SCHEME & SYLLABUS

for

B.TECH. COURSE

in

Electronics Instrumentation & Control Engineering

(w.e.f. Session 2018-19)

DEPARTMENT OF ELECTRONICS ENGINEERING

J.C. BOSE UNIVERSITY OF SCIENCE AND TECHNOLOGY, YMCA, FARIDABAD

J.C.BOSE UNIVERSITY OF SCIENCE & TECHNOLOGY, YMCA, FARIDABAD

VISION

J. C. Bose University of Science & Technology, YMCA, Faridabad (erstwhile 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

J. C. Bose University of Science & Technology, YMCA, Faridabad (erstwhile 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, 4 Associate Professors and 23 Assistant Professors. At present, 8 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 (PEOS)

1. To prepare students to excel in undergraduate programmes and succeed in industry/ technical profession through global, rigorous education.

2. To provide students with a solid foundation in mathematical, scientific and engineering fundamentals required to solve engineering problems and also to pursue higher studies.

3. To train students with good scientific and engineering breadth so as to comprehend, analyze, design, and create novel products and solutions for the real life problems.

4. To provide students with foundation in skill development required to design, develop and fabricate engineering products

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5. To inculcate in students professional and ethical attitude, effective communication skills, teamwork skills, multidisciplinary approach, and an ability to relate engineering issues to broader social context, additional courses with regard to physical, psychological and career growth.

6. To provide student with an academic environment aware of excellence, outstanding leadership, written ethical codes and guidelines with moral values, and the life-long learning needed for successful professional career.

PROGRAMME OUTCOMES (POs)

Engineering Graduates will be able to:

1) Engineering knowledge: Apply knowledge of mathematics, science, engineering fundamentals, and Electronics Engineering to the solution of engineering problems.

2) Problem analysis: Identify, formulate, review literature and analyze Electronics Engineering problems to design, conduct experiments, analyze data and interpret data.

3) Design /development of solutions: Design solution for Electronics Engineering problems and design system component of processes that meet the desired needs with appropriate consideration for the public health and safety, and the cultural, societal and the environmental considerations.

4) Conduct investigations of complex problems: Use research based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions in Electronics Engineering.

5) Modern tool usage: Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modeling to Electronics Engineering activities with an understanding of the limitations.

6) The engineer and society: Apply reasoning informed by the contextual knowledge to assess societal, health, safety, legal and cultural issues and the consequent responsibilities relevant to mechanical engineering practice.

7) Environment and sustainability: Understand the impact of the Electronics Engineering solutions in societal and environmental contexts, and demonstrate the knowledge and need for sustainable development.

8) Ethics: Apply ethical principles and commit to professional ethics and responsibilities and norms of the Electronics Engineering practice.

9) Individual and team work: Function affectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings in Electronics Engineering.

10) Communication: Communicate effectively on complex engineering activities with the engineering committee and with society at large, such as, being able to comprehend and write affective reports and design documentation, make effective presentations in Electronics Engineering.

11) Project Management and finance: Demonstrate knowledge & understanding of the mechanical engineering principles and management principles and apply these to one's own work, as a member and leader in a team, to manage projects and in multidisciplinary environments in Electronics Engineering.

12) Life - long learning: Recognize the need for, and the preparation and ability to engage in independent research and lifelong learning in the broadest contest of technological changes in Electronics Engineering.

PROGRAMME SPECIFIC OUTCOMES (PSOs)

1. To apply the fundamental and design knowledge in the areas of analog & digital circuits, Electronics Instrumentation and Control Systems.
2. To pursue higher studies or get placed in Industries and Organizations.

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

Credits for the B.Tech. (EIC)

S.No.	Semester	Credits
1	First semester	18.5
2	Second semester	19.5
3	Third semester	22
4	Fourth semester	26
5	Fifth semester	20
6	Sixth semester	23
7	Seventh semester*	21
8	Eighth semester*	10
Total Credits		160

Chapter -1

General, Course structure & Theme
&
Semester-wise credit distribution

A. Definition of Credit:

1 Hr. Lecture (L) per week	1 credit
1 Hr. Tutorial (T) per week	1 credit
1 Hr. Practical (P) per week 2 Hours Practical(Lab)/week	0.5 credits 1 credit

B. Course code and definition:

Course code	**Definitions**
L	Lecture
T	Tutorial
P	Practical
BSC	Basic Science Courses
ESC	Engineering Science Courses
HSMC	Humanities and Social Sciences including Management courses
PCC	Professional core courses
PEC	Professional Elective courses
OEC	Open Elective courses
LC	Laboratory course
MC	Mandatory courses
PROJ	Project

C. Category of Courses:

BASIC SCIENCE COURSES

Sl. No.	Course Code	Course Title	Hours per week			Credits
			L	T	P	
1		Physics	3	1	3	5.5
2		Chemistry	3	1	3	5.5
3		Mathematics –I	3	1	0	4
4		Mathematics –2	3	1	0	4

ENGINEERING SCIENCE COURSES

Sl. No.	Course Code	Course Title	Hours per week			Credits
			L	T	P	
1		Basic Electrical Engineering	3	1	2	5
2		Engineering Graphics & Design	0	0	4	2
3		Programming for Problem Solving	3	0	4	5
4		Workshop I	0	0	4	2
5		Workshop II	0	0	4	2

HUMANITIES & SOCIAL SCIENCES INCLUDING MANAGEMENT

Sl. No.	Course Code	Course Title	Hours per week			Credits
			L	T	P	
1		English	2	0	2	3

Chapter -2

Detailed first year curriculum contents

I. Mandatory Induction program

[Induction program for students to be offered right at the start of the first year.]

3 weeks duration
• Physical activity • Creative Arts • Universal Human Values • Literary • Proficiency Modules • Lectures by Eminent People • Visits to local Areas • Familiarization to Dept./Branch & Innovations

B.TECH 1st YEAR EIC (SEMESTER -I)
COURSE STRUCTURE

S.No	Course Code	Course Title	L	T	P	Credits	Sessional	External	Category Code
1	BSC101C	Physics (Waves and Optics)	3	1	-	4	25	75	BSC
2	BSC103 D	Mathematics-I **(**Calculus and Linear Algebra)	3	1	-	4	25	75	BSC
3	ESC102	Engineering Graphics & Design	-	-	4	2	30	70	ESC
4	ESC103	Programming for Problem solving	3	-	-	3	25	75	ESC
5	ESC104	Workshop- I	-	-	4	2	30	70	ESC
6	BSC104C	Physics(Waves and Optics) lab	-	-	3	1.5	15	35	BSC
7	ESC105	Programming for Problem solving Lab	-	-	4	2	15	35	ESC
TOTAL			**9**	**2**	**15**	**18.5**	**165**	**435**	

B.TECH 1st YEAR EIC (SEMESTER -II)
COURSE STRUCTURE

S.No.	Course Code	Course Title	L	T	P	Credits	Sessional	External	Category Code
1	BSC106 D	**Mathematics-II** (Calculus, Ordinary Differential Equations and Complex Variable)	3	1	-	4	25	75	BSC
2	ESC101	Basic Electrical Engineering	3	1	-	4	25	75	AECC
3	BSC 102	Chemistry	3	1	-	4	25	75	BEC
-	ESC106	Workshop- II	-	-	4	2	30	70	BEC
5	HSMC101	English	2	-	-	2	25	75	BEC
6	ESC107	Basic Electrical Engineering Lab	-	-	2	1	15	35	BSC
7	BSC 105	Chemistry Lab	-	-	3	1.5	15	35	BEC
8	HSMC102	English Lab	-	-	2	1	15	35	BEC
TOTAL			**11**	**3**	**11**	**19.5**	**175**	**475**	

Note: Workshop I and Workshop II can be decided for specific branch by the respective Dean/Principal of respective UTD/Institutions

B.TECH 2nd YEAR EIC (SEMESTER -III)
COURSE STRUCTURE

Sr. No	Category	Course Code	Course Title	Hours per week			Credits	Sessional Marks	Final Marks	Total
				L	T	P				
1	PCC	EC301	Electronics Devices	3	0	0	3	25	75	100
2	PCC	EC302	Digital System Design	3	0	0	3	25	75	100
3	PCC	ECC01	Signal and Systems	3	0	0	3	25	75	100
4	PCC	EC304	Network Theory	3	0	0	3	25	75	100
5	BSC	BS301	Mathematics-III	3	1	0	4	25	75	100
6	MC	MC01/ MC02	Indian Constitution/ Essence of Indian Traditional Knowledge	2	0	0	0	25	75	100
7	PCC	EC351	Electronics Devices Lab	0	0	2	1	15	35	50
8	PCC	EC352	Digital System Design Lab	0	0	2	1	15	35	50
9	PCC	EC353	Network Theory Lab	0	0	2	1	15	35	50
9	ESC	ES301	Electronics Workshop-I	0	0	6	3	30	70	100
			Total Credits				**22**	**225**	**625**	**850**

B.TECH 2nd YEAR EIC (SEMESTER -IV)
COURSE STRUCTURE

Sr. No.	Category	Course Code	Course Title	Hours per week			Credits	Sessional Marks	Final Marks	Total
				L	T	P				
1	PCC	EI401	Control System Enginnering	3	0	0	3	25	75	100
2	PCC	EC402	Analog Circuits	3	0	0	3	25	75	100
3	PCC	EI403	Electrical Measurement and Instrumentation	3	0	0	3	25	75	100
4	PCC	ECC02	Electromagnetic Waves	3	0	0	3	25	75	100
5	ESC	ESC01	Engineering Mechanics	3	1	0	4	25	75	100
6	BSC	BSC01	Biology	2	1	0	3	25	75	100
7	PCC	EI451	Control System Engg. Lab	0	0	2	1	15	35	50
8	PCC	EC452	Analog Circuits Lab	0	0	2	1	15	35	50
9	PCC	EI453	Electrical Measurement and Instrumentation Lab	0	0	2	1	15	35	50
10	PCC	ECC52	Electromagnetic Waves Lab	0	0	2	1	15	35	50
11	ESC	ES402	Electronics Workshop-II	0	0	6	3	30	70	100
			Total Credits				26	240	660	900

B.TECH 3rd YEAR EIC (SEMESTER -V)
COURSE STRUCTURE

Sr. No.	Category	Course Code	Course Title	Hours per week			Credits	Sessional Marks	Final Marks	Total
				L	T	P				
1	PCC	EI501	Sensors, Signal Conditioning and Telemetry	3	0	0	3	25	75	100
2	PCC	EI502	Modern Control System	3	0	0	3	25	75	100
3	PCC	ECC03	Microprocessors and Microcontrollers	3	0	0	3	25	75	100
4	PEC		**Program Elective-I**	3	0	0	3	25	75	100
5	MC	MC03	Environmental Sciences	2	0	0	0	25	75	100
6	OEC		**Open Elective** -1	3	0	0	3	25	75	100
7	PCC	ECC51	Microprocessors and Microcontrollers Lab	0	0	2	1	15	35	50
8	PEC	*EIEL551A/ EIEL551B	Power Electronics/ Virtual Instrumentation Lab	0	0	2	1	15	35	50
9	PCC	EI555	Electronics Workshop-III	0	0	6	3	30	70	100
			Total Credits				20	210	590	800

	Course Name	Course Title
Program Elective-I	EIEL501	Power Electronics
	EIEL502	Industrial Instrumentation
	EIEL503	Virtual/Intelligent Instrumentation
Open Elective-I	OE501	Computer Architecture
	OE502	Data Structure
	OE503	Basics of Communication Engineering
	OE504	Financial Management

Note: Exams Duration will be as under

(a) Theory exams will be of 3 hours duration.
(b) Practical exams will be of 08 hours duration
(c) Workshop exam will be of 8 hours duration

