Ch. Charan Singh University Campus Meerut

Study and Evaluation Scheme

B. Tech in Electronics and Instrumentation

,[Effective from the session 2017-18]

B. Tech

(Electronics and Instrumentation)

PROGRAMME OUTCOME

The objective of this course is to familiarize the prospective engineers with techniques in sequences, multivariate integration, ordinary and partial differential equations and complex variables. It aims to equip the students to deal with advanced level of mathematics and applications that would be essential for their disciplines.

The students will learn:

- The effective mathematical tools for the solutions of differential equations that model physical processes
- To apply integral calculus in various field of engineering. Apart from some other applications students will have a basic understanding of Beta and Gamma functions.
- The tool of Fourier series for learning advanced Engineering Mathematics.
- The tools of differentiation of functions of complex variables that are used in varioustechniques dealing with engineering problems

1. facilitate software based learning to provide the required English Language proficiencyto students.
2. To acquaint students with specific dimensions of communication skills i.e. Reading,Writing, Listening, Thinking and Speaking.
3. To train students to use the correct and error-free writing by being well versed in rules ofEnglish grammar.
4. To cultivate relevant technical style of communication and presentation at their work placeand also for academic uses.
5. To enable students to apply it for practical and oral presentation purposes by being honed upin presentation skills and voice-dynamics.
6. To understand the basic concepts of IoT, followed by major components, its layer architecture and how IoT is impacting the Industry in the various forms along with major applications.
7. To make students aware about basic concepts of cloud computing, its benefits and different applications along with insights of major service providers.
8. To understand the basic concepts of Blockchain and its underlying technologies with its implementation as cryptocurrencies.
9. To understand the concept of Additive Manufacturing, its applications in various fields and the basic concepts of drones, their assembly and government regulations involved.
10. To introduce students to the upcoming technology and to develop the required skills for practical applications.

B. Tech

(Electronics and Instrumentation)
Program specific out come

After successful completion of 160 credits, a student shall be eligible to get Under Graduate degree in Engineering. A student will be eligible to get Under Graduate degree with Honours only, if he/she completes additional university recommended courses only (Equivalent to 20 credits; NPTEL Courses of 4 Weeks, 8 Weeks and 12 Weeks shall be of 2, 3 and 4 Credits respectively) through MOOCs. For registration to MOOCs Courses, the students shall follow NPTEL Site http://nptel.ac.in/ as per the NPTEL policy and norms. The students can register for these courses through NPTEL directly as per the course offering in Odd/Even Semesters at NPTEL. These NPTEL courses (recommended by the University) may be cleared during the B. Tech degree program (not necessary one course in each semester). After successful completion of these MooCs courses the students, shall, provide their successful completion NPTEL status/certificates to the University (COE) through their college of study only. The student shall be awarded Hons. Degree (on successful completion of MOOCS based 20 credit) only if he/she secures 7.50 or above CGPA and passed each subject of that Degree Programme in single attempt without any grace marks.

YEAR 4th, SEMESTER-VII

S. No.	SUBJECT	PERIODS			Evaluation Scheme				Subject Total	Credit
					SESSIONAL EXAM.			ESE		
		L	T	P	CT	TA	Total			
1.	Open Elective-I**	3	1	0	30	20	50	100	150	4
2.	Departmental Elective-III	3	1	0	30	20	50	100	150	4
3.	Control System II	3	1	0	30	20	50	100	150	4
4.	Telemetry Principles	3	1	0	30	20	50	100	150	4
5.	Computerized Process Control	3	1	0	30	20	50	100	150	4
6.	*Human Values & Professional Ethics	2	0	0	15	10	25	50	75	-
7.	Control System Lab - II	0	0	2	-	20	20	30	50	1
8.	Telemetry Lab	0	0	3	-	20	20	30	50	2
9.	Industrial Training Viva-Voce	0	0	2	-	50	50	-	50	1
10.	Project	0	0	2	-	50	50	-	50	1
11.	General Proficiency	-	-	-	-	-	50	-	50	1
	Total	**15**	**5**	**9**	**150**	**240**	**440**	**560**	**1000**	**26**

**** Open Electives-I**

1. Entrepreneurship Development
2. Quality Management
3. Operation Research
4. Introduction to Biotechnology

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YEAR 4th, SEMESTER-VIII

S. No.	SUBJECT	PERIODS			Evaluation Scheme				Subject Total	Credit
					SESSIONAL EXAM.			ESE		
		L	T	P	CT	TA	Total			
1.	Open Elective-II**	3	1	0	30	20	50	100	150	4
2.	Departmental Elective-IV	3	1	0	30	20	50	100	150	4
3.	Optimal Control Systems	3	1	0	30	20	50	100	150	4
4.	Biomedical Instrumentation	3	1	0	30	20	50	100	150	4
5.	*Human Values & Professional Ethics	2	0	0	15	10	25	50	75	-
6.	Project	0	0	12	-	100	100	250	350	8
7.	General Proficiency	-	-	-	-	-	50	-	50	1
	Total	**12**	**4**	**12**	**120**	**180**	**350**	**650**	**1000**	**24**

**** Open Electives-II**

1. Non Conventional Energy Resources
2. Non Linear Dynamic Systems
3. Product Development
4. Automation and Robotics

LIST OF ELECTIVES:

Elective – III Departmental Elective III

1. Optical Instrumentation
2. Power Plant Instrumentation
3. Voice Over IP
4. Filter Design
5. Applied Fuzzy Electronic Systems

Elective – IV Departmental Elective IV

1. Biomedical Signal Processing
2. Analytical Instrumentation
3. Micro and Smart Systems
4. Digital System Design using VHDL
5. Advance Display Technologies & Systems

