M.D. UNIVERSITY, ROHTAK
SCHEME OF STUDIES & EXAMINATION
B. Tech. IV YEAR (INSTRUMENTATION AND CONTROL ENGINEERING)
SEMESTER – VII
'F' Scheme effective from 2011-12

Course No.	Course Title	Teaching Schedule				Marks of Class Work	Examination		Total Marks	Duration of Exam
		L	T	P	Total		Theory	Practical		
IC-405 F	INTELLIGENT INSTRUMENTATION	3	1	-	4	50	100	-	150	3
EEE-413-F	MICROCONTROLLER & EMBEDDED SYSTEM DESIGN	3	1	-	4	50	100	-	150	3
ECE-409-F	DIGITAL SIGNAL PROCESSING	3	1	-	4	50	100	-	150	3
EE-407-F	PLC & SCADA	3	1	-	4	50	100	-	150	3
	DEPERTMENT ELECTIVE-1	3	1	-	4	50	100	-	150	3
	*OPEN ELECTIVE-I	4	-	-	4	50	100	-	150	3
EEE-433-F	MICROCONTROLLER & EMBEEDED SYSTEMS DESIGN LAB.	-	-	3	3	50	-	50	100	3
EE-429-F	DIGITAL SIGNAL PROCESSING LAB	-	-	2	2	25	-	25	50	3
EE-417-F	PLCS & SCADA Lab	-	-	3	3	50	-	50	100	3
IC-413-F	PRACTICAL TRAINING-II	-	-	-	-	-	-	-	-	-
GFIC-401-F	GENERAL FITNESS FOR THE PROFESSION	-	-	-	-	-	-	50	50	
	TOTAL	**19**	**5**	**8**	**32**	**425**	**600**	**175**	**1200**	

DEPT. ELECTIVE-I

IC-401-F Industrial process control

IC-458-F Random Process in Control & Estimation

IC-462-F Adaptive Control

EE-406-F Advanced Control System

IC-409-F Power plant instrumentation

IC-404-F Fuzzy Control Systems

IC-464-F Dynamic Behaviour of Processes

IC-466-F Computer Aided Design of Control System

IC-456-F Digital Control System

List of Open Electives

1	HUM-451-F	Language Skills for Engineers	9	CSE-451-F	Artificial Intelligence & Expert Systems
2	HUM-453-F	Human Resource Management	10	CSE-303-F	Computer Graphics
3	HUM-457-F	Business Communication	11	IC-403-F	Embedded Systems & Design
4	HUM-455-F	Entrepreneurship	12	CH-453-F	Pollution & Control
5	HUM-459-F	Renewable Energy Resources and technology	13	IT-471-F	Management Information System
6	PHY-451-F	Nano technology	14	IT-204-F	Multimedia Technologies
7	PHY-453-F	Laser Technology	15	OR-401-F	Operations Research
8	ME-451-F	Mechatronics Systems			

Note:

1. **Students will be allowed to use non-programmable scientific calculator. However, sharing of calculator will not be permitted in the examination.**
2. ***Student will be permitted to opt for any one elective run by the other departments. However, the departments will offer only those electives for which they have expertise. The choice of the students for any elective shall not be a binding for the department to offer, if the department does not have sufficient faculty strength.**
3. **A team consisting of Principal/Director, HOD of concerned department and external examiner appointed by University shall carry out the evaluation of the student for his/her General Fitness for the Profession.**
4. **Assessment of Practical Training-II, carried out at the end of VI semester, will be based on seminar, viva-voce and project report of the student from the industry. According to performance, letter Grades A, B, C, F are to be awarded. A student who is awarded 'F' grade is required to repeat Practical Training.**

M.D. UNIVERSITY, ROHTAK

SCHEME OF STUDIES & EXAMINATION
B.Tech. IV YEAR (INSTRUMENTATION AND CONTROL ENGINEERING)
SEMESTER – VIII
'F' Scheme effective from 2011-12

Sr No	Course No	Subject	Internal Marks	External Marks	Total Marks
1.	**IC- 402-F**	Industrial Training/Institutional Project Work	150	150	300

Note:

The students are required to undergo Industrial Training or Institutional Project Work of duration not less than 5 months in a reputed organization or concerned institute. The students who wish to undergo industrial training, the industry chosen for undergoing the training should be at least a private limited company. The students shall submit and present the mid-term progress report at the Institute. The presentation will be attended by a committee. Alternately, the teacher may visit the Industry to get the feedback of the students.

The final viva-voce of the Industrial Training or Institutional Project Work will be conducted by an external examiner and one internal examiner appointed by the Institute. External examiner will be from the panel of examiners submitted by the concerned institute approved by the Board of Studies in Engg. & Technology. Assessment of Industrial Training or Institutional Project Work will be based on seminar, viva-voce, report and certificate of Industrial Training or Institutional Project Work obtained by the student from the industry or Institute.

The internal marks distributions for the students who have undergone Industrial Training consist of 50 marks from the industry concern and 100 marks by the committee members consisting of faculty members of concerned department of the parent institute.

The teachers engaged for Institutional Project work shall have a workload of 2 hours per group (at least 4 students) per week.

EEE-413-F MICROCONTROLLERS & EMBEDDED SYSTEMS

L T P	Theory : 100 Marks
3 1 -	Class work : 50 Marks
	Total : 150 Marks
	Duration of Exam : 3 Hours

NOTE: For setting up the question paper, Question No. 1 will be set up from all the four sections which will be compulsory and of short answer type. Two questions will be set from each of the four sections. The students have to attempt first common question, which is compulsory, and one question from each of the four sections. Thus students will have to attempt 5 questions out of 9 questions.

