SCHEME & SYLLABUS

for

M.TECH. COURSE

in

ELECTRONICS AND INSTRUMENTATION

(w.e.f. Session 2017-2018)

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, 2Associate 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. Seven month training is mandatory for every B.Tech. Students. Emphasis has been given on project work and workshop for skill enhancement of students. Choice based credit 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.

M. TECH. (ELCTRONICS AND INSTRUMENTATION)

SCHEME AND SYLLABUS

Total Credits : **76**

Total Theory Subjects : **12+1 (AC) + 1(GEC) + 1(MOOCs)**

Total Labs (including Seminars & Projects) : **06**

Total Dissertation : **01**

Total Teaching Schedule:

Lectures	Practical	Total
54	08	62

Total Marks:

Sessionals	End Term	Total
675	1575	2250

Itemized Break-up:

	No.	Hours	Marks	Credits
Theory Subjects	12+3*	54	1300	52+4(MOOCs)
Labs	4	8	200	4
Seminar	1	2	50	1
Projects	1	8	200	4
Thesis	1	1 Semester	500	12
Total	24		2250	77

*MOOCs+GEC+AC

FIRST SEMESTER

Subject Code	Subject Title	Credit (L-T-P)		Marks Weightage		Total (Theory +Sessional)
				Theory	Sessional	
E16I 601	Modern Control System	4	4-0-0	75	25	100
E16I 603	Industrial Process Control	4	4-0-0	75	25	100
E16I 605	Industrial Electronics	4	4-0-0	75	25	100
E16I 607	Optimization techniques	4	4-0-0	75	25	100
				External	Internal	
E16I 609	Control and Computation Lab	1	0-0-2	35	15	50
E16I 611	Modeling and Simulation Lab	1	0-0-2	35	15	50
	Total	18	16-0-4	370	130	500

SECOND SEMESTER

Subject Code	Subject Title	Credit (L-T-P)		Marks Weightage		Total (Theory +Sessional)
				Theory	Sessional	
E16I 602	Non Linear Control System	4	4-0-0	75	25	100
E16I 604	Optimal Control System	4	4-0-0	75	25	100
E16I 606	Electronics Instrumentation	4	4-0-0	75	25	100
	Elective –I*	4	4-0-0	75	25	100
	Audit Course	0	3-0-0	-	-	-
	MOOCs	4	0	-	-	-
				External	Internal	
E16I 610	Advance Microprocessor and Microcontroller Lab	1	0-0-2	35	15	50
E16I 612	Industrial Electronics Lab	1	0-0-2	35	15	50
E16I 614	Seminar	1	0-0-2	--	50	50
	Total	23	19-0-6	370	180	550

***The student will have to select a subject from list of elective as under.**

****passing the MOOCs course is compulsory as per UGC guidelines, these online courses can be registered on UGC website under "Swayam" program. Four credits for the MOOCS course are to be earned in any semester from II to IV.**

THIRD SEMESTER

Subject Code	Subject Title	Credit (L-T-P)		Marks Weightage		Total (Theory +Sessional)
				Theory	Sessional	
E16I 701	Computer Control of Process	4	4-0-0	75	25	100
E16I 703	ANN and Fuzzy Control	4	4-0-0	75	25	100
E16I 705	Stochastic Control	4	4-0-0	75	25	100
	Elective-II*	4	4-0-0	75	25	100
	General Elective Course	3	3-0-0	75	25	100
				External	Internal	
E16I 709	Minor Project	4	0-0-8	140	60	200
	Total	23	19-0-8	515	185	700

***The student will have to select a subject from list of elective as under**

FOURTH SEMESTER

Subject Code	Subject Title	Credit (L-T-P)		Marks Weightage	
				External	Internal
E16I 702	Dissertation	12	0-0-24	350	150
	Total	12	0-0-24	500	

***The student will have to select subject from list of elective as under**

List of Elective

Elective –I

i. Microprocessor based Control System (E16I 608 A)
ii. Digital Signal Processing (E16I 608 B)
iii. Reliability Engineering (E16I 608 C)

Elective – II

i. Robotics and Automation (E16I 707 A)
ii. Biomedical Instrumentation (E16I 707 B)

Audit Course

S.No.	Code	Name of Course	No. of Contact Hours	Credits
1.	AC-101C	German- I	2	0
2.	AC-102C	German –II (With German – I as prerequisite)	2	0
3.	AC-103C	French – I	2	0
4.	AC-104C	French –II (With French – I as prerequisite)	2	0
5.	AC-105C	Sanskrit – I	2	0
6.	AC-106C	Sanskrit – II (With Sanskrit– I as prerequisite)	2	0
7.	AC-107C	Personality Development	2	0
8.	AC-108C	Interview and Group Discussion Skills	2	0
9.	AC-109C	Yoga and Meditation	2	0
10.	AC-110C	Art of Living/ Living Skills	2	0
11.	AC-111C	Contribution of NSS towards Nation/Role of NSS	2	0
12.	AC-112C	Physical Education	2	0