SYLLABUS

CONTROL SYSTEM II		3 1 0
Unit	Topics	Lectures
I	Sampling and Signal Conversion: Sampled-Data Control Systems, Digital to Analog Conversion, Sample and Hold operations, Sample and Hold Devices, frequency–Domain Characteristic of Zero order Hold. **The Z-Transform:** Linear Difference equations, The Pulse Response, The Definition of the Z-transform, Relationship between the Laplace transform and the Z-transform, Relationship between S-plane and the Z-plane, The constant-Damping Loci, The constant- Frequency Loci, The constant-Damping Ratio Loci, The Inverse Z-Transform, Theorems of the Z-transform, Limitations of the Z-transform, Application of the Z-transform ,Stability Analysis, Systems with Dead-Time.	4 6
II	Transfer Functions, Block Diagrams, and Signal flow Graphs The Pulse Transfer Function and The Z-Transfer Function, The Pulse Transfer Function of the Zero-Order Hold and the Relation Between G(s) and G(z), Closed loop systems, The Sampled Signal flow Graph, The Modified Z-transfer function, Multirate Discrete Data System. Transform Design of Digital Controls Design of position Servo Design Specifications, Design on the W- plane, Design of the W-plane, the Digital PID Controllers.	6 4
III	State Space Analysis of Sampled Data Systems Discrete time state equations. Similarity Transformations, The Cayley-Hamilton Theorem, Realization of Pulse Transfer function, State Equations for sampled Data Systems, Concepts of Controllability and Observability, Liapunov Stability Analysis Systems with Dead time.	7
IV	Design of digital controls using State Space analysis Formulation of the optimal control Problem Optimal State Regulator, Use of State Regulator results, Eigen value Assignment by State feedback, State observers Stochastic optimal State Estimation.	6
V	Mechanization of Control algorithms Using Micro Processors General Description of Microcontrollers, Digital quantization, Microprocessor based Position Control System.	7

Text Book:

1. M. Gopal, “Digital Control Engineering”, New Age International Publishers.
2. B.C. Kuo ,“Digital Control Systems”, Oxford University Press.

Course Outcomes: At the end of this course students will demonstrate the ability to:

1. Classify the Instrumentation and Measurement system and various measurementerrors.
2. Analyze and design voltmeter circuits, AC electronic voltmeter, digital frequencymeter and current measurement with electronic instruments.
3. Evaluate various resistance and impedance measuring methods using Bridges andQ-meter.
4. Analyze fundamental operation of CRO and some special type of

oscilloscopes likeDSO, Sampling oscilloscope.

5. Demonstrate calibration method to calibrate various instruments and classifytransducers like for force, pressure, motion, temperature measurement etc.

3.

NTELEMETRY PRINCIPLES		3 1 0
Unit	Topics	Lectures
I	Introduction to Telemetry Principles: Basic System, Classification, Non electrical telemetry systems, Voltage and current Telemetry systems, Frequency Telemetering, Power line carrier Communication.	4
II	Multiplexed System: Frequency Division Multiplex System- FDM, IRIG Standards, FM circuits, Phase Modulation Circuits, Receiving end, Phase Locked Local Loop, Mixers. Time Division Multiplexed System – TDM/PAM system, PAM/ PM systems, TDM- PCM System, Digital Multiplexer, PCM Reception, Coding for varying level, DPCM, Standards.	10
III	Modems: Modems Introduction, QAM, modem protocol.	4
IV	Transmitter and Receiver: Transmitters, Transmission Techniques, Inter stage Coupling, Receiver Antennas: The Ideal structure, dipoles, arrays, current distribution and design consideration, Microwave Antennas.	10
V	Filters: Polynomial, Filters, Active RC Filters, Universal Filter Circuits, Switched Capacitor Filters, Digital Filters Basics of Satellite and Fiber Optic Telemetry Data Acquisition Systems (DAS), µP based DAS, Remote Control	2 8 2

Text Book:

1. D Patranabis, Telemetry Principle; TMH Ed 1 1999.

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1. Classify the Instrumentation and Measurement system and various measurementerrors.
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COMPUTERISED PROCESS CONTROL		3 1 0
Unit	Topics	Lectures
I	Basics of Computer-Aided Process Control: Role of computers in process control, Elements of a computer aided Process control System, Classification of a Computer –Aided Process Control System Computer-Aided Process–control Architecture: Centralized Control Systems, Distributed control Systems, Hierarchical Computer control Systems. Economics of Computer-Aided Process control. Benefits of using Computers in a Process control. Process related Interfaces: Analog Interfaces, Digital Interfaces, Pulse Interfaces, Standard Interfaces	8
II	Industrial communication System: Communication Networking, Industrial communication Systems, Data Transfer Techniques, Computer Aided Process control software, Types of Computer control Process Software, Real Time Operating System.	8
III	Process Modelling for computerized Process control: Process model, Physical model, Control Model, Process modeling. Modelling Procedure: Goals Definition, Information Preparation, Model Formulation, Solution Finding, Results Analysis, Model Validation	8
IV	Advanced Strategies For Computerised Process control: Cascade Control, Predictive control, Adaptive Control, Inferential control, Intelligent Control, Statistical control.	8
V	Examples of Computerized Process Control: Electric Oven Temperature Control, Reheat Furnace Temperature control, Thickness and Flatness control System for metal Rolling, Computer-Aided control of Electric Power Generation Plant.	8

Text Book:

1. S. K. Singh, “Computer Aided Process control”, PHI.

Reference Books:

2. C. L. Smith, “Digital computer Process Control”, Ident Educational Publishers.
3. C. D. Johnson, “Process Control Instrumentation Technology”, PHI.
4. Krishan Kant, “Computer Based Industrial Control”
5. Pradeep B. Deshpande & Raymond H. Ash, “Element of Computer Process Control with Advance Control Applications”, Instrument Society of America, 1981.
6. C. M. Houpis & G. B. Lamond, “Digital Control System Theory”, Tata McGraw Hill.

