SCHEME & SYLLABUS

for

M.TECH. COURSE

in

Electronics and Instrumentation Engineering

(w.e.f. Session 2018-2019)

DEPARTMENT OF ELECTRONICS ENGINEERING

YMCA UNIVERSITY OF SCIENCE AND TECHNOLOGY
FARIDABAD

VISION

YMCA University of Science and Technology aspires to be a nationally and internationally acclaimed leader in technical and higher education in all spheres which transforms the life of students through integration of teaching, research and character building.

MISSION

- To contribute to the development of science and technology by synthesizing teaching, research and creative activities.
- To provide an enviable research environment and state-of-the-art technological exposure to its scholars.
- To develop human potential to its fullest extent and make them emerge as world class leaders in their professions and enthuse them towards their social responsibilities.

Department of Electronics Engineering

VISION

To be a Centre of Excellence for producing high quality engineers and scientists capable of providing sustainable solutions to complex problems and promoting cost effective indigenous technology in the area of Electronics, Communication & Control Engineering for Industry, Research Organizations, Academia and all sections of society.

MISSION

- To frame a well-balanced curriculum with an emphasis on basic theoretical knowledge as well the requirements of the industry.
- To motivate students to develop innovative solutions to the existing problems for betterment of the society.
- Collaboration with the industry, research establishments and other academic institutions to bolster the research and development activities.
- To provide infrastructure and financial support for culmination of novel ideas into useful prototypes.
- To promote research in emerging and interdisciplinary areas and act as a facilitator for knowledge generation and dissemination through Research, Institute - Industry and Institute-Institute interaction.

About Electronics Engineering Department

YMCA University of Science & Technology, Faridabad established in 2009, formerly known as YMCA Institute of Engineering, Faridabad, established in year 1969 as a Joint Venture of Govt. of Haryana and National Council of YMCA of India with active assistance from overseas agencies of West Germany to produce highly practical oriented personnel in specialized field of engineering to meet specific technical manpower requirement of industries. Electronics Engineering Department started in 1969 and has been conducting B.Tech. Courses in Electronics Instrumentation and Control and Electronics and Communication Engineering of 4-Years duration since 1997. Students are admitted through centralized counseling nominated by state govt. in 1st Year and 2nd year through lateral entry entrance test. Besides under graduate degree courses, it is also running M.Tech. Courses in VLSI, Instrumentation and Electronics & Communication. Department of Electronics Engineering is also running Ph.D. Programme. All courses are duly approved by AICTE/ UGC. The Electronics Engineering Department has been well known for its track record of employment of the pass out students since its inception.

The Department has good infrastructure consisting of 11 laboratories, 10 Lecture Halls and 1 Conference Room beside 6 workshops. It has excellent faculty with 2 Professors, 2 Associate Professors and 21 Assistant Professors. At present, 6 faculty members are PhD in various specializations. The various syllabi of UG/PG courses have been prepared with active participation from Industry. The Department is organizing number of expert lectures from industry experts for students in every semester. During the project/dissertation work emphasis has been given on skill enhancement of students. Choice based system allows students to study the subjects of his/her choice from a number of elective courses /audit courses.

Program Educational Objectives:

Students of the Master of Technology programs in Electronics and Instrumentation will demonstrate

1. To educate and train the graduates with knowledge and skills necessary to formulate, design and solve problems in the field of Electronics instrumentation and Control.
2. To provide technical skills in software and hardware tools related to the design and implementation of Instrumentation and Control systems for real time applications.
3. To provide scope for Applied Research and innovation in the various fields of Instrumentation & Control and enabling the students to work in the emerging areas.
4. To enhance communication and soft skills of students to make them work effectively as a team

Program Outcomes:

On successful completion of the Program, the students will be able to

1. Acquire knowledge of Electronics, Instrumentation and Control Engineering with ability to evaluate, analyze and synthesize knowledge related to Process Instrumentation.
2. Analyze complex problems related to Instrumentation and Control Engineering and synthesize the information for conducting research.
3. Solve problems related to Instrumentation and Control Engineering and provide/suggest a range of solutions considering health, safety, societal, and environmental factors.
4. Extract knowledge through literature survey, experimentation and appropriate research methodology, techniques and tools.
5. Learn and use contemporary tools for solving problems related to Process Control, Automation, Measurement and Control etc.
6. Contribute to collaborative-multidisciplinary scientific work, demonstrate capacity for self-management, teamwork and decision making.
7. Manage projects as a member and leader with understanding of engineering and management principles with consideration to economic and financial factors.

8. Communicate effectively in professional and personal domains through verbal, written and graphical forms.
9. Engage in life-long learning to improve knowledge and competence in the world of rapid technological changes.
10. Follow ethical code of conduct in professional activities with understanding of responsibility for sustainable development of society.
11. Adapt to reflective self-learning for continuous personal and professional development.
12. Participate and succeed in competitive examinations like GATE (for placements in PSU's), GRE (for higher studies) etc.

GRADING SCHEME

Marks %	Grade	Grade points	Category
90-100	O	10	Outstanding
80<marks<90	A+	9	Excellent
70<marks< 80	A	8	Very good
60<marks< 70	B+	7	Good
50<marks< 60	B	6	Above average
45<marks< 50	C	5	Average
40<marks< 45	P	4	Pass
<40	F	0	Fail
	Ab	0	Absent

Percentage calculation= CGPA * 9.5

M. TECH. (Electronics and Instrumentation Engineering)

Total Credits	**68**
Total Theory Subjects	**11+2 Audits**
Total Labs (including Projects)	**5**
Total Dissertation	**2**

Semester I

M. Tech. (Electronics and Instrumentation)

Sr. No.	Category	Course Code	Course Title	Hours per week			Credits	Sessional Marks	Final Marks	Total
				L	T	P				
1	PCC	MEI101	Modern Control System	3	0	0	3	25	75	100
2	PCC	MEI102	Industrial Process Control	3	0	0	3	25	75	100
3	PEC		Program Specific Elective-I	3	0	0	3	25	75	100
4	PEC		Program Specific Elective-II	3	0	0	3	25	75	100
5	PCC	RMI101	Research Methodology and IPR	2	0	0	2	25	75	100
6	AUD 1		Audit course 1	2	0	0	0	25	75	100
7	PCC	MEI151	Modeling & Simulation Lab	0	0	4	2	15	35	50
8	PCC	MEI152	Computer Control Lab	0	0	4	2	15	35	50
Total Credits							**18**	180	520	700

	Course Name	Course Title
Program Elective-I	MEIE101	Optimization Technique
	MEIE102	Advanced Mathematics
	MEIE103	Modeling and Simulation Techniques
Program Elective-II	MEIE104	Industrial Electronics
	MEIE105	Industrial Instrumentation
	MEIE106	Embedded System

AUD 1	**AUD01A**	English for Research Paper Writing
	AUD02A	Disaster Management
	AUD03A	Sanskrit for Technical Knowledge
	AUD04A	Value Education
	AUD05A	Constitution of India
	AUD06A	Pedagogy Studies
	AUD07A	Stress Management by Yoga
	AUD08A	Personality Development through Life Enlightenment Skills.
	AUD09A	Swami Vivekananda's Thoughts

Semester II

M. Tech. (Electronics and Instrumentation)

Sr. No.	Category	Course Code	Course Title	Hours per week			Credits	Sessional Marks	Final Marks	Total
				L	T	P				
1	PCC	MEI201	Non Linear Control System	3	0	0	3	25	75	100
2	PCC	MEI202	Optimal Control Theory	3	0	0	3	25	75	100
3	PEC		Program Specific Elective-III	3	0	0	3	25	75	100
4	PEC		Program Specific Elective-IV	3	0	0	3	25	75	100
5	AUD		Audit course 2	2	0	0	0	25	75	100
6	PCC	MEI251	Industrial Electronics Lab	0	0	4	2	15	35	50
7	PCC	MEI252	Digital Signal Processing Lab	0	0	4	2	15	35	50
8	PCC	MEI253	Mini Project	0	0	4	2	15	35	50
Total Credits							**18**	170	480	650

	Course Name	Course Title
Program Elective-III	MEIE201	Industrial Measurement
	MEIE202	Bio-Medical Instrumentation
	MEIE203	Intelligent Instrumentation
Program Elective-IV	MEIE204	Advanced Digital Signal Processing
	MEIE205	Computer Network
	MEIE206	Digital Image Processing

AUD 2 (Audit 2 should be different from audit 1)	**AUD01A**	English for Research Paper Writing
	AUD02A	Disaster Management
	AUD03A	Sanskrit for Technical Knowledge
	AUD04A	Value Education
	AUD05A	Constitution of India
	AUD06A	Pedagogy Studies
	AUD07A	Stress Management by Yoga
	AUD08A	Personality Development through Life Enlightenment Skills.
	AUD09A	Swami Vivekananda's Thoughts

Semester III

M. Tech. (Electronics and Instrumentation)

Sr. No.	Category	Course Code	Course Title	Hours per week			Credits	Sessional Marks	Final Marks	Total
				L	T	P				
1	PEC		Program Specific Elective-V	3	0	0	3	25	75	100
2	OEC		Open Elective	3	0	0	3	25	75	100
3	PCC	MEI351	Dissertation Phase – I	0	0	20	10	100	200	300
Total Credits							**16**	150	350	500

	Course Name	Course Title
Program Specific Elective-V	MEIE301	Digital Control System
	MEIE302	MEMS
	MEIE303	Process Instrumentation
	MEIE304	Stochastic Processes
	MEIE305	Neural Network and Fuzzy Logic
	MEIE306	Industrial Automation Control
Open Elective	MECO-301	Business Analytics
	MECO-302	Industrial Safety
	MECO-303	Operations Research
	MECO-304	Cost Management of Engineering Projects
	MECO-305	Composite Materials
	MECO-306	Waste to Energy

Semester IV

M. Tech. (Electronics and Instrumentation)

Sr. No.	Category	Course Code	Course Title	Hours per week			Credits	Sessional Marks	Final Marks	Total
				L	T	P				
1	PCC	MEI401	Dissertation Phase – II	0	0	32	16	200	300	500
Total Credits							**16**	200	300	500

MEI101

Modern Control System

L T P CR
3 0 0 3

Theory : 75
Class Work : 25
Total : 100
Duration of Exam : 3 Hrs.

Course Objectives:

- To introduce students about the state variable analysis.
- To introduce the students for conversion of state variable model to transfer function model.
- To give the exposure to students about discrete time system & Z-transform methods.
- To give the exposure to the students for stability analysis in Z-plane.
- To introduce the students to state analysis of linear discrete time system and multivariable system.
- To introduce the students to various pole placement methods.
- To introduce the students to digital control system with digital feedback

Syllabus

State Variable Analysis

Introduction, vectors and matrices, state variable representation, conversion of transfer function model to state variable model, conversion of state variable model to transfer function model, decomposition of transfer function into canonical state variable models, Eigen values and Eigen vectors, solution of state equations. Concept of controllability and observability, equivalence between transfer function and state variable representation.

Discrete time system and Z transform methods

Introduction to discrete time system**,** the Z transform, solution of difference equations, inverse Z transform, pulse transfer function, Stability analysis in Z plane.

State variable analysis of discrete time system

State space analysis of linear discrete time system, controllability and observability, multivariable system.

Pole placement and state observers

Introduction, stability improvement by state feedback, necessary and sufficient condition for arbitrary pole placement, state regulator design, design of state observers, state feedback with integral control, digital control system with state feedback.

Course Outcomes: On successful complete of this course, the students should be able to:

- Understand state space variable form, various canonical forms, state equation and its solutions.
- Understand controllability & observability for continous time as well as discrete time systems.

- Understand stability as well as stability improvement using pole placement, state observer for discrete as well as continous time systems.