***The Lab relevant to PEC-I should be choosen.**

B.TECH 3rd YEAR EIC (SEMESTER -VI)
COURSE STRUCTURE

Sr. No	Category	Course Code	Course Title	Hours per week			Credits	Sessional Marks	Final Marks	Total
				L	T	P				
1	PCC	EI601	Industrial Process Control	3	0	0	3	25	75	100
2	PCC	ECC04	Digital Signal Processing	3	0	0	3	25	75	100
3	PEC		**Program Elective-II**	3	0	0	3	25	75	100
4	PEC		**Program Elective-III**	3	0	0	3	25	75	100
5	PEC		**Program Elective-IV**	3	0	0	3	25	75	100
6	OEC		**OE-II**	3	0	0	3	25	75	100
7	PCC	ECC53	Digital Signal Processing Lab	0	0	2	1	15	35	50
8	PCC	**EI653 A/ EI653B	Instrumentation Lab/ VLSI Design Lab	0	0	2	1	15	35	50
9	PCC	EI654	Electronics Workshop-IV	0	0	6	3	30	70	100
			Total Credits				23	210	590	800

	Course Name	Course Title
Program Elective-II	EIEL601	Internet of Things
	EIEL602	Digital Control
	EIEL603	Numerical Methods
Program Elective-III	EIEL604	Computer Based Instrumentation and Control
	EIEL605	Power Plant Instrumentation
	EIEL606	Process Modeling & Optimization
	EIEL607	Building Automation
Program Elective-IV	EIEL608	Analytical instrumentation
	EIEL609	Control System Components
	EIEL610	Optical Instrumentation
	EIEL611	VLSI Design
Open Elective-II	OE601	Digital Communication
	OE602	Scientific Computing
	OE603	Soft Computing
	OE604	Industrial Economics

Note: Exams Duration will be as under

(a) Theory exams will be of 3 hours duration.
(b) Practical exams will be of 08 hours duration
(c) Workshop exam will be of 8 hours duration

****The Lab relevant to PEC-IV should be choosen.**

B.TECH 4th YEAR EIC (SEMESTER -VII)
COURSE STRUCTURE
Semester 7(May be carried out in 8th Semester*)

Sr. No.	Category	Course Code	Course Title	Hours per week			Credits	Sessional Marks	Final Marks	Total
				L	T	P				
1	PEC		**Program Elective-V**	3	0	0	3	25	75	100
2	PEC		**Program Elective-VI**	3	0	0	3	25	75	100
3	PEC		**Program Elective-VII**	3	0	0	3	25	75	100
4	OEC		**OE-III**	3	0	0	3	25	75	100
5	OEC		**OE-IV**	3	0	0	3	25	75	100
6	HSMC	HSMC 01	Effective Tech. Comm.	3	0	0	3	25	75	100
7	PROJ	EIP701	Major Project	0	0	2	1	15	35	50
8	PCC	EI751	Electronics Workshop-V	0	0	4	2	30	70	100
			Total Credits				21	195	555	750

	Course Name	Course Title
Program Elective-V	EIEL701	Embedded System
	EIEL702	PLCs and SCADA
	EIEL703	Instrumentation & System Design
	EIEL704	Introduction to MEMS
Program Elective-VI	EIEL705	Fuzzy Control System
	EIEL706	AI and Expert System
	EIEL707	Micro / Nano Devices and Sensors
	EIEL708	Digital Image & Video Processing
Program Elective-VII	EIEL709	Non Linear Control System
	EIEL710	Batch Process Control
	EIEL711	Stochastic Control
	EIEL712	Electromagnetic compatibility for Instruments
Open Elective-III	OE701	Computer Network
	OE702	Banking System and Taxation
	OE703	Operational Research
Open Elective-IV	OE704	Human Resource Management
	OE705	Mobile Communication and Networks
	OE706	Wireless Sensor Networks
	OE707	Industrial Safety
	OE708	Cyber Laws & Security

Note: Exams Duration will be as under

(a) Theory exams will be of 3 hours duration.
(b) Practical exams will be of 08 hours duration
(c) Workshop exam will be of 8 hours duration

The course contents of 7th Semester may be pursued by the students of UTDs/Departments of Affiliated colleges in 8th semester. In the case of pursuance of internship in 7th semester, the

course contents of 7th semester will be taught in 8th semester and vice-versa. The approval of such interchangeability should be requested from the authority before the commencement of 7th semester.

B.TECH 4th YEAR EIC (SEMESTER -VIII)
COURSE STRUCTURE
Semester- 8 (May be carried out in 7th semester*)

Sr No.	Course	Title	Teaching Schedule	Examination Schedule (Marks)			Credits
				Annual Exam.	Continuous Assessment	Total	
1	EIP801	Industrial Training	**6 Months**	**350**	**150**	**500**	**10**

A) PROCEDURE FOR ANNUAL EXAMINATION AND MARKS.

1. PROJECT EVALUATION	150 MARKS	
2. PROJECT SEMINAR	100 MARKS	**350**
3. PROJECT VIVA	100 MARKS	

B) CONTINUOUS ASSESSMENT MARKS

1. ASSESSMENT BY INSTITUTE FACULTY	50 MARKS.	
2. ASSESSMENT BY INDUSTRIAL GUIDE	50 MARKS.	**150**
3. CONDUCT MARKS	50MARKS.	
TOTAL		**500**

*** The Industry Internship may be pursued by UTDs/Departments of Affiliated colleges in 7th or 8th semester. In the case of pursuance of internship in 7th semester, the course contents of 7th semester will be taught in 8th semester and vice-versa. The approval of such interchangeability should be requested from the authority before the commencement of 7th semester.**

Course code	BSC101C (Th)/ BSC104 (Lab)				
Category	Basic Science Course				
Course title	**Physics (Waves and Optics) (Theory & Lab.)**				
Scheme and Credits	**L**	**T**	**P**	**Credit**	Semester-I
	3	**1**	**3**	**5.5**	

(i) Physics (Waves and Optics) ([L : 3; T:1; P : 0 (4 credits)]

Prerequisites:

(i) Mathematics course on Differential equations

Unit 1: Simple harmonic motion, damped and forced simple harmonic oscillator (7) Mechanical and electrical simple harmonic oscillators, complex number notation and phasor representation of simple harmonic motion, damped harmonic oscillator – heavy, critical and light damping, energy decay in a damped harmonic oscillator, quality factor, forced mechanical and electrical oscillators, electrical and mechanical impedance, steady state motion of forced damped harmonic oscillator, power absorbed by oscillator

Unit 2: Non-dispersive transverse and longitudinal waves in one dimension and introductionto dispersion (7): Transverse wave on a string, the wave equation on a string, Harmonic waves, reflection and transmission of waves at a boundary, impedance matching, standing waves and their eigenfrequencies, longitudinal waves and the wave equation for them, acoustics waves and speed of sound, standing sound waves. Waves with dispersion, water waves, superposition of waves and Fourier method, wave groups and group velocity.

Unit 3: The propagation of light and geometric optics (10): Fermat's principle of stationary time and its applications e.g. in explaining mirage effect, laws of reflection and refraction, Light as an electromagnetic wave and Fresnel equations, reflectance and transmittance, Brewster's angle, total internal reflection, and evanescent wave. Mirrors and lenses and optical instruments based on them, transfer formula and the matrix method

Unit 4: Wave optics (6): Huygens' principle, superposition of waves and interference of light by wavefront splitting and amplitude splitting; Young's double slit experiment, Newton's rings, Michelson interferometer, Mach-Zehnder interferometer. Farunhofer diffraction from a single slit and a circular aperture, the Rayleigh criterion for limit of resolution and its application to vision; Diffraction gratings and their resolving power

Unit 5: Lasers (8): Einstein's theory of matter radiation interaction and A and B coefficients; amplification of light by population inversion, different types of lasers: gas lasers (He-Ne, CO2), solid-state lasers(ruby,Neodymium), dye lasers; Properties of laser beams: monochromaticity, coherence, directionality and brightness, laser speckles, applications of lasers in science, engineering and medicine.

Reference books:

(i) Ian G. Main, Oscillations and waves in physics

(ii) H.J. Pain, The physics of vibrations and waves

(iii)E. Hecht, A. Ghatak, Optics

(iv)O. Svelto, Principles of Lasers

(ii) Physics (Waves & Optics) Lab [L : 0; T:0 ; P : 3 (1.5credits)]

At least 06 experiments from the following

1. To determine the frequency of an electric tuning fork by Melde's experiment and verify λ2 –T law.
2. To study Lissajous Figures.
3. Familiarization with: Schuster`s focusing; determination of angle of prism.
4. To determine refractive index of the Material of a prism using sodium source.
5. To determine the dispersive power and Cauchy constants of the material of a prism using mercury source.
6. To determine the wavelength of sodium source using Michelson's interferometer.
7. To determine wavelength of sodium light using Fresnel's Biprism.
8. To determine wavelength of sodium light using Newton's Rings.
9. To determine wavelength of (1) Na source and (2) spectral lines of Hg source using plane diffraction grating.
10. To determine dispersive power and resolving power of a plane diffraction grating.
11. To determine the wavelength of laser source using diffraction of single slit.
12. To determine the wavelength of laser source using diffraction of double slits.
13. To determine angular spread of He-Ne laser using plane diffraction grating

Note: Experiments may be added or deleted as per the availability of equipments.

Reference Books

1. Advanced Practical Physics for students, B.L. Flint and H.T. Worsnop, 1971, Asia Publishing House
2. A Text Book of Practical Physics, I.Prakash & Ramakrishna, 11th Ed., 1511,Kitab Mahal
3. Advanced level Physics Practicals, Michael Nelson and Jon M. Ogborn, 4th Edition, reprinted 1985, Heinemann Educational Publishers
4. A Laboratory Manual of Physics for undergraduate classes, D.P.Khandelwal,1985, Vani Pub.

Course code	**BSC103D**				
Category	Basic Science Course				
Course title	**MATHEMATICS 1 (Calculus and Linear Algebra)**				
Scheme and Credits	**L**	**T**	**P**	**Credits**	Semester –I
	3	**1**	**-**	**4**	
Pre-requisites (if any)	**-**				

OBJECTIVES:

The objective of this course is to familiarize the prospective engineers with techniques in calculus, multivariate analysis and linear algebra. It aims to equip the students with standard concepts and tools at an intermediate to advanced level that will serve them well towards tackling more advanced level of mathematics and applications that they would find useful in their disciplines. More precisely, the objectives are:

- To introduce the idea of applying differential and integral calculus to notions of curvature and to improper integrals. Apart from some applications it gives a basic introduction on Beta and Gamma functions.
- To introduce the fallouts of Rolle's Theorem that is fundamental to application of analysis to Engineering problems.
- To develop the tool of power series and Fourier series for learning advanced Engineering Mathematics.
- To familiarize the student with functions of several variables that is essential in most branches of engineering.
- To develop the essential tool of matrices and linear algebra in a comprehensive manner.

Module 1: Calculus: (6 hours): Evolutes and involutes; Evaluation of definite and improper integrals; Beta and Gamma functions and their properties; Applications of definite integrals to evaluate surface areas and volumes of revolutions.

Module 2: Calculus: (6 hours): Rolle's Theorem, Mean value theorems, Taylor's and Maclaurin theorems with remainders; indeterminate forms and L'Hospital's rule; Maxima and minima.

Module 3:Sequences and series: (10 hours): Convergence of sequence and series, tests for convergence; Power series, Taylor's series, series for exponential, trigonometric and logarithm functions; Fourier series: Half range sine and cosine series, Parseval's theorem.

Module 4:Multivariable Calculus (Differentiation): (8 hours): Limit, continuity and partial derivatives, directional derivatives, total derivative; Tangent plane and normal line; Maxima, minima and saddle points; Method of Lagrange multipliers; Gradient, curl and divergence.

Module 5:Matrices (10hours): Inverse and rank of a matrix,rank-nullity theorem; System of linear equations; Symmetric, skew- symmetric and orthogonal matrices;

Determinants; Eigenvalues and eigenvectors; Diagonalization of matrices; Cayley-Hamilton Theorem, and Orthogonal transformation.