Course Outcomes: At the end of this course students will demonstrate the ability to:

1. Classify the Instrumentation and Measurement system and various measurementerrors.
2. Analyze and design voltmeter circuits, AC electronic voltmeter, digital frequencymeter and current measurement with electronic instruments.
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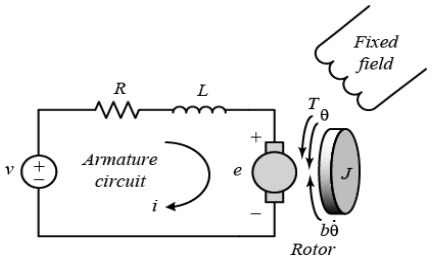
CONTROL SYSTEM LAB II

1. Discrete Time LTI model
2. Discrete pole locations & transients response
   Small damping ($\varepsilon = 0.1\ W_n = 4\pi/5T$) Medium damping ($\varepsilon = 0.4\ W_n = 11\ \pi\ /5T$)
   Large damping ($\varepsilon = 0.8\ W_n = \pi\ /4T$)
3. Digital DC motor Speed control with PID controller
4. Designing Lead & Lag Compensators
5. Kalman Filter design
6. State space design for the Inverted pendulum
7. Consider modelling of DC Motor shown in figure



The motor **Physical Parameters** are

(J)	Moment of inertia of the rotor	0.01 kg.m^2
(b)	Motor viscous friction constant	0.1 N.m.s
(Ke)	Electromotive force constant	0.01 V/rad/sec
(Kt)	Motor torque constant	0.01 N.m/Amp
(R)	Electric resistance	1 Ohm
(L)	Electric inductance	0.5 H

and the **design requirements** are

1. Settling time less than 2 seconds
2. Overshoot less than 5%
3. Steady-state error less than 1%

Write a Matlab Program to find

- **a** LTI characteristics
- **b** PID control response

8. Write a program to check for controllability and observability for the second order system
9. Write a MATLAB program to compute and display the poles and zeros, to compute and display the factored form, and to generate the pole-zero plot of a z-transform that is a ratio of two polynomials in z^{-1} . Using this program, Find and plot the poles and zeroes of G(z) .Also Find the radius of the resulting poles.
10. To design feedback and feedforward compensators to regulate the temperature of a chemical reactor through a heat exchanger.

TELEMETRY LAB

Minimum of 10 experiments to be performed

1. Measurement of Temperature Using RTD/ Thermister and amplification to an appropriate level suitable for Tele transmission.
2. Sampling through a S/H Circuit and reconstruction of the sampled signal. Observe the effect of sampling rate & the width of the sampling pulses.
3. Realization of PCM signal using ADC and reconstruction using DAC using 4-bit/8 bit systems. Observe the Quantization noise in each case.
4. Fabricate and test a PRBS Generator.
5. Realization of data in different formats such as NRZ-L, NRZ-M and NRZ-S.
6. Clock recovery circuit from NRZ-L data using PLL.
7. Manchester coding & decoding (Biphase L) of NRZ-L Data.
8. Coding and decoding NRZ-L into URL-L (Unipolar return to Zero coding).
9. ASK – Modulation and Detection
10. FSK – Modulation and Detection
11. PSK - Modulation and Detection.
12. Error introduction, Error Detection & Correction using Hamming Code.
13. Amplitude modulation and Detection of signal obtained from experiment no.1.

Elective – III

OPTICAL INSTRUMENTATION		3 1 0
Unit	Topics	Lectures
I	Light Sourcing, Transmitting and Receiving Concept of Light, Classification of different phenomenon based on theories of light, Basic light sources and its Characterization, Polarization , Coherent and Incoherent sources, Grating theory ,Application of diffraction grating, Electro-optic effect, Acousto-optic effect and Magneto-optic effect.	8
II	Opto –Electronic devices and Optical Components Photo diode, PIN, Photo-Conductors, Solar cells, ,Phototransistors, Materials used to fabricate LEDs and Lasers Design of LED for Optical communication, Response times of LEDs ,LED drive circuitry, Lasers Classification :Ruby lasers, Neodymium Lasers, He- Ne Lasers, CO2 Lasers, Dye Lasers, Semiconductors Lasers, Lasers Applications.	8
III	Interferometry Interference effect, Radio-metry, types of interference phenomenon and its Application, Michelson's Interferometer and its application Fabry-perot interferometer, Refractometer, Rayleigh's interferometers, Spectrographs and Monochromators, Spectrophotometers, Calorimeters, Medical Optical Instruments	8
IV	Holography: Principle of Holography, On-axis and Off axis Holography, Application of Holography, Optical data storage. Optical Fiber Sensors: Active and passive optical fiber sensor, Intensity modulated, displacement type sensors, Multimode active optical fiber sensor (Micro bend sensor)Single Mode fiber sensor-Phase Modulates and polarization sensors	8
V	Fiber optic fundamentals and Measurements: Fundamental of Fibers, Fiber Optic Communication system, Optical Time domain Reflectometer (OTDR), Time domaindispersion measurement, Frequency Domain dispersion measurement, Laser Doppler velocimeter,	8

Text Book:

1. J. Wilson & J. F. B. Hawkes, "Optoelectronics: An Introduction" PHI/ Pearson
2. Rajpal S. Sirohi "Wave Optics and its Application", Hyderabad, Orient longman Ltd.
3. A. Yariv, "Optical Electronics", C. B. S. Collage Publishing, New York, 1985.