Text Books

1. Control System by B. C. Kuo, TMH
2. Digital and non linear control by M. Gopal, TMH
3. Control System by Nagrath and Gopal, New Age Publications

MEI102

Industrial Process Control

L T P CR
3 0 0 3

Theory : 75
Class Work : 25
Total : 100
Duration of Exam : 3 Hrs.

Course Objectives:

- To introduce the basic principles & importance of process control in industrial process plants;
- To analyse First order, second order, and integrating systems including dead time are treated with basic controller algorithms.
- To introduce the dynamic behavior of processes in different situations
- To introduce about defining controller structure with respect to controlled process and perform parameters tuning in order to assure required performance of the system.
- To introduce the concepts involved in multiple single loops in various applications.
- To introduce about theoretical and empirical mathematical models of different processes
- To introduce about the design of different types of controllers
- To introduce about the key concepts in adaptive control system

Syllabus

Historical prospective, incentives of process control, synthesis of control system, classification and definition of variables.

Need and application of mathematical modeling, lumped and distributed parameters, analogies, thermal, electrical and chemical systems, modeling of CSTR, heat exchanger, interacting and non interacting type of systems, dead time elements.

Control modes, definition, characteristics and comparison of P, PI, PD, PID controllers.

Dynamic behavior of feedback controlled process for different control modes, control system quality, IAE, ISE, IATE criterion, tuning of controllers, Ziegler-Nicholos and Cohen coon methods.

Realization of different control modes in electric and electronic controllers.

Control valves, types, function, hydraulic, pneumatic actuators, solenoid, stepper motors.

Review and limitation of single loop control, need for multi loop systems.

Principle, analysis and application of cascade, ratio, feed forward, feedback, override, split range, selective, auctioneering control.

Introduction to adaptive and self tuning control.

Interaction and decoupling of loops.

Course Outcomes: On successful complete of this course, the students should be able to:

- Understand the basic principles & importance of process control in industrial process plants.
- Model and analyze first order and integrating systems including dead time and their characteristics.
- Understand different types of controller, their tuning and their effect on system performance.
- Describe different control values used in industrial applications.
- Understand concept of single loop, multiple loop, single variable and multivariable controlled process.
- Understand adaptive, self tuning, interaction and decoupling of loops.

Text Books-

1. George Stephnopolous “Chemical Process Control” Prentice Hall
2. Peter Herriot, “ Process control” Tata McGraw Hill
3. Donald R caughanowr “ Process System Analysis and control” McGraw Hill international edition.
4. D.P.Eckmen “ Industrial instrumentation” Wiley Eastern.

MEIE101

Optimization Techniques

L T P CR
3 0 0 3

Theory : 75
Class Work : 25
Total : 100
Duration of Exam : 3 Hrs.

Course Objectives:

- To introduce the students about optimization concepts, formulation of engineering problems amenable to optimization.
- To introduce the students about the concepts for determination of maxima minima for functions of several variables.
- To introduce the students about the formulation of non linear optimization problems with equality & in equality constraints.
- To introduce the students about Uni dimensional optimization.
- To introduce the students about multivariable optimization.
- To introduce the students about Dynamic programming & Geometric programming.

Syllabus

Introduction: –Optimization concepts, Euclidean space, convex functions, gradient vector, Hessian matrix, formulation of engineering problems amenable to optimization, direct approach and indirect methods.

Classical optimization techniques: –maxima minima for functions of several variables, necessary and sufficient conditions, formulation of non linear optimization problems with equality and inequality constraints, solution techniques using Lagrange‟s multiplier and khun-tuckker conditions.

Uni dimensional optimization: –Elimination methods, interpolation methods.

Multivariable optimization: –Methods of steepest descent, Newton Raphson methods, Fletcher power method, constrained optimization.

Other techniques; –Principle of optimality, solution for simple multistage problems, Dynamic Programming,

Course Outcomes: On successful complete of this course, the students should be able to:

- Understand the formulation of engineering problems ammable to optimization using direct approach & indirect approach methods.
- Understand the non linear optimization problems along with their solution for various techniques.
- Understand elimination methods & interpolation methods used in Uni dimensional methods used in optimization.
- Understand the concepts of hill climbing, newton Raphson methods, Fletcher power method for multivariable optimization.
- Understand the solution for simple multistage problems using Dynamic programming & Geometric programming.

Text Books: S. S. Rao, “Optimization Techniques” , TMH

MEIE102 **Advanced Mathematics**

L T P CR

3 0 0 3

Theory : 75
Class Work : 25
Total : 100
Duration of Exam : 3 Hrs.

Course Objective:

- To learn importance of reliability theory, numerical methods used in research.
- Ability to understand the use of statistical quality control in engineering research.

Syllabus

Unit 1: Linear Algebra

Unit 2: Curve Fitting, Bath tub curve, state dependent systems, series and parallel connections, redundancy of systems.

Unit 3: Theory of reliability, maintainability, availability, failure distribution, MTTF, MTBF, Hazard rate,

Unit 4: Solution of Non Linear differential equation

Course Outcomes:

- Knowledge of optimization techniques and importance of reliability theory, numerical methods used in research.
- Ability to understand the use of statistical quality control in engineering research.

Text books:

1. Engineering Mathematics, Erwin Kreyszig, 9th Students edition, Wiley International
2. Reliability and Maintainability Engineering, Charles Ebeling, Tata McGraw Hills Publication
3. Engineering Optimization, S. S. Rao, New Age Publication

Reference books:

1. Numerical Mehods – S. S. Sastry
2. Statistical methods- S. P. Gupta
3. Higher Engineering Mathematics – B.V.Ramana
4. Operations Research- S. D. Sharma
5. Theory and Problems in Numerical Methods – T. Veerarajan, T.Ramachandran
6. Probability and Statistics in Engineering – W. W. Hines et al

MEIE103 **Modeling and Simulation Techniques**

L T P CR		
3 0 0 3	**Theory**	**: 75**
	Class Work	**: 25**
	Total	**: 100**
	Duration of Exam	**: 3 Hrs.**

Course Objectives:

- Introduce computer simulation technologies and techniques, provides the foundations for the student to understand computer simulation needs, and to implement and test a variety of simulation and data analysis libraries and programs. This course focuses what is needed to build simulation software environments, and not just building simulations using preexisting packages.
- Introduce concepts of modeling layers of society's critical infrastructure networks.
- Build tools to view and control simulations and their results.

Syllabus

Unit 1: Simulation Basics: Handling Stepped and Event-based Time in Simulations, Discrete versus Continuous Modelling, Numerical Techniques, Sources and Propagation of Error

Unit 2: Dynamical, Finite State, and Complex Model Simulations: Graph or Network Transitions Based Simulations, Actor Based Simulations, Mesh Based Simulations, Hybrid Simulations

Unit 3: Converting to Parallel and Distributed Simulations: Partitioning the Data, Partitioning the Algorithms, Handling Inter-partition Dependencies

Unit 4: Probability and Statisics for Simulations and Analysis: Introduction to Queues and Random Noise, Random Variates Generation, Sensitivity Analysis

Unit 5: Simulations Results Analysis and Viewing Tools: Display Forms: Tables, Graphs, and Multidimensional Visualization, Terminals, X and MS Windows, and Web Interfaces, Validation of Model Results

Course Outcome: On completion of course students will be able to understand

- Basic Model Forms
- Basic Simulation Approaches
- Handling Stepped and Event-based Time in Simulations
- Discrete versus Continuous Modelling
- Numerical Techniques
- Sources and Propagation of Error

MEIE104

Industrial Electronics

L T P CR
3 0 0 3

Theory : 75
Class Work : 25
Total : 100
Duration of Exam : 3 Hrs.

Course Objectives:

- To introduce students to different power devices to study their construction, characteristics and turning on circuits.
- To give an exposure to students of working & analysis of controlled rectifiers for different loads, inverters, DC choppers and AC voltage controllers
- To introduce the students to various welding techniques
- To introduce the students to various heating techniques
- To introduce the students to various power electronics applications like UPS, SMPS, etc. and some protection circuits.

Syllabus

Unit I: Industrial Solid State Devices : SCR, ASCR, RCT, Triac, Diac, Unijunction Transistor, SUS, SBS, Power MOSFETs, MCT, Static Induction Devices

Unit II: Industrial Converter and Regulated Power Suppliers: Single phase, three phase and six phase controlled rectifiers and their performance , dual converters, single phase and three phase ac regulators.

Unit III: Industrial Choppers: Chopper classification, chopper operation, control strategies, chopper configuration, thyristor chopper circuits, Jones chopper, Morgan chopper, Multiphase chopper

Unit IV: Industrial Invertors : Requirement of practical inverters - Types of inverters - Single phase inverters using Thyristers -Ability to operate into inductive load - Overcurrent protection - Output. Voltage control - waveform control Typical inverter circuits - Three phase inverters.

Unit V: Industrial Process Control and applications : Resistance welding controls - Resistance Welding process - Basic circuit for A.C. resistance Welding - Types of resistance Welding - Electronic Welding Control. (b) Induction heating - basic Principle - Theory - Applications - High frequency Power Source for Induction heating. (c) Dielectric heating - basic Principle - Theory - Applications - Electrodes used in Dielectric heating - Method of Coupling of Electrodes to the R.F. Generator - Thermal losses in Dielectric heating. (d) UPS, SMPS

Course Outcomes: On successful completion of this course, the students should be able to:

- Understand the working, characteristics and applications of various power devices (SCR, Diac, Triac, UJT etc) and analyze the devices in different connection conditions.
- Understand the converter, chopper, inverter and analyzes their characteristics.

- Understand the operational characteristics of various A.C. voltage controllers and compare their performances.
- Understand the various types of Industrial electronics control techniques and their applications.

Text Books:-

1. Industrial Electronics : G.K. Mittal , Khanna Publisher
2. Industrial Electronics : Noel Morris ,McGraw Hill
3. Power Electronics : Ned Mohan, Wiely Eastern Publication
4. Power Electronics : C.W.Lander, McGraw Hill

MEIE105

Industrial Instrumentation

L T P CR
3 0 0 3

Theory : 75
Class Work : 25
Total : 100
Duration of Exam : 3 Hrs.

Course Objectives:

- To introduce the students regarding methods of Error Analysis, Uncertainty Analysis, Statistical Analysis & Gaussian Error Distribution
- To the students for the methods of least square, curve fitting & rejection of data.
- To introduce the students for various static & dynamic characteristics of instruments.
- To introduce the students for classification & selection of various types of transducers.
- To introduces the students for different types of AC bridges used for measurement of low resistance, high resistance & medium resistance.
- To introduces the students for Radioactive Instrumentation and Refractometry.
- To introduces the students for studying various types of Telemetry Techniques.
- To give the exposure to various types of recorders.

Syllabus

Unit1: Error Analysis: Types of errors, Methods of error analysis, Uncertainty analysis, Statistical analysis, Gaussian error distribution, Chi-Square test, Correlation coefficient, Student‟s t-test, Method of least square, Curve fitting, Graphical analysis, rejection of data.

Unit II: Static and Dynamic characteristics: Dynamic analysis of instrumentation system, Relative merits of analytical and experimental modeling of dynamic behavior, Response of zero, first and 2nd order system to step, Pulse, Harmonic and random test signals, Frequency spectra, Auto correlation spectral density, Loading effects under static and dynamic conditions, Simulation of dynamic response.

Unit III: Classification, selection of transducers, Resistance, inductance and capacitance type of transducers, measurement of displacement, strain, force, liquid level, pressure, velocity and acceleration.

Unit IV: Measurement of low, medium, and high resistance, A.C. Bridges, Measurement of inductance and capacitance, R.L.C. Measurement, DeSauty's, Maxwell's, Anderson's, Schering and Campbell‟s bridges, errors in bridge measurements.