GENERAL ELECTIVE COURSES

Students have to select General Elective Course from the given list:

Courses offered by Computer Engineering Department

S.No.	Code	Name of Course	No. of Contact Hours	Credits
1.	GC-101C	Intelligent Systems	3	3
2.	GC-102C	Cyber laws and Security	3	3
3.	GC-103C	Soft Computing	3	3
4.	GC-104C	Web Technology and Information Retrieval	3	3
5.	GC-105C	Intellectual Property and Rights	3	3

Courses offered by Electrical Engineering Department

S.No.	Code	Name of Course	No. of Contact Hours	Credits
1.	GL-201C	Installation Testing & Maintenance of Electrical Equipments	3	3
2.	GL-202C	Utilization of Electrical Power & Traction	3	3

Courses offered by Mechanical Engineering Department :

S.No.	Code	Name of Course	No. of Contact Hours	Credits
1.	GM-301C	Industrial Engineering	3	3
2.	GM-302C	Quality Management	3	3
3.	GM-303C	Automobile Engineering	3	3
4.	GM-304C	CAM and Automation	3	3
5.	GM-305C	Manufacturing Processes	3	3
6.	GM-306C	Power Plant Engineering	3	3

Courses offered by Electronics Engineering Department

(Not for Electronics Engineering students):

S.No.	Code	Name of Course	No. of Contact Hours	Credits
1.	GE-401C	Microprocessor and Interfacing	3	3
2.	GE-402C	Digital Signal Processing	3	3
3.	GE-403C	Instrumentation and Control	3	3
4.	GE-404C	Data Communication and Networking	3	3

Courses offered by HAS Department

S.No.		Name of Course	No. of Contact Hours	Credits
1.	GA-501C	Soft Skills for Engineers	3	3
2.	GA-502C	Maths –III	3	3

Courses offered by MBA Department

S.No.		Name of Course	No. of Contact Hours	Credits
1.	GB-601C	Human Resource Management	3	3
2.	GB-602C	Financial Management	3	3
3.	GB-603B	Marketing Management	3	3
4.	GB-604B	Entrepreneur Development	3	3
5.	GB-605B	Principles of Management and Economics	3	3

Courses offered under Open Elective

The syllabus of open elective will be standard one taken from reputed Institute/University.

S.No.	Code	Name of Course	No. of Contact Hours	Credits
1.	GO-701C	Physical Education	3	3
2.	GO-702C	Indian History	3	3
3.	GO-703C	General Psychology	3	3
4.	GO-704C	Fundamentals of Linguistics Science	3	3
5.	GO-705C	Swami Vivekanand's Thoughts	3	3
6.	GO-706C	National Integration	3	3
7.	GO-707C	Moral Values	3	3

SESSIONAL MARKS

The allocation of theory and sessional weightage for end semester examination would be as under:-

1. **For Theory**
    a) Sessional Weightage 25%
    b) End Semester Exam 75%
2. **For Practical**
    a) Sessional Weightage 30%
    b) End Semester Exam 70%

The academic performance of a student shall be graded on a TEN-POINT SCALE and the awards for grades based upon marks obtained out of 100 shall be made as follow:

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

E16I-601 Modern Control System

L T P CR			
4 0 0 4	**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

E16I-603 **Industrial Process Control**

L T P CR			
4 0 0 4	**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.

E16I-605 Industrial Electronics

L T P CR			
4 0 0 4	**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 :
(a) 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

E16I-607 Optimization Techniques

L T P CR			
4 0 0 4	**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: –
Concepts of Hill climbing, methods of steepest descent, Newton Raphson methods, Fletcher power method, constrained optimization.

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

E16I-609 Control and Computational Lab

L T P CR			
0 0 2 1	**External**	**:**	**35**
	Internal	**:**	**15**
	Total	**:**	**50**
	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

E16I-611 **Modelling & Simulation Lab**

L T P CR			
0 0 2 1	**External**	**:**	**35**
	Internal	**:**	**15**
	Total	**:**	**50**
	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.