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POWER PLANT INSTRUMENTATION		3 1 0
Unit	Topics	Lectures
I	Energy sources, their availability, worldwide energy production, energy scenario of India. Introduction to Power generation- Classification: Renewable and non-renewable energy generation resources. Renewable: small hydro; modern biomass; wind power; solar; geothermal and bio-fuels. Non renewable: fossil fuels (coal, oil and natural gas) and nuclear power. Boiler: Types of boilers, boiler safety standards. Boiler instrumentation, control and optimization, combustion control, air to fuel ratio control, three element drum level control, steam temperature and pressure control, boiler interlocks, sequence event recorder, data acquisition systems.	8
II	Thermal Power Plant- Method of power generation, layout and energy conversion process, Types of Turbines & control, Types of Generators, condensers. Types of pumps and Fans, variable speed pumps and Fans, Material handling system, study of all loops-water, steam, fuel etc.	8
III	Hydroelectric Power Plant- Site selection, Hydrology, Estimation electric power to be developed, classification of Hydropower plants, Types of Turbines for hydroelectric power plant, pumped storage plants, storage reservoir plants.	8
IV	Wind Energy: Power in wind, Conversion of wind power, Aerodynamics of wind turbine, types of wind turbine, and modes of operation, power control of wind turbines, Betz limit, Pitch & Yaw control, wind mill, wind pumps, wind farms, different generator protections, data recording, trend analysis, troubleshooting & safety. Solar Energy: solar resource, solar energy conversion systems: Solar PV technology: Block diagram of PV system, advantages and limitations. Solar thermal energy system: Principle, solar collector and its types, solar concentrator and its types, safety.	8
V	Nuclear Power Plant: Nuclear power generation, control station and reactor control. **Comparison of various plants:** Comparison of thermal power plant, hydro electric power plant, wind, solar, nuclear power plant on the basis of: Performance, efficiency, site selection, Economics-capital and running, safety standards, pollution, effluent management and handling. Power plant safety, Pollution monitoring, control Sound, Air, smoke, dust, study of Electrostatic precipitator.	8

Text Books:

1. G.F. Gilman, “Boiler Control Systems Engineering”, ISA Publication.
2. P. K. Nag, “Power plant engineering”, McGraw Hill.

Reference Books:

1. B. H. Khan, "Non-conventional energy resources", McGraw Hill.
2. Chetan Singh Solanki, "Renewable energy Technology", Prentice Hall Publication.
3. S. P. Sukhatme, "Solar Energy", Tata McGraw Hill.
4. G. D. Rai, "Nonconventional energy sources", Khanna Publication.

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VOICE OVER IP		3 1 0
Unit	Topic	Lectures
I	**Introduction:** Carrier-Grade, VoIP, VoIP Challenges, Overview of the IP Protocol Suite, The Internet Protocol, IP Version 6, IP Multicast, The Transmission Control Protocol, The User Datagram Protocol, The Stream Control Transmission Protocol, The Real-Time Transport Protocol, The RTP Control Protocol, Security and Performance Optimization **Speech-Coding Techniques** A Little about Speech, Audio, and Music, Voice Sampling, Voice Quality, Types of Speech Coders, Waveform Coders, Analysis-by-Synthesis Codecs, G.722–Wideband Audio	8
II	**Signaling Protocols:** H.323: Multimedia Conferencing over IP The H.323 Architecture, RAS Signaling, Call Signaling, Call Scenarios, H.245 Control Signaling, Conference Calls, Securing an H.323 Network. **The Session Initiation Protocol** The SIP Architecture, Overview of SIP Messaging Syntax, Examples of SIP Message Sequences, Redirect and Proxy Servers, The Session Description Protocol, Usage of SDP with SIP, SIP Extensions and Enhancements, Usage of SIP for Features and Services, Interworking	8
III	**Distributed Gateways and the Softswitch Architecture** Separation of Media and Call Control, Softswitch Architecture, Protocol Requirements for Controlling Media Gateways, Protocols for Controlling Media Gateways, MGCP, MEGACOP/H.248.1.	8
IV	**VoIP and SS7** The SS7 Protocol Suite, SS7 Network Architecture, ISUP, Performance Requirements for SS7, SIGTRAN, Interworking SS7 and VoIP Architectures	8
V	**Quality of Service** The Need for QoS, Overview of QoS Solutions, The Resource Reservation Protocol, DiffServ, Multiprotocol Label Switching, Combining QoS Solutions	8

Text Books:

1. Richard Swale, Daniel Collins," Carrier-Grade VoIP", McGraw-Hill Education 3rd Edition,2014.
2. Olivier Hersent, Jean Pierre Petit, David Gurle, "IP Telephony – Deploying Voice Over-IP Protocols", John Wiley & Sons Ltd, 2005

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FILTER DESIGN		3 0 1
Unit	Topic	Lectures
I	Introduction: Fundamentals, Types of filters and descriptive terminology, why we use Analog Filters, Circuit elements and scaling, Circuit simulation and modelling. Operational amplifiers: Opamp models, Opamp slew rate, Operational amplifiers with resistive feedback: Noninverting and Inverting, Analyzing Opamp circuits, Block diagrams and feedback, The Voltage follower, Addition and subtraction, Application of Opamp resistor circuits.	8
II	First order filter: Bilinear transfer functions and frequency response – Bilinear transfer function and its parts, realization of passive elements, Bode plots, Active realization, The effect of A(s), cascade design.	8

