M.Tech.(Instrumentation) Program

In M.Tech. (Instrumentation) Program, there are total of 12 theory subjects with total of 50 credits and major project of 25 credits.

No Numerical marks will be assigned to thesis work. It will be either accepted or rejected. However the quality of the work reported in the thesis can be graded in terms of "Very Good", "Good", or "Average."

Instructions to the Examiners/Paper-Setters

1. Examiner will set 7 questions having equal marks. First compulsory question should cover whole syllabus. The rest of the paper should be divided into two parts (section-A and Section-B) having three questions each and the candidate is required to attempt at least two questions from each section.
2. All questions should carry equal marks.

SCHEME OF EXAMINATION M.TECH.(INSTRUMENTATION)

M.TECH. (INSTRUMENTATION)
EXAMINATION SCHEME Session 2020-22

FIRST SEMESTER

S.No	SUBJECT	SCHEDULE FOR TEACHING				THEORY MARKS			PRACTICAL MARKS			CREDITS
		L	T	P	TOTAL	Exam	Sess	Total	Exam.	Sess.	Total	C
1.	Signal Processing-I INS 61.01	3	–	–	3	75	25	100	–	–	–	3
	Signal Processing-I INS 61.52	–	–	2	2	–	–	–	30	20	50	1
2.	Analog & Digital Electronics INS 61.02	3	–	–	3	75	25	100	–	–	–	3
	Analog & Digital Electronics INS 61.51	–	–	2	2	–	–	–	30	20	50	1
3.	Transducers-I INS 61.03	3	–	–	3	75	25	100	–	–	–	3
	Transducers-I INS 61.53	–	–	2	2	–	–	–	30	20	50	1
4.	Elective-I											
5.	Elective-II											
	Elective subjects :(Any two of the followings a-d)											
a	*Foundation of Measurement INS 61.04	4	–	–	4	100	50	150	–	–	–	4
b	*Photonics INS 61.05	3	–	–	3	75	25	100	–	–	–	3
	* Photonics INS 61.54	–	–	2	2	–	–	–	30	20	50	1
c	*Design of Mechanical Elements. INS 61.06	4	–	–	4	100	50	150	–	–	–	4
d	*Process Dynamics & Control INS 61.07	4	–	–	4	100	50	150	–	–	–	4
	TOTAL MARKS: 750 **TOTAL CREDITS: 20**											
	*** Subject to the availability of the faculty.**											

SECOND SEMESTER

S.No	SUBJECT	SCHEDULE FOR TEACHING				THEORY MARKS		PRACTICAL MARKS				CREDITS
		L	T	P	TOTAL	Exam.	Sess.	Total	Exam	Sess.	Total	C
1.	Microprocessors in Instrumentation INS 62.01	3	–	–	3	75	25	100	–	–	–	3
	Microprocessors in Instrumentation INS 62.51	–	–	2	2	–	–	–	30	20	50	1
2.	Automatic Control System INS 62.02	3	–	–	3	75	25	100	–	–	–	3
	Automatic Control System INS 62.52	–	–	2	2	–	–	–	30	20	50	1
3.	Analytical Instrumentation INS 62.03	3	–	–	3	75	25	100	–	–	–	3
	Analytical Instrumentation INS 62.53	–	–	2	2	–	–	–	30	20	50	1
4.	Elective-I											
5.	Elective-II											
	Elective subjects :(Any two of the followings a-d)											
a	*Robotics INS 62.04	4	–	–	4	100	50	150	–	–	–	4
b	*Medical Instruments INS 62.05	3	–	–	3	75	25	100	–	–	–	3
	*Medical Instruments INS 62.54	–	–	2	2	–	–	–	30	20	50	1
c	*Signal Processing-II INS 62.06	3	–	–	3	75	25	100	–	–	–	3
	*Signal Processing-II INS 62.55	–	–	2	2	–	–	–	30	20	50	1
d	*Transducers-II INS 62.07	3	–	–	3	75	25	100	–	–	–	3
	*Transducers-II INS 62.56	–	–	2	2	–	–	–	30	20	50	1
	TOTAL MARKS: 750 **TOTAL CREDITS: 20**											
	*** Subject to the availability of the faculty.**											

THIRD SEMESTER

S.No	SUBJECT	SCHEDULE FOR TEACHING				THEORY MARKS			PRACTICAL MARKS			CREDITS
		L	T	P	TOTAL	Exam.	Sess.	Total	Exam.	Sess.	Total	C
1.	Elective-I											
2.	Elective-II											
	Elective subjects :(Any two of the followings a-d)											
a	*Computer Aided Design &Computer Aided Manufacturing INS 71.01	3	-	-	3	75	25	100	-	-	-	3
	*CAD/CAM INS 71.51	-	-	3	3	-	-	-	30	20	50	2
b	*Instrumentation for Special Applications INS 71.02	3	-	-	3	75	25	100	-	-	-	3
	*Instrumentation for special applications INS 71.52	-	-	3	3	-	-	-	30	20	50	2
c	*Selected Topics INS 71.03	3	-	-	3	75	25	100	-	-	-	3
	*Selected Topics INS 71.53	-	-	3	3	-	-	-	30	20	50	2
d	*Virtual Instrumentation INS 71.04	3	-	-	3	75	25	100	-	-	-	3
	*Virtual Instrumentation INS 71.54	-	-	3	3	-	-	-	30	20	50	2
3.	Major Project INS 71.55	-	-	20	20	-	-	-	-	-	-	10
	TOTAL MARKS: 300 **TOTAL CREDITS:20**											
	*** Subject to the availability of the faculty.**											

FOURTH SEMESTER

S.No	SUBJECT	SCHEDULE FOR TEACHING				THEORY MARKS			PRACTICAL MARKS			CREDITS
		L	T	P	TOTAL	Exam	Sess.	Total	Exam	Sess.	Total	C
1.	Major Project & Thesis INS 72.01	-	-	30	30	-	-	-	-	-	-	15
	TOTAL CREDITS: 15											

GRAND TOTAL: 1800
TOTAL CREDITS: 50(Theory + Practical) + 25(Major Project) = 75

COURSE CONTENTS FOR M.TECH (INSTRUMENTATION) 2020-22

SEMESTER – I

Signal Processing-I, INS 61.01

Hours : 45

L	T	P
3	x	2

Note: Examiner will set 7 questions having equal marks. First compulsory question should cover whole syllabus. The rest of the paper should be divided into two parts (section-A and Section-B) having three questions each and the candidate is required to attempt at least two questions from each section.
All questions should carry equal marks; Time allowed : 3 Hours; Max. Marks: 75(Exam)+25(Internal)

SECTION-A

Unit-I (11 hours)

Classification of discrete time signal and systems, Mathematical operations on discrete time signals. Sampling and aliasing, Linear, Circular & Sectioned convolution, Inverse system and Deconvolution, Correlation, Cross correlation and Auto correlation.