Textbooks/References:

1. G.B. Thomas and R.L. Finney, Calculus and Analytic geometry, 9th Edition,Pearson, Reprint, 2002.
2. Erwin kreyszig, Advanced Engineering Mathematics, 9th Edition, John Wiley & Sons, 2006.
3. Veerarajan T., Engineering Mathematics for first year, Tata McGraw-Hill, New Delhi, 2008.
4. Ramana B.V., Higher Engineering Mathematics, Tata McGraw Hill New Delhi, 11thReprint, 2010.
5. D. Poole, Linear Algebra: A Modern Introduction, 2nd Edition, Brooks/Cole, 2005.
6. N.P. Bali and Manish Goyal, A text book of Engineering Mathematics, Laxmi Publications, Reprint, 2008.
7. B.S. Grewal, Higher Engineering Mathematics, Khanna Publishers, 36th Edition, 2010.

Course code	ESC 102				
Category	Engineering Science Courses				
Course title	**Engineering Graphics & Design (Theory & Lab.)**				
Scheme and Credits	**L**	**T**	**P**	**Credit**	Semester – I
	-	**0**	**4**	**2**	
Pre-requisites (if any)	-				

Detailed contents

Traditional Engineering Graphics:

Principles of Engineering Graphics; Orthographic Projection; Descriptive Geometry; Drawing Principles; Isometric Projection; Surface Development; Perspective; Reading a Drawing; Sectional Views; Dimensioning & Tolerances; True Length, Angle; intersection, Shortest Distance.

Computer Graphics:

Engineering Graphics Software; -Spatial Transformations; Orthographic Projections; Model Viewing; Co-ordinate Systems; Multi-view Projection; Exploded Assembly; Model Viewing; Animation; Spatial Manipulation; Surface Modelling; Solid Modelling; Introduction to Building Information Modelling (BIM)

Module 1: Introduction to Engineering Drawing covering,

Principles of Engineering Graphics and their significance, usage of Drawing instruments, lettering, Conic sections including the Rectangular Hyperbola (General method only); Cycloid, Epicycloid, Hypocycloid and Involute; Scales – Plain, Diagonal and Vernier Scales;

Module 2: Orthographic Projections covering,

Principles of Orthographic Projections-Conventions - Projections of Points and lines inclined to both planes; Projections of planes inclined Planes - Auxiliary Planes;

Module 3: Projections of Regular Solids covering,

Those inclined to both the Planes- Auxiliary Views; Draw simple annotation, dimensioning and scale. Floor plans that include: windows, doors, and fixtures such as WC, bath, sink, shower, etc.

Module 4: Sections and Sectional Views of Right Angular Solids covering,

Prism, Cylinder, Pyramid, Cone – Auxiliary Views; Development of surfaces of Right Regular Solids - Prism, Pyramid, Cylinder and Cone; Draw the sectional orthographic views of geometrical solids, objects from industry and dwellings (foundation to slab only)

Module 5: Isometric Projections covering,

Principles of Isometric projection – Isometric Scale, Isometric Views, Conventions; Isometric Views of lines, Planes, Simple and compound

Solids; Conversion of Isometric Views to Orthographic Views and Vice-versa, Conventions;

Module 6: Overview of Computer Graphics covering, listing the computer technologies that impact on graphical communication, Demonstrating knowledge of the theory of CAD software [such as: The Menu System, Toolbars (Standard, Object Properties, Draw, Modify and Dimension), Drawing Area (Background, Crosshairs, Coordinate System), Dialog boxes and windows, Shortcut menus (Button Bars), The Command Line (where applicable), The Status Bar, Different methods of zoom as used in CAD, Select and erase objects.; Isometric Views of lines, Planes, Simple and compound Solids];

Module 7: Customisation& CAD Drawing consisting of set up of the drawing page and the printer, including scale settings, Setting up of units and drawing limits; ISO and ANSI standards for coordinate dimensioning and tolerance; Orthographic constraints, Snap to objects manually and automatically; Producing drawings by using various coordinate input entry methods to draw straight lines, Applying various ways of drawing circles.

Course Outcomes

All phases of manufacturing or construction require the conversion of new ideas and design concepts into the basic line language of graphics. Therefore, there are many areas (civil, mechanical, electrical, architectural and industrial) in which the skills of the CAD technicians play major roles in the design and development of new products or construction. Students prepare for actual work situations through practical training in a new state-of-the-art computer designed CAD laboratory using engineering software. This course is designed to:

Learn about the visual aspects of engineering design.

Analyse engineering graphics standards.

Prepare orthographic and isometric projection.

Draw section of solids and conic sections.

Exposure to computer-aided geometric design

Suggested Text/Reference Books:

1. Bhatt N.D., Panchal V.M. & Ingle P.R., (2014), Engineering Drawing, Charotar Publishing House
2. Shah, M.B. & Rana B.C. (2008), Engineering Drawing and Computer Graphics, Pearson Education
3. Agrawal B. & Agrawal C. M. (2012), Engineering Graphics, TMH Publication
4. Aggarwal M L & Sandhya Dixit (2017), Engineering Graphics and Machine Drawing, Dhanpat Rai & Company P Ltd.
5. Narayana, K.L. & P Kannaiah (2008), Text book on Engineering Drawing, Scitech Publishers, (Corresponding set of) CAD Software Theory and User Manuals
6. Narayana, K.L. & P Kannaiah (2008), Text book on Engineering Drawing, Scitech Publishers (Corresponding set of) CAD Software Theory and User Manuals

Course code	ESC103(Th)/ESC105(Lab)				
Category	Engineering Science Course				
Course title	**Programming for Problem Solving (Theory & Lab.)**				
Scheme and Credits	**L**	**T**	**P**	**Credit**	Semester – I/II
	3	**0**	**4**	**5**	
Pre-requisites (if any)	-				

(i)Programming for Problem Solving ([L : 3; T:0; P : 0 (3 credits)] [contact hrs : 40]

Detailed contents

Unit 1 **Introduction to Programming (4 lectures)** Introduction to components of a computer system (disks, memory, processor, where a program is stored and executed, operating system, compilers etc.) - **(1 lecture).**

Idea of Algorithm: steps to solve logical and numerical problems. Representation of Algorithm: Flowchart/Pseudocode with examples. **(1 lecture)**

From algorithms to programs; source code, variables (with data types) variables and memory locations, Syntax and Logical Errors in compilation, object and executable code- **(2 lectures)**

Unit 2:**Arithmetic expressions and precedence (2 lectures)** Conditional Branching and Loops **(6 lectures)** Writing and evaluation of conditionals and consequent branching **(3 lectures)** Iteration and loops **(3 lectures)**

Unit 3 **Arrays (6 lectures)** Arrays (1-D, 2-D), Character arrays and Strings

Unit 4 **Basic Algorithms (6 lectures)** Searching, Basic Sorting Algorithms (Bubble, Insertion and Selection), Finding roots of equations, notion of order of complexity through example programs (no formal definition required)

Unit 5 **Function (5 lectures)** Functions (including using built in libraries), Parameter passing in functions, call by value, Passing arrays to functions: idea of call by reference

Unit 6 **Recursion (4 -5 lectures)** Recursion, as a different way of solving problems. Example programs, such as Finding Factorial, Fibonacci series, Ackerman function etc. Quick sort or Merge sort.

Unit 7 **Structure (4 lectures)** Structures, Defining structures and Array of Structures

Unit 8 **Pointers (2 lectures)** Idea of pointers, Defining pointers, Use of Pointers in self-referential structures, notion of linked list (no implementation)

Unit 9 **File handling** (only if time is available, otherwise should be done as part of the lab)

Suggested Text Books

(i) Byron Gottfried, Schaum's Outline of Programming with C, McGraw-Hill

(ii) E. Balaguruswamy, Programming in ANSI C, Tata McGraw-Hill

Suggested Reference Books

(i) Brian W. Kernighan and Dennis M. Ritchie, The C Programming Language, Prentice Hall of India

Course Outcomes

The student will learn

- To formulate simple algorithms for arithmetic and logical problems.
- To translate the algorithms to programs (in C language).
- To test and execute the programs and correct syntax and logical errors.
- To implement conditional branching, iteration and recursion.
- To decompose a problem into functions and synthesize a complete program using divide and conquer approach.
- To use arrays, pointers and structures to formulate algorithms and programs.
- To apply programming to solve matrix addition and multiplication problems and searching and sorting problems.
- To apply programming to solve simple numerical method problems, namely rot finding of function, differentiation of function and simple integration.

(ii)Laboratory - Programming for Problem Solving[L : 0; T:0 ; P : 4 (2credits)]

Tutorial 1: Problem solving using computers:
Lab1: Familiarization with programming environment

Tutorial 2: Variable types and type conversions:
Lab 2: Simple computational problems using arithmetic expressions

Tutorial 3: Branching and logical expressions:
Lab 3: Problems involving if-then-else structures

Tutorial 4: Loops, while and for loops:
Lab 4: Iterative problems e.g., sum of series

Tutorial 5: 1D Arrays: searching, sorting:
Lab 5: 1D Array manipulation

Tutorial 6: 2D arrays and Strings
Lab 6: Matrix problems, String operations

Tutorial 7: Functions, call by value:
Lab 7: Simple functions

Tutorial 8 &9: Numerical methods (Root finding, numerical differentiation, numerical integration):
Lab 8 and 9: Programming for solving Numerical methods problems

Tutorial 10: Recursion, structure of recursive calls
Lab 10: Recursive functions

Tutorial 11: Pointers, structures and dynamic memory allocation
Lab 11: Pointers and structures

Tutorial 12: File handling:
Lab 12: File operations

Laboratory Outcomes

- To formulate the algorithms for simple problems
- To translate given algorithms to a working and correct program
- To be able to correct syntax errors as reported by the compilers
- To be able to identify and correct logical errors encountered at run time
- To be able to write iterative as well as recursive programs
- To be able to represent data in arrays, strings and structures and manipulate

them through a program

- To be able to declare pointers of different types and use them in defining self-referential structures.
- To be able to create, read and write to and from simple text files.

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Course code	BSC106D				
Category	Basic Science Course				
Course title	**Mathematics -II (Calculus, Ordinary Differential Equations and Complex Variable)**				
Scheme and Credits	**L**	**T**	**P**	**Credit**	Semester-II
	3	**1**	**0**	**4**	
Pre-requisites (if any)	**-**				

OBJECTIVES:

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

a. To acquaint the student with mathematical tools needed in evaluating multiple integrals and their usage.
b. To introduce effective mathematical tools for the solutions of differential equations that model physical processes.
c. To introduce the tools of differentiation and integration of functions of complex variable that are used in various techniques dealing engineering problems.

Module 1:Multivariable Calculus (Integration): (10 hours) Multiple Integration: Double integrals (Cartesian), change of order of integration in double integrals, Change of variables (Cartesian to polar), Applications: areas and volumes, Center of mass and Gravity (constant and variable densities);Triple integrals (Cartesian), orthogonal curvilinear coordinates, Simple applications involving cubes, sphere and rectangular parallelepipeds; Scalar line integrals, vector line integrals, scalar surface integrals, vector surface integrals, Theorems of Green, Gauss and Stokes.

Module 2:First order ordinary differential equations:(6 hours) Exact, linear and Bernoulli's equations, Euler's equations, Equations not of first degree: equations solvable for p, equations solvable for y, equations solvable for x and Clairaut's type.

Module 3: Ordinary differential equations of higher orders:(8 hours) Second order linear differential equations with variable coefficients, method of variation of parameters, Cauchy-Euler equation; Power series solutions; Legendre polynomials, Bessel functions of the first kind and their properties.

Module 4: Complex Variable – Differentiation:(8 hours): Differentiation, Cauchy-Riemann equations, analytic functions, harmonic functions, finding harmonic conjugate; elementary analytic functions (exponential, trigonometric, logarithm) and their properties; Conformal mappings, Mobius transformations and their properties.