E16I-602 **Non Linear Control Systems**

L T P CR			
4 0 0 4	**Theory**	**:**	**75**
	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

E16I-604 Optimal Control Theories

L T P CR			
4 0 0 4	**Theory**	**:**	**75**
	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

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

Controllability: –
Linear independence, complete state controllability of continuous system, complete state controllability of discrete system, alternate form of the conditions of complete state controllability, output controllability.

Observability: –
Complete state Observability of continuous system, complete state Observability of discrete system, alternate form of the conditions of complete state Observability, Principle of duality.

Time Optimal Control System: –
Time optimal control for continuous time system with bounded control signals, time optimal control for discrete time system. optimal control system based on quadratic performance indices. Calculus of variations, applications of optimal control to dynamic systems. Pontryagin minimum principle and its application to optimal control problems with constraints, 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

E16I-606 Electronic Instrumentation

L T P CR			
4 0 0 4	**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

E16I-608B **Digital Signal Processing**

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

Course Objectives:

- To introduce the different type of signals and systems
- To introduce the use of sampling and Quantization.
- To introduce to analyze the difference equations to describe LTI Systems , impulse response, frequency response , magnitude response, phase response of LTI system.
- To introduce to analyze the DFT and its properties, FFT, decimation in time algorithm, decimation in frequency algorithm.
- To introduce the different types of structures , filters ,algorithms of FIR and IIR systems to design of IIR filter by bilinear transformation, design of FIR using windows, properties of FIR filters.
- To introduce the different types of linear and optimum filters like Forward Predictions and backward predictions.
- To introduce the effects of finite register lengths and truncation and rounding in digital signal processing for IIR and FIR filters statistical analysis of quantization in floating point and fixed point realization of FIR and IIR filters,

Syllabus

Unit I:
Classification of signals, concept of frequency in continuous time and discrete time signals A/D, D/A conversion i.e. sampling and quantization. Classification of discrete time systems, introduction to IIR and FIR systems.

Unit II:
Analysis of discrete time linear time invariant system, techniques for the analysis of linear systems, convolution sum, properties of convolution and the interconnection of LTI systems, stability of LTI systems, difference equations to describe LTI systems, impulse response of LTI system.

Unit III:
Z transformation, ROC, Properties of Z transformation, rational Z transformation, one sided Z transformation, solution of difference equation, basic network structure of IIR system, direct form cascade form, parallel form, basic network structure of FIR system, DFT and its properties, fast fourier transform (FFT), decimation in time algorithm, decimation in frequency algorithm, design of IIR filter by bilinear transformation, design of FIR using windows, properties of FIR filters.

Unit IV:
Lionear prediction and optimum linear filters-forword and backword linear prediction, Levinson-Durbin algorithm, Schur algorithm, AR and ARMA model, Wiener Filter- FIR, IIR, non casual (speech recognition application)

Unit V:
Effects of finite register lengths in digital signal processing, effects of truncation and rounding, finite register length effects in realization of digital signal IIR filter, statistical analysis of quantization in floating point realization of IIR filters, finite register length effects in realization of FIR filters, statistical analysis of quantization in fixed point realization of FIR filters, statistical analysis of quantization in
floating point realization of FIR filters.

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

- Understand the different type of signals and systems & use of sampling and Quantization analysis of LTI Systems.
- Understand and analyze the DFT and its properties, FFT, decimation in time algorithm, decimation in frequency algorithm and z-transform.
- Understand the different types of structures, filters, algorithms of FIR and IIR systems to design of IIR filter by bilinear transformation, design of FIR using windows, properties of FIR filters.
- Understand the different types of linear and backward predictions, optimum filters & algorithms like Levinson Durbin and schur.
- Understand the effects of finite register lengths and truncation and rounding in digital signal processing for IIR and FIR filters, statistical analysis of quantization in floating point and fixed point realization of FIR and IIR filters,

Text Books:

1. Alan V. Oppenhelm/ Ronald. W. Schafer, Digital Signal Processing, Pearson Education.
2. John G. Prokis & Dimities G. Manolakis, Digital Signal Processing, PHI, 1998.
3. Dimities G. Manolakis, Vinay K.Ingale & Stephen M Kogon, Statistical and Adaptive Signal Processing, McGraw Hill International Education

E16I-608C Reliability Engineering

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

Course Objectives:

- To introduce the concept and need for reliability
- To introduce the analytical form of reliability function, derivation for exponential distribution function and other kind of distribution
- To introduce the Different types and modes of failure and causes of failure in different systems
- To introduce Reliability evaluation techniques applicable to general non series parallel system
- To introduce Marko processes for repairable and non repairable systems and their applications in reliability analysis
- To introduce Methods to improve reliability, quality control, derating and debugging

Syllabus

Unit I:
Basic Definitions, concept and need for reliability, inherent value of reliability in modern systems, hazard rate, failure density function, mean time to failure and repair, relationship between basic variables, analytical form of reliability function, derivation for exponential distribution function, other kind of distribution

Unit II:
Different types and modes of failure, causes of failure in different systems, systems structures, series, parallel, standby, k-out-off-n configuration, their reliability analysis

Unit III:
Reliability evaluation techniques applicable to general non series parallel systems, Marko processes for repairable and non repairable systems and their applications in reliability analysis, faults and digital circuits, use of TMR and multiplex TMR.