Section-A

INTRODUCTION OF MICROCONTROLLER: Different types of microcontrollers: Embedded microcontrollers, External memory microcontrollers; Processor Architectures: Harvard V/S Princeton , CISC V/S RISC; microcontrollers memory types; microcontrollers features : clocking, i/o pins, interrupts, timers, peripherals.

Section-B

MICROCONTROLLER ARCHITECTURE: Introduction to PIC microcontrollers, Architecture and pipelining, program memory considerations, Addressing modes, CPU registers, Instruction set, simple operations.

Section-C

Microcontrollers - Microcontroller 8051- Architecture, Pin Diagram, I/O Ports, Internal RAM and Registers, Interrupts, Addressing Modes, Memory Organization and External Addressing, Instruction Set, Assembly Language Programming, Real Time Applications of Microcontroller-Interfacing with LCD, ADC, DAC, Stepper Motor, Key Board and Sensors.

Section-D

Embedded Systems- Introduction, Classification, Processors, Hardware Units, Software Embedded into System, Applications and Products of Embedded Systems, Structural Units in Processor, Memory Devices, I/O Devices, Buses, Interfacing of Processor Memory and I/O Devices, Case Study of an Embedded System for a Smart Card.

Text Books:

1. B. B. Brey: The Intel Microprocessors, Architecture, Programming and Interfacing, Pearson Education.
2. Design with PIC Microcontrollers by John B. Peatman , Pearson.
3. Raj Kamal: Embedded Systems- Architecture, Programming and Design, TMH, New Delhi.
4. V. Udayashankara and M. S. Mallikarjunaswamy: 8051 Microcontroller, TMH, New Delhi.

References:

1. Mazidi and Mazidi: The 8051 Microcontroller and Embedded Systems, Pearson Education.
2. A. V. Deshmukh: Microcontroller (Theory and Application), TMH.
3. D. V. Hall: Microprocessors and Interfacing, TMH
4. Programming and Customizing the 8051 Microcontroller : Predko ; TMH.
5. Programming Embedded Systems in C and C++ : Michael Barr; SHROFF PUB. &DISTR

EE-409-F **DIGITAL SIGNAL PROCESSING**

L T P	Class Work : 50
3 1 -	Exam : 100
	Total : 150
	Duration of Exam : 3 Hrs.

NOTE: For setting up the question paper, Question No. 1 will be set up from all the four sections which will be compulsory and of short answer type. Two questions will be set from each of the four sections. The students have to attempt first common question, which is compulsory, and one question from each of the four sections. Thus students will have to attempt 5 questions out of 9 questions.

Section-A

DISCRETE-TIME SIGNALS: Signal classifications, frequency domain representation, time domain representation, representation of sequences by Fourier transform, properties of Fourier transform, discrete time random signals, energy and power theorems.

DISCRETE-TIME SYSTEMS : Classification, properties, time invariant system, finite impulse Response (FIR) system, infinite impulse response (IIR) system.

Section-B

SAMPLING OF TIME SIGNALS: Sampling theorem, application, frequency domain representation of sampling, reconstruction of band limited signal from its samples. discrete time processing of continuous time signals, changing the sampling rate using discrete time processing.

Z-TRANSFORM : Introduction, properties of the region of convergence, properties of the Z-transform, inversion of the Z-transform, applications of Z-transform.

Section-C

BASICS OF DIGITAL FILTERS : Fundamentals of digital filtering, various types of digital filters, design techniques of digital filters : window technique for FIR, bi-linear transformation and backward difference methods for IIR filter design, analysis of finite word length effects in DSP, DSP algorithm implementation consideration. Applications of DSP.

Section-D

MULTIRATE DIGITAL SIGNAL PROCESSING: Introduction to multirate digital signal processing, sampling rate conversion, filter structures, multistage decimator and interpolators, digital filter banks.

TEXT BOOKS :

1. Digital Signal Processing : Proakis and Manolakis; PHI

2. Digital Signal Processing: Salivahanan, Vallavaraj and Gnanapriya;TMH

REFERENCE BOOKS:

1. Digital Signal Processing: Alon V. Oppenhelm;PHI

2. Digital Signal processing(II-Edition): Mitra, TMH

IC-405-F **INTELLIGENT INSTRUMENTATION**

L T P	Theory : 100 marks
3 1 -	Class Work : 50 marks
	Total : 150 marks
	Duration of exam. : 3 hours

NOTE: For setting up the question paper, Question No. 1 will be set up from all the four sections which will be compulsory and of short answer type. Two questions will be set from each of the four sections. The students have to attempt first common question, which is compulsory, and one question from each of the four sections. Thus students will have to attempt 5 questions out of 9 questions.

Section -A

INTRODUCTION:
Definition of an intelligent instrumentation system; feature of intelligent instrumentation ; components of intelligent instrumentation; Block diagram of an intelligent instrumentation.

Section -B

INTERFACING INSTRUMENTS & COMPUTERS:
Basic issue of interfacing; Address decoding; Data transfer control; A/D converter; D/A converter; Other interface consideration.

Section -C

INSTRUMENTATION/ COMPUTER NETWORKS:
Serial & parallel interfaces; Serial communication lines; Parallel data bus; EEE 488bus; Local area networks(LANs) : Star networks, Ring &bus networks, Fiber optic distributed networks, Field bus; Communication Protocols for very large systems: communication network rationalization.