Unit-II(12 hours)

Analysis of LTI-DTS using Z-transform. Structures for Realization of FIR and IIR systems. DTFT and its properties. Inverse discrete time Fourier transform. Analysis of LTI-DTS using DTFT. DFT of Discrete time signal and its properties.

SECTION-B

Unit-III (11 hours)

Analysis of LTI-DTS using DFT. Fast Fourier Transform(FFT).
DIT and DIF Radix-2 FFT. Computation of inverse DFT using FFT. Finite Impulse Response (FIR) filter and its design techniques.

Unit-IV (11 hours)

Infinite Impulse Response (IIR) filter and its design techniques. Energy and Power spectrum estimation. Overview of Digital Signal processors. DSP- applications for Audio, telecommunication and Biomedical-Signal processing.

Books suggested :

Essential Books:

1. Digital Signal Processing, 2nd Edition, A.Nagoor Kani, Tata McGraw Gukk Education Pvt. Ltd., 2012.
2. Digital Signal Processing, principles Algorithms and application 4th edition, John G.Proakis, Dimitris G, Manolakis Pearson Education (LPE) 2007.
3. Digital Signal Processing, S.Salivahanan, A Vallavaraj, C.Gnanapriya, Total McGraw-Hill Publishing Company Ltd., 2008.
4. Understanding Digital Signal Processing,Richard G.Lyon,3rd edition, Pearson Prentice Hall, 2010.

Reference Books:

1. Digital Signal Processing:An overvien of Basic Principles,Jack cartinhour Prentice Hall,1st edition(1999).
2. Digital Signal Processing & the Microcontroller,Dale Grover,John Deller,Prentice Hall PTR, First Edition (1998).
3. Digital Signal Processing: A Computer-based Approach, Sanjit Mitra, McGraw Hill Education,4th edition(2013).
4. Digital Signal Processing, Alan V.Oppenheim,Ronald W.Schafer,John R. Buck, Prentice Hall India Learning Pvt. Ltd., 1st edition 2015.
5. Digital Signal Processing - A practical Approach 2nd edition Emmanuel C. Ifeachor and Barrie W. Jervis Pearson Education (LPE) 2009.

ANALOG AND DIGITAL ELECTRONICS INS 61.02 **Hours : 45**

L	T	P
3	x	2

Note: Examiner will set 7 questions having equal marks. First compulsory question should cover whole syllabus. The rest of the paper should be divided into two parts (section-A and Section-B) having three questions each and the candidate is required to attempt at least two questions from each section.
All questions should carry equal marks; Time allowed : 3 Hours; Max. Marks: 75(Exam)+25(Internal)

SECTION-A

Unit-I (11 hours)

Amplifiers for Instrumentation applications, their design and op-amp characteristics; the op-amp with and without feedback, offset consideration, common mode voltage and differential mode operational amplifiers, the op-amp behavior at higher frequencies, practical considerations, noise associated with op-amp, analog applications of op-amp, analog multiplexers.

Unit-II (11 hours)

Analog filter design; filter design parameters first order and second order analog filters for various types of analog filters. Power supplies; [Regulated power supply, stabilization, voltage regulator & op-amp based regulated power supply, an overview of SMPS and UPS], op-amp based oscillators and waveform generators.

SECTION-B

Unit-III (12 hours)

Combinational circuit design; adder and subtractor circuit design, application of combinational circuit design, sequential circuit design; Synchronous and Asynchronous sequential circuit, problems in Asynchronous sequential circuit, digital filters, digital multiplexers and their applications.

Unit-IV (11 hours)

A/D and D/A converters, memories; types of RAM, types of ROM, basic concept of programmable logic device (*PLD*); programmable logic array *(*PLA*)* and programmable array logic (PAL), cache memory, associative memory, computer circuits; types of Buses, Serial Bus, Parallel Bus, An overview of Micro-processors and Micro-controller.

Books suggested:

Essential Books:

1. Operational Amplifiers: Integrated and Hybrid circuits by George B. Ruttkowski, P.E., John Wiley & Sons, INC.,1993
2. Digital circuits and Design by S. Salivahanan, S. Arivazhagan, Vikas Publishing House Pvt. Ltd.,2009 4th Edition.

Reference Books:

1. Op-Amps and Linear Integrated circuits by Ramakant A. Gayakwad, Prentice-Hall of India, 2000
2. An Engineering Approach to Digital Design by William I. Flectcher, 2009, PHI learning
3. Digital Logic Application and Design by John M. Yarbrough, CL Engineering, 2006

TRANSDUCERS-I INS 61.03: **Hours : 45**

L T P
3 x 2

Note: Examiner will set 7 questions having equal marks. First compulsory question should cover whole syllabus. The rest of the paper should be divided into two parts (section-A and Section-B) having three questions each and the candidate is required to attempt at least two questions from each section.
All questions should carry equal marks; Time allowed : 3 Hours; Max. Marks: 75(Exam)+25(Internal)

SECTION-A

Unit-I(11 hours)
Transducer classification and its characteristics.
Displacement Transducer : Resistive, capacitive and inductive.
Thickness Transducer : Capacitive, Inductive.
Pressure Transducer : Resistive, Capacitive.
Moisture transducer: Inductive, capacitive and load cell.

Unit-II(12 hours)
Thermoelectric Transducer : RTD, PRT and its calibration, Thermistor, Thermocouple transducers, Integrated circuit temperature and Pyroelectric transducers.
Photoelectric Transducer : Photoconductive, Photovoltaic and Photo emissive based transducers.

SECTION-B

Unit-III(11 hours)
Galvanomagnetic Transducer : Hall effect Transducer,
Magnetoresistance Magnetostriction & Magnetoelastic based transducers.
Piezoelectric Transducer : Force, Torque, Pressure and Acceleration transducer.

Unit-IV(11 hours)
Electromagnetic Acoustic Transducer (EMAT).
Flow Transducer: Ultrasonic, Rotameter and Electromagnetic transducers. IR Radiation transducer, Acturators.

Books suggested:

Essentials Books:

1. Sensor and Transducers, D. Patranabi, 2nd edition, PHI Learning Pvt. Ltd., 2003.
2. Instrumentation, Measurement and Analysis, BC Nakra, KK Chaudhry, 2nd edition Tata McGraw-Hill Publishing Co. Ltd. 2004.
3. Transducer & Instrumentation, DVS Murthy 2nd edition, PHI Learning Pvt. Ltd., 2010.
4. Electronic Instrumentation, H.S. Kalsi, McGraw Hill Education, 3rd edition 2010.