Unit IV:
Methods to improve reliability, quality control, derating, debugging, environmental control, use of various kinds of redundancy etc.

Unit V:
Reliability optimization- various methods, redundancy allocation, the trade off between reliability and cost.

Unit VI:
Reliability allocation, reliability testing methods, maintenance, distinction of repair and maintenance, analysis of simple maintenance policies, system diagnostic, fault free analysis, top down and bottom up approach, diagnostic charts

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

- Understand the concept and need for reliability
- Understand the analytical form of reliability function, derivation for exponential distribution function and other kind of distribution
- Understand the Different types and modes of failure and causes of failure in different systems
- Understand Reliability evaluation techniques applicable to general non series parallel system
- Understand Marko processes for repairable and non repairable systems and their applications in reliability analysis
- Understand Methods to improve reliability, quality control, derating and debugging

Text Books:

1. L.S.Srinath, Concepts of Reliability , TMH
2. Ballaguruswamy, Reliability Engineering, TMH

E16I-610 Advanced Microprocessor & Micro Controllers Lab

L T P CR			
0 0 2 1	**External**	**:**	**35**
	Internal	**:**	**15**
	Total	**:**	**50**
	Duration of Exam	**:**	**3 Hrs.**

List of Experiments

1. Study of 8086 Microprocessor kit, its operation and commands.
2. Write a well documented program for copying 12 bytes from source to destination on 8086 Microprocessor kit.
3. Write a program for 8086 for division of a defined double word (stored in a data segment) by given double word.
4. Write a well documented program for finding square root of given number on 8086 Microprocessor kit.
5. Write a program using 8086 and verify for:

(a) Finding largest number from an array.
(b) Finding smallest number from an array.

6. Write a program using 8086 for arranging an array of numbers in descending order.
7. Write a program using 8086 for arranging an array of numbers in ascending order.
8. Write a program for 8086 for finding square of a number using look up table.
9. Write a program to interface a two-digit number using 7 segment LEDs, use 8086 microprocessor and 8255 PPI.
10. Write a program to control the operation of stepper motor using 8086 microprocessor and 8255 PPI.

Course Outcomes:

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

- Understand microprocessor 8086.
- Implement various mathematical functions using microprocessor 8086.
- Implement look up table technique.
- Understand the operation based on strings.
- Understand the concept of interfacing with different peripherals(SSD and Stepper motor).

E16I-610 Industrial Electronics Lab

L	T	P	CR
0	0	2	1

External	**:**	**35**
Internal	**:**	**15**
Total	**:**	**50**
Duration of Exam	**:**	**3 Hrs.**

E16I-701 Computer Control of Process

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

Course Objectives:

- To introduce about the Review of z transform, modified Z transform and Delta transform Relation between discrete and continuous transfer function
- To introduce about the Open loop and closed loop response of SDS design and implementation of different digital control algorithm
- To introduce about LTI System and . Model-State space models
- To introduce about Parameter Estimation Methods
- To introduce about Adaptive control and Model reference Adaptive system

Syllabus

Computer control: Introduction: Review of z transform, modified Z transform and Delta transform Relation between discrete and continuous transfer function– poles and Zeroes of Sample data system (SDS)- Stability Analysis in Z domain .

Introduction to Pulse Transfer function: Open loop and closed loop response of SDS design and implementation of different digital control algorithm: Dead beat, Dahlin and internal Model Control algorithm with Examples

Different model of discrete System: LTI System: - Family of Discrete transfer function. Model-State space models:-Distributed parameter model. Models for time varying and non-linear system: linear time varying model, non-linear state space models, non-linear black box models-Fuzzy models

Parameter Estimation methods: General principles – Minimising Prediction errors-Linear Regression and the Least Square method –Statistical frame work for Parameter estimation and the maximum likely hood method –instrument variable method- recursive and weighted Least square method .

Adaptive control: Introduction –Deterministic self Tuning Regulated: Indirect and direct self tuning regulator.