Section -D

SOFTWARE FILTERS :
Description of Spike Filter, Low pass filter, High pass filter etc.

TEXT BOOK:
1. Principles of measurement & Instrumentation: Alan S. Moris ; PHI

EE-429-F **DIGITAL SIGNAL PROCESSING LAB**

L T P
0 0 2

CLASS WORK : 25
EXAM : 25
TOTAL : 50
DURATION OF EXAM : 3 HRS

LIST OF EXPERIMENTS:

Perform the experiments using MATLAB:

1. To represent basic signals (Unit step, unit impulse, ramp, exponential, sine and cosine).
2. To develop program for discrete convolution.
3. To develop program for discrete correlation.
4. To understand stability test.
5. To understand sampling theorem.
6. To design analog filter(low-pass, high pass, band-pass, band-stop).
7. To design digital IIR filters(low-pass, high pass, band-pass, band-stop).
8. To design FIR filters using windows technique.
9. To design a program to compare direct realization values of IIR digital filter
10. To develop a program for computing parallel realization values of IIR digital filter.
11. To develop a program for computing cascade realization values of IIR digital filter
12. To develop a program for computing inverse Z-transform of a rational transfer function.]

NOTE: At least ten experiments have to be performed in the semester; out of which at least seven experiments should be performed from above list. Remaining three experiments may either be performed from the above list order signed & set by the concerned institution.

EEE –433-F MICROCONTROLLER & EMBEDED SYSTEM DESIGN LAB

L T P	Class Work: 25
- - 2	Exam: 25
	Total: 50
	Duration of Exam: 2 Hrs.

8051/ AT 89C51 Micro Controller

1. Write an Assembly language Programme (ALP) to generate 10kHz square wave.
2. To study implementation & interfacing of display devices like LCD, LED Bar graph & seven segment display with Microcontroller 8051/ AT 89C51 **.**
3. To study implementation & interfacing of different motors like stepper motor, DC motor & servo motors.
4. Write an ALP for temperature & pressure measurement .
5. Write a program to interface a graphical LCD with 89C51.
6. To study programming and Transmission & reception of data through serial port & study of parallel printer port.

PIC Microcontroller

7. To interface PWM based voltage regulator using PIC Microcontroller .
8. Study and analysis of interfacing of graphical LCD using PIC controller.
9. Study and interfacing of IR(RC5 protocol) communication using PIC controller.
10. Study of SD/ MMC card interface using 18F4550.

EE-407-F **PLC And SCADA**

L T P
3 1 -

Theory : 100
Class Work : 50
Total : 150
Duration of Exam : 3 Hrs.

NOTE: For setting up the question paper, Question No. 1 will be set up from all the four sections which will be compulsory and of short answer type. Two questions will be set from each of the four sections. The students have to attempt first common question, which is compulsory, and one question from each of the four sections. Thus students will have to attempt 5 questions out of 9 questions.

Section -A

SCADA: Need of SCADA system, Distributed control Systems (DCS), General definition and SCADA components. Hardware Architecture, Software architecture, Protocol detail, Discrete control and Analog control, application & benefits, PLCs Vs RTUs, RTU Block diagram, , MTU communication interface, Future trends, Internet based SCADA display system, Components of control systems in SCADA.
PLC programming language standards: ladder logic, functional block, structural text, instruction, ladder diagrams, trouble shooting, features,

Section -B

SCADA in Power Systems: Main task in power systems- Planning, operation, accounting, tasks of national control centre, regional control centre, Generating station control room, AGC-SCADA, SCADA in generation, SCADA in Power Distribution, SCADA in Power Grid.

Section -C

Supervisory Power Management: Energy Management System, power system operation states, security analysis, computer programmes-generating planning, transmission planning, system studies, energy audit, state estimation, load forecasting.
Utility distribution system design, regulation, distribution automation, DMS, design, layout and construction and commissioning of substations, Substation Automation and Equipment condition monitoring.

Section -D

Automatic mapping and facility management, Distribution system design, Facility mapping, tracking, facility inventory, system and equipment maintenance, trouble call management, Customer level intelligent automation system, computer level monitoring and control of distribution transformers, Substation and feeder level automation

TEXT BOOKS:

1. SCADA: by Stuart A. Boyer: IAS 1999
2. Switch Gear & Protection by S.S. Rao: Khanna Publication New Delhi
3. Power system Control Technology by Terson , Prentice Hall New Delhi

REFERENCE BOOKS:

1. Planning for demand side management in the electric sector by J. Parikh, B. Reddy & R. Benerjee: TMH
2. Hand book of Telemetry of Remote control by Elliot L. Gruenberg MGH New Delhi
3. Electronics Communication by Roddy & Coolen
4. Optical fiber Communication by Gower: Eastern Publication, New Delhi
5. Optical Fibre Communication System by M K Raina, Satya Parkashan, New Delhi
6. Electric Power system by S.L. Uppal
7. Power System Engineering by S K Gupta, Umesh Publication

IC-404-F **FUZZZY CONTROL SYSTEM**

L T P
3 1 -

Theory/Exam : 100
Class Work : 50
Total : 150
Duration of Exam : 3 Hrs.

NOTE: For setting up the question paper, Question No. 1 will be set up from all the four sections which will be compulsory and of short answer type. Two questions will be set from each of the four sections. The students have to attempt first common question, which is compulsory, and one question from each of the four sections. Thus students will have to attempt 5 questions out of 9 questions.

Section –A

INTRODUCTION: Fuzzy control from an industrial perspective, knowledge-based controllers, knowledge representation in KBC's.