Reference Books:

1. Sensors: Vol-I "Fundamental and General Aspect' edited by W.Gopel J.Hesse, J.N.Nemel VCH Weinheim 2008.
2. Sensors: A comprehensive survey edited by W.Gopel, J.Hesse, J.N.Nemel Vol.2 Chemical and biochemical sensors-Part-I VCH Weinheim 2008.
3. Sensors: A comprehensive survey edited by W.Gopel, J.Hesse, J.N.Nemel Vol.4 (Thermal Sensors), VCH Weinheim 2008.
4. Sensors: A comprehensive survey edited by W.Gopel, J.Hesse, J.N.Nemel Vol.5(Magnetic sensors) VCH Wemheim 2008.
5. Sensors: A comprehensive survey edited by W.Gopel, J.Hesse, J.N.Zemel, Vol.6, optical sensors, VCH Weinheim 2008.
6. Handbook of transducers by H.N.Norton; Prentice Hall, 1989.

FOUNDATIONS OF MEASUREMENT INS 61.04 **Hours : 45**

L	T	P
4	x	x

Note: Examiner will set 7 questions having equal marks. First compulsory question should cover whole syllabus. The rest of the paper should be divided into two parts (section-A and Section-B) having three questions each and the candidate is required to attempt at least two questions from each section.
All questions should carry equal marks; Time allowed : 3 Hours; Max. Marks: 75(Exam)+25(Internal)

SECTION-A

Unit-I (11hours)
Theory of Measurement, Introduction to probability- Classical, Relative frequency and axiomatic. Probability Definition, Addition rule and conditional probability, Multiplication rule, total probability, Bays Theorem and independence.
Random variables: Discrete, continuous and mixed variables, Probability mass, Probability Density and cumulative distribution functions, Mathematical expectation, Moments. Discrete uniform Binomial, Geometric, Poisson, Exponential, Normal Distributions. Functions of Random Variable. Joint distributions: Joint, Marginal and Conditional. Product moments, correlation, independence of random variables, bivariate normal distribution.

Unit-II(12hours)
Classification of Random processes, Methods of description of Random processes, Special cases of Random processes, avg values of Random processes, Stationary, examples of SSS process, Analytical representation of Random processes, Autocorrelation function & its properties. Power Spectral Density function and properties, Gaussian Processes, Poisson Process, Markov Process.

SECTION-B

Unit-III(11 hours)
Estimation of parameters of Random processes in presence of noise. Parameter Estimation Model, Estimator Structure- Likelihood function, ML and MAP estimates. Performance Analysis – Cramer- Rao bounds. Linear estimation and non-linear estimation.

Unit-IV(11 hours)
Linear Estimation: Optimum Processor properties, Linear filter – Stationary processes, Infinite Past – Weiner Filters. Kalman Filter- Derivation of estimator Equation application, generalizations.

Books Suggested:

Essential Books:

1. H.L.Van ; Trees,Detection, Estimation and Modulation Theory; John Wiley; Vol I, II & III 2004.
2. A. Papoulis, S.Vnnikrishna Pillai; Probability, Random variables and Stochastic-Processes , Tata Mc-Graw Hill, International edition 3rd Edn. 2002.
3. T. Veerajan; Probbility, Statistics and Random Processes; TMH Publishing company; 2nd Edn 2004

PHOTONICS INS 61.05: **Hours : 45**

L	T	P
3	x	2

Note: Examiner will set 7 questions having equal marks. First compulsory question should cover whole syllabus. The rest of the paper should be divided into two parts (section-A and Section-B) having three questions each and the candidate is required to attempt at least two questions from each section.
All questions should carry equal marks; Time allowed : 3 Hours; Max. Marks: 75(Exam)+25(Internal)

SECTION-A

Unit-I(11 hours)

Nature of Light : wave theory, corpuscular theory, laws of reflection and reflection, dispersion, interference , superposition of coherent and incoherent waves, Fresnel's Diffraction, polarization and its types, its applications, dispersive prisms and Grating.

Unit-II(11 hours)

Generation of light: Black body radiation, incandescent, Spectral Lamps, Lasers-spontaneous and stimulated emission , required conditions for lasing, principal pumping schemes, functioning of Ruby, ND:YAG, HeNe, Carbon dioxide, Dye Laser, Laser characteristics, their uses

SECTION-B

Unit-III(12 hours)

Fibre optics: optical fibre principle and structure, Critical angle, Numerical aperture, classification of fibres and materials used, losses, applications, Fibre optic sensors
Detection of light: Thermal detectors, photon detectors, optical materials used for different detectors, Characteristics

Unit-IV(11 hours)

Representative devices based on electro-optics and acoustooptics, principles of photometry and instrumental aspects, design concepts of UV-Visible and IR spectrometer.

Books Suggested:

Essential Books:

1. Optical electronics, Ajoy Ghatak and K. Thyagarajan, Cambridge University Press, first edn.1989
2. Fibre optics principles and practices, Abdul Al-Azzawi, CRC press, first Indian reprint, 2013
3. Optoelectronics : an introduction, J. Wilson, J.F.B. Hawkes, 4th Edn. *Prentice Hall International, 2000*
4. Optics - F. Grahan Smith and J.H. Thomson, John Wiley and Sons Ltd., London, 1988.

Reference Books:

1. Physical Optics Notebook : Tutorials in Fourier optics;George O.Reynoids, John B.Develis, George, B.Parrent, Jr. & Brain J. Thompson, American Inst. Of Physics 1989.
2. Modern Optical Engineering, 4th Edn. W.J.Smith, McGraw Hill Book Publication, NewYork, 2008.
3. An Introduction to Fibre Optics Systems, 2nd Edn, Power, Mc. Graw Hill 2010.
4. Hand book of optics, Michel Bass, Vol-1 andVol.-2, Michel Bass, 2nd edition McGraw Hill.
5. Handbook of Analytical Instruments 3rd Edition, R. S. Khandpur, McGraw-Hill Education, 2015

DESIGN OF MECHANICAL ELEMENTS INS 61.06: **Hours : 45**

L	T	P
4	x	x

Note: Examiner will set 7 questions having equal marks. First compulsory question should cover whole syllabus. The rest of the paper should be divided into two parts (section-A and Section-B) having three questions each and the candidate is required to attempt at least two questions from each section.
All questions should carry equal marks; Time allowed : 3 Hours; Max. Marks: 75(Exam)+25(Internal)

SECTION-A

Unit-I(11 hours)
Basics of Mechanisms: Physical Principles – efficiency of machines, mechanical advantage, velocity ratio; Inclined Plane, Pulley Systems, Screw-Type Jack, Levers and Mechanisms – Levers, Winches, Windlasses and Capstans, Pulleys and Belts, Sprockets and Chains, Cam Mechanisms, Bearings, Springs.

Unit-II(11 hours)
Linkages: Four-Bar Linkages and Typical Industrial Applications, design of Four-Bar Linkages for Angular Motion, Design of Slider-Crank Mechanisms, Design of Crank and Rocker Mechanism.
Gears and Gearing: Gear Classification and Terminology, Simple Gear Trains, Compound Gear Trains, Planetary Gears, Design of Spur and Bevel Gears.