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III	Second order low pass and band pass filters: Design parameters, Second order circuit, frequency response of low pass and band pass circuits, Integrators and others biquads.	8
IV	Second order filters with arbitrary transmission zeros: By using summing, By voltage feed forward, cascade design revisited. Low pass filters with maximally flat magnitude: the ideal low pass filter, Butterworth response, Butterworth pole locations, low pass filter specifications, arbitrary transmission zeros.	8
V	Low pass filter with equal ripple (Chebyshev) magnitude response: The chebyshev polynomial ,The chebyshev magnitude response, Location of chebyshev poles, Comparison of maximally flat & equal–ripple responses, Chebyshev filter design Inverse chebyshev and cauer filters: Inverse chebyshev response, From specifications to pole and zero locations, Cauer magnitude response, Chebyshev rational functions, Cauer filter design.	8

Text Book:

1. Rolf. Schaumann, Haiqiao Xiao, Mac. E. Van Valkenburg, “Analog Filter Design”, 2nd Indian Edition, Oxford University Press.

Reference Books:

1. J. Michael Jacob ,”Applications and Design with Analog Integrated Circuits”, Second edition, PHI learning.
2. T. Deliyannis, Yichuang Sun, J.K. Fidler, “Continuous-Time Active Filter Design”, CRC Press.

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APPLIED FUZZY ELECTRONIC SYSTEMS		3 1 0
Unit	Topic	Lectures

I	History of Fuzzy Logic, Fuzzy Sets, Possibility Distributions, Fuzzy Rules, Fuzzy Sets, Operations of Fuzzy Sets, Properties of Fuzzy Sets, Geometric Interpretations of Fuzzy Sets, Possibility Theory, Fuzzy Relations and their Compositions, Fuzzy Graphs, Fuzzy Numbers, Functions with Fuzzy Arguments, Arithmetic Operations of Fuzzy Numbers.	8
II	Fuzzy Rules: Fuzzy Mapping Rule, Fuzzy Implication Rule, Fuzzy Rule Based Models for Function Approximations, Theoretical Foundation of Fuzzy Mapping Rules, Types of Fuzzy Rule Based Models: Mamdani Model, TSK Model, Standard Additive Model, Fuzzy Implications and Approximate Reasoning: Propositional Logic, First Order Predicate Calculus, Fuzzy Implications,	8

	Approximate Reasoning, Criteria and Family of Fuzzy Implications, Possibility vs. Probability, Probability of Fuzzy Event, Probabilistic Interpretations of Fuzzy Sets, Fuzzy Measure.	
III	Uncertainty in information; Classical Sets, Fuzzy Sets and their properties; Cardinality of Classical Relations and their properties, The a- Level Set, Cardinality of Fuzzy Relations and their properties; Composition; Tolerance and Equivalence relationship; Membership Functions; Fuzzification and Defuzzification process; Fuzzy to Crisp Conversions; Lambda cuts; Extension Principle, Crisp functions and its mapping, Fuzzy functions and its mapping; Fuzzy Numbers; Internal Analysis in Arithmetic.	8
IV	Approximate method of Extension, Vertex Method, DSW Algorithm, and Restricted DSW Algorithm and their comparison, Classical Predicate Logic; Fuzzy Logic; Approximate Reasoning; Fuzzy Tautologies, Contradictions, Equivalence, and Logical Proof; Fuzzy Rule Based Systems, Models of Fuzzy AND, OR, and Inverter; Fuzzy Algebra; Truth Tables; Fuzzy Functions; Concept of Fuzzy Logic Circuits; Fuzzy Flip- Flop; Fuzzy Logic Circuits in Current Mode, Furry Numbers.	8
V	Fuzzy Logic in Control Engineering: Fundamental Issues in Control Engineering, Control Design Process, Semiformal Aspects of Design Process, Mamdani Architecture of Fuzzy Control, The Sugeno-Takagi Architecture. Fuzzy Logic in Hierarchical Control Architecture, Historical Overview and Reflections on Mamdani`s Approach, Analysis of Fuzzy Control System via Lyapunov`s Direct Method, Linguistic Approach to the analysis of Fuzzy Control System, Parameter Plane Theory of Stability, Takagi-Sugeno-Kang Model Of Stability Analysis.	8

Text Book:

1. John Yen, Reza Langari, “Fuzzy Logic: Intellegent Control and Information”, Pearson Publication.
2. Ahmad M. Ibrahim, “Introduction to Applied Fuzzy Electronics”, Prentice Hall Publication.
3. Ahmad M. Ibrahim, “Fuzzy Logic for Embedded Systems Applications”, Newnes Publications.
4. Witold Pedrycz, Fernando Gomide, “Fuzzy Systems Engineering: Toward Human-Centric Computing”, John Wiley Publications.

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measurement etc.