Module 5: Complex Variable – Integration:(8 hours): Contour integrals, Cauchy-Goursat theorem (without proof), Cauchy Integral formula (without proof), Liouville's theorem and Maximum-Modulus theorem (without proof); Taylor's series, zeros of analytic functions, singularities, Laurent's series; Residues, Cauchy Residue theorem (without proof), Evaluation of definite integral involving sine and cosine, Evaluation of certain improper integrals using the Bromwich contour.

Textbooks/References:

1. G.B. Thomas and R.L. Finney, Calculus and Analytic geometry, 9th Edition, Pearson, Reprint, 2002.
2. Erwin kreyszig, Advanced Engineering Mathematics, 9th Edition, John Wiley & Sons, 2006.
3. W. E. Boyce and R. C. DiPrima, Elementary Differential Equations and Boundary Value Problems, 9th Edn., Wiley India, 2009.
4. S. L. Ross, Differential Equations, 3rd Ed., Wiley India, 1984.
5. E. A. Coddington, An Introduction to Ordinary Differential Equations, Prentice Hall India, 1995.
6. E. L. Ince, Ordinary Differential Equations, Dover Publications, 1958.
7. J. W. Brown and R. V. Churchill, Complex Variables and Applications, 7th Ed., Mc- Graw Hill, 2004.
8. N.P. Bali and Manish Goyal, A text book of Engineering Mathematics, Laxmi Publications, Reprint, 2008.
9. B.S. Grewal, Higher Engineering Mathematics, Khanna Publishers, 36th Edition, 2010

Course code	ESC 101(Th)/ESC107(Lab)				
Category	Engineering Science Course				
Course title	**Basic Electrical Engineering (Theory & Lab.)**				
Scheme and Credits	**L**	**T**	**P**	**Credit**	Semester –I/II
	3	**1**	**2**	**5**	
Pre-requisites (if any)	**-**				

(i)Basic Electrical Engineering [L : 3; T:1; P : 0 (4 credits)]

Detailed contents :

Module 1 : DC Circuits (8 hours) Electrical circuit elements (R, L and C), voltage and current sources, Kirchoff current and voltage laws, analysis of simple circuits with dc excitation. Superposition, Thevenin and Norton Theorems. Time-domain analysis of first-order RL and RC circuits.

Module 2: AC Circuits (8 hours) Representation of sinusoidal waveforms, peak and rms values, phasor representation, real power, reactive power, apparent power, power factor. Analysis of single-phase ac circuits consisting of R, L, C, RL, RC, RLC combinations (series and parallel), resonance. Three- phase balanced circuits, voltage and current relations in star and delta connections.

Module 3: Transformers (6 hours) Magnetic materials, BH characteristics, ideal and practical transformer, equivalent circuit, losses in transformers, regulation and efficiency. Auto-transformer and three-phase transformer connections.

Module 4: Electrical Machines (8 hours) Generation of rotating magnetic fields, Construction and working of a three-phase induction motor, Significance of torque-slip characteristic. Loss components and efficiency, starting and speed control of induction motor. Single-phase induction motor. Construction, working, torque-speed characteristic and speed control of separately excited dc motor. Construction and working of synchronous generators.

Module 5: Power Converters (6 hours) DC-DC buck and boost converters, duty ratio control. Single-phase and three-phase voltage source inverters; sinusoidal modulation.

Module 6: Electrical Installations (6 hours) Components of LT Switchgear: Switch Fuse Unit (SFU), MCB, ELCB, MCCB, Types of Wires and Cables, Earthing. Types of Batteries, Important Characteristics for Batteries. Elementary calculations for energy consumption, power factor improvement and battery backup.

Suggested Text / Reference Books

(i) D. P. Kothari and I. J. Nagrath, "Basic Electrical Engineering", Tata McGraw Hill, 2010.

(ii) D. C. Kulshreshtha, "Basic Electrical Engineering", McGraw Hill, 2009.

(iii)L. S. Bobrow, "Fundamentals of Electrical Engineering", Oxford University Press, 2011.

(iv)E. Hughes, "Electrical and Electronics Technology", Pearson, 2010.

(v) V. D. Toro, "Electrical Engineering Fundamentals", Prentice Hall India, 1989.

Course Outcomes

- To understand and analyze basic electric and magnetic circuits

- To study the working principles of electrical machines and power converters.
- To introduce the components of low voltage electrical installations

(ii)Basic Electrical Engineering Laboratory [L : 0; T:0 ; P : 2 (1 credit)]

List of experiments/demonstrations:

- Basic safety precautions. Introduction and use of measuring instruments – voltmeter, ammeter, multi-meter, oscilloscope. Real-life resistors, capacitors and inductors.
- Measuring the steady-state and transient time-response of R-L, R-C, and R-L-C circuits to a step change in voltage (transient may be observed on a storage oscilloscope). Sinusoidal steady state response of R-L, and R-C circuits – impedance calculation and verification. Observation of phase differences between current and voltage. Resonance in R-L-C circuits.
- Transformers: Observation of the no-load current waveform on an oscilloscope (non-sinusoidal wave-shape due to B-H curve nonlinearity should be shown along with a discussion about harmonics). Loading of a transformer: measurement of primary and secondary voltages and currents, and power.
- Three-phase transformers: Star and Delta connections. Voltage and Current relationships (line-line voltage, phase-to-neutral voltage, line and phase currents). Phase-shifts between the primary and secondary side. Cumulative three-phase power in balanced three-phase circuits.
- Demonstration of cut-out sections of machines: dc machine (commutator-brush arrangement), induction machine (squirrel cage rotor), synchronous machine (field winging - slip ring arrangement) and single-phase induction machine.
- Torque Speed Characteristic of separately excited dc motor.
- Synchronous speed of two and four-pole, three-phase induction motors. Direction reversal by change of phase-sequence of connections. Torque-Slip Characteristic of an induction motor. Generator operation of an induction machine driven at super-synchronous speed.
- Synchronous Machine operating as a generator: stand-alone operation with a load. Control of voltage through field excitation.
- Demonstration of (a) dc-dc converters (b) dc-ac converters – PWM waveform (c) the use of dc-ac converter for speed control of an induction motor and (d) Components of LT switchgear.

Laboratory Outcomes

- Get an exposure to common electrical components and their ratings.
- Make electrical connections by wires of appropriate ratings.
- Understand the usage of common electrical measuring instruments.
- Understand the basic characteristics of transformers and electrical machines.
- Get an exposure to the working of power electronic converters.

Course code	BSC102(Th)/BSC105(Lab)				
Category	Basic Science Course				
Course title	**Chemistry (Theory & Lab.)** **Contents** (i) Chemistry (Concepts in chemistry for engineering) (ii) Chemistry Laboratory				
Scheme and Credits	**L**	**T**	**P**	**Credits**	Semester –II
	3	**1**	**3**	**5.5**	
Pre-requisites (if any)	-				

(i)Chemistry (Concepts in chemistry for engineering) [L : 3; T:1; P : 0 (4 credits)]

Detailed contents

(i) Atomic and molecular structure (12 lectures)

Schrodinger equation. Particle in a box solutions and their applications for conjugated molecules and nanoparticles. Forms of the hydrogen atom wave functions and the plots of these functions to explore their spatial variations. Molecular orbitals of diatomic molecules and plots of the multicenter orbitals. Equations for atomic and molecular orbitals. Energy level diagrams of diatomic. Pi-molecular orbitals of butadiene and benzene and aromaticity. Crystal field theory and the energy level diagrams for transition metal ions and their magnetic properties. Band structure of solids and the role of doping on band structures.

(ii) Spectroscopic techniques and applications (8 lectures)

Principles of spectroscopy and selection rules. Electronic spectroscopy. Fluorescence and its applications in medicine. Vibrational and rotational spectroscopy of diatomic molecules. Applications. Nuclear magnetic resonance and magnetic resonance imaging, surface characterisation techniques. Diffraction and scattering.

(iii) Intermolecular forces and potential energy surfaces (4 lectures)

Ionic, dipolar and van Der Waals interactions. Equations of state of real gases and critical phenomena. Potential energy surfaces of H_3, H_2F and HCN and trajectories on these surfaces.

(iv) Use of free energy in chemical equilibria (6 lectures)

Thermodynamic functions: energy, entropy and free energy. Estimations of entropy and free energies. Free energy and emf. Cell potentials, the Nernst equation and applications. Acid base, oxidation reduction and solubility equilibria. Water chemistry. Corrosion.

Use of free energy considerations in metallurgy through Ellingham diagrams.

(v) Periodic properties (4 Lectures)

Effective nuclear charge, penetration of orbitals, variations of s, p, d and f orbital energies of atoms in the periodic table, electronic configurations, atomic and ionic sizes, ionization energies, electron affinity and electronegativity, polarizability, oxidation states, coordination numbers and geometries, hard soft acids and bases, molecular geometries

(vi) Stereochemistry (4 lectures)

Representations of 3 dimensional structures, structural isomers and stereoisomers, configurations and symmetry and chirality, enantiomers, diastereomers, optical activity, absolute configurations and conformational analysis. Isomerism in transitional metal compounds

(vii) Organic reactions and synthesis of a drug molecule (4 lectures)

Introduction to reactions involving substitution, addition, elimination, oxidation, reduction, cyclization and ring openings. Synthesis of a commonly used drug molecule.

Suggested Text Books

1. University chemistry, by B. H. Mahan
2. Chemistry: Principles and Applications, by M. J. Sienko and A. Plane
3. Fundamentals of Molecular Spectroscopy, by C. N. Banwell
4. Engineering Chemistry (NPTEL Web-book), by B. L. Tembe, Kamaluddin and M. S. Krishnan
5. Physical Chemistry, by P. W. Atkins
6. Organic Chemistry: Structure and Function by K. P. C. Volhardt and N. E. Schore, 5th Edition

Course Outcomes

The concepts developed in this course will aid in quantification of several concepts in chemistry that have been introduced at the 10+2 levels in schools. Technology is being increasingly based on the electronic, atomic and molecular level modifications.

Quantum theory is more than 100 years old and to understand phenomena at nanometer levels; one has to base the description of all chemical processes at molecular levels. The course will enable the student to:

- Analyse microscopic chemistry in terms of atomic and molecular orbitals and intermolecular forces.
- Rationalise bulk properties and processes using thermodynamic considerations.
- Distinguish the ranges of the electromagnetic spectrum used for exciting different molecular energy levels in various spectroscopic techniques
- Rationalise periodic properties such as ionization potential, electronegativity, oxidation states and electronegativity.
- List major chemical reactions that are used in the synthesis of molecules.

(ii) Chemistry Laboratory[L : 0; T:0 ; P : 3 (1.5 credits)]

Choice of 10-12 experiments from the following:

- Determination of surface tension and viscosity
- Thin layer chromatography
- Ion exchange column for removal of hardness of water
- Determination of chloride content of water
- Colligative properties using freezing point depression
- Determination of the rate constant of a reaction
- Determination of cell constant and conductance of solutions
- Potentiometry - determination of redox potentials and emfs
- Synthesis of a polymer/drug
- Saponification/acid value of an oil
- Chemical analysis of a salt
- Lattice structures and packing of spheres
- Models of potential energy surfaces
- Chemical oscillations- Iodine clock reaction
- Determination of the partition coefficient of a substance between two immiscible

liquids

- Adsorption of acetic acid by charcoal
- Use of the capillary viscosimeters to the demonstrate of the isoelectric point as the pH of minimum viscosity for gelatin sols and/or coagulation of the white part of egg .

Laboratory Outcomes

- The chemistry laboratory course will consist of experiments illustrating the principles of chemistry relevant to the study of science and engineering. The students will learn to:
- Estimate rate constants of reactions from concentration of reactants/products as a function of time
- Measure molecular/system properties such as surface tension, viscosity, conductance of solutions, redox potentials, chloride content of water, etc
- Synthesize a small drug molecule and analyse a salt sample

Course code	HSMC 101(Th)/HSMC102(Lab)				
Category	Humanities and Social Sciences including Management				
Course title	**English (Theory & Lab.)**				
Scheme and Credits	**L**	**T**	**P**	**Credit**	Semester – II
	2	**0**	**2**	**3**	
Pre-requisites (if any)	-				

English

Detailed contents

1. Vocabulary Building

The concept of Word Formation, Root words from foreign languages and their use in English, Acquaintance with prefixes and suffixes from foreign languages in English to form derivatives. Synonyms, antonyms, and standard abbreviations.