SECTION-B

Unit-III(11 hours)
Shafts and Couplings: Shaft Materials, Design Considerations, Critical Speeds of Rotating Shafts, Design of Shafts subjected to Static Loads, Classification of Couplings, Design Considerations in Rigid and Flexible Couplings.

Unit-IV(12 hours)
Ergonomics and Design: Introduction to ergonomics, Postures and Movement, Environmental Factors, Ergonomics Approach to Design, Case Studies is Ergonomic Design of Computer Workstation, Gaming Console Housings and Automotive Instrumentation.

Essential Books:

1. Theory of Machines; R. S. Khurmi; S. Chand; 14th Edition; 2005.
2. Mechanical Design of Machine Elements and Machines; Jack A.Collins, Henry Busby and George Staab; Wiley India Private Limited; 2nd edition; 2011.
3. Mechanisms and Mechanical Devices Sourcebook; Neil Sclator; McGraw-Hill Education; 5th edition; 2011.
4. Ergonomics for Beginners: A Quick Reference Guide; Jan Dul and Bernard Weerdmeester; CRC Press; 5th edition; 2008
5. A. Collins: Mechanical Design of machine elements and machine; 2nd Edn.; Wiely India.

PROCESS DYNAMICS AND CONTROL INS 61.07: **Hours : 45**

L	T	P
4	x	x

Note: Examiner will set 7 questions having equal marks. First compulsory question should cover whole syllabus. The rest of the paper should be divided into two parts (section-A and Section-B) having three questions each and the candidate is required to attempt at least two questions from each section.
All questions should carry equal marks; Time allowed : 3 Hours; Max. Marks: 75(Exam)+25(Internal)

SECTION-A

Unit-I(11 hours)
Process & Control System Review: Control systems, Process control principles, Servomechanism, Process Control Block diagram, Identification of elements, Control System evaluation, stability, Regulation, transient regulation, evaluation criteria, analog & digital processing. Introduction to supervisory & digital control, Functions of error, accuracy, sensitivity, resolution, linearity, time response of 1^{st} order & 2^{nd} order system.

Unit-II(12 hours)
Process Characteristics: Process, Process variable, mathematical modeling of liquid, gas, thermal, mechanical and chemical system. Linearization, liquid level control in a tank. Dynamics of manometer, response of non-interacting and interacting first order elements in series.

SECTION-B

Unit-III(11 hours)
Controller characteristics: Characteristics of on-off, proportional, integral, derivative modes and their combinations.
Closed loop in Automatic control: Block diagram & closed loop response, effect of proportional control on the response of a controlled process, effect of integral control, derivative and composite control actions. Design of Feedback controllers-simple performance criteria. Time Integral performance criteria- ISE, IAE¸IATE, Tunings of controllers.

Unit-IV(11 hours)
Controllers: Electronics, pneumatic, hydraulic controllers implementing. Single and composite mode of controllers. Latest trends in industrial controllers employing PLCs & other logic devices such as DCS & Computer based systems etc.
Final control elements: Types & function of Control valves. Electrical, Pneumatic, hydraulic actuators.

Books recommended:

Essential Books:

1. CD Johnson; Process Control Instrumentation Technology; PHI; 8^{th} Ed^{n}; 2013.

2. D.P.Eckman; Automatic Process Control; Wiley Eastern Ltd, 2009.

3. D.R.Coughanowr; Steven E.LeBlanc; Process System analysis & control; Mc Graw Hill International Edn., 3^{rd} Ed^{n}, 2016,.

4. G. Stephanopoulus; Chemical Process Control; PHI, 2014.

5. Surekha Bhanot; Process Control Principles and Applications; Oxford Univ. Press; 2016.

6. J.P. Navani: Electrical Measurements and Process Control, S. Chand; 2015.

7. J.P. Navani: Electrical Measurements and instrumentation, S. Chand; 2015.

Reference Books:

1. Instrument Engineers' Handbook of Process Control; Bela G. Liptak; 4th Edn. Chilton Book Company, CRC Press, 2003.
2. Industrial Instrumentation; D.P. Eckman; CBS, Publisher 2015
3. Principles of Process Control; D. Patranabis; 3rd Edn. TMH 2014.
4. Process Control; Peter Harriot; Mc Graw Hill Education, 2001.
5.Programmable logic controllers - Principles and Applications; John W.Webb, Ronald A.Reis; Prentice Hall; 5th Edn., 2003.
6. Timothy J. Ross; Fuzzy logic with engineering applications; Wiley India, 3rd Edn., 2011.
7. Madhu Mitra, Samarjit Sen Gupta; Programmable logic controllers and Industrial automation -An Introduction; Penram International Publishing (India) Pvt. Ltd.; 2007.
8.Uttam Ray Chaudhari, Utpal Ray Chaudhari; Fundamentals of Automatic Process Control; CRC Press 2013.
9.Alavala: Principles of industrial instrumentation and control system, Cengage Learining Asia, 2009.
10. Narciso F. Macia: Modeling and control of dynamic systems; Cengage Learing India

Ins 61.52 SIGNAL PROCESSING - I(Practical)

Max. Marks: 30(Exam)+20(Internal)

Practicals based on the contents given above in theory.

INS 61.51 ANALOG AND DIGITAL ELECTRONICS (Practical)

Max. Marks: 30(Exam)+20(Internal)

Practicals based on the contents given above in theory.

INS 61.53 TRANSDUCER - I(Practical)

Max. Marks: 30(Exam)+20(Internal)

Practicals based on the contents given above in theory.

INS 61.54 PHOTONICS (Practical)

Max. Marks: 30(Exam)+20(Internal)

Practicals based on following topics spectral attenuation of optical fiber, Numerical aperture of optical fibres, Audio, video and data transmission through optical fibers, thin film deposition.

SEMESTER-II

MICROPROCESSORS IN INSTRUMENTATION INS 62.01: **Hours : 45**

L	T	P
3	x	2

Note: Examiner will set 7 questions having equal marks. First compulsory question should cover whole syllabus. The rest of the paper should be divided into two parts (section-A and Section-B) having three questions each and the candidate is required to attempt at least two questions from each section.
All questions should carry equal marks; Time allowed : 3 Hours; Max. Marks: 75(Exam)+25(Internal).

SECTION-A

Unit-I(11 hours)
Numbering and coding system. Overview of microprocessor family. Introduction to 8051 Assembly programming. 8051 addressing modes, 8051 Hardware. Date types and time delay in 8051, I/O programming Logic operations and Data conversion programs in 8051C.

Unit-II(12 hours)
8051 Timer and counter programming in C. 8051-Serial port programming in C/ 8051 interrupts, programming timer interrupts, programming external hardware interrupts and serial communications, interrupts LCD and keyboard interfacing.