OPTIMAL CONTROL SYSTEMS		3 1 0
Unit	Topic	Lectures
I	General Mathematical Procedures: Formulation of the optimal control Problem, Calculus of variations, Minimum principle, Dynamic Programming, Numerical Solution of Two-point Boundary value problem.	8
II	Optimal Feedback Control: Discrete-Time linear State regulator, Continuous-Time Linear state Regulator results of solve other linear problems, Suboptimal Linear regulators, Minimum-time Control of Linear Time-Invariant System.	8
III	Stochastic Optimal Linear Estimation and Control Stochastic processes and linear systems, Optimal Estimation for Linear Discrete time Systems Stochastic Optimal Linear Regulator,	8
IV	Microprocessor and DSP control Basic computer Architecture, Microprocessor Control of Control System, Single Board Controllers with Custom Designed Chips, Digital Signal Processors,	8
V	Effect of finite World Length and Quantization on Controllability and Closed Loop –Pole Placement, Effects of Quantization, and Time Delays in Microprocessor Based control systems.	8

Text Books:

1. M. Gopal, "Modern Control Engineering", New Age International Publishers.
2. B.C. Kuo, "Digital Control Systems", Oxford University Press

Reference Book:

1. Brain D.O. Anderson, John B. Moore, "Optimal control Linear Quadratic Methods", Prentice Hall of India Private Limited

Course Outcomes: At the end of this course students will demonstrate the ability to:

1. Classify the Instrumentation and Measurement system and various measurementerrors.
2. Analyze and design voltmeter circuits, AC electronic voltmeter, digital frequencymeter and current measurement with electronic instruments.
3. Evaluate various resistance and impedance measuring methods using Bridges andQ-meter.
4. Analyze fundamental operation of CRO and some special type of oscilloscopes likeDSO, Sampling oscilloscope.
5. Demonstrate calibration method to calibrate various instruments and classifytransducers like for force, pressure, motion, temperature measurement etc.

BIOMEDICAL INSTRUMENTATION		3 1 0
Unit	Topic	Lectures
I	Introduction: Specifications of bio-medical instrumentation system, Man-Instrumentation system Components, Problems encountered in measuring a living system. Basics of Anatomy and Physiology of the body. Bioelectric potentials: Resting and action potentials, propagation of action potential, The Physiological potentials – ECG, EEG, EMG, ERG, EOG and Evoked responses. Electrodes and Transducers: Electrode theory, Biopotential Electrodes – Surface electrodes, Needle electrodes, Microelectrodes, Biomedical Transducer.	8
II	Cardiovascular Measurements: Electrocardiography – ECG amplifiers, Electrodes and Leads, ECG –Single channel, Three channel, Vector Cardiographs, ECG System for Stresses testing, Holter recording, Blood pressure measurement, Heart sound measurement. Pacemakers and Defibrillators. Patient Care & Monitoring: Elements of intensive care monitoring, displays, diagnosis, Calibration & Reparability of patient monitoring equipment.	8
III	Respiratory system Measurements: Physiology of Respiratory system. Measurement of breathing mechanism – Spirometer. Respiratory Therapy equipments: Inhalators, Ventilators & Respirators, Humidifiers, and Nebulizers & Aspirators. Nervous System Measurements: Physiology of nervous system, Neuronal communication, Neuronal firing measurements.	8
IV	Ophthalmology Instruments: Electroretinogram, Electro - oculogram, Ophthalmoscope, Tonometer for eye pressure measurement. Diagnostic techniques: Ultrasonic diagnosis, Eco - cardiography, Eco-encephalography, Ophthalmic scans, X-ray & Radio-isotope diagnosis and therapy, CAT-Scan, Emission computerized tomography, MRI.	8
V	Bio-telemetry: The components of a Bio-telemetry system, Implantable units, Telemetry for ECG measurements during exercise, for Emergency patient monitoring. Prosthetic Devices and Therapies: Hearing Aides, Myoelectric Arm, Dia-thermy, Laser applications in medicine.	8

Text Books:

1. R. S. Khandpur, “Biomedical Instrumentation”, TMH
2. S. K. Venkata Ram, “Bio-Medical Electronics &Instrumentation (Revised)”, Galgotia.
3. J. G. Webster (editor), “Medical Instrumentation Application & Design”, 3rd Ed

WILEY, India

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4. Analyze fundamental operation of CRO and some special type of oscilloscopes likeDSO, Sampling oscilloscope.
5. Demonstrate calibration method to calibrate various instruments and classifytransducers like for force, pressure, motion, temperature measurement etc.

Reference Book:

1. Cromwell, “Biomedical Instrumentation and Measurements” PHI
2. J. G. Webster, “Bio- Instrumentation”, Wiley
3. S. Ananthi, “A Text Book of Medical Instruments”, New Age International
4. Carr & Brown, “Introduction to Biomedical Equipment Technology”, Pearson
5. Pandey & Kumar, “Biomedical Electronics and Instrumentation”, Kataria

Elective – IV

BIOMEDICAL SIGNAL PROCESSING		3 1 0
Unit	Topic	Lectures
I	Introduction to Bio-Medical Signals: Classification, Acquisition and Difficulties during Acquisition. Basics of Electrocardiography, Electroencephalography, Electromyography & electro-retinography Role of Computers in the Analysis, Processing, Monitoring & Control and image reconstruction in bio-medical field.	8
II	ECG: Measurement of Amplitude and Time Intervals, QRS Detection (Different Methods), ST Segment Analysis, Removal of Baseline Wander And Power line Interferences, Arrhythmia Analysis, Portable Arrhythmia Monitors.	8
III	Data Reduction: Turning Point algorithm, AZTEC Algorithm, Fan Algorithm, Huffman and Modified Huffman Coding, Run Length Coding.	8
IV	EEG: Neurological Signal Processing, EEG characteristic, linear prediction theory, Sleep EEG, Dynamics of Sleep/Wake transition. Study of pattern of brain waves, Epilepsy-Transition, detection and Estimation. EEG Analysis By Spectral Estimation: The Bt Method, Periodogram, Maximum Entropy Method & AR Method, Moving Average Method. The ARMA Methods, Maximum Likelihood Method.	8
V	EP Estimation: by Signal Averaging, Adaptive Filtering:- General Structures of Adaptive filters, LMS Adaptive Filter, Adaptive Noise Cancelling, Wavelet Detection:- Introduction, Detection By Structural features, Matched Filtering, Adaptive Wavelet Detection, Detection of Overlapping Wavelets.	8

