	2	-	-
CO4	3	2	1	3	3	1	1	-	-	2	2	2

(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 Study:

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

MODEL QUESTION PAPER

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?

INS-303 (a)	Biomedical Instrumentation	L-3,T-1,P-2	4Credits

Pre-requisite: Understanding of graduate level in Biomedical Instrumentation

Course Objectives:

- To make student understand the identification, classification, and working principle of various Biomedical Instruments used for Bio-potential measurement and application.
- To make students understand these instruments in diagnosis, therapeutic treatment and imaging fields.

Course Outcomes: At the end of the course, the student will be able to

CO1	• Identify various Bio-potential and their specification in terms of amplitude and frequency.
CO2	• Decide the applications of therapeutic instruments for treatment purpose.
CO3	• Decide the applications of therapeutic instruments for treatment purpose.
CO4	• Understand applications of imaging instruments and the modalities involved in each technique.

Mapping of course outcomes with the program outcomes

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	2	3	2	2	1	1	-	2	1	-	-
CO2	3	2	3	3	-	1	2	-	2	1	-	-
CO3	3	2	3	3	2	-	2	-	2	1	-	-
CO4	3	2	3	3	-	-	2	-	2	1	-	-

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 aBiotelemetry System Radio telemetry System, Uses Of Biotelemetry

b. Operation Theatre Equipment:

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

UNIT-IV

a. Safety Instrumentation:

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

b. Advanced Biomedical Instrumentation:

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

Books For Study:

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

MODEL QUESTION PAPER

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?

INS-303(b)	Micro Electro Mechanical Systems	L-3,T-1,P-2	4Credits

Pre-requisite: Understanding of graduate level in Micro Electro Mechanical Systems

Course Objectives:

- To teach the fundamentals of MEMS
- To teach Scaling laws in miniaturization
- To teach topics including Micro system Fabrication and design
- To teach Microsystem Design - Design considerations

CourseOutcomes: At the end of the course, the student will be able to

CO1	• Basic structure of MEMS and design
CO2	• Learn Scaling laws in miniaturization
CO3	• Analyze applications of MEMS and their importance as sensors
CO4	• Understand the Microsystem Design and its considerations

Mapping of course outcomes with the program outcomes

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	2	2	2	1	2	1	-	-	2	-	-
CO2	3	2	2	2	2	2	2	-	2	-	2	-
CO3	3	2	2	2	1	2	2	-	-	2	-	-
CO4	3	2	2	2	2	2	1	-	1	-	2	-

(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 Study:

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

INS-303 (c)	Instrumentation for Environmental Science	L-3,T-1,P-2	4Credits

Pre-requisite: Understanding of graduate level Instrumentation in Environmental Science

Course Objectives:

- To teach the necessity of instrumentation and control for environment
- To teach Ground water monitoring
- To teach Air pollution
- To teach Air monitoring. Flow monitoring Rain water harvesting

Course Outcomes: At the end of the course, the student will be able to

CO1	• Learn necessity of instrumentation & control for environment
CO2	• Gain knowledge in Ground water monitoring and waste water monitoring
CO3	• Learn the effects of air pollution
CO4	• Understand air monitoring. Flow monitoring and Rain water harvesting

Mapping of course outcomes with the program outcomes

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	2	3	2	2	1	-	-	2	1	1	-
CO2	3	2	3	3	2	1	2	-	2	-	1	-
CO3	3	2	3	3	2	-	-	-	2	1	1	-
CO4	3	2	3	3	2	1	2	-	2	1	1	-

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

UNIT I

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

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

UNIT II

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

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

UNIT III

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

UNIT IV

a. Air monitoring: measurement of ambient air quality.

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

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

Books For Study:

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.