Unit V: Radioactive instrumentation and Refractometry:

a. X-ray spectrometry: Instrumentation for X-ray spectrometry, X-ray diffractometer: Bragg‟s law, Auger emission spectroscopy, Electron spectroscopy for chemical analysis (ESCA).

b. Radiation detectors: Ionization chamber, Geiger-Muller counter, proportional counter, scintillation counters
c. Refractometry: Principle, Abbe and Differential refractometer

UNIT VI: Methods of Data transmission: General telemetry systems, DC and AC telemetry system. Modulation, Pulse telemetry systems, Digital telemetry.

UNIT VII: Graphic Recorders: Graphic analog recorder, magnetic tape analog recorders, oscillograhic analog recorders, digital recorders

Course Outcomes: On successful complete of this course, the students should be able to:

- Understand the methods of Error Analysis, Gaussian Error Distribution and Methods of Least Square.
- Understand and implement the static & dynamic characteristics of instruments.
- Understand the loading effects under static & dynamic conditions.
- Understand the criteria for selection of transducers & working of various types of transducers.
- Understand and implement the methods used for measurement of low resistance, medium resistance & high resistance using bridges.
- Understand about the use of the radioactive instrumentation & refractometry.
- Understand about the use of Analog & Digital Telemetry systems.
- Understand the working of various types of Analog & Digital recorders.

Text Books:

1. Instrumental Methods of Analysis, Willard, Merritt, Dean, Settle, CBS Publishers & Distributors, New Delhi, Seventh edition.
2. Introduction to Instrumental Analysis, Robert D. Braun, McGraw-Hill Book Company.
3. Principles of Instrumental Analysis, Skoog, Holler, Nieman, Thomsonbrooks-cole publications, 5th edition.
4. Electrical Measurement & Measuring Instruments E.W.Golding
5. Electrical Measurement A.K.Sawhney

MEIE106 **Embedded Systems**

L T P CR **Theory : 75**

3 0 0 3 **Class Work : 25**

Total : 100

Duration of Exam : 3 Hrs.

Course Objectives:

- To learn design concept and approach of embedded systems using advanced controllers.
- To learn hardware design features and memories of embedded systems.
- To learn software design features of embedded systems.
- To learn processor peripherals and their interfacing with microprocessors.

Syllabus

UNIT 1: Concept of Embedded Systems Design: Embedded system overview, design challenges, processor technology, design technology, and Examples of Embedded System.

UNIT 2: Custom single-purpose processors: Hardware, Basic combinational logic design, Sequential logic design, custom single purpose processor design.

UNIT 3: General purpose processors: Software, Basic architecture, operation, programmer's view, development environment, ASIC processors.

UNIT 4: Microprocessors memories: Memory write ability and storage permanence, common memory types, memory hierarchy and cache, Advanced RAM.

UNIT 5: **Standard single**: purpose processors, peripherals, Timers, counters, watchdog timers, UART, PWM, RTC, LCD controllers, keypad controllers, ADCs, Stepper motor controllers.

UNIT 6: Microprocessor Interfacing: Communication basics, I/O addressing, Interrupts, DMA, arbitration.

Course Outcomes: On successful completion of this course, the students should be able to:

- Understand design concept and approach of embedded systems using advanced controllers.
- Understand hardware design features and memories of embedded systems.
- Understand software design features of embedded systems.
- Understand processor peripherals and their interfacing with microprocessors.

Text/Reference Books:

1. Frank Vahid , "Embedded System Design" Wiley India Edition, 2001.
2. J.W. Valvano, "Embedded Microcomputer System: Real Time Interfacing", Brooks/Cole,
3. 2000.
4. Jack Ganssle, "The Art of Designing Embedded Systems", Newness, 1999.
5. V.K. Madisetti, "VLSI Digital Signal Processing", IEEE Press (NY, USA), 1995.
6. David Simon, "An Embedded Software Primer", Addison Wesley, 2000.
7. K.J. Ayala, "The 8051 Microcontroller: Architecture, Programming, and Applications", Penram Intl, 1996.

RMI101 **Research Methodology and IPR**

L T P CR **Theory : 75**

2 0 0 2 **Class Work : 25**

Total : 100

Duration of Exam : 2 Hrs.

Syllabus

Unit 1: Meaning of research problem, Sources of research problem, Criteria Characteristics of a good research problem, Errors in selecting a research problem, Scope and objectives of research problem. Approaches of investigation of solutions for research problem, data collection, analysis, interpretation, Necessary instrumentations

Unit 2: Effective literature studies approaches, analysis Plagiarism , Research ethics,

Unit 3: Effective technical writing, how to write report, Paper Developing a Research Proposal, Format of research proposal, a presentation and assessment by a review committee

Unit 4: Nature of Intellectual Property: Patents, Designs, Trade and Copyright. Process of Patenting and Development, technological research, innovation, patenting, development. International Scenario: International cooperation on Intellectual Property, Procedure for grants of patents, Patenting under PCT.

Unit 5: Patent Rights: Scope of Patent Rights, Licensing and transfer of technology, Patent information and databases, Geographical Indications.

Unit 6: New Developments in IPR: Administration of Patent System, New developments in IPR, IPR of Biological Systems, Computer Software etc. Traditional knowledge Case, Studies, IPR and IITs.

Course Outcomes: On successful completion of this course, the students should be able to:

- Understand research problem formulation.
- Analyze research related information
- Follow research ethics
- Understand that today's world is controlled by Computer, Information Technology, but tomorrow world will be ruled by ideas, concept, and creativity.
- Understanding that when IPR would take such important place in growth of individuals & nation, it is needless to emphasis the need of information about Intellectual Property Right to be promoted among students in general & engineering in particular.
- Understand that IPR protection provides an incentive to inventors for further research work and investment in R & D, which leads to creation of new and better products, and in turn brings about, economic growth and social benefits.

References:

1. Stuart Melville and Wayne Goddard, “Research methodology: an introduction for science & engineering students’”
2. Wayne Goddard and Stuart Melville, “Research Methodology: An Introduction”
3. Ranjit Kumar, 2 nd Edition , “Research Methodology: A Step by Step Guide for beginners”
4. Halbert, “Resisting Intellectual Property”, Taylor & Francis Ltd ,2007.
5. Mayall , “Industrial Design”, McGraw Hill, 1992.
6. Niebel , “Product Design”, McGraw Hill, 1974.
7. Asimov , “Introduction to Design”, Prentice Hall, 1962.
8. Robert P. Merges, Peter S. Menell, Mark A. Lemley, “ Intellectual Property in New Technological Age”, 2016.
9. T. Ramappa, “Intellectual Property Rights Under WTO”, S. Chand, 2008

MEI151 **Control and Computational Lab**

L T P CR		
0 0 4 2	**Theory**	**: 75**
	Class Work	**: 25**
	Total	**: 100**
	Duration of Exam	**: 3 Hrs.**

List of Experiments

1. To develop the state variables and state equation of the Continuous Stirred Tank Reactor (CSTR).
2. A) To model and observe dynamic response of mass storage capacity system.
   B) To observe effect of system parameters on its performance.
3. A) To model and observe dynamic response of two non-interacting mass storage capacity system.
   B) To observe effect of system parameters on its performance.
4. To model and observe dynamic response of two interacting mass storage capacity system. To observe effect of system parameters on its performance.
5. To model single order mass storage capacity system with time delay. Also observe effect of time delay on time response characteristics of the system.
6. Study and design P controller for a given transfer function of a system using Simulink in MATLAB. Observe effect of different parameters of controller on the performance characteristics of closed loop system.
7. Study and design PI controller for a given transfer function of a system using Simulink in MATLAB. Observe effect of different parameters of controller on the performance characteristics of closed loop system.
8. Study and design PID controller for a given transfer function of a system using Simulink in MATLAB. Observe effect of different parameters of controller on the performance characteristics of closed loop system.
9. To observe dynamic characteristics of feed forward controller.
10. To observe dynamic characteristics of feed backward controller.

Course Outcomes: On successful complete of this course, the students should be able to:

- To model multicapacity systems and observe their characteristics using MATLAB.
- To model multicapacity systems with time delay and observe their characteristics using MATLAB.
- To understand effect of different controllers i.e. P, PI, PID on the dynamic performance of closed loop system using MATLAB SIMULINK.
- To observe dynamic characteristics of feed forward and feed backward controller

MEI152 **Modelling & Simulation Lab**

L T P CR		
0 0 4 2	**Theory**	**: 75**
	Class Work	**: 25**
	Total	**: 100**
	Duration of Exam	**: 3 Hrs.**

List of Experiments

1. To convert various control system forms into state space form & vice versa using MATLAB.
2. To check the controllability & observability of a continuous time system using MATLAB.
3. To check the controllability & observability of a discrete time system using MATLAB.
4. To convert a given state space form of a system into phase variable ,controllable canonical & diagonal canonical form using MATLAB
5. To design a state feedback controller using pole placement with MATLAB& check the stability of the system.
6. To design a state observer for a given control system using MATLAB.
7. To check the stability of a continuous time system using bode plot&Nyquist plot.
8. To calculate state transition matrix for a given state space system using various methods in MATLAB.

Course outcome:

After completion of the lab, the students will be able to

- Understand the various representations & canonical forms of a control system.
- Understand the concept of stability for a control system.
- Understand the concept of controllability & observability of continuous time& discrete time control systems.
- Design a state feedback controller using pole placement & state observer.

MEI201 **Non Linear Control Systems**

L T P CR **Theory : 75**
3 0 0 3 **Class Work : 25**
Total : 100
Duration of Exam : 3 Hrs.

Course Objectives:

- To introduce the students regarding describing function analysis of non linear control system.
- To introduce the students regarding phase plane analysis of linear control system & non linear control system.
- To introduce the students about the methods of stability of linear systems & non linear systems using Liapunov Stability Analysis.
- To introduce the methods for estimating the time response behavior of dynamic systems.
- To introduce the methods to formulate Liapunov Function.

Syllabus

Describing function analysis of non linear control systems –
Introduction to non linear system, nonlinear control system, Describing functions, describing function analysis to non linear control systems**.**

Phase plane analysis -
Introduction, methods of constructing trajectories, obtaining time solutions from phase plane plots, singular points, phase plane analysis of linear control systems, phase plane analysis of nonlinear systems,estimating the time response behavior of dynamic system.

Liapunov stability Analysis –
Introductions, definitions, second method of liapunov, stability analysis of linear system, stability analysis of non linear systems, methods to formulate liapunov function.

Course Outcomes: On successful complete of this course, the students should be able to:

- Understand and Differentiate between linear and nonlinear system, characteristics of non linear system, methods of analysis of non linear system for stability.
- Understand about the phase plane analysis and also about the methods of constructing trajectories for stability analysis.
- Understand about the concept of Liapunov Stability criteria.

Text Books:

1. K Ogatta, “Control System Theory” , PHI
2. Gibson, “Non Linear Control System” , TMH
3. M. Gopal “ Discrete and non linear system”, TMH

MEI202 **Optimal Control Theory**

L T P CR **Theory : 75**
3 0 0 3 **Class Work : 25**
Total : 100
Duration of Exam : 3 Hrs.

Course Objectives:

- To introduce the students about optimal control system and time optimal control system.
- To introduce the students for formulation of optimization.
- To introduce the students about the complete state problems controllability of continuous system & discrete system.
- To introduce the students about the complete state of observability of continuous & discrete system.
- To introduce the students about the time optimal control for continuous time system & discrete time system.
- To introduce the applications of optimal control to dynamics systems.
- To introduce Dynamic programming & optimal control of distributed parameter system.

Syllabus

Unit 1: Introduction: – Introduction, optimal control system, performance indices, Formulation of optimization problems, time optimal control systems.