Text Books:

1. Willis J. Tomkin, “Biomedical Digital Signal Processing”, PHI.
2. D. C. Reddy, “Biomedical Signal Processing”, McGraw Hill
3. Crommwell,Weibel and Pfeifer, “Biomedical Instrumentation and Measurement”, PHI

Reference Books:

1. Arnon Cohen, “Biomedical Signal Processing (volume-I)”, Licrc Press\
2. Rangaraj M. Rangayyan, “Biomedical Signal Analysis A Case Study Approach”, John Wiley and Sons Inc.\
3. John G. Webster, “Medical instrumentation Application and Design”, John Wiley & Sons Inc.

Course Outcomes: At the end of this course students will demonstrate the ability to:

1. Classify the Instrumentation and Measurement system and various

measurementerrors.

2. Analyze and design voltmeter circuits, AC electronic voltmeter, digital frequencymeter and current measurement with electronic instruments.
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ANALYTICAL INSTRUMENTATION		3 1 0
Unit	Topic	Lectures
I	UV – Visible Spectroscopy: Introduction, Electromagnetic Radiation, Laws relating to absorption radiation, Absorption Instruments, Ultraviolet and visible absorption spectroscopy, Calorimeters, Double Beam spectrophotometer (Optical Diagram & Block Diagram) Microprocessor based Spectrophotometer (Block Diagram)	8
II	Infrared Spectroscopy, Basic Components of IR Spectrophotometers, Type of Infrared Spectrophotometers, Sample Handling Techniques.	8
III	Flame photometers: principle, constructional details of flame photometers, types of flame photometers, types of flame photometers, clinical flame photometers, accessories for flame photometer, expression for concentration, interferences in flame photometry, procedure for determinations. Atomic Absorption Spectrometers: Atomic Absorption Spectroscopy, Atomic Absorption Instrumentation, Sources of interferences, meter scale.	8
IV	Mass Spectrometers: Basic Mass Spectrometer, Principle of operation, Type of Mass Spectrometers, components of Mass Spectrometers, inductively coupled plasma-mass spectrometer, trapped ion analyzers, ion cyclotron resonance (ICR) mass spectrometer, quadruple ion trap mass spectrometer, applications of mass spectrometry, gas chromatograph-mass spectrometer, liquid chromatograph-mass spectrometer, tandem mass spectrometry (MS/MS).	8
V	Nuclear Magnetic Resonance (NMR) Spectroscopy, Principle of NMR, types of NMR spectrometers, constructional details of NMR spectrometer, variation T-60A NMR spectrometer, sensitivity enhancement for analytical NMR-spectroscopy, Fourier transform NMR spectroscopy.	8

Text Books:

1. R. S. Kandpur, "Handbook Of Analytical Instruments", TMH 2nd Edition,
2. Willard, Merritt, Dean and Settle, "Instrumental Methods of Analysis", 7th Edition, CBS Publishers.

Course Outcomes: At the end of this course students will demonstrate the ability to:

1. Classify the Instrumentation and Measurement system and various measurementerrors.
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oscilloscopes likeDSO, Sampling oscilloscope.

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MICRO AND SMART SYSTEMS		3 1 0
Unit	Topic	Lectures
I	Introduction, Why miniaturization?, Microsystems versus MEMS, Why micro fabrication?, smart materials, structures and systems, integrated Microsystems, applications of smart materials and Microsystems,.	8
II	Micro sensors, actuators, systems and smart materials: Silicon capacitive accelerometer, piezoresistive pressure sensor, conductometric gas sensor, an electrostatic combo-drive, a magnetic microrelay, portable blood analyzer, piezoelectric inkjet print head, micromirror array for video projection, smart materials and systems.	8
III	Micromachining technologies: silicon as a material for micro machining, thin film deposition, lithography, etching, silicon micromachining, specialized materials for Microsystems, advanced processes for micro fabrication.	8
IV	Modeling of solids in Microsystems: Bar, beam, energy methods for elastic bodies, heterogeneous layered beams, bimorph effect, residual stress and stress gradients, poisson effect and the anticlastic curvature of beams, torsion of beams and shear stresses, dealing with large displacements, In-plane stresses. Modelling of coupled electromechanical systems: electrostatics, Coupled Electro-mechanics: statics, stability and pull-in phenomenon, dynamics. Squeezed film effects in electro-mechanics.	8
V	Integration of micro and smart systems: integration of Microsystems and microelectronics, microsystems packaging, case studies of integrated Microsystems, case study of a smart-structure in vibration control. Scaling effects in Microsystems: scaling in: mechanical domain, electrostatic domain, magnetic domain, diffusion, effects in the optical domain, biochemical phenomena.	8

Text book:

1. G. K. Ananthasuresh, K. J. Vinoy, S. Gopalakrishnan, K. N. Bhat and V. K. Atre, "Micro and smart systems", Wiley India, 2010.

Course Outcomes: At the end of this course students will demonstrate the ability to:

1. Classify the Instrumentation and Measurement system and various measurementerrors.
2. Analyze and design voltmeter circuits, AC electronic voltmeter, digital frequencymeter and current measurement with electronic instruments.
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classifytransducers like for force, pressure, motion, temperature measurement etc.