(SkillOrientedCourse)

INS – 305	Microcontrollers and Interfacing	L-3,T-1,P-2	4Credits

Pre-requisite: Understanding of graduate level in Microcontrollers

Course Objectives:

- To make the student to understand the fundamentals of microcontroller.
- To teach addressing modes, Instructions and programming in 8051
- To teach 8051 Memory and I/O device Interfacing
- To teach Interfacing DAC / ADC with 8051 Microcontroller

CourseOutcomes: At the end of the course, the student will be able to

CO1	• .Uunderstand the fundamentals of microcontroller.
CO2	• Understand . **a**ddressing modes, Instructions and programming in 8051
CO3	• Understand 8051 Memory and I/O device Interfacing. Interrupts and Timer/counters, .
CO4	• Learn8051 Memory and I/O device Interfacing

Mapping of course outcomes with the program outcomes

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	2	3	2	-	1	-	-	2	2	-	-
CO2	3	2	3	3	2	1	2	-	2	2	-	-
CO3	3	2	3	3	-	1	-	-	2	2	-	-
CO4	3	2	3	-	2	1	2	-	2	2	-	-

(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 Newmann Architectures, commercial microcontroller devices

b.8051 Microcontroller

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

UNIT –II

a. Addressing modes, Instructions and programming in 8051

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

b. Interrupts, Timer/counters, . Serial communication and Parallel Communication

Interrupts - Interrupts in MCS-51 -Timers and counters – Communications – Serial 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.

MODEL QUESTION PAPER

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?

INS – 306 (a)	Computer Architecture and Organization	L-3,T-1,P-2	4Credits

Pre-requisite: Understanding of graduate level in Computer Architecture and Organization

Course Objectives:

- To teach basics of Computer Architecture and block diagram
- To teach the Micro Programmed Control
- To teach the The Memory System and Input-Output Organization
- To teach thePipeline And Vector Processing

Course Outcomes: At the end of the course, the student will be able to

CO1	Understand internal block diagram of computer
CO2	know the Micro Programmed Control and organization of computer
CO3	Know The Memory System and Input-Output Organization
CO4	Know thePipeline And Vector Processing

Mapping of course outcomes with the program outcomes

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	2	3	2	2	1	1	-	2	1	-	
CO2	3	2	3	3	2	1	2	-	2	1	1	-
CO3	3	2	3	3	2	1	2	-	2	1	-	-
CO4	3	2	-	3	2	1	2	-	2	1	-	-

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 Study:

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

MODEL QUESTION PAPER

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?

(OpenElective)

INS-306(b)	Industrial Organization and Management	L-5,T-1,P-0	4Credits

Pre-requisite: Understanding of graduate level in Industrial Organization and Management

Course Objectives:.

- To give the basics Industrial Management and Business organization
- To teach the Quality, Inspection and Environment Management :
- To teach the Production Planning, Inventory Control and Supply Chain Management:
- To teach Human Resources Management

Course Outcomes: At the end of the course, the student will be able to

CO1	Learn the basics Industrial Management and Business organization
CO2	Learn the Quality, Inspection and Environment Management
CO3	Learn the Production Planning, Inventory Control and Supply Chain Management
CO4	Learn the Human Resources Management

Mapping of course outcomes with the program outcomes

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	2	2	2	2	1	2	-	1	2	1	-

CO2	3	2	2	2	3	2	2	-	1	2	-	-
CO3	3	3	-	2	3	2	2	-	1	2	1	-
CO4	3	2	3	2	3	2	2	-	1	2	-	-

(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 Study:

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.

INS- 401	Introduction to VLSI Circuits	L-5,T-1,P-0	4Credits

Pre-requisite: Understanding of graduate level in Introduction to VLSI Circuits

Course Objectives:

- To make the student familiar with VLSI system design aspects
- To teach the physical Structure and Fabrication of CMOS ICs.
- To teach the elements of Physical Design and Electrical Characteristics of MOSFETs
- To teach the electronic analysis of CMOS logic gates

Course Outcomes: At the end of the course, the student will be able to

CO1	• Understand the fundamentals of VLSI systems
CO2	• Learn the physical Structure and Fabrication of CMOS ICs.
CO3	• Understand the elements of Physical Design and Electrical Characteristics of MOSFETs
CO4	• Understand the electronic analysis of CMOS logic gates

Mapping of course outcomes with the program outcomes

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	2	2	-	1	1	1	-	2	1	2	-
CO2	3	2	3	-	1	1	1	-	2	1	2	-
CO3	3	2	2	2	1	1	1	-	2	1	2	-
CO4	3	3	2	2	1	1	1	-	2	1	2	-

(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 Study:

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.