2. Basic Writing Skills

Sentence Structures, Use of phrases and clauses in sentences, Importance of proper punctuation, Creating coherence, Organizing principles of paragraphs in documents, Techniques for writing precisely

3. Identifying Common Errors in Writing

Subject-verb agreement, Noun-pronoun agreement, Misplaced modifiers, Articles, Prepositions, Redundancies, Clichés

4. Nature and Style of sensible Writing

Describing, Defining, Classifying, Providing examples or evidence

5. Writing introduction and conclusion

6. Writing Practices

Comprehension, Précis Writing, Essay Writing

English Laboratory[L : 0; T:0 ; P : 2 (1 credit)]

- Listening Comprehension
- Pronunciation, Intonation, Stress and Rhythm
- Common Everyday Situations: Conversations and Dialogues
- Communication at Workplace
- Interviews
- Formal Presentations

Suggested Readings:

(i) *Practical English Usage.* Michael Swan. OUP. 1995.
(ii) *Remedial English Grammar.* F.T. Wood. acmillan.2007
(iii) *On Writing Well.* William Zinsser. Harper Resource Book. 2001
(iv) *Study Writing.* Liz Hamp-Lyons and Ben Heasly. Cambridge University Press. 2006.
(v) *Communication Skills*. Sanjay Kumar and PushpLata. Oxford University Press. 2011.
(vi) *Exercises in Spoken English.* Parts. I-III. CIEFL, Hyderabad. Oxford University Press

Course Outcomes

The student will acquire basic proficiency in English including reading and listening comprehension, writing and speaking skills.

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Course code	ESC 104				
Category	Engineering Science Courses				
Course title	**Workshop-I**				
Scheme and Credits	**L**	**T**	**P**	**Credit**	Semester-I
	-	**0**	**4**	**2**	
Pre-requisites (if any)	**-**				

Workshop-I
PART-A
Computer Engineering Workshop

Course Outcomes (COs):

After the completion of the course the student will be able to:

CO1- Acquire skills in basic engineering practice.

CO2- Have working knowledge of various equipments used in workshop.

CO3- Have hands on experience about various machines and their components.

CO4- Obtain practical skills of basic operation and working of tools used in the workshop.

1. To study and demonstrate Block diagram of Digital Computer System and brief explanation of each unit.
2. To demonstrate History/ Generation/ classifications and different types of Personnel Computer.To study and demonstrate internal parts of a Computer System (Card level) and other peripheral devices and explanation of POST & BIOS.
3. To study and demonstrate primary memory and secondary memory.
4. To demonstrate CPU Block diagram and other Peripheral chips, Mother Board/ Main Board and its parts, Connectors, Add On Card Slots etc.
5. To study working of various types of monitors: CRT type, LCD type & LED type.
6. To study Keyboard and Mouse: Wired, Wireless, Scroll & Optical with detail working.
7. To study Printers: Dot Matrix Printers, Daisy wheel Printers, Ink-Jet Printers and Laser Jet Printers with detailed working explanation.
8. Assembly / Installation and Maintenance of Personnel Computer Systems: Practical exercise on assembly of Personnel Computer System, Installation of Operating System: Windows & Linux etc, Installation of other Application Softwares and Utility Softwares, Fault finding in Personnel Computers: Software or Hardware wise, Virus: Introduction, its Types & Removal techniques, Data Backup and Restore, Data Recovery Concepts, Typical causes of Data loss.
9. To demonstrate networking concepts: Introduction of Connecting devices: Hub, Switch & Router etc, Networking Cable preparation: Normal & Cross Cables, Data Transferring Techniques from one Computer System to another Computer System, Configuration of Switch/ Routers etc.

PART-B
Electrical Workshop

1. Introduction of Electrical Safety precautions, Electrical Symbols, Electrical Materials, abbreviations commonly used in Electrical Engg. and familiarization with tools used in Electrical Works.
2. To make a Straight Joint & Tee joint on 7/22 PVC wire and Britannia Joint on GI wire.

3. To study fluorescent Tube Light, Sodium Lamp and High Pressure Mercury Vapour Lamp.
4. To study different types of earthing and protection devices e.g. MCBs, ELCBs and fuses.
5. To study different types of domestic and industrial wiring and wire up a circuit used for Stair case and Godown wiring.
6. To make the connection of fan regulator with lamp to study the effect of increasing and decreasing resistance in steps on the lamp.
7. To fabricate half wave and full wave rectifiers with filters on PCB.
8. Maintenance and Repair of Electrical equipment i,e Electric Iron , Electric Toaster ,Water heater, Air coolers and Electric Fans etc.
9. To study soldering process with simple soldering exercises.
10. To make the connection of a three core cable to three pin power plug and connect the other cable end by secured eyes connection using 23/0.0076"or 40/0.0076" cable.

PART- C

Electronics Workshop

1. To study and demonstrate basic electronic components, Diode, Transistor, Resistance, Inductor and capacitor.
2. To study and demonstrate resistance color coding, measurement using color code and multimeter and error calculation considering tolerance of resistance.
3. To study and demonstrate Multimeter and CRO- front panel controls, description of block diagram of CRT and block diagram of CRO.
4. To study and demonstrate Vp(peak voltage),Vpp(peak to peak voltage), Time, frequency and phase using CRO.
5. Introduction to function generator. Functions of front panel controls and measurement of different functions on CRO.
6. To study and demonstrate variable DC regulated power supply, function of controls and DC measurement using multimeter and CRO.
7. Soldering practice on wire mesh or a resistance decade board includes fabrication, soldering, lacing, harnessing forming and observation.
8. Testing of components using multimeter and CRO like diode, transistor, resistance capacitor, Zener diode and LED.
9. To study and demonstrate rectification, half wave, Full wave and bridge rectifier. Fabrication,assembly and waveform observation.
10. To design and fabricate a printed circuit board of a Zener regulated/ series regulated power supply and various measurements, testing of power supply.

Note: At least 8 exercises are to be performed from each part by the students.

Course code	ESC 106				
Category	Engineering Science Courses				
Course title	**Workshop-II**				
Scheme and Credits	**L**	**T**	**P**	**Credit**	Semester-II
	-	**0**	**4**	**2**	
Pre-requisites (if any)	**-**				

MECHANICAL WORKSHOP

Course Outcomes (COs): After studying this course the students would:

CO 1- Have exposure to mechanical workshop layout and safety aspects.
CO 2- Understand the functions of various machines and cutting tools used in machine shop.
CO 3- Practice real time job preparation using various operations related to machine shop such as filing, drilling, milling & turning.
CO 4 - Practice job preparation in welding shop.
CO 5 - Learn to use different measuring tools like vernier caliper, vernier height gauge and micrometer.
CO 6 - Practice job preparation in sheet metal shop.

List of Exercises:

Fitting, sheet metal and welding workshop:

1. To study layout, safety measures and different engineering materials (mild steel, medium carbon steel, high carbon steel, high speed steel and cast iron etc) used in workshop.
2. To study and use of different types of tools, equipments, devices & machines used in fitting, sheet metal and welding section.
3. To determine the least count of vernier calliper, vernier height gauge, micrometer and take different reading over given metallic pieces using these instruments.
4. To study and demonstrate the parts, specifications & operations performed on lathe machine.
5. To study and demonstrate the parts, specifications & operations performed on milling machine.
6. To study and demonstrate the parts, specifications & operations performed on shaper machine.
7. To prepare a job involving different type of filing practice exercise in specified dimensions.
8. To prepare a job involving multi operational exercise (drilling, counter sinking, tapping, reaming, hack sawing etc.)
9. To prepare a multi operational sheet metal job (self secured single groove joint/ hasp & stay etc.).
10. To practice striking an arc, straight short bead, straight continuous bead and restart of electrode in flat position by arc welding on given M.S. plate as per size.
11. To practice tack weld of two close plate in flat position by arc welding on given M.S. plate as per size.
12. To practice close butt joint in flat position by arc welding on given M.S. plate as per size.

NOTE: - At least nine exercises should be performed from the above list; remaining three may either be performed from above list or designed by the concerned institution as per the scope of the syllabus and facilities available in institute.

EC301	**Electronic Devices**		
L T P CR	**Theory**	**:**	**75**
3 0 0 3	**Class Work**	**:**	**25**
	Total	**:**	**100**
	Duration of Exam	**:**	**3 Hrs.**

Course Objects:

- To give exposure to students about Semiconductor Physics.
- To give the exposure about characteristics of semiconductor devices.
- To introduce the working of difficult semiconductor electronics devices.
- To introduce about the fabrication terminologies semiconductor electronics devices.

Syllabus

Unit 1: Introduction to Semiconductor Physics: Review of Quantum Mechanics, Electrons in periodic Lattices, E-k diagrams. Energy bands in intrinsic and extrinsic silicon, Carrier transport, diffusion current, drift current, mobility and resistivity, sheet resistance, design of resistors

Unit 2: Generation and recombination of carriers: Poisson and continuity equation P-N junction characteristics, I-V characteristics, and small signal switching models, Avalanche breakdown, Zener diode, Schottky diode

Unit 3: Bipolar Junction Transistor, I-V characteristics, Ebers-Moll Model, MOS capacitor, C-V characteristics, MOSFET, I-V characteristics, and small signal models of MOS transistor, LED, photodiode and solar cell;

Unit 4: Integrated circuit fabrication process: oxidation, diffusion, ion implantation, photolithography, etching, chemical vapor deposition, sputtering, twin-tub CMOS process.

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

- Understand the principles of semiconductor Physics.
- Understand and utilize the mathematical models of semiconductor junctions and MOS transistors for circuits and systems.
- Understand various semiconductor, fabrication process.
- Understand the design & characteristics of semiconductor device.

Text /Reference Books:

1. G. Streetman, and S. K. Banerjee, “Solid State Electronic Devices,” 7th edition, Pearson,2014.
2. D. Neamen, D. Biswas "Semiconductor Physics and Devices," McGraw-Hill Education
3. S. M. Sze and K. N. Kwok, “Physics of Semiconductor Devices,” 3rd edition, John Wiley &Sons, 2006.
4. C.T. Sah, “Fundamentals of solid state electronics,” World Scientific Publishing Co. Inc, 1991.
5. Y. Tsividis and M. Colin, “Operation and Modeling of the MOS Transistor,” Oxford Univ.Press, 2011.

EC302	**Digital System Design**		
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 fundamentals of digital electronics.
- To familiar the students about the design and analyze various combinational circuits.
- To get exposure to the students about design and analyze various sequential circuits.
- To introduce logic family & semiconductor memories.
- To introduce basic knowledge of HDL & their ways of implementation.

Syllabus

Unit 1: Logic Simplification and Combinational Logic Design, Review of Boolean Algebra and De Morgan's Theorem, SOP & POS forms, Canonical forms, Karnaugh maps up to 6 variables, Binary codes, Code Conversion.

Unit 2: MSI devices like Comparators, Multiplexers, Encoder, Decoder, Driver & Multiplexed Display, Half and Full Adders, Subtractors, Serial and Parallel Adders, BCD Adder, Barrel shifter and ALU

Unit 3: Sequential Logic Design: Building blocks like S-R, JK and Master-Slave JK FF, Edge triggered FF, Ripple and Synchronous counters, Shift registers, Finite state machines, Design of synchronous FSM, Algorithmic State Machines charts. Designing synchronous circuits like Pulse train generator, Pseudo Random Binary Sequence generator, Clock generation

Unit 4: Logic Families and Semiconductor Memories: TTL NAND gate, Specifications, Noise margin, Propagation delay, fan-in, fan-out, Tristate TTL, ECL, CMOS families and their interfacing, Memory elements, Concept of Programmable logic devices like FPGA, Logic implementation using Programmable Devices.