Unit 2: Calculus of variations :- Calculus of variations, applications of optimal control to dynamic systems. Pontryagin minimum principle and its application to optimal control problems with constraints

Unit 3: Dynamic Programming: Dynamic Programming, Bellman- Jacobi equation and its applications, introduction to optimal control of distributed parameter system. Solution algebraic Ricattii‟s equation for linear regulator problem.

Course Outcomes: On successful complete of this course, the students should be able to:

- Understand about the optimal control & performance indices.
- Understand about the complete state controllability of continuous system & discrete system.
- Understand about the time optimal control for continuous system & discrete time system.
- Understand about the optimal control system based on quadratic performance induces and applications of optimal control to dynamic systems.

- Understand about Ricattii‟s equation for linear regulator problem

Text Books:

1. A.J.Kirk, “Optimal Control Theory” ,TMH
2. M. Gopal, “introducing Optimal Control System” , TMH
3. M. Gopal, “Descrete and Non Linear system” , TMH
4. Nagrath And Gopal, “Control System” , TMH
5. K.Ogatta, Modern Control System, TMH

MEIE201 **Industrial Measurement**

L T P CR		
3 0 0 3	**Theory**	**: 75**
	Class Work	**: 25**
	Total	**: 100**
	Duration of Exam	**: 3 Hrs.**

Course Objectives:

- To learn measurement of Pressure, Flow and Temperature

Syllabus

Unit 1: Measurement Techniques Pressure
Unit 2: Measurement Techniques Flow
Unit 3: Measurement Techniques Temperature

Course Outcomes: On successful complete of this course, the students should be able to:

- Understand measurement of Pressure, Flow and Temperature

Text Books:

1. Instrumental Methods of Analysis, Willard, Merritt, Dean, Settle, CBS Publishers & Distributors, New Delhi, Seventh edition.
2. Introduction to Instrumental Analysis, Robert D. Braun, McGraw-Hill Book Company.
3. Principles of Instrumental Analysis, Skoog, Holler, Nieman, Thomsonbrooks-cole publications, 5th edition.
4. Electrical Measurement & Measuring Instruments E.W.Golding
5. Electrical Measurement A.K. Sawhney

MEIE202 **Bio Medical Instrumentation**

L T P CR		
3 0 0 3	**Theory**	**: 75**
	Class Work	**: 25**
	Total	**: 100**
	Duration of Exam	**: 3 Hrs.**

Course Objectives:

- To introduce students to the origin of Bio-electric signals & sources of low recording circuits.
- To introduce the students about the various types of recorders and transducers used.
- To introduce the students about Bio-medical recorders & display devices.
- To introduce the students about various BP measurement techniques.
- To introduce the students and about MRI and Ultrasonic imaging systems.
- To introduce the students about various types of cardiac pacemakers & defibrillators.
- To introduce the students about bio-telemetry & applications of bio-telemetry in patient care.
- To introduce the students about various types of LASERs and their applications in Bio-medical Fields.

Syllabus

Unit I: Introduction, general block diagram of bio medical instrumentation system, origin of bio electric signals, recording systems, preamplifiers, main amplifiers and transducers used for medical instrumentation system, types of recorders

Unit II: Biomedical recorders and display systems-ECG, EEG,EMG, electrodes used for ECG, EEG and EMG, oscilloscopes used for bio medical measurement, multi channel display

Unit III: Blood gas analyzer- blood pressure measurement, patient monitoring systems, blood pH measurement, complete blood gas analyzer

Unit IV: Special machines- X ray machine, MRI, ultrasonic imaging systems, A-scanner, B-scanner, echo cardiograph

Unit V: Cardiac pacemakers and defibrillators- external pace maker, implanted pace maker, programmable pace maker, DC defibrillators, implantable defibrillators

Unit VI: Laser applications in bio medical field- ruby laser, argon laser, helium neon laser, CO2 laser, Na-yag laser

Course Outcomes: On successful complete of this course, the students should be able to:

- Understand the various types of bio-electric signals, bio-medical recorders & display systems.
- Understand the oscilloscopes bio-medical measurements.
- Understand the various types of BP measurement techniques.
- Understand the basic principles and applications of MRI and Ultrasonic imaging techniques.

- Understand the various types of pacemakers & defibrillators.
- Understand the components of bio-telemetry and its applications required for patient care.
- Understand the various types of LASERs & their applications in Bio-medical field.

Text Books

1. R.S.Khandpur, " Introduction to bio medical Instrumentation", TMH
2. Cromwell, "Bio medical Instrumentation" , TMH

MEIE203

Intelligent Instrumentation

L T P CR
3 0 0 3

Theory : 75
Class Work : 25
Total : 100
Duration of Exam : 3 Hrs.

Course Objectives:

- To introduce the students about intelligent instrumentation system and characteristics of intelligent instrumentation.
- To introduce the students for various types of instrumentation/computer networks.
- To introduce students virtual instrumentation and programming in Labview.
- To introduce the students about various types of interfacing techniques.
- To introduce the students about various types of analysis techniques.

Syllabus

Unit 1: Introduction: Definition of an intelligent instrumentation system, Static and Dynamic characteristics of intelligent instrumentation, feature of intelligent instrumentation, Block Diagram of an intelligent instrumentation.

Unit 2: Instrumentation/Computer Networks: Serial & parallel interfaces, serial communication standards, parallel data bus, EEE 488bus, Local area networks (LANs), Star networks, Ring & bus networks, Fiber optic distributed networks.

Unit 3: Virtual Instrumentation: Introduction to graphical programming data flow & graphical programming techniques, advantage of Virtual Instrumentation techniques, Virtual Instrumentations and sub Virtual Instrumentation loops and charts, arrays, clusters and graphs, case and sequence structure, formula notes, string and file Input/Output.

Unit 3: Interfacing Instruments & Computers: Basic issues of interfacing, Address decoding, Data transfer control, A/D converter, D/A converter, other interface consideration.

Unit 4: Analysis Technique: DSP software, Measurement filters and wavelets, windows, curve fitting probability and statistics.

Course Outcomes: On successful complete of this course, the students should be able to:

- Define the meaning of intelligent instrumentation syatem and its static and dynamic characteristics.
- Understand the various serial and parallel data transfer standards i.e. RS232 and IEEE488.
- Write VI program in LABVIEW to implement various virtual instrumentation system.
- Do interfacing of ADC and DAC and other peripherals to microprocessor using decoders.
- To implement various filters and wavelets using DSP software.

BOOKS:

1. Intelligent instrumentation :G.C. Barney: PHI.
2. Labview for everyone: Lisa, K. Wells and Jeffery Travis: PHI.

REFRENCES:

1. Principles of measurement & instrumentation: Alan S. Moris; PHI.
2. Labview graphical programming 2nd edition: Gray Johanson; TMH.

MEIE204

Advanced Digital Signal Processing

L T P CR		
3 0 0 3	**Theory**	**: 75**
	Class Work	**: 25**
	Total	**: 100**
	Duration of Exam	**: 3 Hrs.**

Course Objectives:

- To analyze of different type of signals and systems.
- To analyze the DTFT AND DFT and their properties, fast fourier transform (FFT), decimation in time algorithm, decimation in frequency algorithm.
- To understand the use of sampling and reconstruction and to understand the use of z-transform in discrete time systems.
- To analyze the different types of structures of FIR and IIR systems and to design IIR filters, design of FIR using windows, properties of FIR filters.
- To describe the effects of finite word lengths and truncation and rounding in digital signal processing for IIR and FIR filters.

Syllabus

Unit 1: Introduction of DSP: Introduction to Signal Processing, Discrete Linear Systems, superposition Principle, Unit-Sample response, stability &causality Criterion.

Unit 2: Fourier Transform &inverse Fourier transform: Frequency domain design of digital filters, Fourier transform, use of Fourier transform in Signal processing. The inverse fourier transform, Sampling continuous function to generate a sequence, Reconstruction of continuous –time signals from Discrete-time sequences.

Unit 3: DFT &FFT &Z transform with Applications: Discrete Fourier transform, properties of DFT, Circular Convolution, Fast Fourier Transform, Realizations of OFT. The Z transform, the system function of a digital filter, Digital Filter implementation from the system function, the inverse Z- transform, properties &applications, Special computation of finite sequences, sequence of infinite length &continuous time signals, computation of fourier series &time sequences from spectra.

Unit 4: Digital Filter Structure &Implementation: Linearity, time- invariance &causality, the discrete convolution, the transfer function, stability tests, steady state response, Amplitude &Phase characteristics, stabilization procedure, Ideal LP Filter, Physical reliability &specifications.FIR Filters, Truncation windowing &Delays, design example, IIR Filters: Review of design of analog filters &analog frequency transformation. Digital frequency transformation. Design of LP filters using impulse invariance method, Bilinear transformation, Phase equalizer, digital all pass filters.

Unit 5: Implementation of Filters: Realization block diagrams, Cascade &parallel realization, effect of infinite-word length, transfer function of degree 1&2, Sensitivity comparisons, effects of finite precision arithmetic on Digital filters.

Course Outcomes: On successful complete of this course, the students should be able to:

- Analyze of different type of signals and systems.
- Analyze the DTFT AND DFT and their properties, fast fourier transform (FFT), decimation in time algorithm, decimation in frequency algorithm.
- Understand the use of sampling and reconstruction and to understand the use of z-transform in discrete time systems.
- Analyze the different types of structures of FIR and IIR systems and to design IIR filters, design of FIR using windows, properties of FIR filters.
- Describe the effects of finite word lengths and truncation and rounding in digital signal processing for IIR and FIR filters.

Text Books

1. Alam V. Oppenheim & Ronald W. Schafer, "Digital Signal Processing" PHI.
2. J G Proakis, "Digital Signal Processing", (PHI) 3rd Edition.

Reference Books

1. Rabiner & Gold, "Theory & application of digital Signal Processing", PHI 1992.
2. Roman kuc, "Introduction to Digital Signal Processing," McGraw hill Edition.

MEIE205

Computer Network

L T P CR
3 0 0 3

Theory : 75
Class Work : 25
Total : 100
Duration of Exam : 3 Hrs.

Course Objectives:

- To give exposure to student that how data is transferred in computers.
- To study the performance of a network.
- To study the basics of different layers of TCP/ & how information is transferred between them.
- To solve issues occurring at different layers.

Syllabus

Unit 1: Introduction to computer networks and the Internet: Application layer: Principles of network applications, The Web and Hyper Text Transfer Protocol, File transfer, Electronic ail, Domain name system, Peer-to-Peer file sharing, Socket programming, Layering concepts.

Unit 2: Switching in networks: Classification and requirements of switches, a generic switch, Circuit Switching, Time-division switching, Space-division switching, Crossbar switch and evaluation of blocking probability, 2-stage, 3-stage and n-stage networks, Packet switching, Blocking in packet switches, Three generations of packet switches, switch fabric, Buffering, Multicasting, Statistical

Unit 3: Multiplexing. Transport layer: Connectionless transport, User Datagram Protocol, Connectionoriented transport – Transmission Control Protocol, Remote Procedure Call.

Unit 4: Transport layer: Connectionless transport, User Datagram Protocol, Connection-oriented transport, Transmission Control Protocol, Remote Procedure Call.

Unit 5: Congestion Control and Resource Allocation: Issues in Resource Allocation, Queuing Disciplines, TCP congestion Control, Congestion Avoidance Mechanisms and Quality of Service.

Unit 6: Network layer: Virtual circuit and Datagram networks, Router, Internet Protocol, Routing algorithms, Broadcast and Multicast routing.

Unit 7: Link layer: ALOHA, Multiple access protocols, IEEE 802 standards, Local Area Networks, addressing, Ethernet, Hubs, Switches.