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.

INS - 402	Embedded Systems and Real Time Operating Systems	L-3,T-1,P-2	4Credits

Pre-requisite: Understanding of graduate level in Embedded Systems

Course Objectives:

- To teach the basics of o embedded systems and pic microcontroller
- To teach the concepts of ARM processors and architecture of ARM 7
- To teach the real time operating systems and concepts
- To teach the RTOS application domains

Course Outcomes: At the end of the course, the student will be able to

CO1	Learn the basics of o embedded systems and pic microcontroller
CO2	Understand the concepts of ARM processors and architecture of ARM 7
CO3	Learn the real time operating systems and concepts
CO4	Understand the RTOS application domains

Mapping of course outcomes with the program outcomes

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	2	2	2	1	2	1	-	2	2	1	-
CO2	3	2	2	2	2	2	2	-	2	2	2	-
CO3	3	2	-	2	1	2	2	-	1	2	1	-
CO4	3	2	-	2	2	2	1	-	1	2	2	-

(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, Program 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 Study:

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.

MODEL QUESTION PAPER

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

INS -403 (a)	Programmable Logic Controllers	L-3,T-1,P-2	4Credits

Pre-requisite: Understanding of graduate level Programmable Logic Controllers

Course Objectives:

- To teach Process Dynamics and Process Control Action
- To teach Process Controllers and Tuning
- To teach Analysis of Control Loop
- To teach Multivariable Control and Intelligent Controllers

Course Outcomes : At the end of the course, the student will be able to

CO1	Learn Process Dynamics and Process Control Action
CO2	Learn Process Controllers and Tuning
CO3	Learn Analysis of Control Loop
CO4	Learn Multivariable Control and Intelligent Controllers

Mapping of course outcomes with the program outcomes

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	2	2	1	2	1	1	-	-	3	-	1
CO2	3	2	1	1	1	1	-	-	-	3	-	1
CO3	3	2	2	1	2	1	-	-	-	3	-	1
CO4	3	2	1	1	1	2	-	-	-	3	-	1

(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 Study:

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.

MODEL QUESTION PAPER

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

INS- 403 (b)	Computational Mathematics	**L-3,T-1,P-2**	**4Credits**

Pre-requisite: Understanding of graduate level in Computational Mathematics

Course Objectives:

- To teach the basics of Special Functions and their importance in different fields
- To teach the fundamentals of Integral Transforms and its applications in communications
- To teach the different numerical techniques and their applications
- To teach the complex Variables and their importance

Course Outcomes: At the end of the course, the student will be able to

CO1	Learn the basics of Special Functions and their importance in different fields
CO2	Learn the fundamentals of Integral Transforms and its applications in communications
CO3	Understand the different numerical techniques and their applications
CO4	Understand the complex Variables and their importance

Mapping of course outcomes with the program outcomes

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	2	1	-	1	-	1	2	-	2	3	-	-
CO2	2	2	1	2	1	1	1	-	1	-	-	-
CO3	3	2	-	2	1	1	2	-	1	3	-	-
CO4	2	2	-	2	1	1	2	-	1	-	-	-

(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 Study:

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.