THE MATHEMATICS OF FUZZY CONTROL:
Vagueness, fuzzy logic versus probability theory, fuzzy sets, their properties & operations on fuzzy sets, fuzzy relations & operations on fuzzy relations, the Extension Principle, Fuzzy propositions, The Compositional Rule of Inference, Different implications, Representing a set of rules.

Section -B

FKBC DESIGN PARAMETERS: The PKBC architecture, choice of variables & content of rules, Derivation of rules, choice of membership functions, choice of scaling factors, choice of fuzzification procedure, choice of defuzzification procedure, comparison and evaluation of defuzzification methods.

Section -C

NONLINEAR FUZZY CONTROL: The Control Problem, The FKBC as a Non-Linear Transfer Element, Types of FKBC such as PID-like FKBC, Sliding Mode FKBC, Sugeno FKBC.

STABILITY OF FUZZY CONTROL SYSTEMS: The State space approach, Stability and robustness indices, input-output stability, circle criterion, the conicity criterion.

Section -D

ADAPTIVE FUZZY CONTROL: Design & Performance Evaluation, Approaches to Design such as membership function tuning using gradient descent, membership function tuning using performance criteria, the self-organizing controller, model based controller.

TEXT BOOK:
An Introduction to Fuzzy Control: D.,Driankov, H.Hellendoorn and M.Reinfrank.; Narosa.

REFERENCE BOOKS:
Fuzzy Control Systems : Abraham Kandel and Gideon Imngholz; Narosa

EE-417-F **PLC SCADA LAB**

L T P
0 0 2

CLASS WORK : 25
EXAM : 25
TOTAL : 50
DURATION OF EXAM : 3 HRS

LIST OF EXPERIMENTS:

1) To study Ladder logic programming of a industrial PLC like SEIMENS/FATEK/MICROLOGIX
2) To write programme for control of Drinks machine,.
3) To write a Programme for Car Parking.
4) To study step step sequence in a PLC
5) To write a programme & interface simulated hardware unit of Tank level control.
6) To write a programme & interface & control a traffic light using PLC.
7) To write a programme & interface & control a simulated elevator control using PLC
8) To write a programme & interface & control a conveyer belt using PLC
9) To write a programme & interface & control speed of a DC motor using PLC
10) To write a programme & interface & temperature control system using analog outputs of a PLC.

At least ten experiments based on the syllabus of EE-407-F (PLC & SCADA) be developed at the Institution Level. The students will be required to perform at least eight experiments in the semester.

IC- 401-F INDUSTRIAL PROCESS CONTROL

L T P	Theory : 100 Marks
3 1 -	Class work : 50 Marks
	Total : 150 Marks
	Duration of Exam. : 3 Hrs.

NOTE: For setting up the question paper, Question No. 1 will be set up from all the four sections which will be compulsory and of short answer type. Two questions will be set from each of the four sections. The students have to attempt first common question, which is compulsory, and one question from each of the four sections. Thus students will have to attempt 5 questions out of 9 questions.

Section-A

BASIC CONSIDERATIONS

Introduction to process control system, control loop study-Generalization with load-changes at arbitrary points in the loop, offset and its analysis, modelling consideration for control purposes, degree of freedom and process controllers, formulating the scope at modelling for process control. Computer simulation and linearization of non linear system transfer function and input output models, Dynamic behaviour of first order lag system, process with variable time constant and gain. Dynamic behaviour of second order and higher order system-multicaplacity process, real time process, inverse response process, Introduction to feedback control and effects P, I & D controllers.

Section-B

DESIGNING FEED BACK CONTROLLER :

Outline of the design problems, Selection of type of feedback controller. Time-Integral performance criterion, Process Reaction Curveand frequency response characteristic, Ziegler-Nichol Rule, effect of dead time, dead time compensator and inverse response cdompensator.

Section-C

CONTROL SYSTEMS WITH MULTIPLE LOOPS:

Cascade, spilt-range feedforward, ratio inferential and adaptive control.

INTERACTION & DE-COUPLING OF CONTROL LOOP :
Interaction of control loops, relative gain array and selection of the loops, Design of non-interacting control loop.

Section-D

UNIT-5. COMPUTER PROCESS INTERFACE FOR DATA ACQUISITION & CONTROL :
Introduction to digital computer control of processes. Design of control system for complete plant.
Text Book: Chemical process Control – George Stephanopoulos. Pub. PHI
Ref. Books:
1) Digital Computer Process Control-C.L.Smith Pub: Intext Educational Publisher
2) Process Control-F.G.Shinskey, Pub. Mc-Graw Hill
3) Advanced Process Control-W.H.Ray, Pub. Mc Graw Hill
4) Process system and analysis and control-D.R.Coushanour, TMH
5) Process Instrument & Control handbook-D.M.Considins,Pub: Mc -Graw Hil

IC- 458-F RANDOM PROCESSES IN CONTROL AND ESTIMATION

L T P	
4 - -	Theory : 100 marks Class work : 50 marks Total : 150 marks Duration of exam : 3 hours

NOTE: For setting up the question paper, Question No. 1 will be set up from all the four sections which will be compulsory and of short answer type. Two questions will be set from each of the four sections. The students have to attempt first common question, which is compulsory, and one question from each of the four sections. Thus students will have to attempt 5 questions out of 9 questions.

Section-A

Introduction to random variables and random processes. Eiener;s theory of optimization.

Section-B

Application ofWiener,s theory in the compensator design for feedback control systems.