Unit 5: VLSI Design flow: Design entry, Schematic, FSM & HDL, different modeling styles in VHDL, Data types and objects, Dataflow, Behavioral and Structural Modeling, Synthesis and Simulation VHDL constructs and codes for combinational and sequential circuits.

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

- Design and analyze combinational logic circuits.
- Acquire basic knowledge of digital logic families & semiconductor memories.
- Design & analyze synchronous sequential logic circuits.
- Use HDL & appropriate EDA tools for digital logic design and simulation.

Text/Reference Books:

1. R.P. Jain, "Modern digital Electronics", Tata McGraw Hill, 4th edition, 2009.
2. Douglas Perry, "VHDL", Tata McGraw Hill, 4th edition, 2002.
3. W.H. Gothmann, "Digital Electronics- An introduction to theory and practice", PHI, 2nd edition, 2006.
4. D.V. Hall, "Digital Circuits and Systems", Tata McGraw Hill, 1989 Charles Roth, "Digital System Design using VHDL", Tata McGraw Hill 2nd edition 2012.

ECC01	**Signal and Systems**		
L T P CR	**Theory**	**:**	**75**
3 0 0 3	**Class Work**	**:**	**25**
	Total	**:**	**100**
	Duration of Exam	**:**	**3 Hrs.**

Course Objects:

- To introduce students about various types of signals and their classifications.
- To introduce students about LSI (linear shift invariant) systems and their properties.
- To introduce students about properties of Fourier Series, Fourier Transforms like DTFT and DFT.
- To introduce students about Laplace Transform, Z Transform and State-Space Analysis.

Syllabus

Unit 1: Signals and systems as seen in everyday life, and in various branches of engineering and science, Energy and power signals, continuous and discrete time signals, continuous and discrete amplitude signals, System properties, linearity: additivity and homogeneity, shift-invariance, causality, stability, realizability.

Unit 2: Linear shift-invariant (LSI) systems, impulse response and step response, convolution, input output behavior with a periodic convergent inputs, Characterization of causality and stability of linear shift-invariant systems, System representation through differential equations and difference equations.

Unit 3: Periodic and semi-periodic inputs to an LSI system, the notion of a frequency response and its relation to the impulse response, Fourier series representation, the Fourier Transform, convolution/multiplication and their effect in the frequency domain, magnitude and phase response, Fourier domain duality. The Discrete-Time Fourier Transform (DTFT) and the Discrete Fourier Transform (DFT), Parseval's Theorem, the idea of signal space and orthogonal bases

Unit 4: The Laplace Transform, notion of eigen functions of LSI systems, a basis of eigen functions, region of convergence, poles and zeros of system, Laplace domain analysis, solution to differential equations and system behavior

Unit 5: The z-Transform for discrete time signals and systems eigen functions, region of convergence, z-domain analysis.

Unit 6: State-space analysis and multi-input, multi-output representation, the state-transition matrix and its role, The Sampling Theorem and its implications spectra of sampled signals. Reconstruction: ideal interpolator, zero-order hold, first order hold, and so on, Aliasing and its effects, relation between continuous and discrete time systems.

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

- Analyze different types of signals.
- Represent continuous and discrete systems in time and frequency domain using different transforms.
- Investigate stability of system.
- Perform sampling and reconstruction of a signal.

Text/Reference books:

1. A.V. Oppenheim, A.S. Willsky and I.T. Young, "Signals and Systems", Prentice Hall, 1983.
2. R.F. Ziemer, W.H. Tranter and D.R. Fannin, "Signals and Systems - Continuous and Discrete", 4th edition, Prentice Hall, 1998.
3. Papoulis, "Circuits and Systems: A Modern Approach", HRW, 1980.
4. B.P. Lathi, "Signal Processing and Linear Systems", Oxford University Press, 1998.
5. Douglas K. Lindner, "Introduction to Signals and Systems", McGraw Hill International Edition: 1999.
6. Simon Haykin, Barry van Veen, "Signals and Systems", John Wiley and Sons (Asia) Private Limited, 1998.
7. Robert A. Gabel, Richard A. Roberts, "Signals and Linear Systems", John Wiley and Sons, 1995.
8. M. J. Roberts, "Signals and Systems - Analysis using Transform methods and MATLAB", TMH, 2003.
9. J. Nagrath, S. N. Sharan, R. Ranjan, S. Kumar, "Signals and Systems", TMH New Delhi, 2001.
10. Ashok Ambardar,"Analog and Digital Signal Processing", 2nd Edition, Brooks/ Cole Publishing Company (An international Thomson Publishing Company), 1999.

EC304 **Network Theory**

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 basic electrical circuits with nodal & mesh analysis.
- To give exposure to the students about various network theorem applicable to AC & DC circuits.
- To introduce application of Laplace & Fourier behavior.
- To introduce students about synthesis and analysis of electrical network.
- To introduce students about transient analysis, two port of network and various types of filters.

Syllabus

Unit 1: Node and Mesh Analysis, matrix approach of network containing voltage and current sources, and reactances, source transformation and duality. Network theorems, Superposition, reciprocity, Thevenin's, Norton's, Maximum power Transfer, compensation and Tallegen's theorem as applied to AC, circuits. Trigonometric and exponential Fourier series, Discrete spectra and symmetry of waveform, steady state response of a network to non-sinusoidal periodic inputs, power factor, effective values, Fourier transform and continuous spectra, three phase unbalanced circuit and power calculation.

Unit 2: Laplace transforms and properties, Partial fractions, singularity functions, waveform synthesis, analysis of RC, RL, and RLC networks with and without initial conditions with Laplace transforms evaluation of initial conditions.

Unit 3: Transient behavior, concept of complex frequency, Driving points and transfer functions poles and zeros of admittance function, their properties, sinusoidal response from pole-zero locations, convolution theorem and Two four port network and interconnections, Behaviors of series and parallel resonant circuits, Introduction to band pass, low pass, high pass and band reject filters.

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

- Understand basics electrical circuits with nodal and mesh analysis.
- Appreciate electrical network theorems.
- Apply Laplace Transform for steady state and transient analysis.
- Determine different network functions.
- Appreciate the frequency domain techniques.

Text/Reference Books

1. Van, Valkenburg.; "Network analysis"; Prentice hall of India, 2000.
2. Sudhakar, A., Shyammohan, S. P.; "Circuits and Network"; Tata McGraw-Hill New Delhi, 1994.
3. A William Hayt, "Engineering Circuit Analysis" 8th Edition, McGraw-Hill Education.

BS301 **Mathematics-III**

L T P CR	**Theory**	**: 75**
3 1 0 4	**Class Work**	**: 25**
	Total	**: 100**
	Duration of Exam	**: 3 Hrs.**

COURSE OBJECTIVES:

To gain knowledge about: Laplace Transform, Fourier Transform, Z- transform and Numerical Methods.

Unit-1: Transform Calculus-1: Polynomials, Orthogonal, Polynomials – Lagrange's, Chebysev Polynomials; Trigonometric**,** Polynomials, Laplace Transform, Properties of Laplace Transform, Laplace transform of periodic functions. Finding inverse Laplace transform by different methods, convolution theorem. Evaluation of integrals by Laplace transform, solving ODEs and PDEs by Laplace Transform method.

Unit-2: Transform Calculus-2: Fourier transforms, Z-transform ,Properties, methods, inverses and their applications.

Unit 3: Vector differentiation, gradient, divergence and curl, line and surface integrals, path independence, statements and illustrations of theorems of Green, Stokes and Gauss, arc length parameterization, applications.

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

- To understand Laplace Transform and its applications
- To understand Fourier Transform, Z Transform and their applications
- To solve the curl, gradient and divergence
- To apply the applications curl, gradient and divergence in various theorems in various applications

Textbooks/References

1. Erwin Kreyszig, Advanced Engineering Mathematics, 9th Edition, John Wiley & Sons, 2006.
2. B.S. Grewal, Higher Engineering Mathematics, Khanna Publishers, 35th Edition, 2000.
3. Veerarajan T., Engineering Mathematics, Tata McGraw-Hill, New Delhi, 2008.
4. P. Kandasamy, K. Thilagavathy, K. Gunavathi, Numerical Methods, S. Chand & Company, 2nd Edition, Reprint 2012.
5. S.S. Sastry, Introductory methods of numerical analysis, PHI, 4th Edition, 2005.

MC01 **Indian Constitution**

L T P CR
2 0 0 0

Theory :75
Class Work :25
Total :100

Basic features and fundamental principles

The Constitution of India is the supreme law of India. Parliament of India cannot make any law which violates the Fundamental Rights enumerated under the Part III of the Constitution. The Parliament of India has been empowered to amend the Constitution under Article 368, however, it cannot use this power to change the "basic structure" of the constitution, which has been ruled and explained by the Supreme Court of India in its historical judgments. The Constitution of India reflects the idea of "Constitutionalism" – a modern and progressive concept historically developed by the thinkers of "liberalism" – an ideology which has been recognized as one of the most popular political ideology and result of historical struggles against arbitrary use of sovereign power by state. The historic revolutions in France, England, America and particularly European Renaissance and Reformation movement have resulted into progressive legal reforms in the form of "constitutionalism" in many countries. The Constitution of India was made by borrowing models and principles from many countries including United Kingdom and America.

The Constitution of India is not only a legal document but it also reflects social, political and economic perspectives of the Indian Society. It reflects India's legacy of "diversity". It has been said that Indian constitution reflects ideals of its freedom movement; however, few critics have argued that it does not truly incorporate our own ancient legal heritage and cultural values. No law can be "static" and therefore the Constitution of India has also been amended more than one hundred times. These amendments reflect political, social and economic developments since the year 1950. The Indian judiciary and particularly the Supreme Court of India has played an historic role as the guardian of people. It has been protecting not only basic ideals of the Constitution but also strengthened the same through progressive interpretations of the text of the Constitution. The judicial activism of the Supreme Court of India and its historic contributions has been recognized throughout the world and it gradually made it "as one of the strongest court in the world".

Course content

1. Meaning of the constitution law and constitutionalism
2. Historical perspective of the Constitution of India
3. Salient features and characteristics of the Constitution of India
4. Scheme of the fundamental rights
5. The scheme of the Fundamental Duties and its legal status
6. The Directive Principles of State Policy – Its importance and implementation
7. Federal structure and distribution of legislative and financial powers between the Union and the States
8. Parliamentary Form of Government in India – The constitution powers and status of the President of India
9. Amendment of the Constitutional Powers and Procedure
10. The historical perspectives of the constitutional amendments in India
11. Emergency Provisions: National Emergency, President Rule, Financial Emergency
12. Local Self Government – Constitutional Scheme in India
13. Scheme of the Fundamental Right to Equality
14. Scheme of the Fundamental Right to certain Freedom under Article 19

15. Scope of the Right to Life and Personal Liberty under Article 21.

REFERENCES:

1. The Constitutional Law Of India 9th Edition, by Pandey. J. N.
2. The Constitution of India by P.M.Bakshi
3. Constitution Law of India by Narender Kumar
4. Bare Act by P. M. Bakshi

MC02 **Essence of Indian Knowledge Tradition**

भारतीयविद्यासार

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

Course objective

The course aims at imparting basic principles of thought process, reasoning and inferencing. Sustainability is at the core of Indian Traditional knowledge Systems connecting society and nature. Holistic life style of yogic science and wisdom capsules in Sanskrit literature are also important in modern society with rapid technological advancements and societal disruptions. Part-I focuses on introduction to Indian Knowledge Systems, Indian perspective of modern scientific world-view, and basic principles of Yoga and holistic health care system.