SECTION-B

Unit-III(11 hours)

ADC, DAC and sensor interfacing, Semiconductor memory. Memory addresses decoding. 8051 interface with external memory, Accessing external data memory in 8051/8951 interfacing and programming with 8255.

Unit-IV(11 hours)
DS12887 RTC interfacing and programming. Stepper motor and DC motor using C. An overview of Arduino programming and its applications.

Books recommended:

Essential Books:

1. Microprocessors and Microcontrollers , A. Nagoor Kani, Tata McGraw Hill, 2012
2. The 8051 Microcontroller and Embedded Systems, M A Mazidi, J G Mazidi, R D Mc-Kinlay by Prentice Hall India, 2006
3. Microprocessors: Principles and Applications, Charles M. Gilmore 2001.
4. Beginning Arduino Programming (Technology in Action); Brian Evans;
5. Huong: the Atmel AVR microcontroller: Mega and x Mega in assembly and c w/CD.

AUTOMATIC CONTROL SYSTEM INS 62.02: **Hours : 45**

L	T	P
3	x	2

Note: Examiner will set 7 questions having equal marks. First compulsory question should cover whole syllabus. The rest of the paper should be divided into two parts (section-A and Section-B) having three questions each and the candidate is required to attempt at least two questions from each section.
All questions should carry equal marks; Time allowed : 3 Hours; Max. Marks: 75(Exam)+25(Internal)

SECTION-A

Unit-I (11 hours)
An overview of Laplace Transform, theorems of the Laplace Transform, inverse Laplace Transform, application of Laplace Transform for solving linear ordinary differential equations. Signal flow graphs, Mathematical Modeling of physical systems, Linear systems; controllability, observability, Equations and transfer functions of control system.

Unit-II (11 hours)
Time domain analysis of control systems, typical test signals for the time response of control system, steady state error, transient response of prototype second order system, stability of linear control systems; Routh- Hurwitz criterion, Root locus technique.

SECTION-B

Unit-III (12 hours)
Frequency response of control systems; frequency domain specifications, Polar plots, Nyquist Criterion, Bode plot, Gain margin, Phase margin, Sample-data control systems; Z-transform, relationship between Z-transform and Laplace transform, stability tests of sample data control system.

Unit-IV (11 hours)
State-space methods; characteristic equations, Eigen values and Eigen vectors. Nonlinear control systems; common physical nonlinearities. The phase plain method, basic concept. The describing function method. Basic concept of Lyapunov stability criterion. Computers in control.

Books suggested :

Essential Books:

1. Automatic Control Systems, Benjamin C. Kuo, Johnwiley & Sons, Farid Golnaraghi, 8th Edn. 2009.
2. Modern Control Engineering, Katsushiko Ogata, Pearson Hall, 2010, 5th Edn.
3. Automatic Control Engineering, Francis H. Raven, Mc Graw Hill,5th Edn., 1995.

Reference Books:

1. Modern Control Systems, Richard C. Dorf, 12th edition, Pearson Edu., 2011 Robert H. Bishop.

2. Process Systems Analysis & Control, D.R. Coughanwar, Steven E.Leblanc Mc Graw Hill Pub. Co., 2009, 3rd Edn.

ANALYTICAL INSTRUMENTATION INS 62.03. **Hours : 45**

L T P
3 x 2

Note: Examiner will set 7 questions having equal marks. First compulsory question should cover whole syllabus. The rest of the paper should be divided into two parts (section-A and Section-B) having three questions each and the candidate is required to attempt at least two questions from each section.
All questions should carry equal marks; Time allowed : 3 Hours; Max. Marks: 75(Exam)+25(Internal)

SECTION-A

Unit-I (11 hours)
Basics of Physical methods of chemical analysis, spectral methods of analysis, basic techniques, terminology, units. Interaction of e.m. radiations with matter, emission, absorption & scattering techniques. Analytical data presentation.

Unit-II (12 hours)
Instrumentation of X-Ray, UV-Visible and infrared techniques. Various light sources, spectrometers, detectors, data processing comparison of various spectral analytical techniques.

SECTION-B

Unit-III (11 hours)
Electron Microscopy, Analytical techniques based on separation method: Basics of Chromatography, Electrophoresis. Mass Spectrometry and related instrumentation.

Unit-IV (11 hours)
Basics of Electrometric methods of analysis. Techniques and related instrumentations of pH and ion selective potentiometry. Voltammetry, coulometry and conductometry. Error analysis.

Books suggested:

Essential Books:

1. Instrumental methods of Chemical analysis,Galen W.Ewing, 2003, Textbook Publishers.
2. Instrumental methods of analysis; H.H. Willard, Lynnel Merritt, Jr. John A. Dean, F.A. Settle, CBS Publishers, 7th Edn., 1986.
3. Principles of Instrumentation analysis; Douglass A. Skoog, F. James Holler, Timothy A. Nieman, Harcourt college Publishers, Fifth edition, 2001.

Reference Books:

1. Handbook of Analytical Instruments; R. S. Khandpur, Tata McGraw Hill Edn.; 2nd Edn,2006.

2. Ewing's, Analytical Insturuments' Handbook; Edited by Jack Cazes, CRC Press, Taylor & Francis Group, 3rd Edn, 2004.

ROBOTICS INS 62.04:

Hours : 45

L	T	P
4	x	x

Note: Examiner will set 7 questions having equal marks. First compulsory question should cover whole syllabus. The rest of the paper should be divided into two parts (section-A and Section-B) having three questions each and the candidate is required to attempt at least two questions from each section.
All questions should carry equal marks; Time allowed : 3 Hours; Max. Marks: 75(Exam)+25(Internal).

SECTION-A

Unit-I(11 hours)

Introduction: Robot technology and terms related to robot. Robot physical configurations, Joints and Links, Industrial Applications of Robotic Manipulators

Unit-II(11 hours)

Drive Systems and Kinematics: Elements and types of drive and control systems, Precision of movement, Actuators – stepper, DC servo and brushless motors, Power Transmission Systems, Manipulator Kinematics – forward and inverse.

SECTION-B

Unit-III(11 hours)

Sensors: Purpose of sensors, internal and external sensors, common sensors – Accelerometers, gyros, encoders, tachometers, strain gauge based force-torque sensors. Tactile, Proximity and Range sensors in robots – Infrared, Sonar, Laser; Velocity sensors.

Unit-IV(12 hours)

Machine Vision: Machine Vision System, Description, Cameras - single, stereo, omni, FLIR, Sensing, Digitizing, Image Processing and Analysis, Application of Machine Vision System.