Section-C

Gauss Markov model for vectorrandom processes. Kalman filtering and prediction for discrete time and continuous time sytems.

Section-D

Minimum variance control.

TEXT BOOKS:

1. Stochastic optimal linear estimation and Control : J.S.Meditch
2. Compensator Design for Stochastic Processor : Newton, Kaser and Gould

IC- 462-F **ADAPTIVE CONTROL**

L T P
4 - -

Theory : 100 marks
Class work : 50 marks
Total : 150 marks
Duration of exam.: 3 hours

NOTE: For setting up the question paper, Question No. 1 will be set up from all the four sections which will be compulsory and of short answer type. Two questions will be set from each of the four sections. The students have to attempt first common question, which is compulsory, and one question from each of the four sections. Thus students will have to attempt 5 questions out of 9 questions.

Section-A

WHAT IS ADAPTIVE CONTROL:
Introduction, Adaptive Schemes, Adaptive Control Theory, Application, Conclusion.

WHY ADAPTIVE CONTROL:
Introduction, When is constant-gain feedback insufficient?, Robust Control, The Adaptive Control Problem, Conclusion.

Section-B

REAL TIME PARAMETER ESTIMATION:
Introduction, Least squares & regression models, Estimating parameters in Dynamical systems, Experimental conditions, Properties of Recursive estimators, Implementation Issues, Conclusions.

MODEL-REFERENCE ADAPTIVE SYSTEMS:
Introduction, The MRAS problem, The Gradient approach, MRAS based on stability theory, Direct MRAS for General linear systems, MRAS for partially known system, Conclusions.

Section-C

SELF TUNING REGULATION:
The basic idea, Indirect self tuning regulators, Direct self tuning regulators, Unification of direct self-tuning regulators, Linear quadratic STRs, Adaptive Predictive Control, A priori knowledge in STR, Conclusion.

STABILITY, CONVERGENCE & ROBUSTNESS:
Introduction, Global stability, Convergence, Averaging, An example of Averaging analysis, Robustness, Stochastic averaging, Parameterization, Instability mechanism, Universal stabilizers, Conclusions.

Section-D

STOCHASTIC ADAPTIVE CONTROL:
Introduction, Problem formulation, Dual Control, Sub-optimal strategies, Examples, Conclusions.

AUTO TUNING:
Introduction, PID Control, Transient Response Methods, Methods based on Relay feedback, Conclusions.

TEXT BOOK:

1. Adaptive control : Kail Johan Astron & Bjorn Witten marks ; Wesley Publishing Company

REFERENCE BOOK :

1. Adaptive Control : Shankar Sastry & Marc Bodson ; PHI

EE-406-F **ADVANCED CONTROL SYSTEMS**

L T P
3 1 -

Theory : 100
Class Work : 50
Total : 150
Duration of Exam : 3 Hrs.

NOTE: For setting up the question paper, Question No. 1 will be set up from all the four sections which will be compulsory and of short answer type. Two questions will be set from each of the four sections. The students have to attempt first common question, which is compulsory, and one question from each of the four sections. Thus students will have to attempt 5 questions out of 9 questions.

Section –A

STATE VARIABLE TECHNIQUES: State variable representation of systems by various methods. Solution of state equations-state transition matrix. Transfer function from state variable model. Controllability & observability of state variable model.

Section -B

SECOND ORDER SYSTEMS & STATE PLANE:
Phase portrait of linear second systems. Method of isoclines, phase portrait of second order system with non-linearities, limit cycle, singular points.

Section -C

DESCRIBING FUNCTION ANALYSIS: Definition, limitations, use of describing function for stability analysis , describing function of ideal relay, relay with hysteresis & dead zone, saturation/coulomb friction & backlash,

LINEAR APPROXIMATION OF NONLINEAR SYSTEMS: Taylor series, Liapunov's 2nd method.

Section -D

SAMPLED DATA SYSTEMS: Sampling process,impulse modulation, mathematical analysis of sampling process, application of Laplace transform, Shannon's theorem, reconstruction of sampled signal zero order & first order hold, Z-transform, definition, evaluation of Z-transform, Inverse Z-transform, pulse transfer function, limitations of Z-transform, state variable formulation of discrete time systems. Solution of discrete time state equations, stability, definition, the Schur-Cohn stability criterion, Jury's test of stability of extension of Routh-Hurwitz criterion to discrete time systems.

TEXT BOOKS:
1. Digital Control & State Variable Methods : M.Gopal ; TMH.

REFERENCE BOOKS :
1. Modern Control Theory : M.Gopal ; Wiley International.
2. Discrete time control system : K.Ogate ; PHI
3. Digital Control Systems : B.C.Kuo
4. Applied non-linear control : J.E.Slotine & W.P.Li; PrenticeHall, USA,

5. Nonlinear Control Systems: Isidari ; Springer-Verlag.

IC-464-F **DYNAMIC BEHAVIOUR OF PROCESES**

L T P	
4 -	Theory : 100 marks Class work : 50 marks Total : 150 marks Duration of exam. : 3 hours

NOTE: For setting up the question paper, Question No. 1 will be set up from all the four sections which will be compulsory and of short answer type. Two questions will be set from each of the four sections. The students have to attempt first common question, which is compulsory, and one question from each of the four sections. Thus students will have to attempt 5 questions out of 9 questions.

Section -A

INTRODUCTION TO DYMAMICS:
A Perspective, The Unsteady State, The Quasi-Steady State, Static versus Dynamic Behavior.
PROCESS MODELS:
Macroscopic and Microscopic Conservation Laws, Flow Problems, Heat Transfer Problem, Mass Exchange Problems, Reactor Problems, General Forms of Models.