Course Outcomes: On successful completion of this course, the students should be able to:

- Understand the concepts of networking thoroughly.
- Design a network for a particular application.
- Analyze the performance of the network.
- Understand various issues at different layers.

Text Reference books:

1. J.F. Kurose and K. W. Ross, “Computer Networking – A top down approach featuring the Internet”, Pearson Education, 5th Edition
2. L. Peterson and B. Davie, “Computer Networks – A Systems Approach” Elsevier Morgan Kaufmann Publisher, 5th Edition.
3. T. Viswanathan, “Telecommunication Switching System and Networks”, Prentice Hall
4. S. Keshav, “An Engineering Approach to Computer Networking” , Pearson Education
5. B. A. Forouzan, “Data Communications and Networking”, Tata McGraw Hill, 4th Edition
6. Andrew Tanenbaum, “Computer networks”, Prentice Hall
7. D. Comer, “Computer Networks and Internet/TCP-IP”, Prentice Hall
8. William Stallings, “Data and computer communications”, Prentice Hall

MEIE206 **Digital Image Processing**

L T P CR		
3 0 0 3	**Theory**	**: 75**
	Class Work	**: 25**
	Total	**: 100**
	Duration of Exam	**: 3 Hrs.**

Course Objectives:

- To introduce the students with the fundamentals of digital image processing techniques as well as image enhancement & filtering.
- To give exposure to students regarding color image processing & image segmentation.
- To introduce the concept of Multi-resolution image processing tech, as well as image compression techniques and standards.
- To impart knowledge regarding video coding & video segmentation.

Syllabus

Unit 1: Digital Image Fundamentals: Elements of visual perception, image sensing and acquisition, image sampling and quantization, basic relationships between pixels–neighbourhood, adjacency, connectivity, distance measures.

Unit 2: Image Enhancements and Filtering: Gray level transformations, histogram equalization and specifications, pixel-domain smoothing filters, linear and order-statistics, pixel-domain sharpening filters, first and second derivative, two-dimensional DFT and its inverse, frequency domain filters, low-pass and high-pass.

Unit 3: Color Image Processing: Color models–RGB, YUV, HSI; Color transformations–formulation, color complements, color slicing, tone and color corrections; Color image smoothing and sharpening; Color Segmentation.

Unit 4: Image Segmentation: Detection of discontinuities, edge linking and boundary detection, thresholding – global and adaptive, region-based segmentation.

Unit 5: Wavelets and Multi-resolution image processing: Uncertainty principles of Fourier Transform, Time-frequency localization, continuous wavelet transforms, wavelet bases and multi-resolution analysis, wavelets and Subband filter banks, wavelet packets.

Unit 6: Image Compression: Redundancy, inter-pixel and psycho-visual, Lossless compression predictive, entropy, Lossy compression, predictive and transform coding, Discrete Cosine Transform, Still image compression standards, JPEG and JPEG-2000.

Unit 7: Fundamentals of Video Coding: Inter-frame redundancy, motion estimation techniques fullsearch, fast search strategies, forward and backward motion prediction, frame classification-I, P and B, Video sequence hierarchy, Group of pictures, frames, slices, macro-blocks and blocks; Elements of a video encoder and decoder; Video coding standards, MPEG and H.26X.

Unit 8: Video Segmentation: Temporal segmentation–shot boundary detection, hard-cutsand soft-cuts, spatial segmentation – motion-based, Video object detection and tracking.

Course Outcomes: On successful completion of this course, the students should be able to:

- Mathematically represent the various types of images and analyze them.

- Process these images for the enhancement of certain properties or for optimized use of the resources.
- Develop algorithms for image compression and coding.
- Understand the various types of video segmentation.

Text/Reference Books:

1. R.C. Gonzalez and R.E. Woods, Digital Image Processing, Second Edition, Pearson Education 3rd edition 2008.
2. Anil Kumar Jain, Fundamentals of Digital Image Processing, Prentice Hall of India.2nd edition 2004.
3. Murat Tekalp , Digital Video Processing" Prentice Hall, 2nd edition 2015.

MEIE301 **Digital Control System**

L T P CR
3 0 0 3

Theory : 75
Class Work : 25
Total : 100
Duration of Exam : 3 Hrs.

Course Objectives:

- Study of different transform techniques for digital control
- Design of discrete controller for continuous system
- Stability analysis of discrete system

Unit 1: Introduction to digital control, Configuration of basic digital control system, discrete transfer function, discrete model sampled data systems using z- transform, transfer function model, signal analysis and dynamic response, zero-order hold equivalent, introduction to first-order-hold equivalent, transformation between s, z, w plane, z-Domain description of sampled continuous time systems.

Unit 2: Controller design, Controller Design using transform techniques: Root locus and frequency domain analysis compensator design.

Unit 3 : State space theory, Control system analysis using state variable method, vector and matrices, state variable representation, conversion of state variable to transfer function and vice versa, conversion of transfer function to canonical state variable models, system realization, solution of state equations.

Unit 4: State space design, Design using state-space methods: controllability and observability, control law design, pole placement, pole placement design using computer aided control system design (CACSD).

Unit 5: Observer design: Observer design, Deadbeat controller design, Delayed system, controller design for delayed systems.

Unit 6: Stability analysis: Stability analysis and Jury‘s stability criterion, Lyapunov stability analysis to linear systems and discrete systems, Stability improvement by state feedback.

Course Outcomes:

- Ability to design discrete controllers for system in time domain.
- Ability to design discrete controllers for system in frequency domain.
- Ability to analyze stability of a discrete system.

Text Books

1. K. Ogata,―Discrete Control Systems‖, PHI,2nded., 1995
2. M. Gopal, ―Digital Control and state variable methods‖, TMH, 2nd ed., 2006

Reference Books

1. Isermann, ―Digital Control Systems‖, Springer-Verlag, 1989
2. B. C. Kuo, ―Digital Control System‖, 2nded., 1995

MEIE302 **MEMS**

L T P CR

3 0 0 3

Theory : 75
Class Work : 25
Total : 100
Duration of Exam : 3 Hrs.

Course Objectives:

- To introduce about MEMS & Micro fabrications.
- To give exposure about essential material properties.
- To introduce about various transducers techniques
- To introduce about various fabrication & maching process of MEMS.

Syllabus

Unit 1: Introduction and Historical Background, Scaling Effects. Micro/Nano Sensors, Actuators and Systems overview, Case studies, Review of Basic MEMS fabrication

Units2:Oxidation, Deposition Techniques, Lithography (LIGA), and Etching. Micromachining, Surface Micromachining, sacrificial layer processes, Stiction, Bulk Micromachining, Isotropic Etching and Anisotropic Etching, Wafer Bonding, Mechanics of solids in MEMS/NEMS, Stresses, Strain, Hookes's law, Poisson effect, Linear Thermal Expansion, Bending, Energy methods, Overview of Finite Element Method, Modeling of Coupled Electromechanical Systems.

Unit 3: MEMS types and their applications: Mechanical MEMS, Strain and pressure sensors, Accelerometers etc., Electromagnetic MEMS, Micromotors, Wireless and GPS MEMS etc Magnetic MEMS, all effect sensors, SQUID magnetometers, Optical MEMS, Micromachined fiber optic component, Optical sensors, Thermal MEMS, thermo-mechanical and thermo-electrical actuators, Peltier heat pumps.

Course Outcomes: On successful completion of this course, the students should be able to:

- Appreciate the underlying working principles of MEMS and NEMS devices.
- Be comfortable with the design, analysis & testing of MEMS. .
- Apply the MEMS for different applications.
- Understand about the different MEMS process used in MEMS/NEMS devices.

Text/Reference Book:

1. G. K. Ananthasuresh, K. J. Vinoy, S. Gopalkrishnan K. N. Bhat, V. K. Aatre, Micro and Smart Systems, Wiley India, 2012.
2. S. E.Lyshevski, Nano-and Micro-Electromechanical systems: Fundamentals of Nano- and Microengineering (Vol. 8). CRC press, (2005).
3. S. D. Senturia, Microsystem Design, Kluwer Academic Publishers, 2001.
4. M. Madou, Fundamentals of Microfabrication, CRC Press, 1997.
5. G. Kovacs, Micromachined Transducers Sourcebook, McGraw-Hill, Boston, 1998.
6. M.H. Bao, Micromechanical Transducers: Pressure sensors, accelerometers, and Gyroscopes, Elsevier, New York, 2000.
7. R.C Jaeger, "Introduction to Microelectronics Fabrication", 2nd edition, Addison Wesley, 2000.

MEIE303

Process Instrumentation

L T P CR
3 0 0 3

Theory : 75
Class Work : 25
Total : 100
Duration of Exam : 3 Hrs.

Course Outcomes:

- To learn process identification techniques.
- To learn Implementation of control schemes for different processes

Syllabus

Process identification using various techniques, Analysis of some common processes like Distillation column, Boilers, Heat Exchangers, Dryers, Continuous Stirred Tank Reactor, Compressors. Modeling of some common processes & Utilities like Boiler, Refrigeration unit, Chiller plant, D. M. water plant, Instrument air supply. Application of Advanced process Instrumentation Tools to various processes.

Course Outcomes:

- Utilization of various process identification techniques.
- Implementation of control schemes for different processes

Reference Books:

1. Andrews and Williams, “Principles of Applied instrumentation”, Vol. I, II, III, IV, Gulf Publications company
2. F. G. Shinsky, “Process Control System,” Mc Graw Hills, 1996.
3. B.G. Liptak , “Process Control”, Chilton Publications, Fourth edition, 2009.
4. Design and Application of Process Control Systems, ISA

MEIE304 **Stochastic Processes**

L T P CR **Theory : 75**

3 0 0 3 **Class Work : 25**

Total : 100

Duration of Exam : 3 Hrs.

Course Objectives:

- To introduce the students to Stochastic Processes & limitation of deterministic control and processes.
- To introduce the students for various types of probabilities.
- To introduce students for various theorems comes under repeated trails.
- To introduce the students about various types of random variables.
- To introduce the students to mean, variance, moments & conditional statistics.
- To introduce the students for various types of stationary processes, correlation & spectra.

Syllabus

Unit I: Introduction: Overview of stochastic process, limitation of deterministic control and processes.

Unit II: Probability and axioms: Definitions, axioms and probability, conditional probability.

Unit III: Repeated Trails: Combined experiments, Bernoulli trails, asymptotic theorems, poison theorem, Bay‟s theorem and statistics.

Unit IV:Random Variables: Distribution and density function, conditional distributions, total probability and Bay‟s theorem, mean and variance, moments characteristics functions, two random variables, moments and conditional statistics.

Unit V: Stationary processes, system with stochastic inputs, Periodicity, correlation and spectra.

Course Outcomes: On successful complete of this course, the students should be able to:

i. Understand the stochastic processes & limitation of deterministic control & processes.
ii. Understand and solve the problems related to various types of probability.
iii. Solve the problems by applying Asymptotic theorems, poison theorems & Bay‟s theorems
iv. Know about the basic concept of the random variables & solve the problems of mean, variance & moments.
v. Apply Bay‟s theorem for solving the complex problems.
vi. Know about stationary processes & solve the problems related to stationery processes.
vii. Understand the basics of correlation & spectra.

Text Books :

Populis, “Probability, Random Variables and stochastic process” McGraw Hill

MEIE305 **Neural Network and Fuzzy Logic**

L T P CR		
3 0 0 3	**Theory**	**: 75**
	Class Work	**: 25**
	Total	**: 100**
	Duration of Exam	**: 3 Hrs.**

Course Objectives:

- To introduce the students regarding Neural network characteristics and history of development of neural network principles.
- To introduce the students regarding Learning methods and neural network models, types of learning, supervised, unsupervised, reinforced learning etc
- To give the exposure to the students regarding Recurrent back propagation, introduction to counter propagation networks, CMAC networks and ART networks
- To introduce the students regarding applications of neural network
- To introduce the students regarding the concepts of Fuzzy logic, Fuzzification and Defuzzification

Syllabus

Unit I: Introduction, Neural network characteristics, history of development of neural network principles, artificial neural net terminology, models of neuron, topology.

