SCHEME OF EXAMINATION M.TECH.(INSTRUMENTATION)

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

FIRST SEMESTER

SECOND SEMESTER

S.No	SUBJECT	SCHEDULE FOR TEACHING				THEORY MARKS			PRACTICAL MARKS			CREDITS
		L	T	P	TOTAL	Exam.	Sess.	Total	Exam	Sess.	Total	C
	Elective subjects :(Any two of the followings a-d)											

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FOURTH SEMESTER

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

SEMESTER I

Signal Processing-I, INS 61.01   Hours : 45

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,

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 PT

FOUNDATIONS OF MEASUREMENT INS 61.04   Hours : 45

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.

PROCESS DYNAMICS AND CONTROL INS 61.07:   Hours : 45

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 1st order & 2nd order system.

Unit-II(12 hours)
Process Ch

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/F1 12 Tr 7.92.010( )-9( )10(-9( )tPxamBT/F1 7.92 Tf1 0 0 1 486.67 592.9

SEMESTER-II

MICROPROCESSORS IN INSTRUMENTATION INS 62.01:   **Hours : 45**
                                                                L   T   P

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

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-

ANALYTICAL INSTRUMENTATION INS 62.03.   Hours : 45

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-

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

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

<u>INS 62.51 MICROPROCESSOR IN INSTRUMENTATION (Practical)</u>

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

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

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.

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

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.