Section -B

METHODS OF ANALYSIS:
Vectors, Matrices, and Linear Algebra, Unity of Linear Approximations, Linearization-Ordinary Differential Equations, Local Linearization-Partial Differential Equations, Perturbation Methods, Laplace Transform method, Calculus of Variations.
INPUT-OUTPUT REPRESENTATION:
Block Diagram Notation, Transfer Functions, Transfer Matrices, Time Response, Some Simple Disturbances, Frequency Response, Linear Stability, Stability Criteria from Frequency Response.

Section -C

APPROXIMATE LINEAR MODEL:
Reduction in Order, Input-Output Approximations, Modal approximations, Singular Perturbations, Weakly coupled Systems.
NON-LINEAR RESPONSE:
State Plane Responses, Methods of Poincare and Krylov and Bopgoliubov, Perturbation Methods, Quasilinearization, Unsteady State Operation, Optimal Periodic Processes.

Section -D

THE DIRECT METHOD OF LYAPUNOV:
The Lyapunov Function,. Geometric Interpretation, Linear Systems, Slightly Nonlinear Systems, Krasovskii Forms, Other Lyapunov Functions.
FLOW AND DIFFUSION RESPONSE:
Classification of partial Differential Equations, Hyperbolic Equations, Frequency Response, Method of Characteristics, Inversion Techniques, Wave Responses, Parabolic Systems, Time and Frequency Responses, Axial Dispersion, Comparison of Flow and Diffusion Responses, Stability Considerations.
TEXT BOOK:

1. Dynamic Behavior of processes : John C. Friendly.

IC-466-F COMPUTER AIDED DESIGN OF CONTROL SYSTEMS

L T P	
4 - -	Theory : 100 marks Class work : 50 marks Total : 150 marks Duration of exam.: 3 hours

NOTE: For setting up the question paper, Question No. 1 will be set up from all the four sections which will be compulsory and of short answer type. Two questions will be set from each of the four sections. The students have to attempt first common question, which is compulsory, and one question from each of the four sections. Thus students will have to attempt 5 questions out of 9 questions.

Section -A

INTRODUCTION TO INTERACTIVE COMPUTING AND USE OF GRAPHICS:
Requirements of interactive computing. Dedicated vs. time-sharing modes, interactive interface. CRT as a display device, Graphical quality, capacity, speed of modification, ease of programming. Line drawing. Solid area graphics and three dimensional display. Frame refreshing. Intelligent graphics terminals (Tecktronic 4051, IBM 5100). Graphics packages (GINOF, GIMOM and others). Use of interactive input tools such as light pen, cursor, Geometry of plotting in two dimensions, scaling.

Section -B

PROGRAM DESIGN AND STRUCTURE FOR INTERACTIVE COMPUTING:
Comparison of languages in terms of structured programming. Interactive use of languages in terms of structured programming. Interactive use. Portability. Use of small computers. Program evaluation. CAD facilities at UMIST based on DEC-10. Computer configuration of CAD of control systems.

Section -C

CAD OF SISO SYSTEMS:
System specification, Nyquist, inverse Nyquist, Bode and root locus plots. Development of software for graphic display of these plots. Design of compensators, software development for simulation.

Section -D

CAD OF MIMO SYSTEMS:
Stability, integrity, interaction, diagonal dominance. Graphical criteria for D.D. INA and minimum sensitivity INA. Software development for model transformation. Software development for INA method and optimal control. Simulation of MIMO systems.

IC- 456-F **DIGITAL CONTROL SYSTEM**

L T P
4 - -

Theory : 100 marks
Class work : 50 marks
Total : 150 marks
Duration of exam.: 3 hours

NOTE: For setting up the question paper, Question No. 1 will be set up from all the four sections which will be compulsory and of short answer type. Two questions will be set from each of the four sections. The students have to attempt first common question, which is compulsory, and one question from each of the four sections. Thus students will have to attempt 5 questions out of 9 questions.

Section -A

INTRODUCTION:
What are sampled data and Digital Control System? Importance of Sampling in Control System. A Survey of the Methods of Analysis and Synthesis of Sampled-Data system.

THE SAMPLING PROCESS:
Introduction, Mathematical Analysis of the Sampling Process, Mathematical Description of the Ideal Sampling Process-The Ideal Sampler, Summary.

Section -B

RECONSTRUCTION OF SAMPLED SIGNALS:
Introduction, Data Reconstruction by Polynomial Extrapolation, The Zero Order Hold, The First Order Hold, The Fractional Order Hold, The Exponential Hold

THE Z-TRANSFORM THEORY:
Definition of the Transform, Evaluation of Z-Transform, Mapping of the S-Plane into the Z-Plane, The Inverse Z-Transformation, Theorems of the Z-Transform, The Pulse Transfer Function, Limitations of the Ztransform Method, Response of Open Loop Sampled, Data Systems between sampling instants, Theorem of the Modified Z-Transforms.

Section -C

BLOCK DIAGRAM, SIGNAL FLOW GRAPH AND MATRIX REPRESENTATION OF SAMPLED DATA SYSTEMS: Block Diagram Analysis and Transfer Functions of Closed Loop Sampled Data Systems, Signal Flow Graphs of Sampled Data Systems, Modified Z-Transform of Outputs of Closed Loop Sampled Data Systems, Transmission Matrix of Sampled Data Systems, The State-Variable Approach.