DIGITAL SYSTEM DESIGN USING VHDL		3 1 0
Unit	Topic	Lectures
I	Introduction to VHDL, reserve words, structures, modeling, objects, data type and operators, sequential statements and processes, sequential modeling and attributes, conditional assignment, concatenation and case, array loops and assert statements, subprograms.	8
II	Digital System Design Automation– Abstraction Levels, System level design flow, RTL design flow, VHDL. RTL Design with VHDL – Basic structures of VHDL, Combinational circuits, Sequential circuits, Writing Test benches, Synthesis issues, VHDL Essential Terminologies VHDL Constructs for Structures and Hierarchy Descriptions – Basic Components, Component Instantiations, Iterative networks, Binding Alternatives, Association methods, generic Parameters, Design Configuration	8
III	Concurrent Constructs for RT level Descriptions – Concurrent Signal Assignments, Guarded signal assignment Sequential Constructs for RT level Descriptions – Process Statement, Sequential WAIT statement, VHDL Subprograms, VHDL library Structure, Packaging Utilities and Components, Sequential Statements. VHDL language Utilities - Type Declarations and Usage, VHDL Operators, Operator and Subprogram overloading, Other TYPES and TYPE – related issues, Predefined Attributes	8
IV	VHDL Signal Model – Characterizing hardware languages, Signal Assignments, Concurrent and Sequential Assignments, Multiple Concurrent Drivers Standard Resolution.	8
V	Hardware Cores and Models - Synthesis rules and styles, Memory and Queue Structures, Arithmetic Cores, Components with Separate Control and Data parts. Core Design Test and Testability - Issues Related to Design Test, Simple Test benches.	8

Text Books:

1. Z. Navabi, “VHDL-Modular Design and Synthesis of cores and Systems”, TMH – 3rd Edition.

2. R.D.M. Hunter, T. T. Johnson, “Introduction to VHDL” Spriger Publication, 2010.

Course Outcomes: At the end of this course students will demonstrate the ability to:

1. Classify the Instrumentation and Measurement system and various measurementerrors.
2. Analyze and design voltmeter circuits, AC electronic voltmeter, digital frequencymeter and current measurement with electronic instruments.
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4. Analyze fundamental operation of CRO and some special type of oscilloscopes likeDSO, Sampling oscilloscope.
5. Demonstrate calibration method to calibrate various instruments and classifytransducers like for force, pressure, motion, temperature measurement etc.

Reference Books:

1. C. H. Roth, “Digital System Design using VHDL”, PWS Publishing
2. Douglas Perry, “VHDL- Programming by examples”, MGH

ADVANCED DISPLAY TECHNOLOGIES & SYSTEMS	3 1 0

Unit	Topic	Lectures
I	Properties of Light, Geometric Optics, Optical Modulation; Vision and Perception: Anatomy of Eye, Light Detection and Sensitivity, Spatial Vision and Pattern Perception, Binocular Vision and Depth Perception; Driving Displays: Direct Drive, Multiplex and Passive Matrix, Active Matrix Driving, Panel Interfaces, Graphic Controllers, Signal Processing Mechanism; Power Supply: Fundamentals, Power Supply Sequencing.	8
II	Display Glasses, Inorganic Semiconductor TFT Technology, Organic TFT Technology; Transparent Conductors, Patterning Processes: Photolithography for Thin Film LCD, Wet Etching, Dry Etching; Flexible Displays: Attributes, Technologies Compatible with Flexible Substrate and Applications, TFT Signal Processing Techniques; Touch Screen Technologies: Introduction, Coatings, Adhesive, Interfaces with Computer Mechanism.	8
III	Inorganic Phosphors, Cathode Ray Tubes, Vacuum Florescent Displays, Filed Emission Displays; Plasma Display Panels, LED Display Panels; Inorganic Electroluminescent Displays: Thin Film Electroluminescent Displays, AC Powder Electroluminescent Displays; Organic Electroluminescent Displays: OLEDs, Active Matrix for OLED Displays; Liquid Crystal Displays: Fundamentals and Materials, Properties of Liquid Crystals, Optics and Modeling of Liquid Crystals; LCD Device Technology: Twisted Numeric and Super twisted Numeric Displays, Smectic LCD Modes, In-Plane Switching Technology, Vertical Aligned Nematic LCD Technology, Bistable LCDs, Cholesteric Reflective Displays; LCD Addressing, LCD Backlight and Films, LCD Production, Flexoelectro-Optic LCDs.	8
IV	Paper like and Low Power Displays: Colorant Transposition Displays, MEMs Based Displays, 3-D Displays, 3-D Cinema Technology, Autostereoscopic 3-D Technology, Volumetric and 3-D Volumetric Display Technology, Holographic 3-D Technology; Mobile Displays: Trans-reflective Displays for Mobile Devices, Liquid Crystal Optics for Mobile Displays, Energy Aspects of Mobile Display Technology.	8
V	Microdisplay Technologies: Liquid Crystals on Silicon Reflective Microdisplay, Transmissive Liquid Crystal Microdisplay, MEMs Microdisplay, DLP Projection Technology; Microdisplay Applications: Projection Systems, Head Worn Displays; Electronic View Finders, Multifocas Displays, Occlusion Displays, Cognitive Engineering and Information Displays; Display Metrology, Standard Measurement Procedures, Advanced Measurement Procedures: Spatial Effects, Temporal Effects, Viewing Angle, Ambient Light; Display Technology Dependent Issues, Standards and Patterns, Green Technologies in Display Engineering.	8

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5. Demonstrate calibration method to calibrate various instruments and classifytransducers like for force, pressure, motion, temperature measurement etc.

Text Book:

1. Janglin Chen, Wayne Cranton, Mark Fihn , “Handbook of Visual Display Technology”, Springer Publication.