Model reference Adaptive system: Design of MRAC using Lyapnovand MIT rule – auto tuning gain scheduling adaptive control design with examples

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

- Understand about the Review of z transform, modified Z transform and Delta transform Relation between discrete and continuous transfer function
- Understand about the Open loop and closed loop response of SDS design and implementation of different digital control algorithm
- Understand about LTI System and Model-State space models
- Understand about Parameter Estimation Methods
- Understand about Adaptive control and Model reference Adaptive system

Text Book:-

1. Lennart ljung- system Identification. Theory for The user-PTR Prentice Hal Information and system sciences series, NJ, 1999
2. P. Deshponde and ash, computer controlled system ISA Press, USA
3. Richard H. Middieton Graham Goowin‘ Digital control and estimation A unified Approach ‘prentice Hall NJ, 1999
4. Dale E. Seborg, Thomas F Edgar, Duncan …mellichamp,’Process Dynamics and control Willey India 2006
5. Astrom A.J,Bjorn Witten mark ,Adaptive Control, Second Edition ,Prentice Hall of india , New Delhi, 1994

E16I-703 Artificial Neural Network and Fuzzy Control

L T P CR			
4 0 0 4	**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"

E16I-705 Stochastic Processes

L T P CR			
4 0 0 4	**Theory**	**:**	**75**
	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:

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

Text Books :

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

E16I-707A **Robotics and Automation**

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

Course Objectives:

- To introduce the students regarding robot components and basic structure of robots alongwith resolution, accuracy and repeatability.
- To give the exposure to the students regarding forward and reverse kinematic analysis of four axis, five axis & six axis robot.
- To introduce the students regarding differential motions, velocity analysis dynamic analysis and force analysis of robots.
- To introduce the students for the uses of various types of sensors in robots.
- To introduce the students regarding robot languages and methods of programming.
- To introduce the students regarding fuzzy logic applications in robots.

Syllabus

Fundamentals: Historical information, robot components, robot characteristics, robot anatomy, basic structure of robots, resolution, accuracy and repeatability.

Robot Kinematics: Position Analysis forward and inverse kinematics of robots, including frame representations, transformations, position and orientation analysis, and the Denavit-Hartenberg representation of robot kinematics, the manipulators, the wrist motion and grippers. Examples- Kinematics analysis and inverse kinematics analysis of four axis, five axis and six axis robot.

Differential motions, Inverse Manipulator Kinematics: Differential motions and velocity analysis of robots and frames.

Dynamic Analysis and Forces analysis of robot dynamics and forces. Lagrangian mechanics is used as the primary method of analysis and development .

Trajectory Planning methods of path and trajectory planning, both in joint-space and in Cartesian-space Actuators and Sensors actuators, including hydraulic devices, electric motors such as DC servomotors and stepper motors, Pneumatic devices, as well as many other novel actuators. It also covers microprocessor control of these actuators, mechatronics. Tactile sensors, proximity and range sensors, force and torque sensors, uses of sensors in robotics.

Robot Programming, Systems and Applications: Robot languages, Method of robots programming, lead through programming methods, a robot programs as a path in space, motion interpolation, WAIT, SIGNAL and DELAY commands, branching capabilities and limitation of lead through methods and robotic applications .

Fuzzy Logic Control: Basic principles of fuzzy logic and its applications in microprocessor control and robotics.

Recommended Books: -

- Gonzalez, R. C., Fu, K. S. and Lee, C.S.G., Robotics Control Sensing, Vision and Intelligence, McGraw Hill (1987).
- Koren,Y., Robotics for Engineers, McGraw Hill (1985).
- Niku, S.B., Introduction to Robotics, Analysis, Systems, Applications, Dorling Kingsley (2006).
- Predko, M., Programming robot controllers, McGraw Hill (2002).

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

- Understand robot characteristics and basic structure of robots.
- Understand kinematic analysis and in verse analysis of four axis, five axis & six axis robot.
- Understand the velocity analysis, dynamic analysis & force analysis of robots.
- Understand the uses of various types of sensors used in robots.
- Understand the various methods of programming & applications of fuzzy logic in robots.

E16I-707B **Bio Medical Instrumentation**

L T P CR			
4 0 0 4	**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, blood PO2 , PCO2, 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

GO-705C **SWAMI VIVEKANANDA'S THOUGHTS**

L T P CR			
0 0 3 4	**External**	**:**	**75**
	Internal	**:**	**25**
	Total	**:**	**100**
	Duration of Exam	**:**	**3 Hrs.**

Course Objectives:

1. To introduce biography and philosophical thought of Swami Vivekananda
2. To present Swami Vivekananda's views on major religions of the world and Universal Religion
3. 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 characteristics – 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:

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