Unit II: Learning methods and neural network models, types of learning, supervised, unsupervised, reinforced learning, knowledge, representation and acquisition, Basic Hopfield model, basic learning laws, unsupervised learning, competitive learning, Kmeans clustering algorithm. Kohnen‟s feature maps.

Unit III: Artificial neural networks – Radial basis function neural networks, Basic learning laws in REF nets, Recurrent back propagation, introduction to counter propagation networks, CMAC networks and ART networks.

Unit IV: Applications of neural nets, applications such as pattern recognition, pattern mapping, Associative memories, speech and decision making.

Unit V: Fuzzy logic Basic concepts of fuzzy logic, fuzzy Vs crisp set, linguistic variables, membership functions, fuzzy sets and operations on fuzzy sets, IF-Then rules, variable inference techniques, De-fuzzyfication. Basic fuzzy inference algorithm, Fuzzy system design, antilock breaking system, industrial applications.

Course Outcomes: On successful complete of this course, the students should be able to:

- Understand Neural network characteristics and history of development of neural network principles.
- Understand Learning methods and neural network models, types of learning, supervised, unsupervised, reinforced learning etc
- Understand Recurrent back propagation, introduction to counter propagation networks, CMAC networks and ART networks
- Understand applications of neural network
- Understand the concepts of Fuzzy logic, Fuzzification and Defuzzification

Text Books:

1. B. Yagnanarayana, “Artificial neural networks” PHI
2. Z. M. Zurada, “Introduction to artificial neural systems” Jaico Publications
3. Ross J.T.”fuzzy logic with engineering applications”

MEIE306

Industrial Automation Control

L T P CR
3 0 0 3

Theory : 75
Class Work : 25
Total : 100
Duration of Exam : 3 Hrs.

Course Objective:

- To learn selection of DCS & network protocol based on applications.
- To learn Implementation of DCS for various process/plant

Syllabus

Evolution of instrumentation and control, Role of automation in industries, Benefits of automation. Different types of processes. Typical examples of continuous, batch, discrete and hybrid processes. Study of Process flow , detailed P&ID, Critical loops, Safety and Alarms, Reliability and Fail safe operation requirements, Efficient running and adhering to standards.

Different standard for programming the control system Different types of control system. Controlling advance applications with DCS, SCADA and PLCs. Discussion of available and suitable feature in hybrid control system.

HART, Foundation fieldbus, Profibus protocol introduction, frame structure, programming, implementation examples, Benefits, Advantages and Limitations Comparison with other fieldbus standards including Device net, Profibus, Controlnet, CAN, Industrial Ethernet etc.

Distributed Control Systems Engineering and Design DCS detail engineering, specifications, configuration and programming, functions including database management, reporting, Sequential event recording alarm management, communication, third party interface, control, display etc. Enhanced functions viz. Advance Process Control, Batch application, Historical Data Management, OPC support, Security and Access Control etc. Performance Criteria for DCS and other automation tools.

Course Outcomes:

- Selection of DCS & network protocol based on applications.
- Implementation of DCS for various process/plant

Reference Books:

1. Popovic and Bhatkar , " Distributed Computer Control For Industrial Automation", Marcel Dekker,INC, 2005.
2. Webb and Reis, "Programmable Logic Controllers: Principles and Applications", PHI,2009.
3. S.K.Singh, "Computer Aided Process Control", PHI, 2007.

OPEN ELECTIVES

MECO-301 **Business Analytics**

L T P CR
3 0 0 3

Theory : 75
Class Work : 25
Total : 100
Duration of Exam : 3 Hrs.

Course Objectives:

- Understand the role of business analytics within an organization.
- Analyze data using statistical and data mining techniques and understand relationships between the underlying business processes of an organization.
- To gain an understanding of how managers use business analytics to formulate and solve business problems and to support managerial decision making.
- To become familiar with processes needed to develop, report, and analyze business data.
- Use decision-making tools/Operations research techniques.
- Mange business process using analytical and management tools.
- Analyze and solve problems from different industries such as manufacturing, service, retail, software, banking and finance, sports, pharmaceutical, aerospace etc.

Syllabus

Unit1: Business analytics: Overview of Business analytics, Scope of Business analytics, Business Analytics Process, Relationship of Business Analytics Process and organisation, competitive advantages of Business Analytics. Statistical Tools, Statistical Notation, Descriptive Statistical methods, Review of probability distribution and data modelling, sampling and estimation methods overview.

Unit 2: Trendiness and Regression Analysis: Modelling Relationships and Trends in Data, simple Linear Regression, Important Resources, Business Analytics Personnel, Data and models for Business analytics, problem solving, Visualizing and Exploring Data, Business Analytics Technology.

Unit 3: Organization Structures of Business analytics, Team management, Management Issues, Designing Information Policy, Outsourcing, Ensuring Data Quality, Measuring contribution of Business analytics, Managing Changes. Descriptive Analytics, predictive analytics, predicative Modelling, Predictive analytics analysis, Data Mining, Data Mining Methodologies, Prescriptive analytics and its step in the business analytics Process, Prescriptive Modelling, nonlinear Optimization.

Unit 4: Forecasting Techniques: Qualitative and Judgmental Forecasting, Statistical Forecasting Models, Forecasting Models for Stationary Time Series, Forecasting Models for Time Series with a Linear Trend, Forecasting Time Series with Seasonality, Regression Forecasting with Casual Variables, Selecting Appropriate Forecasting Models. Monte Carlo Simulation and Risk Analysis: Monte Carle Simulation Using Analytic Solver Platform, New-Product Development Model, Newsvendor Model, Overbooking Model, Cash Budget Model.

Unit 5: Decision Analysis: Formulating Decision Problems, Decision Strategies with the without Outcome Probabilities, Decision Trees, The Value of Information, Utility and Decision Making.

Unit 6: Recent Trends in : Embedded and collaborative business intelligence, Visual data recovery, Data Storytelling and Data journalism.

Course Outcomes: On successful complete of this course, the students should be able to:

1. Students will demonstrate knowledge of data analytics.
2. Students will demonstrate the ability of think critically in making decisions based on data and deep analytics.
3. Students will demonstrate the ability to use technical skills in predicative and prescriptive modeling to support business decision-making.
4. Students will demonstrate the ability to translate data into clear, actionable insights.

MECO-302 **Industrial Safety**

L T P CR

3 0 0 3

Theory : 75
Class Work : 25
Total : 100
Duration of Exam : 3 Hrs.

Syllabus

Unit-I: Industrial safety: Accident, causes, types, results and control, mechanical and electrical hazards, types, causes and preventive steps/procedure, describe salient points of factories act 1948 for health and safety, wash rooms, drinking water layouts, light, cleanliness, fire, guarding, pressure vessels, etc, Safety color codes. Fire prevention and firefighting, equipment and methods.

Unit-II: Fundamentals of maintenance engineering: Definition and aim of maintenance engineering, Primary and secondary functions and responsibility of maintenance department, Types of maintenance, Types and applications of tools used for maintenance, Maintenance cost & its relation with replacement economy, Service life of equipment.

Unit-III: Wear and Corrosion and their prevention: Wear- types, causes, effects, wear reduction methods, lubricants-types and applications, Lubrication methods, general sketch, working and applications, i. Screw down grease cup, ii. Pressure grease gun, iii. Splash lubrication, iv. Gravity lubrication, v, Wick feed lubrication vi. Side feed lubrication, vii. Ring lubrication, Definition, principle and factors affecting the corrosion. Types of corrosion, corrosion prevention methods.

Unit-IV: Fault tracing: Fault tracing-concept and importance, decision treeconcept, need and applications, sequence of fault finding activities, show as decision tree, draw decision tree for problems in machine tools, hydraulic, pneumatic,automotive, thermal and electrical equipment's like, I. Any one machine tool, ii. Pump iii. Air compressor, iv. Internal combustion engine, v. Boiler, vi. Electrical motors, Types of faults in machine tools and their general causes.

Unit-V: Periodic and preventive maintenance: Periodic inspection-concept and need, degreasing, cleaning and repairing schemes, overhauling of mechanical components, overhauling of electrical motor, common troubles and remedies of electric motor, repair complexities and its use, definition, need, steps and advantages of preventive maintenance. Steps/procedure for periodic and preventive maintenance of I. Machine tools, ii. Pumps, iii. Air compressors, iv. Diesel generating (DG) sets, Program and schedule of preventive maintenance of mechanical and electrical equipment, advantages of preventive maintenance. Repair cycle concept and importance

Reference:

1. Maintenance Engineering Handbook, Higgins & Morrow, Da Information Services.
2. Maintenance Engineering, H. P. Garg, S. Chand and Company.
3. Pump-hydraulic Compressors, Audels, Mcgrew Hill Publication.
4. Foundation Engineering Handbook, Winterkorn, Hans, Chapman & Hall London.

MECO-303 **Operations Research**

L T P CR
3 0 0 3

Theory : 75
Class Work : 25
Total : 100
Duration of Exam : 3 Hrs.

Syllabus

Unit 1: Optimization Techniques, Model Formulation, models, General L.R Formulation, Simplex Techniques, Sensitivity Analysis, Inventory Control Models

Unit 2 Formulation of a LPP, Graphical solution revised simplex method, duality theory, dual simplex method - sensitivity analysis - parametric programming

Unit 3: Nonlinear programming problem, Kuhn-Tucker conditions min cost flow problem, max flow problem, CPM/PERT

Unit 4: Scheduling and sequencing - single server and multiple server models, deterministic inventory models, Probabilistic inventory control models, Geometric Programming.

Unit 5: Competitive Models,Single and Multi-channel Problems, Sequencing Models, Dynamic Programming, Flow in Networks, Elementary Graph Theory, Game Theory Simulation

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

- Students should able to apply the dynamic programming to solve problems of discreet and continuous variables.
- Students should able to apply the concept of non-linear programming
- Students should able to carry out sensitivity analysis
- Student should able to model the real world problem and simulate it.

References:

1. H.A. Taha, Operations Research, An Introduction, PHI, 2008
2. H.M. Wagner, Principles of Operations Research, PHI, Delhi, 1982.
3. J.C. Pant, Introduction to Optimisation: Operations Research, Jain Brothers, Delhi, 2008
4. Hitler Libermann Operations Research: McGraw Hill Pub. 2009
5. Pannerselvam, Operations Research: Prentice Hall of India 2010
6. Harvey M Wagner, Principles of Operations Research: Prentice Hall of India 2010

MECO-304 **Cost Management of Engineering Projects**

L T P CR			
3 0 0 3	**Theory**	**:**	**75**
	Class Work	**:**	**25**
	Total	**:**	**100**
	Duration of Exam	**:**	**3 Hrs.**

Syllabus

Unit 1: Introduction and Overview of the Strategic Cost Management Process

Unit 2: Cost concepts in decision-making; Relevant cost, Differential cost, Incremental cost and Opportunity cost. Objectives of a Costing System; Inventory valuation; Creation of a Database for operational control; Provision of data for Decision-Making. Project: meaning, Different types, why to manage, cost overruns centres, various stages of project execution: conception to commissioning. Project execution as conglomeration of technical and nontechnical activities. Detailed Engineering activities, Pre project execution main clearances and documents Project team, Role of each member. Importance Project site, Data required with significance. Project contracts, Types and contents, Project execution Project cost control, Bar charts and Network diagram, Project commissioning, mechanical and process.