Section -D

TIME RESPONSE ANALYSIS:
System characteristic equation, Time response, Maping S-plane into Z-plane, Steady state accuracy, Stability Techniques, Bi-linear transformation, Routh Hurwitz Criterion, Jury stability test, Root locus, Nyquist criterion, Bode diagram, Interpretation of frequency response, Closed loop frequency response.

DIGITAL CONTROLLER DESIGN:
Introduction to controller design, Control system specification, Compensation , phase lag compensator, phase lead compensator, phase lead design procedure, lag lead compensator, PID controllers, Analysis and design of Digital Control Systems using root locus and transform techniques.

TEXT BOOKS:

1. Digital Control & State Variable Methods. : M.Gopal ;. TMH
2. Digital Control System Analysis and Design : Charles L.Philips & H.Troy Nagle ;Prentice Hall International.

REFERENCE BOOK :

1. Discrete Time Control System: K. Ogata. ; Prentice Hall International

HUM-459-F RENEWABLE ENERGY RESOURCES & TECHNOLOGY

L T P
3 1 -

Theory : 100
Class Work : 50
Total : 150
Duration of Exam : 3 Hrs.

NOTE: For setting up the question paper, Question No. 1 will be set up from all the four sections which will be compulsory and of short answer type. Two questions will be set from each of the four sections. The students have to attempt first common question, which is compulsory, and one question from each of the four sections. Thus students will have to attempt 5 questions out of 9 questions.

Section -A

Introduction: Energy Sources and their availability, renewable energy sources, Prospects of renewable energy sources, application of non conventional and renewal energy sources.

Enviormental Aspects of Electric Energy Geneneration: Introduction Thermal pollution, Atmospheric pollution, Effects of Hydroelectric projects,Nuclear power generation and enviorment, Green House Gas Effects, Global Environmental awareness,Energy options for Indian Economy.

Section -B

Solar Energy : Solar radiation estimation, Basic Principle of Solar Energy physical Principal of the conversion of solar radiation into heat, Collectors, Solar Energy storage system, solar thermal electric conversion, solar electric Power Plant & applications.

Wind Energy: Basic Principle of wind energy conversion, nature & Power of wind, site selection, wind energy conversion SYSTEM. Scheme for Electric Generation, Generator Control load control, Inter connected SYSTEM & applications.

Section -C

Bio Mass Energy: Biomass conversion technologies bio mass generation, classification of Bio Gas Plants material used in Bio Gas Plants., Selection of site & applications.

Geothermal Enrgy: Sources of Geothermal energy Estimation of Geothermal Power, Geothermal Power Plants, Geothermal energy in India and Prospects.

Ocean Energy: Ocean thermal electric conversion, site selection, Power Plant, Prospects of ocean energy in India, tidal Power tidal Power Plant, Prospects in India.

Section -D

MHD & Hydrogen Energy: Basic Principle MHD SYSTEM, advantages, Power OUTPUT of MHD Generation, future Prospects. Principle and classification of fuel cell energy, hydrogen as alternative fuel for Generation of Electrical Energy & applications.

Fuel Cell: Fuel Cell, Management of Fuel, Thermonic power generation, water Resource Electricity deviend scenario storage and handling, Pricing, Contract etc, Introduction to risk, rules and regulation Aspects of Risk & Hazard Health & risk assessment visit to site, Mini hydro generators.

TEXT BOOKS:

1. Renewable Energy Sources and Emerging Technologies : D.P Kothari, K.C.Singla, Rakesh Ranjan- PHI Publications.
2. NON-Conventional energy Sources : G.D. Rai – Khanna Publications.
3. Renewal energy sources and their environmental aspects by Abbari: PHI
4. Electric Power : Dr. S.L. Uppal - Khanna Publications

REFERENCE BOOKS:

1. Power Plant Engineering : Jain & Bala Subramanyam

IC-409-F POWER PLANT INSTRUMENTATION

L T P	Theory : 100
3 1 -	Class Work : 50
	Total : 150
	Duration of Exam : 3 Hrs.

NOTE: For setting up the question paper, Question No. 1 will be set up from all the four sections which will be compulsory and of short answer type. Two questions will be set from each of the four sections. The students have to attempt first common question, which is compulsory, and one question from each of the four sections. Thus students will have to attempt 5 questions out of 9 questions.

Section -A

Steam Generators, Condensers and Turbines:
Classification of steam generators, selection, operation of locomotive, Babcock Wilcox, Cochran boilers, Types of condensers, effect of air in condensers, Dalton's law of partial pressure, cooling water calculations, steam nozzles, types of steam turbine efficiencies, compounding, governing and control.

Steam Power Plant:
Classification, Operation, Description of Rankine cycle, Regenerative cycle, Reheat Regenerative Cycle, Binary Vapour Cycle, Selection of plant site and its layout, coal handling system, combustion system, Fluidised bed combustion, Ash handling, Feed pumps, Heat exchangers, Economizers, Super heaters, Reheaters, Air preheaters, Feed water heaters, Evaporators.

Section -B

Hydro-Electric Power Plants:
Hydrological Cycle, Hydrograph, Flow duration curve, Selection of site, Essential features, Classificatioon of hydro plants, Selection of water turbines for hydro power plant, Automatic and remote control of hydrostation, layout of hydro power plant.

Nuclear power plants:
Nuclear physics, Binding energry,Radio active decay.Fertile material,Mass defect,Nuclear reactions type and appilication,Genration of nuclear energry by fission, Nuclear reaactors. Site selections, safety measures, plant layout,Fusion reaction,Future of nuclear power.