Course Contents

Basic structure of Indian Knowledge System: अष्टादशविद्या -४वेद,४उपवेद (आयुर्वेद, धनुर्वेद, गन्धर्ववेद, स्थापत्य आदि) ६वेदांग (शिक्षा, कल्प, निरुक्त, व्याकरण, ज्योतिष, छंद) ४ उपाङ्ग (धर्मशास्त्र, मीमांसा, पुराण, तर्कशास्त्र)

- Modern Science and Indian Knowledge System
- Yoga and Holistic Health care
- Case studies

References

- V. Sivaramakrishnan (Ed.), *Cultural Heritage of India-course material*, Bharatiya Vidya Bhavan, Mumbai. 5th Edition, 2014
- Swami Jitatmanand, *Modern Physics and Vedant*, Bharatiya Vidya Bhavan
- Swami Jitatmanand, *Holistic Science and Vedant*, Bharatiya Vidya Bhavan
- Fritzof Capra, *Tao of Physics*
- Fritzof Capra, *The Wave of life*
- VN Jha (Eng. Trans.), *Tarkasangraha of Annam Bhatta*, International Chinmay Foundation, Velliarnad, Arnakulam
- *Yoga Sutra of Patanjali*, Ramakrishna Mission, Kolkata
- GN Jha (Eng. Trans.), Ed. RN Jha, *Yoga-darshanam with Vyasa Bhashya*, Vidyanidhi Prakashan, Delhi 2016
- RN Jha, *Science of Consciousness Psychotherapyand Yoga Practices*, Vidyanidhi Prakashan, Delhi 2016
- P B Sharma (English translation), *Shodashang Hridayan*

Pedagogy: Problem based learning, group discussions, collaborative mini projects.

Outcome: Ability to understand, connect up and explain basics of Indian traditional knowledge in modern scientific perspective.

EC 351	**Electronics Devices Lab**		
L T P CR	**Theory**	**:**	**35**
0 0 2 1	**Class Work**	**:**	**15**
	Total	**:**	**50**

List of Experiments

1. Study of IV Characteristics of PN junction diode.
2. Study of IV Characteristics of zener diode.
3. Study of transistor common base characteristics
4. Study of transistor common emitter characteristics.
5. Study of Zener diode as a voltage regulator.
6. Study of FET common source amplifier.
7. Study of FET common Drain amplifier.
8. Study of Zener diode as a voltage regulator.
9. Study of CC amplifier as a buffer.
10. Study of 3-terminal IC regulator.
11. Study of LED, photo diode and solar cell.

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

- Understand the characteristics of PN junction diode.
- Understand the application of diode & Zener diode experimentally.
- Obtain input and output characteristics of transistors in CE, CB & CC configurations.
- Obtain FET characteristics.
- Write experimental reports and work in a team in professional way.

EC 352	**Digital System Design Lab**		
L T P CR	**Theory**	**:**	**35**
0 0 2 1	**Class Work**	**:**	**15**
	Total	**:**	**50**

List of Experiments

1. Study of TTL gates – AND, OR, NOT, NAND, NOR, EX-OR, EX-NOR.
2. Design & realize a given function using K-maps and verify its performance.
3. To verify the operation of multiplexer & Demultiplexer.
4. To verify the operation of comparator.
5. To verify the truth tables of S-R, J-K, T & D type flip flops.
6. To verify the operation of bi-directional shift register.
7. To design & verify the operation of 3-bit synchronous counter.
8. Design all gates using VHDL.
9. Write VHDL programs for the following circuits, check the wave forms and the hardware generated a. half adder b. full adder
10. Write VHDL programs for the following circuits, check the wave forms and the hardware generated a. multiplexer b. demultiplexer
11. Write VHDL programs for the following circuits, check the wave forms and the hardware generated a. decoder b. encoder
12. Write a VHDL program for a comparator and check the wave forms and the hardware generated
13. Write a VHDL program for a code converter and check the wave forms and the hardware generated
14. Write a VHDL program for a FLIP-FLOP and check the wave forms and the hardware generated
15. Write a VHDL program for a up/down counter and check the wave forms and the hardware generated.

Course Outcome: On the successful competition of this course, the students should be able to:

- Verify the operation of basic & universal gates.
- Design & verify the standards of combinational circuits.
- Verify the operations of different type of flip flops.
- Design the counters using flip flops for a given sequence.
- Write & execute VHDL program for combinational & sequential circuits.
- Write experimental reports and work in a team in professional way

EC 353	**Network Theory Lab**		
L T P CR	**Theory**	**:**	**35**
0 0 2 1	**Class Work**	**:**	**15**
	Total	**:**	**50**

List of Experiments

1. Transient response of RC circuit.
2. Transient response of RL circuit.
3. To find the resonance frequency, Band width of RLC series circuit.
4. To calculate and verify ―Z" parameters of a two port network.
5. To calculate and verify "Y" parameters of a two port network.
6. To determine equivalent parameter of parallel connections of two port network.
7. To plot the frequency response of low pass filter and determine half-power frequency.
8. To plot the frequency response of high pass filters and determines the half-power frequency.
9. To plot the frequency response of band-pass filters and determines the band-width.
10. To calculate and verify "ABCD" parameters of a two port network.
11. To synthesize a network of a given network function and verify its response.
12. Introduction of P-Spice

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

- Design RC & RL circuits and check their transient response experimentally.
- Design RLC series circuits & find the frequency response.
- Analyse the circuits of two port network and verify ‘ABCD’ ‘Z’ & ‘Y’ parameters of two port network.
- Design & plot the frequency response of low pass filter, high pass filter & band-pass filter experimentally.
- Synthesize a network using Foster & Cauer Forms.
- Write experimental reports and work in a team in professional way.

ES 301	**Electronics Workshop-I**		
L T P CR	**Theory**	**:**	**70**
0 0 6 3	**Class Work**	**:**	30
	Total	**:**	**100**

List of Problems

1. Testing of Electronics Devices

   1) Diode 2) Transoms 3) Capacitors 4) Inductor

2. Design, Fabrication, Testing & Measurement of half & full wave rectifier
3. Design and fabrication of fixed & variable regulators (Zenes, Transistor and IC)
4. Design of transistor as a switch, amplifier and multivibrator.
5. To study of 555 as Astable, Monostable, Bistable multivibrator.
6. To design various applications of OP amp such as

   1) Amplifiers (Inverting & Non Inverting)

   2) Adder, Subtractor & scale changer

   3) Integrator and differentiator

   4) Oscillator and Schmitt trigger

7. Mini project based on anolog circuits of above.

EI401	**Control System Engineering**			
L T P CR		**Theory**	**:**	**75**
3 0 0 3		**Class Work**	**:**	**25**
		Total	**:**	**100**
		Duration of Exam	**:**	**3 Hrs.**

Course Objectives:

- To study different control problem, control hardware and their models.
- To study different control algorithm and to familiarize with stability of a system using different tests.
- To study designing of various controllers and tuning of process controller.
- To study linear, nonlinear and optimal control problems.

Syllabus

Unit 1: Introduction to Control Problem: Industrial Control examples, Transfer function, System with dead-time, System response, Control hardware and their models, potentiometers, synchros, LVDT, dc and ac servomotors, tacho-generators, electro hydraulic valves, hydraulic servomotors, electro pneumatic valves, pneumatic actuators, Closed-loop systems. Block diagram and signal flow graph analysis.

Unit 2: Feedback control systems: Stability, steady-state accuracy, transient accuracy, disturbance rejection, insensitivity and robustness, proportional, integral and derivative systems, Feedforward and multi-loop control configurations, stability concept, relative stability, Routh stability criterion.

Unit 3: Time response of second order systems, steady-state errors and error constants, Performance specifications in time-domain, Root locus method of design, Lead and lag compensation, Frequency-response analysis, Polar plots, Bode plot, stability in frequency domain, Nyquist plots, Nyquist stability criterion, Performance specifications in frequency-domain, Frequency domain

Unit 4: Methods of design, Compensation & their realization in time & frequency domain, Lead and Lag compensation, Op-amp based and digital implementation of compensators, Tuning of process controllers, State variable formulation and solution.

Unit 5: Introduction to Optimal control & Nonlinear control, Optimal Control problem, Regulator problem, Output regulator, treking problem, Nonlinear system, Basic concept & analysis.

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

- Characterize a system and find its study state behaviour.
- Investigate stability of a system using different tests.
- Design various controllers.
- Solve liner, non-liner and optimal control problems.

Text/Reference Books:

1. Gopal. M., "Control Systems: Principles and Design", Tata McGraw-Hill, 1997.
2. Kuo, B.C., "Automatic Control System", Prentice Hall, sixth edition, 1993.
3. Ogata, K., "Modern Control Engineering", Prentice Hall, second edition, 1991.
4. Nagrath & Gopal, "Modern Control Engineering", New Age International, New Delhi

EC402 **Analog Circuits**

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

Course Objectives:

- To study the concept of diode circuits, BJT and FET with their configurations and to analyse different amplifiers using BJT and EFT.
- To familiar with different types of power amplifiers, their characteristics and different types of feedback configuration.
- To introduce the concept of different types of oscillators.
- To give exposure to the students regarding of OP-AMP and application of OP-AMP.
- To give exposure to the students regarding the concepts of different types of DAC and ADC.

Syllabus

Unit 1: Diode Circuits, Amplifier models: Voltage amplifier, current amplifier, trans-conductance amplifier and trans-resistance amplifier, Biasing schemes for BJT and FET amplifiers, bias stability, various configurations (such as CE/CS, CB/CG, CC/CD) and their features, small signal analysis, low frequency transistor models, estimation of voltage gain, input resistance, output resistance etc., design procedure for particular specifications, low frequency analysis of multistage amplifiers.

Unit 1: High frequency transistor models, frequency response of single stage and multistage amplifiers, cascode amplifier, Various classes of operation (Class A, B, AB, C etc.), their power efficiency and linearity issues, Feedback topologies, Voltage series, current series, voltage shunt, current shunt, effect of feedback on gain, bandwidth etc., calculation with practical circuits, concept of stability, gain margin and phase margin.

Unit 2: Oscillators: Review of the basic concept, Barkhausen criterion, RC oscillators (phase shift, Wien bridge etc.), LC oscillators (Hartley, Colpitt, Clapp etc.), non-sinusoidal oscillators.

Unit 3: Current mirror: Basic topology and its variants, V-I characteristics, output resistance and minimum sustainable voltage (VON), maximum usable load, Differential amplifier, Basic structure and principle of operation, calculation of differential gain, common mode gain, CMRR and ICMR. OP-AMP design, design of differential amplifier for a given specification, design of gain stages and output stages, compensation.

Unit 4: OP-AMP applications: review of inverting and non-inverting amplifiers, integratorand differentiator, summing amplifier, precision rectifier, Schmitt trigger and its applications, Active Filters, Low pass, high pass, band pass and band stop, design guidelines.

Unit 5: Digital-to-analog converters (DAC): Weighted resistor, R-2R ladder, resistorstring etc., Analog to-digital converters (ADC), Single slope, dual slope, successive approximation, flash etc. Switched capacitor circuits, Basic concept, practical configurations, application in amplifier, integrator, ADC etc.

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

- Understand the characteristics of diodes and transistors.
- Design and analyze various rectifier and amplifier circuits.
- Design sinusoidal and non-sinusoidal oscillators.
- Understand the functioning of OP-AMP and design OP-AMP based circuits.
- Design ADC and DAC.

Text/Reference Books:

1. J.V. Wait, L.P. Huelsman and GA Korn, Introduction to Operational Amplifier theory and applications, McGraw Hill, 1992.
2. J. Millman and A. Grabel, Microelectronics, 2nd edition, McGraw Hill, 1988.
3. P. Horowitz and W. Hill, The Art of Electronics, 2nd edition, Cambridge University Press, 1989.
4. A.S. Sedra and K.C. Smith, Microelectronic Circuits, Saunder's College11
5. Publishing, Edition IV.
6. Paul R. Gray and Robert G.Meyer, Analysis and Design of Analog Integrated Circuits, John Wiley, 3rd Edition.