Unit 3: Cost Behavior and Profit Planning Marginal Costing, Distinction between Marginal Costing and Absorption Costing, Break-even Analysis, Cost-Volume-Profit Analysis, Various decision-making problems, Standard Costing and Variance Analysis, Pricing strategies, Pareto Analysis, Target costing, Life Cycle Costing, Costing of service sector, Just-in-time approach, Material Requirement Planning, Enterprise Resource Planning, Total Quality Management and Theory of constraints, Activity-Based Cost Management, Bench Marking, Balanced Score Card and Value-Chain Analysis. Budgetary Control; Flexible Budgets, Performance budgets, Zero-based budgets, Measurement of Divisional profitability pricing decisions including transfer pricing.

Unit 4: Quantitative techniques for cost management, Linear Programming, PERT/CPM, Transportation problems, Assignment problems, Simulation, Learning Curve Theory.

References:

1. Cost Accounting A Managerial Emphasis, Prentice Hall of India, New Delhi
2. Charles T. Horngren and George Foster, Advanced Management Accounting
3. Robert S Kaplan Anthony A. Alkinson, Management & Cost Accounting
4. Ashish K. Bhattacharya, Principles & Practices of Cost Accounting A. H. Wheeler publisher
5. N.D. Vohra, Quantitative Techniques in Management, Tata McGraw Hill Book Co. Ltd.

MECO-305 **Composite Materials**

L T P CR
3 0 0 3

Theory : 75
Class Work : 25
Total : 100
Duration of Exam : 3 Hrs.

Syllabus

UNIT–I: **INTRODUCTION:** Definition, Classification and characteristics of Composite materials, Advantages and application of composites, Functional requirements of reinforcement and matrix, Effect of reinforcement (size, shape, distribution, volume fraction) on overall composite performance.

UNIT – II: **REINFORCEMENTS:** Preparation-layup, curing, properties and applications of glass fibers, carbon fibers, Kevlar fibers and Boron fibers. Properties and applications of whiskers, particle reinforcements, Mechanical Behavior of composites, Rule of mixtures, Inverse rule of mixtures, Isostrain and Isostress conditions.

UNIT – III: Manufacturing of Metal Matrix Composites: Casting, Solid State diffusion technique, Cladding, Hot isostatic pressing, Properties and applications, Manufacturing of Ceramic Matrix Composites, Liquid Metal Infiltration, Liquid phase sintering, Manufacturing of Carbon, Carbon composites, Knitting, Braiding, Weaving, Properties and applications.

UNIT–IV: Manufacturing of Polymer Matrix Composites: Preparation of Moulding compounds and prepregs hand layup method, Autoclave method, Filament winding method, Compression moulding, Reaction injection moulding. Properties and applications.

UNIT V: Strength: Laminar Failure Criteria-strength ratio, maximum stress criteria, Maximum strain criteria, interacting failure criteria, hygrothermal failure, Laminate first play failure-insight strength, Laminate strength-ply discount truncated maximum strain criterion, strength design using caplet plots, stress concentrations.

TEXT BOOKS:

1. Material Science and Technology, Vol 13, Composites by R.W.Cahn, VCH, West Germany.
2. Materials Science and Engineering, An introduction. WD Callister, Jr., Adapted by R. Balasubramaniam, John Wiley & Sons, NY, Indian edition, 2007.

References:

1. Hand Book of Composite Materials-ed-Lubin.
2. Composite Materials, K.K.Chawla.
3. Composite Materials Science and Application, Deborah D.L. Chung.
4. Composite Materials Design and Applications, Danial Gay, Suong V. Hoa, and Stephen W. Tasi.

MECO-306 **Waste to Energy**

L T P CR

3 0 0 3

Theory : 75
Class Work : 25
Total : 100
Duration of Exam : 3 Hrs.

Unit-I: Introduction to Energy from Waste: Classification of waste as fuel, Agro based, Forest residue, Industrial waste, MSW, Conversion devices, Incinerators, gasifiers, digestors

Unit-II: Biomass Pyrolysis: Pyrolysis, Types, slow fast, Manufacture of charcoal, Methods, Yields and application, Manufacture of pyrolytic oils and gases, yields and applications.

Unit-III: Biomass Gasification: Gasifiers, Fixed bed system, Downdraft and updraft gasifiers, Fluidized bed gasifiers, Design, construction and operation, Gasifier burner arrangement for thermal heating, Gasifier engine arrangement and electrical power, Equilibrium and kinetic consideration in gasifier operation.

Unit-IV: Biomass Combustion: Biomass stoves, Improved chullahs, types, some exotic designs, Fixed bed combustors, Types, inclined grate combustors, Fluidized bed combustors, Design, construction and operation, Operation of all the above biomass combustors.

Unit-V: Biogas: Properties of biogas (Calorific value and composition), Biogas plant technology and status, Bio energy system, Design and constructional features, Biomass resources and their classification, Biomass conversion processes, Thermo chemical conversion, Direct combustion, biomass gasification, pyrolysis and liquefaction, biochemical conversion, anaerobic digestion, Types of biogas Plants, Applications, Alcohol production from biomass, Bio diesel production, Urban waste to energy conversion, Biomass energy programme in India.

References:

1. Non Conventional Energy, Desai, Ashok V., Wiley Eastern Ltd., 1990.
2. Biogas Technology - A Practical Hand Book - Khandelwal, K. C. and Mahdi, S. S., Vol. I & II, Tata McGraw Hill Publishing Co. Ltd., 1983.
3. Food, Feed and Fuel from Biomass, Challal, D. S., IBH Publishing Co. Pvt. Ltd., 1991.
4. Biomass Conversion and Technology, C. Y. WereKo-Brobby and E. B. Hagan, John Wiley & Sons, 1996.

ENGLISH FOR RESEARCH PAPER WRITING (AUD01A)

L T P CR			
2 0 0 0	Theory	:	75
	Class Work	:	25
	Total	:	100
	Duration of Exam	:	3 Hrs.

Course objectives:

- Understand that how to improve your writing skills and level of readability
- Learn about what to write in each section
- Understand the skills needed when writing a Title Ensure the good quality of paper at very first-time submission

Unit 1: Planning and Preparation, Word Order, Breaking up long sentences, Structuring Paragraphs and Sentences, Being Concise and Removing Redundancy, Avoiding Ambiguity and Vagueness

Unit 2: Clarifying Who Did What, Highlighting Your Findings, Hedging and Criticising, Paraphrasing and Plagiarism, Sections of a Paper, Abstracts. Introduction

Unit 3: Review of the Literature, Methods, Results, Discussion, Conclusions, The Final Check.

Unit 4: key skills are needed when writing a Title, key skills are needed when writing an Abstract, key skills are needed when writing an Introduction, skills needed when writing a Review of the Literature,

Unit 5: skills are needed when writing the Methods, skills needed when writing the Results, skills are needed when writing the Discussion, skills are needed when writing the Conclusions

Unit 6: useful phrases, how to ensure paper is as good as it could possibly be the first- time submission

Suggested Studies:

1. Goldbort R (2006) Writing for Science, Yale University Press (available on Google Books)
2. Day R (2006) How to Write and Publish a Scientific Paper, Cambridge University Press
3. Highman N (1998), Handbook of Writing for the Mathematical Sciences, SIAM. Highman's

Book .

1. Adrian Wallwork , English for Writing Research Papers, Springer New York Dordrecht Heidelberg London, 2011

DISASTER MANAGEMENT (AUD02A)

L T P CR			
2 0 0 0	Theory	:	75
	Class Work	:	25
	Total	:	100
	Duration of Exam	:	3 Hrs.

Course Objectives:

- learn to demonstrate a critical understanding of key concepts in disaster risk reduction and humanitarian response.
- critically evaluate disaster risk reduction and humanitarian response policy and practice from multiple perspectives.
- develop an understanding of standards of humanitarian response and practical relevance in specific types of disasters and conflict situations.
- critically understand the strengths and weaknesses of disaster management approaches, planning and programming in different countries, particularly their home country or the countries they work in

Syllabus

Unit1: Introduction: Disaster: Definition, Factors And Significance; Difference Between Hazard And Disaster; Natural And Manmade Disasters: Difference, Nature, Types And Magnitude.

Unit 2: Repercussions Of Disasters And Hazards: Economic Damage, Loss Of Human And Animal Life, Destruction Of Ecosystem. Natural Disasters: Earthquakes, Volcanisms, Cyclones, Tsunamis, Floods, Droughts And Famines, Landslides And Avalanches, Man-made disaster: Nuclear Reactor Meltdown, Industrial Accidents, Oil Slicks And Spills, Outbreaks Of Disease And Epidemics, War And Conflicts.

Unit 3: Disaster Prone Areas In India: Study Of Seismic Zones, Areas Prone To Floods And Droughts, Landslides And Avalanches, Areas Prone To Cyclonic And Coastal Hazards With Special Reference To Tsunami, Post-Disaster Diseases And Epidemics.

Unit 4: Disaster Preparedness And Management: Preparedness, Monitoring Of Phenomena Triggering A Disaster Or Hazard; Evaluation Of Risk, Application Of Remote Sensing, Data From Meteorological And Other Agencies, Media Reports, Governmental And Community Preparedness.

Unit 5: Risk Assessment: Disaster Risk: Concept And Elements, Disaster Risk Reduction, Global And National Disaster Risk Situation, Techniques of Risk Assessment, Global Co-Operation In Risk Assessment And Warning, People's Participation In Risk Assessment. Strategies for Survival.

Unit 6: Disaster Mitigation: Meaning, Concept And Strategies Of Disaster Mitigation, Emerging Trends in Mitigation, Structural Mitigation And Non-Structural Mitigation, Programs of Disaster Mitigation In India.

SUGGESTED READINGS:

1. R. Nishith, Singh AK, "Disaster Management in India: Perspectives, issues and strategies "'New Royal book Company.
2. Sahni, Pardeep Et.Al. (Eds.)," Disaster Mitigation Experiences And Reflections", Prentice Hall Of India, New Delhi.
3. Goel S. L. , Disaster Administration And Management Text And Case Studies" ,Deep &Deep Publication Pvt. Ltd., New Delhi.

SANSKRIT FOR TECHNICAL KNOWLEDGE (AUD03A)

L T P CR			
2 0 0 0	**Theory**	**:**	**75**
	Class Work	**:**	**25**
	Total	**:**	**100**
	Duration of Exam	**:**	**3 Hrs.**

Course Objectives

- To get a working knowledge in illustrious Sanskrit, the scientific language in the world
- Learning of Sanskrit to improve brain functioning
- Learning of Sanskrit to develop the logic in mathematics, science & other subjects enhancing the memory power
- The engineering scholars equipped with Sanskrit will be able to explore the huge knowledge from ancient literature

Syllabus

Unit 1: Alphabets in Sanskrit, Past/Present/Future Tense, Simple Sentences

Unit 2: Order, Introduction of roots, Technical information about Sanskrit Literature

Unit 3: Technical concepts of Engineering-Electrical, Mechanical, Architecture, Mathematics

Suggested reading

1. "Abhyaspustakam" – Dr.Vishwas, Samskrita-Bharti Publication, New Delhi
2. "Teach Yourself Sanskrit" Prathama Deeksha-Vempati Kutumbshastri, Rashtriya Sanskrit Sansthanam, New Delhi Publication
3. "India's Glorious Scientific Tradition" Suresh Soni, Ocean books (P) Ltd., New Delhi.