Essential BOOKS:

1. Introduction to Robotics: Analysis, Control, Applications, Saeed B. Niku, John Wiley and Sons, 2010.
2. Robotic Engineering: An Integrated Approach, Klafter Richard D., Chmielewski Thomas A., Negin Michael, Prentice Hall, 1993.
3. Industrial Robotics – Technology, Programming and Automation, Mikell P. Groover, Roger N. Nagel, N. G. Odray, Mitchell Walls, McGraw Hill, 1988

MEDICAL INSTRUMENTS INS 62.05: **Hours : 45**

L T P
3 x 2

Note: Examiner will set 7 questions having equal marks. First compulsory question should cover whole syllabus. The rest of the paper should be divided into two parts (section-A and Section-B) having three questions each and the candidate is required to attempt at least two questions from each section.
All questions should carry equal marks; Time allowed : 3 Hours; Max. Marks: 75(Exam)+25(Internal)

SECTION-A

Unit-I(11 hours)
Introduction to biomedical engineering, Biometrics, Man-Instrumentation System, Physiological Systems of Body, Constrains in measuring a living system.

Sensor and transducers for biological applications-specify Types, properties and selection of transducers for biological instrumentation applications. Electrical safety from medical equipment, shock hazards from electrical equipment, Methods of prevention from accident.

Unit-II (11 hours)
Sources of Bioelectric signals. Anatomy and physiology of the organs resulting in generation of bioelectric signals . Measurement of bioelectric signals such as ECG, EEG, EMG, EOG, ERG.
Instrumentation for measurement of Physiological signals such as blood pressure, temperature, oxygen saturation, blood flow, patient monitoring system and telemetry etc.

SECTION-B

Unit-III (12 hours)
Modern Imaging Systems such as X-Ray machines, X-Ray Computer Tomography, Magnetic Resonance Imaging, Ultrasound Imaging, Nuclear Medical Imaging: Emission Computed Tomography ECT, Single Photon Emission Computed Tomography SPECT, Positron Emission Tomography PET.

Unit-IV (11 hours)
Working Principle and Instrumentation of Therapeutic equipments like Pacemakers, Defibrillators, Physiotheraphy Equipments, Haemodialysis, Ventilators and Lasers in Biomedical Field.

Books Suggested :

Essential Books:

1. Handbook of Biomedical Instrumentation;R.S.Khandpur;3rd Edn; TMH; 2017.
2. Leslie Cromwel,Fred J. Weibell, Erich A. Pfeiffer; Biomedical Instrumentation & Measurements; Pearson Education; 2nd Edn; 2017.
3. Joseph J. Carr, John M. Brown; Introduction to Biomedical Equipment Technology; Pearson Education Asia;4th Edn; 2015.
4. Shakti Chatterjee: Biomedical instrumentation system Cengage; 2010.
5. Laurence J Street; Introduction to Biomedical Engineering Tech.; CRC Press. 3rd Edn, 2016.

Reference Books:

1. Principles of Applied Biomedical Instrumentation. Geddes & Baker; 3rd Edn; Wiley, 2016.
2. Biomedical Instruments Theory & Design; 2nd Revised Edn; Walter Welkowitz; SID Deutsch' Metin Akay; Elsevier; 2012.
3. John G.Webster; Medical Instrumentation applications & Design; John Wiley & Sons ; 4th Edn; 2015.
4. G.R. Sinha; Biometric concepts and applications; Wiley Pub ltd; 2006.

SIGNAL PROCESSING–II, INS 62.06 **Hours : 45**

L	T	P
3	x	2

Note: Examiner will set 7 questions having equal marks. First compulsory question should cover whole syllabus. The rest of the paper should be divided into two parts (section-A and Section-B) having three questions each and the candidate is required to attempt at least two questions from each section.
All questions should carry equal marks; Time allowed : 3 Hours; Max. Marks: 75(Exam)+25(Internal)

SECTION-A

Unit-I (11)
Model of a Neurons- Non-Linear models and Stochastic model. Neural network architecture – Single layer feed forward network multiplayer feed forward architectures. Recurrent network, knowledge representation.
Unit-II(11)
Learning processes- Error correction learning, memory based learning, Hebbian learning, competitive learning, Boltzmann learning. Perceptrons-single layer perceptrons, multiplayer perceptrons.

SECTION-B

Unit-III(12)
Fuzzy control basics, Fuzzy system design, Fuzzyfications, Inference Mechanism Defuzification methods, Tuning of Fuzzy control system.

Unit-IV(11)
Coherent and incoherent optical processing – optical correlators, time integrating and space integrating correlator, incoherent matrix vector multiplier, Holographic memories.

Books Suggested:

Essential Books:

1. 'Neural Networks and Fuzzy systems' Bart Kosko, Prentice Hall of India, 2001
2. 'Fuzzy logic with engineering applications' Timothy J.Ross JohnWiley & Sons, Edition 2010.

Reference Books:

1. 'Neural Networks' a comprehensive Foundation Simon Haykin 2nd Ed. Pearson Education Asia (LPE) 2013.
2. 'Fuzzy systems Design principles' Riza C, Berkan Sheldon L.Trubatch, IEEE Press standard Publishers 2000.
3. 'Fuzzy sets and Fuzzy logic; Theory and application George J.Klir/Bo Yuan, Prentice Hall of India (EEE) 2001
4. Hand Books of Optics, Mc-Graw Hills, 2009, 3rd Edn. By Michael Bass, Optical Society of Amercia, Casimer Decusatis.

TRANSDUCSERS–II, INS 62.07: **Hours : 45**

L	T	P
3	x	2

Note: Examiner will set 7 questions having equal marks. First compulsory question should cover whole syllabus. The rest of the paper should be divided into two parts (section-A and Section-B) having three questions each and the candidate is required to attempt at least two questions from each section.
All questions should carry equal marks; Time allowed : 3 Hours; Max. Marks: 75(Exam)+25(Internal)

SECTION-A

Unit-I (11 hours)

Chemical Sensor Characteristics and classification of chemical sensor mechanism.Metal-Oxide Chemical Sensors, ChemFET, Conductometric Sensors ,Amperometric Sensors , Gas Sensors, Chemiresistors.

Thermal Sensors , Lambda sensor, Hydrogen sensor (PEMFC), measurement of pH.

Unit-II (12hours)

Motion and position sensors: Microwave motion detector, Capacitive occupancy sensor, triboelectric detectors, optoelectronic , visible, NIR and FIR motion detectors,

Optical sensors: optical bridge, proximity detector with polarized light, fiber-optic sensors, Fabry-Perot sensors, Grating sensors

Thickness and level sensors: Thin film sensors, Ablation sensors, Liquid level Sensors

SECTION-B

Unit-III (11 hours)

Biosensors:Introduction, Immobilization of the Biosensing using Physical Methods and Chemical Methods, Amperometric Biosensors; Mediated Amperometric Biosensors,Potentiometric Biosensors; Ion Selective Electrodes (ISEs) , Enzyme electrode, Photometric Biosensors, Biomimetic Sensors, Glucose Sensors

Unit-IV (11 hours)

Sensor Materials and Technologies:Materials; semiconductor as a Sensing Material ,
Surface Processing: Deposition of Thin and Thick Films, Spin-Coating, Vacuum Deposition , Sputtering, Chemical Vapor Deposition , e-beam evaporation.
Nano-Technology: Material synthesis using chemical method. Characterisation of nano semiconductor material.