INS-403 (c)	Electrical Engineering Materials	**L-3,T-1,P-2**	**4Credits**

Pre-requisite: Understanding of graduate level in Electrical Engineering Materials

Course Objectives:

- To teach the concepts of bonding and different crystal systems
- To teach different polarizations and importance of dielectrics
- To teach the basics of semiconductors and their importance in devices
- To teach the shape memory alloys and its importance

Course Outcomes: At the end of the course, the student will be able to

CO1	Learn the concepts of bonding and different crystal systems
CO2	Understand the concepts different polarizations and importance of dielectrics
CO3	Learn the basics of semiconductors and their importance in devices
CO4	Learn the basics of shape memory alloys and its importance

Mapping of course outcomes with the program outcomes

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	2	**3**	2	3	1	2	-	3	2	3	-

CO3	3	3	3	-	3	1	-	-	3	-	3	-
CO3	3	2	-	2	2	1	1	-	1	2	1	-
CO4	3	3	-	3	-	1	1	-	3	-	3	-

(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 Study:

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

(MultidisciplinaryCourse)

INS-405	Project Work	L-3,T-1,P-0	4Credits

Pre-requisite: Understanding of graduate level

Course Objectives: .

- To train the students for independent thinking, planning and execution of any selected problem.
- To take-up a simple problem with an aim, plan the experiment, take the measurements, discuss the results and give the conclusion.
- To motivate the students towards the research
- To motivate them towards new innovations

Course Outcomes: At the end of the course, the student will be able to

CO1	• Get the experience of working on a problem independently with planning and execution.
CO2	• Develop skills related to presentation of data, analysis discussion of the results and draw conclusions
CO3	• Learn the importance of research for development and self sustaining
CO4	• Understand the need of the society

Mapping of course outcomes with the program outcomes

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	2	1	2	2	1	2	-	2	-	-	3
CO2	3	2	1	2	2	2	2	-	2	-	1	3
CO3	3	2	1	2	1	2	2	-	2	-	-	3
CO4	3	3	1	2	2	2	2	-	2	-	1	2

INS405: Project Work

INS-406 (a)	Agro Based Instrumentation	L-3,T-1,P-2	4Credits

Pre-requisite: Understanding of graduate level in Agro Based Instrumentation

Course Objectives:

- To create awareness of Properties of Soil.
- To study the concept of flow diagram of Sugar Plant.
- To study the role of Irrigation System .
- To study about SCADA and DMA

Course Outcomes: At the end of he course, the student will be able to

CO1	• Understand the Properties of Soil.
CO2	• Understand the concept of flow diagram of Sugar Plant.
CO3	• Understand the role of Irrigation System .
CO4	• Understand the working of SCADA and DMA in agriculture.

Mapping of course outcomes with the program outcomes

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	2	1	2	2	-	2	-	2	2	-	1
CO2	3	2	1	2	2	2	-	-	2	2	-	-
CO3	3	2	1	2	1	2	2	-	2	2	-	1
CO4	3	2	1	2	2	-	-	-	2	2	-1	-

(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 Study:

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

MODEL QUESTION PAPER

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?

INS-406 (b)	Industrial Automation	L-3,T-1,P-2	4Credits

Pre-requisite: Understanding of graduate level in Agro Based Instrumentation

Course Objectives:

- To make the students understand the fundamentals of automation and various automation systems used in industry such as PLC, DCS, and SCADA.
- Students should understand the working of these systems and should be able to determine hardware and software requirements of SIS and SIL.
- They should further understand how to design any application based on these systems.
- To make the students understand the fundamentals of Open loop and Closed loop controls

Course Outcomes: At the end of the course, the student will be able to

CO1	• Define automation, it's importance, expectations from automation and applications in industry.
CO2	• Uderstand the working of these systems and should be able to determine hardware and software requirements of SIS and SIL.
CO3	• Understand evolution and architecture of DCS, hierarchical control in DCS, programming DCS
CO4	• Understand the fundamentals of Open loop and Closed loop controls

Mapping of course outcomes with the program outcomes

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	2	2	2	2	3	-	2	-	3	1	-	-
CO3	2	3	3	3	3	1	-	-	3	2	-	-
CO3	2	2	2	2	2	-	1	-	1	1	-	-
CO4	3	3	3	3	3	-	-	-	3	3	-	-

(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-opticcable 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 reduction 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 Study:
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,