Course Output

1. Understanding basic Sanskrit language
2. Ancient Sanskrit literature about science & technology can be understood
3. Being a logical language will help to develop logic in students

VALUE EDUCATION (AUD04A)

L T P CR			
2 0 0 0	**Theory**	**:**	**75**
	Class Work	**:**	**25**
	Total	**:**	**100**
	Duration of Exam	**:**	**3 Hrs.**

Course Objectives

- Understand value of education and self- development
- Imbibe good values in students
- Let the should know about the importance of character

Unit 1: Values and self-development, Social values and individual attitudes, Work ethics, Indian vision of humanism, Moral and non, moral valuation. Standards and principles, Value judgements

Unit 2: Importance of cultivation of values, Sense of duty. Devotion, Self-reliance. Confidence, Concentration, Truthfulness, Cleanliness, Honesty, Humanity. Power of faith, National Unity, Patriotism.Love for nature ,Discipline

Unit 3: Personality and Behavior Development, Soul and Scientific, attitude, positive thinking, integrity and discipline, Punctuality, Love and Kindness, Avoid fault Thinking, Free from anger, Dignity of labour, Universal brotherhood and religious tolerance, True friendship, Happiness Vs suffering, love for truth, Aware of self-destructive habits, Association and Cooperation, Doing best for saving nature

Unit 4: Character and Competence, Holy books vs Blind faith, Self-management and Good health, Science of reincarnation, Equality, Nonviolence ,Humility, Role of Women, All religions and same message, Mind your Mind, Self-control, Honesty, Studying effectively

Suggested reading

1. Chakroborty, S.K. “Values and Ethics for organizations Theory and practice”, Oxford University Press, New Delhi

Course outcomes

- Knowledge of self-development
- Learn the importance of Human values
- Developing the overall personality

CONSTITUTION OF INDIA (AUD05A)

L T P CR			
2 0 0 0	**Theory**	**:**	**75**
	Class Work	**:**	**25**
	Total	**:**	**100**
	Duration of Exam	**:**	**3 Hrs.**

Course Objectives:

- Understand the premises informing the twin themes of liberty and freedom from a civil rights perspective.
- To address the growth of Indian opinion regarding modern Indian intellectuals' constitutional role and entitlement to civil and economic rights as well as the emergence of nationhood in the early years of Indian nationalism.
- To address the role of socialism in India after the commencement of the Bolshevik Revolution in 1917 and its impact on the initial drafting of the Indian Constitution.

Syllabus

Unit 1: History of Making of the Indian Constitution: History**,** Drafting Committee, (Composition & Working)

Unit 2: Philosophy of the Indian Constitution: Preamble, Salient Features.

Unit 3: Contours of Constitutional Rights & Duties: Fundamental Rights, Right to quality, Right to Freedom, Right against Exploitation, Right to Freedom of Religion, Cultural and Educational Rights, Right to Constitutional Remedies, Directive Principles of State Policy, Fundamental Duties.

Unit 4: Organs of Governance: Parliament, Composition, Qualifications and is qualifications, Powers and Functions, Executive, President, Governor, Council of Minister, Judiciary, Appointment and Transfer of Judges, Qualifications, Powers and Functions

Unit 5: Local Administration: District's Administration head: Role and Importance, Municipalities: Introduction, Mayor and role of Elected Representative, CEO of Municipal Corporation, Pachayati raj, Introduction, PRI: Zila Pachayat, Elected officials and their roles, CEO Zila Pachayat, Position and role, Block level, Organizational Hierarchy (Different departments), Village level, Role of Elected and Appointed officials, Importance of grass root democracy

Unit 6: Election Commission: Election Commission, Role and Functioning, Chief Election Commissioner and Election Commissioners, State Election Commission, Role and Functioning, Institute and Bodies for the welfare of SC/ST/OBC and women.

Course Outcomes:

- Discuss the growth of the demand for civil rights in India for the bulk of Indians before the arrival of Gandhi in Indian politics.

- Discuss the intellectual origins of the framework of argument that informed the conceptualization of social reforms leading to revolution in India.
- Discuss the circumstances surrounding the foundation of the Congress Socialist Party [CSP] under the leadership of Jawaharlal Nehru and the eventual failure of the proposal of direct elections through adult suffrage in the Indian Constitution.
- Discuss the passage of the Hindu Code Bill of 1956.

Suggested reading

1. The Constitution of India, 1950 (Bare Act), Government Publication.
2. Dr. S. N. Busi, Dr. B. R. Ambedkar framing of Indian Constitution, 1st Edition, 2015.
3. M. P. Jain, Indian Constitution Law, 7th Edn., Lexis Nexis, 2014.
4. D.D. Basu, Introduction to the Constitution of India, Lexis Nexis, 2015.

PEDAGOGY STUDIES (AUD06A)

L T P CR			
2 0 0 0	**Theory**	**:**	**75**
	Class Work	**:**	**25**
	Total	**:**	**100**
	Duration of Exam	**:**	**3 Hrs.**

Course Objectives:

1. Review existing evidence on the review topic to inform programme design and policy making undertaken by the DfID, other agencies and researchers.
2. Identify critical evidence gaps to guide the development.

Unit 1: Introduction and Methodology: Aims and rationale, Policy background, Conceptual, framework and terminology, Theories of learning, Curriculum, Teacher education, Conceptual framework, Research questions**,** Overview of methodology and Searching,

Unit 2: Thematic overview: Pedagogical practices are being used by teachers in formal and informal classrooms in developing countries, Curriculum, Teacher education.

Unit 3: Evidence on the effectiveness of pedagogical practices, Methodology for the in depth stage: quality assessment of included studies, How can teacher education (curriculum and practicum) and the school curriculum and guidance materials best support effective pedagogy? Theory of change, Strength and nature of the body of evidence for effective pedagogical practices, Pedagogic theory and pedagogical approaches, Teachers' attitudes and beliefs and Pedagogic strategies.

Unit 4: Professional development: alignment with classroom practices and follow-up support, Peer support, Support from the head teacher and the community, Curriculum and assessment, Barriers to learning: limited resources and large class sizes

Unit 5: Research gaps and future directions: Research design, Contexts, Pedagogy, Teacher education, Curriculum and assessment, Dissemination and research impact.

Course Outcomes:

Students will be able to understand:

- What pedagogical practices are being used by teachers in formal and informal classrooms in developing countries?
- What is the evidence on the effectiveness of these pedagogical practices, in what conditions, and with what population of learners?
- How can teacher education (curriculum and practicum) and the school curriculum and guidance materials best support effective pedagogy?

Suggested reading

1. Ackers J, Hardman F (2001) Classroom interaction in Kenyan primary schools, Compare, 31 (2): 245-261.
2. Agrawal M (2004) Curricular reform in schools: The importance of evaluation, Journal of Curriculum Studies, 36 (3): 361-379.

3. Akyeampong K (2003) Teacher training in Ghana - does it count? Multi-site teacher education research project (MUSTER) country report 1. London: DFID.
4. Akyeampong K, Lussier K, Pryor J, Westbrook J (2013) Improving teaching and learning of basic maths and reading in Africa: Does teacher preparation count? International Journal, Educational Development, 33 (3): 272–282.
5. Alexander RJ (2001) Culture and pedagogy: International comparisons in primary education. Oxford and Boston: Blackwell.
6. Chavan M (2003) Read India: A mass scale, rapid, 'learning to read' campaign.
7. www.pratham.org/images/resource%20working%20paper%202.pdf.

STRESS MANAGEMENT BY YOGA (AUD07A)

L T P CR			
2 0 0 0	**Theory**	**:**	**75**
	Class Work	**:**	**25**
	Total	**:**	**100**
	Duration of Exam	**:**	**3 Hrs.**

Course Objectives

- To achieve overall health of body and mind
- To overcome stress

Syllabus

Unit 1: Definitions of Eight parts of yog. (Ashtanga)

Unit 2: Yam and Niyam, Do`s and Don't's in life., i) Ahinsa, satya, astheya, bramhacharya and aparigraha, ii) Shaucha, santosh, tapa, swadhyay, ishwarpranidhan

Unit 3: Asan and Pranayam, i) Various yog poses and their benefits for mind & body, ii)Regularization of breathing techniques and its effects-Types of pranayam

Course Outcomes:

- Develop healthy mind in a healthy body thus improving social health also
- Improve efficiency

Suggested reading

1. 'Yogic Asanas for Group Tarining-Part-I" : Janardan Swami Yogabhyasi Mandal, Nagpur
2. "Rajayoga or conquering the Internal Nature" by Swami Vivekananda, Advaita Ashrama (Publication Department), Kolkata

PERSONALITY DEVELOPMENT THROUGH LIFE ENLIGHTENMENT SKILLS (AUD08A)

L T P CR			
2 0 0 0	**Theory**	**:**	**75**
	Class Work	**:**	**25**
	Total	**:**	**100**
	Duration of Exam	**:**	**3 Hrs.**

Course Objectives:

- To learn to achieve the highest goal happily
- To become a person with stable mind, pleasing personality and determination
- To awaken wisdom in students

Unit 1: Neetisatakam-Holistic development of personality, Verses 19,20,21,22 (wisdom), Verses 29,31,32 (pride & heroism), Verses 26,28,63,65 (virtue), Verses 52,53,59 (dont's), Verses 71,73,75,78 (do's)

Unit 2: Approach to day to day work and duties, Shrimad Bhagwad Geeta, Chapter 2-Verses 41, 47,48, Chapter 3 Verses 13, 21, 27, 35, Chapter 6 Verses 5,13,17, 23, 35, Chapter 18 Verses 45, 46, 48.

Unit 3: Statements of basic knowledge, Shrimad Bhagwad Geeta: Chapter2 Verses 56, 62, 68**,** Chapter 12 Verses 13, 14, 15, 16,17, 18**,** Personality of Role model. Shrimad Bhagwad Geeta, Chapter2 Verses 17, Chapter3 Verses 36,37,42, Chapter4 Verses 18, 38,39**,** Chapter18 Verses 37,38,63

Course Outcomes:

- Study of Shrimad-Bhagwad-Geeta will help the student in developing his personality and achieve the highest goal in life
- The person who has studied Geeta will lead the nation and mankind to peace and prosperity
- Study of Neetishatakam will help in developing versatile personality of students.

Suggested reading

1. "Srimad Bhagavad Gita" by Swami Swarupananda Advaita Ashram (Publication Department), Kolkata
2. Bhartrihari's Three Satakam (Niti-sringar-vairagya) by P.Gopinath, Rashtriya Sanskrit, Sansthanam, New Delhi.

SWAMI VIVEKANANDA'S THOUGHTS (AUD09A)

L T P CR			
2 0 0 0	**Theory**	**:**	**75**
	Class Work	**:**	**25**
	Total	**:**	**100**
	Duration of Exam	**:**	**3 Hrs.**

Course Objectives:

- To introduce biography and philosophical thought of Swami Vivekananda
- To present Swami Vivekananda's views on major religions of the world and Universal Religion
- To present Swami Vivekananda' teaching and views on social issues.

Syllabus

Unit 1: Swami Vivekananda a Brief biography, Influence of Ramakrishna on Vivekananda, Parliament of Religions, Establishment of Ramakrishna mission.

Unit 2: Philosophy of Swami Vivekananda, Nature of Reality, Nature of Self, Nature of the universe, The doctrine of Maya, Identity of Self and God, Karma Yoga, Raj Yoga , Bhakti Yoga, Gyan Yoga.

Unit 3: Swami Vivekananda's observations on major religions of the world (a) Hinduism (b) Christianity (c) Islam

Unit 4: The concept of Universal Religion and its characteristic, Fundamental unity of all religions, acceptance and not tolerance is the principle.

Unit 5: Vivekananda and Nationalism, The message of patriotism, spirituality as the basis of patriotism, Sociological views of Vivekananda, His views on caste and untouchability, status of women, His views on Education, Swami Vivekananda's concept of Vedantic Socialism

Books: The Complete Works of Swami Vivekananda Vol. 1 to 8 Relevant Chapters