Essential Books:

1. Handbook of Modern Sensors Physics, Designs, and Applications, Jacob Fraden, fifth Edition, Springer, 2016
2. Introductory Bioelectronics for Engineers and Physical Scientists, Ronald Pethig Stewart Smith, First Edition, John Wiley and Sons, 2013
3. Principles of instrumental analysis, Douglas A. Skoog, James J. Leary. Stanley R. Crouch 6th ed, Thomson, Brooks/Cole, 2004

Additional reference:

1. Sensors: 'A comprehensive survey edited by W.Gopel, J.Hesse, J.N.Zemel, Vol.2 Chemical and Biochemical sensors, Part-I VCH Weinheim, 1991.

2. Sensors: A comprehensive survey edited by W.Gopel, J.Hesse, J.N.Zemel, Vol.3 Chemical and Biochemical sensors- Part-II, VCH Weinheim,1991.

3. 'Hand Book of transducers' By H.N.Norton; Prentice Hall, 1988.

4. Sensors:'A comprehensive survey edited by W.Gopel, J.Hesse, J.N.Zemel, Vol.1 Fundamanetal and General aspects, VCH, 1989.

5. Microsensors Principles & applications, by Julian W. Gardner, John Wiley, 1999.

6. Handbook of Analytical Instruments 3ed Edition, R. S. Khandpur, McGraw-Hill Education, 2015

INS 62.51 MICROPROCESSOR IN INSTRUMENTATION (Practical)

Max. Marks: 30(Exam)+20(Internal)

Practical based on the contents given above in Theory

INS 62.52 AUTOMATIC CONTROL SYSTEM (Practical)

Max. Marks: 30(Exam)+20(Internal)

Practical based on the contents given above in Theory.

INS 62.53 ANALYTICAL INSTRUMENTATION (Practicals)

Max. Marks: 30(Exam)+20(Internal)

Practical based on the topics given above in Theory.

INS 62.54 : MEDICAL INSTRUMENTS (Practical)

Max. Marks: 30(Exam)+20(Internal)

Practical related to the theory topics given above.

INS 62.55 : SIGNAL PROCESSING - II (Practical)

Max. Marks: 30(Exam)+20(Internal)

Practical related to the theory topics given above.

INS 62.56 Transducsers - II (Practical)

Max. Marks: 30(Exam)+20(Internal)

Practical related to the theory topics given above.

SEMESTER - III

COMPUTER AIDED DESIGN & COMPUTER AIDED MANUFACTURING INS 71.01:

Hours : 45

L	T	P
3	x	2

Note: Examiner will set 7 questions having equal marks. First compulsory question should cover whole syllabus. The rest of the paper should be divided into two parts (section-A and Section-B) having three questions each and the candidate is required to attempt at least two questions from each section.
All questions should carry equal marks; Time allowed : 3 Hours; Max. Marks: 75(Exam)+25(Internal)

SECTION-A

Unit-I(11 hours)
Hardware requirements for CAD designing such as computer, input/output devices - data gloves, mice, joystick, force ball, Biological input sensors, voice recognition systems etc. CRTs, storage CRTs, digital storage devices etc. Data representation, operating system. Eye coordination system. Introduction to CAD/CAM, Product design cycle, Automation and CAD/CAM.

Unit-II(11 hours)
Computer aided design system software, operating system, graphics system. The overlay system, graphics data base structure and handling, operating features, symbols, Macros, editing facility, data selection, graphics transformation and plotting. Transformation system, windowing and clipping, two and three dimensional transformation, Linear transformations, display files for three dimensional data, visuals of three dimensional data.

SECTION-B

Unit-III(11 hours)
Geometric modelling dimensions of models, types of models, construction of solid models. Draughting for mechanical systems, annotation, arrows and pointers, dimensioning, text, cross-hatching, draughting examples.

Unit-IV(12hours)
CAD for electronic circuits, fundamentals, design tables, general circuit analysis programme, circuit simulation, PC layout examples using SMARTWORK/similar software. Digital system checkout, levels of tests, field testing, production testing. Detailed flow, Input unit, output unit, memory unit, instruction register, computer cycle, programme counter and index register. Test methods, maintenance panel, computer testing and computer trouble shooting.

Essential Books:

1. CAD/CAM Computer Aided Design & Manufacturing M.P.Groover, E.W. Zimmers, Pearson Edu. India- 2008
2. Computer Aided Manufacturing; PN Rao, NK Tewari, T.K. Kundra; Tata Mc-Graw Hills-2008.
3. CAD/CAM Principles, Practice & Manufacturing Management; 2nd Edn; Chris, MC-Mohan & Jimmie Browne; Pearson Edu. Asia, 2000
4. Mastering Auto CAD-2014 and AutoCAD LT 2014: George Omura;BPB, Brian C. Benton John, Wiley & Sons, 2013

INSTRUMENTATION FOR SPECIAL APPLICATIONS INS 71.02 **Hours : 45**

L	T	P
3	x	2

Note: Examiner will set 7 questions having equal marks. First compulsory question should cover whole syllabus. The rest of the paper should be divided into two parts (section-A and Section-B) having three questions each and the candidate is required to attempt at least two questions from each section.
All questions should carry equal marks; Time allowed : 3 Hours; Max. Marks: 75(Exam)+25(Internal)

SECTION-A

Unit-I (12 hours)
Miniaturized analytical systems; Design concept, signal sensing, resultant output, analytical standards, calibration and applications of miniaturized analytical systems. Materials and techniques used in miniaturized analytical systems, Micro valves and Micro pumps.

Unit-II (11 hours)
Total analysis systems: hyphenated Techniques; design concept, principles and instrumentation of available state of the art hyphenated techniques**,** types of interfaces to couple chromatographic to spectroscopic techniques, resultant outputs and applications of hyphenated techniques

SECTION-B

Unit-III (11 hours)

Biosensing and chemical detectors, design concept of biosensor, type of biosensors, the bio recognition elements and the transducer of biosensors, biological elements and immobilisation methods of biological component of biosensors.

Unit-IV (11 hours)
Design concept, principle and instrumentation, for a perspective State-of-the-art instrumentation of one instrument each for the following areas:

Environmental Sciences
Life Sciences
Analytical Sciences

Essential Books:

1.Micro Total Analysis systems, Van den Berg, A., J.Michael RamSey 2001, Springer.
2.Micro System Technology in Chemistry and life Sciences, Desktop Editions in Chemistry, Manz, A., Becker H. (Eds.), Vol. 194. Springer 1999.
3.Biosensors: A Practical approach, Case A.E.G. (Ed.) Oxford IRL. Press, 1998.