Section -C

Gas Turbine:
Elements of gas turbines, Open and closed cycles for gas turbines, Performance terms, Thermal refinement to gas turbines cycle, Plant layout, applications, gas turbines Cycle calculations.

Diesel Power Plants:
Classifications of IC Engines and their performance, Four stroke and two stroke diesel engines, combustion phenomenon; Essential components, Celane number, knocking, super charging, operation and layout of diesel power plant.

Section -D

Combined Operation of Different Power Plants:
Advantages of combined operation of plants, load division between power stations, coordination of different types of Power Plants.

Pollution Control:
Pollution from thermal & nuclear plants, Particulate emission and control, electrostatic precipitator, solid
waste disposal.

Reference Books:
1. A course in Electrical Power Soni,Gupta & Bhatanagar (Dhanpat Rai & Sons)
2. Power Plant Engineering P.C. Sharma (Kataria & Sons)
3. Power Station Engineering and Economy B.G.A. Skrotzki & W. A Vapot (TMH)
4. Power Plant Engineering R.K. Rajput (Luxmi Publications)
5. Power Plant Engineering M.M. EI Wakit (Mc Graw Hill, USA)

IC-403-F **EMBEDDED SYSTEM DESIGN**

L T P
3 1 -

Class Work : 50 Marks
Exam : 100 Marks
Total : 150 Marks
Duration of Exam : 3 Hrs.

NOTE: For setting up the question paper, Question No. 1 will be set up from all the four sections which will be compulsory and of short answer type. Two questions will be set from each of the four sections. The students have to attempt first common question, which is compulsory, and one question from each of the four sections. Thus students will have to attempt 5 questions out of 9 questions.

Section -A

INTRODUCTION

Different types of microcontrollers: Embedded microcontrollers, External memory microcontrollers; Processor Architectures: Harvard V/S Princeton , CISC V/S RISC; microcontrollers memory types; microcontrollers features : clocking, i/o pins, interrupts, timers, peripherals.

Section -B

MICROCONTROLLER ARCHITECTURE

Introduction to PIC microcontrollers, Architecture and pipelining, program memory considerations, Addressing modes, CPU registers, Instruction set, simple operations.

INTERRUPTS AND I/O PORTS

Interrupt logic, Timer2 scalar initialization, IntService Interrupt service routine, loop time subroutine, External interrupts and timers, Synchronous serial port module, Serial peripheral device, O/p port Expansion, I/p port expansion, UART.

Section -C

SOFTWARE

Development tools/ environments, Assembly language programming style, Interpreters, High level languages, Intel hex format object files, Debugging.

PROGRAMMING WITH MICROCONTROLLERS

Arithmetic operations, Bit addressing, Loop control, Stack operation, Subroutines, RAM direct addressing, state machines, Oscillators, Timer Interrupts, Memory mapped I/O.

Section -D

DESINING USING MICROCONTROLLERS

Music box, Mouse wheel turning, PWM motor control, Aircraft Demonstration, ultra sonic distance measuring, Temperature Sensor, Pressure Sensor, Magnetic Field Sensor.

TEXT BOOK:

1. Design with PIC Microcontrollers by John B. Peatman , Pearson.

REFERENCE BOOKS :

1. Programming and Customizing the 8051 Microcontroller : Predko ; TMH.
2. Designing Embedded Hardware : John Catsoulis ;SHROFF PUB. & DISTR. ND.
3. Programming Embedded Systems in C and C++ : Michael Barr; SHROFF PUB. & DISTR. ND.

OR-401-F **Operations Research**

L T P **Class Work :** 50 Marks
3 1 **Exam :**100 Marks

Total : 150 Marks

Duration of Exam : 3 Hrs.

NOTE: For setting up the question paper, question no 1 will be set up from all the four sections which will be compulsory and of short answer type. Two questions will be set from each of the four sections. The students have to attempt first common question, which is compulsory, and one question from each of the four sections. Thus students will have to attempt 5 questions out of 9 questions.

Section – A

Development – Definition– Characteristics and Phases – Types of models – operation Research models – applications.

ALLOCATION : Linear Programming Problem Formulation – Graphical solution – Simplex method – Artificial variables techniques -Two–phase method, Big-M method – Duality Principle.

Section – B

TRANSPORTATION PROBLEM – Formulation – Optimal solution, unbalanced transportation problem – Degeneracy. Assignment problem – Formulation – Optimal solution - Variants of Assignment Problem-Traveling Salesman problem.

REPLACEMENT : Introduction – Replacement of items that deteriorate with time – when money valueis not counted and counted – Replacement of items that fail completely, group replacement. staffing problem,equipment renewal problem.

Section – C

System Reliability:Introduction-Definition-Failure Rates-Bath-tub shaped failure rate(Hazard Rate)-Reliability of systems-series arrangement and parallel arrangement-methods of assuring reliability.

Section – D

Information Theory-Introduction, measure of Information, binary unit of information , entropy, properties of average measure of entropy, important relations for various entropies, set of axioms for an entropy function, uniqueness theorem, communication system, noiseless channel, cannel capacity,efficiency and redundanc,exected mutual information,encoding.

TEXT BOOK :

1. Operations Research / S.D.Sharma-Kedarnath
2. Introduction to O.R/ Taha/ Pearsons

REFERENCES :

Operation Research/A.P.VERMA/SK KATARIA AND SONS

Operations Research/P.K.GUPTA & D.S.HIRA :