Reference Books:

1. Chemical Sensors, Edmonds T.E., Chapman & Hall, New York, 1988
2. Analytical Chemistry, R. Kelliner, J. Mermet, J. M.Otto,H.M. Widmer (Eds.), Wiley, VCH, New York, 2000.

SELECTED TOPICS :INS 71.03: **Hours : 45**

L	T	P
3	x	2

Note: Examiner will set 7 questions having equal marks. First compulsory question should cover whole syllabus. The rest of the paper should be divided into two parts (section-A and Section-B) having three questions each and the candidate is required to attempt at least two questions from each section.
All questions should carry equal marks; Time allowed : 3 Hours; Max. Marks: 75(Exam)+25(Internal)

SECTION-A

Unit-I(11)

Shape Memory Alloys (NiTiNOL), Applications of shape memory Alloys: Properties of Shape Memory Alloys. SMA Hybrid composites.

Unit-II(11)

Electrorheological and Magnetorheological fluids Mechanism and properties and applications. Smart structures - Actuators piezoceramic based, electrostrictive (Lead - Magnesium - Niobate) PMN based actuators, Electroceramic composite actuators, polyvinylidene Fluoride (PVDF)actuators, Magnetostrictive actuators (Terfenol-D)

SECTION-B

Unit-III(11)

Molecular Electronics Devices -, Organic rectifiers, Molecular switching in Neuromal Membrane

Unit-IV(12)

Integrated, smart and intelligent sensors, principles of intelligent sensor, applications of intelligent sensors.

Essential Books:

1. Smart structure Analysis and Design, A.V. Srinivasan, D.Michael Mc-Farland Cambridge Press 2001.
2. Fiber Optics Smart Structures, Eric Udd Johan- Wiley 1995.
3. Molecular Electronic Devices, II F.L. Cartar; Ed. Marcel Dekker, New York, 1987.
4. Intelligent Sensors, Brignell J and White N; CRC Press, 2nd Revised Edn.1996.

Virtual Instrumentation INS71.04: **Hours : 45**

L	T	P
3	x	2

Note: Examiner will set 7 questions having equal marks. First compulsory question should cover whole syllabus. The rest of the paper should be divided into two parts (section-A and Section-B) having three questions each and the candidate is required to attempt at least two questions from each section.
All questions should carry equal marks; Time allowed : 3 Hours; Max. Marks: 75(Exam)+25(Internal)

SECTION-A

Unit-I (10 hours)
Introduction to Virtual Instrumentation, Historical Perspective, Advantages, Basic Representations, Conventional vs. Virtual instrumentation, System Hardware requirements for the Virtual Instrumentation set-up: Input devices like data gloves, mice, joystick etc. Output devices like various graphical displays & CRTs etc. Data acquisition cards and terminal blocks like SCXI- 1120, 1121,1125,1530,1540 SCXI-1327, 1520, 1315.

Unit-II(12 hours)
Introduction to LabVIEW, Front Panel, and Block diagram Pallets, Knowledge of various controls and indicators of front panel. Block diagrams-Vis & Express Vis, Nodes, Terminals, and Wires. Creating and using VIs, Sub-VIs, Editing and debugging tools.

SECTION-B

Unit-III(13 hours)
Details of LabVIEW Programming techniques- Structures, Arrays, Clusters, Charts and Graphs, Signal Processing examples.

Unit-IV(10 hours)
Components of Data acquisition, DAQ Hardware configuration using DAQ assistant for Input & output mode. Applications of VIs in various fields like Industrial applications, defense, Medical.

Books Suggested:
Essential Books:

1. Robert H. Bishop; Learning with LabVIEW; Pearson Education; 2015.
2. Sanjay Gupta & Joseph John; Virtual Instrumentation Using LabVIEW; Tata Mc-Graw Hills; 2nd , 2016.
3. LabVIEW; Advanced Programming Techniques; Bitter Rick, Taqui Mohiuddin, Matt Nawrock; 2nd Edn.; CRC Press,2009.

Reference Books:

1. Lab View Basic 1 course Manual, National Instruments (Hard Copy)2003.
2. Lab View Measurement Manual, National Instruments (Hard Copy)2003.
3. Lab View Users' Manual, National Instruments (Hard Copy)2003.
4. www.ni.com
5. www.natinst.com

INS 71.51 COMPUTER AIDED DESIGN AND COMPUTER AIDED

MANUFACTURING (Practical)

Max. Marks: 30(Exam)+20(Internal)

Practicals related to the topics given in above Theory.

INS 71.52: INSTRUMENTATION FOR SPECIAL APPLICATIONS (Practical)

Max. Marks: 30(Exam)+20(Internal)

Practical based on the topics given above in Theory.

INS 71.53 SELECTED TOPICS (Practical)

Max. Marks: 30(Exam)+20(Internal)

Practicals based on the contents given above in Theory.

INS 71.54 Virtual Instrumentation (Practical):

Max. Marks: 30(Exam)+20(Internal)

The practical based on the above mentioned theory.

MAJOR PROJECT: INS 71.55

L	T	P
x	x	20

Each student will be required to work on the major project approved by the department faculty. The project work will span over IIIrd and IVth semesters during which periodic progress reports will be monitored. At the end of the IIIrd semester, the project progress will be evaluated by the departmental faculty. At the end of IV semester, the student will submit the thesis based on his project research work conducted in the Department on the approved topic under the supervision of a faculty member of the Department. Students would be required to present one seminar on the thesis topic. These would be presented before the Department faculty and students of the Department. The evaluation will be done by a Board consisting of Supervisor, Chairman or his nominee and a member of Faculty to be nominated by Board of Studies out of a panel of three Examiners suggested by the supervisor.

SEMESTER – IV

MAJOR PROJECT & THESIS INS: 72.01

L	T	P
x	x	30

Each student will be required to work on the major project approved by department faculty that will span III and IV semesters during which periodic progress reports will be monitored. At the end of III semester, project progress will be evaluated by the departmental faculty.

At the end of IV semester, the student will submit the thesis based on his project work.

The student will conclude his project work and submit the thesis as detailed under INS 71.55 (Major Project). Evaluation of thesis work will be done by the external examiner.

No Numerical marks will be assigned to thesis work. It will be either accepted or rejected. However the quality of the work reported in the thesis can be graded in terms of marks/grades. The criteria for evaluation of thesis to award grades for thesis will be as under:-

S.No.	Grade	Condition
1.	A^+	Publication from Thesis in SCI indexed journal.
2.	A	Publication from Thesis in Scopus indexed journal.
3.	B^+	Publication from Thesis in proceedings of Conferences which is Scopus indexed.
4.	B	Presented Paper in International Conference.
5.	C^+	Presented Paper in National Conference.