EI403	**Electrical Measurement and Instrumentation**		
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 fundamentals of various types of Instruments.
- To introduce the principle, working and applications of various types of measuring instruments.
- To introduce the principle, working and applications of various types of Wattmeters and Energy Meters.
- To introduce the principle, working and applications of various types of Instrument Transformers.
- To introduce the principle, working and applications of various types of AC and DC bridges.
- To introduce the various types of transducers and Electronics Instruments.

Syllabus

Unit 1: Analog Ammeters and Voltmeters: PMMC and MI Instruments, Construction, Torque Equation, Range Extension, Effect of temperature, Classification, Errors, Advantages and Disadvantages.

Unit 2: Analog Wattmeters and Power Factor Meters: Power and Power Factor, Electrodynamometer type wattmeter, power factor meter, Construction, theory, Shape of scale, torque equation, Advantages and disadvantages, active and reactive power measurement in single phase, Measurement in three phase.

Unit 3: Analog Energy Meter: Single phase induction type energy meters, construction, theory, Operation, lag adjustments, Max Demand meters/indicators, Measurement of VAH and VARh.

Unit 4: DC and AC Bridges: Measurement of resistance, Wheatstone Bridge, Kelvin‘s Bridge, Kelvin‘s Double Bridge, Measurement of inductance, Capacitance, Maxwell‘s Bridge, Desauty Bridge, Anderson Bridge, Schering Bridge, Wien Bridge, Applications and Limitations.

Unit 5: Instrument Transformers: Current Transformer and Potential Transformer construction, theory, phasor diagram, errors, testing and applications.

Unit 6: Transducers: Transducers Measurement of Temperature, RTD, Thermistors, LVDT, Strain Gauge, Piezoelectric Transducers, Digital Shaft Encoders, Tachometer, Hall effect sensors.

Unit 7: Electronic Instruments: Electronic Display Device, Digital Voltmeters, CRO, Digital Storage Oscilloscope, measurement of voltage and frequency, Lissajous Patterns, Wave Analyzers, Harmonic Distortion Analyzer.

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

- Compare performance of MC, MI and Dynamometer types of measuring instruments, Energy meters and CRO.
- Determine the circuit parameters using AC and DC bridges.
- Understand the principle and working of various types of Instrument Transformers.
- Select transducers for the measurement of various electrical quantities like temperature, displacement and strain
- Understand operating principles of electronic measuring instruments

TEXT BOOK:

1. A course in Electrical And Electronic measurement and instrumentation : A.K. Sawhney, Dhanpat Rai Publication.

REFERENCE BOOKS:

1. Electrical Measurements: E.W. Golding, TMH
2. Electrical and Electronic measurement and instrumentation: J.B. Gupta, Kataria and Sons.
3. Electronic instrumentation and measurement technique : W.D. Cooper & A.D. Helfrick
4. Measuring systems: E.O. Doeblin; TMH.

ECC02 **Electromagnetic Waves**

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

Course Objects:

- To introduce the concept of Transmission line, how the no loss transmission occurs and understanding the concept of Smith Chart.
- To give exposure to the students regarding the physical meaning and importance of Maxwell's equation and how it derived from basic laws of Electromagnetic.
- To introduce how the Electromagnetic waves are formed, it's propagation in different medium and the concept of Poynting Vector.
- To introduce the phenomenon of Reflection or refraction of wave when strikes obliquely or normally to any surface.
- To introduce the concept of travelling of wave in waveguides and other phenomena.
- To impart the knowledge of principle of radiation and radiation characteristics of an antenna.

Syllabus

Unit 1: Transmission Lines: Equations of Voltage and Current on TX line, Propagation constant and characteristic impedance, and reflection coefficient and VSWR, Impedance Transformation on Loss-less and Low loss Transmission line, Power transfer on TX line, Smith Chart, Admittance Smith Chart, Applications of transmission lines, Impedance Matching, use transmission line sections as circuit elements.

Unit 2: Maxwell's Equations: Basics of Vectors, Vector calculus, Basic laws of Electromagnetics, Maxwell's Equations, Boundary conditions at Media Interface.

Unit 3: Uniform Plane Wave: Uniform plane wave, Propagation of wave, Wave polarization, Poincare's Sphere, Wave propagation in conducting medium, phase and group velocity, Power flow and Poynting vector, Surface current and power loss in a conductor

Unit 4: Plane Waves at a Media Interface: Plane wave in arbitrary direction, Reflection and refraction at dielectric interface, Total internal reflection, wave polarization at media interface, Reflection from a conducting boundary.

Unit 5: Wave propagation in parallel plane waveguide, Analysis of waveguide general approach, Rectangular waveguide, Modal propagation in rectangular waveguide, Surface currents on the waveguide walls, Field visualization, Attenuation in waveguide.

Unit 6: Radiation: Solution for potential function, Radiation from the Hertz dipole, Power radiated by hertz dipole, Radiation Parameters of antenna, receiving antenna, Monopole and Dipole antenna,

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

- Understand characteristics and wave propagation on high frequency transmission lines as well as carryout impedance transformation on TL.
- Use sections of transmission line sections for realizing circuit elements.
- Characterize uniform plane wave and calculate reflection & transmission of waves at media interface.
- Analyze wave propagation on metallic waveguides in modal form.
- Understand principle of radiation and radiation characteristics of an antenna.

Text/Reference Books:

- R.K. Shevgaonkar, Electromagnetic Waves, Tata McGraw Hill India, 2005.
- E.C. Jordan & K.G. Balmain, Electromagnetic waves & Radiating Systems, Prentice Hall, India.
- Narayana Rao, N: Engineering Electromagnetics, 3rd ed., Prentice Hall, 1997.
- David Cheng, Electromagnetics, Prentice Hall.

ESC01 **Engineering Mechanics**

L T P CR
3 1 0 4

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

Course Objective:-

- To provide an introductory treatment of Engineering
- To give a working knowledge of statics with emphasis on force equilibrium and free body diagrams.
- To provide an understanding of the kinds of stress and deformation and how to determine them in a wide range of simple, practical structural problems.
- To give an understanding of the mechanical behavior of materials under various load conditions

Syllabus

Unit 1: Introduction to Engineering Mechanics covering, Force Systems Basic concepts, Particle equilibrium in 2-D & 3-D; Rigid Body equilibrium; System of Forces, Coplanar Concurrent Forces, Components in Space – Resultant- Moment of Forces and its Application; Couples and Resultant of Force System, Equilibrium of System of Forces, Free body diagrams, Equations of Equilibrium of Coplanar Systems and Spatial Systems; Static Indeterminancy

Unit 2: Friction covering, Types of friction, Limiting friction, Laws of Friction, Static and Dynamic Friction; Motion of Bodies, wedge friction, screw jack & differential screw jack.

Unit 3: Basic Structural Analysis covering, Equilibrium in three dimensions; Method of Sections; Method of Joints; How to determine if a member is in tension or compression; Simple Trusses; Zero force members; Beams & types of beams; Frames & Machines;

Unit 4: Centroid and Centre of Gravity covering, Centroid of simple figures from first principle, centroid of composite sections; Centre of Gravity and its implications; Area moment of inertia- Definition, Moment of inertia of plane sections from first principles, Theorems of moment of inertia, Moment of inertia of standard sections and composite sections; Mass moment inertia of circular plate, Cylinder, Cone, Sphere, Hook.

Unit 5: Virtual Work and Energy Method- Virtual displacements, principle of virtual work for particle and ideal system of rigid bodies, degrees of freedom. Active force diagram, systems with friction, mechanical efficiency. Conservative forces and potential energy (elastic and gravitational), energy equation for equilibrium. Applications of energy method for equilibrium. Stability of equilibrium.

Unit 6: Review of particle dynamics- Rectilinear motion; Plane curvilinear motion (rectangular, path, and polar coordinates). 3-D curvilinear motion; Relative and constrained motion; Newton's 2nd law (rectangular, path, and polar coordinates). Work-kinetic energy power, potential energy.Impulse-momentum (linear, angular); Impact (Direct and oblique).

Unit 7:Introduction to Kinetics of Rigid Bodies covering, Basic terms, general principles in dynamics; Types of motion, Instantaneous centre of rotation in plane motion and simple problems; D'Alembert's principle and its applications in plane motion and connected bodies Work energy principle and its application in plane motion of connected bodies; Kinetics of rigid body rotation.

Unit 8:Mechanical Vibrations covering, Basic terminology, free and forced vibrations, resonance and its effects; Degree of freedom; Derivation for frequency and amplitude of free vibrations without damping and single degree of freedom system, simple problems, types of pendulum, use of simple, compound and torsion pendulums; Tutorials from the above **Unit**s covering, To find the various forces and angles including resultants in various parts of wall crane, roof truss, pipes, etc.; To verify the line of polygon on various forces; To find coefficient of friction between various materials on inclined plan; Free body diagrams various systems including block-pulley; To verify the principle of moment in the disc apparatus; Helical block; To draw a load efficiency curve for a screw jack

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

- Use scalar and vector analytical techniques for analyzing forces in statically determinate structures
- Apply fundamental concepts of kinematics and kinetics of particles to the analysis of simple, practical problems
- Apply basic knowledge of maths and physics to solve real-world problems, Understand measurement error, and propagation of error in processed data.
- Understand basic kinematics concepts – displacement, velocity and acceleration (and their angular counterparts);
- Understand basic dynamics concepts – force, momentum, work and energy; Understand and be able to apply Newton's laws of motion;
- Understand and be able to apply other basic dynamics concepts - the Work-Energy principle, Impulse-Momentum principle and the coefficient of restitution;
- Extend all of concepts of linear kinetics to systems in general plane motion (applying Euler's Equation and considering energy of a system in general plane motion, and the work of couples and moments of forces)
- Learn to solve dynamics problems. Appraise given information and determine which concepts apply, and choose an appropriate solution strategy; and Attain an introduction to basic machine parts such as pulleys and mass-spring systems.

Text/Reference Books:

1. Irving H. Shames (2006), Engineering Mechanics, 4th Edition, Prentice Hall
2. F. P. Beer and E. R. Johnston (2011), Vector Mechanics for Engineers, Vol I - Statics, Vol II, – Dynamics, 9th Ed, Tata McGraw Hill
3. R. C. Hibbler (2006), Engineering Mechanics: Principles of Statics and Dynamics, Pearson Press.
4. Andy Ruina and Rudra Pratap (2011), Introduction to Statics and Dynamics, Oxford University Press
5. Shanes and Rao (2006), Engineering Mechanics, Pearson Education,
6. Hibler and Gupta (2010),Engineering Mechanics (Statics, Dynamics) by Pearson Education
7. Reddy Vijaykumar K. and K. Suresh Kumar(2010), Singer's Engineering Mechanics
8. Bansal R.K.(2010), A Text Book of Engineering Mechanics, Laxmi Publications
9. Khurmi R.S. (2010), Engineering Mechanics, S. Chand & Co.
10. Tayal A.K. (2010), Engineering Mechanics, Umesh Publications

BSC01	**Biology**			
L T P CR	**Theory**	**:**		**75**
2 1 0 3	**Class Work**	**:**		**25**
	Total	**:**		**100**
	Duration of Exam	**:**	**3**	**Hrs.**

Course Objectives:

To convey that Biology is as important a scientific discipline as Mathematics, Physics and Chemistry.

1) "Genetics is to biology what Newton's laws are to Physical Sciences", 2) all forms of life have the same building blocks and yet the manifestations are as diverse as one can imagine, 3) without catalysis life would not have existed on earth, 4) molecular basis of coding and decoding (genetic information) is universal and that 5) fundamental principles of chemical and physical energy transactions are the same in physical/chemical and biological world.

Module 1.(2 hours)- Introduction

Purpose: To convey that Biology is as important a scientific discipline as Mathematics, Physics and Chemistry

Bring out the fundamental differences between science and engineering by drawing a comparison between eye and camera, Bird flying and aircraft. Mention the most exciting aspect of biology as an independent scientific discipline. Why we need to study biology? Discuss how biological observations of 18th Century that lead to major discoveries. Examples from Brownian motion and the origin of thermodynamics by referring to the original observation of Robert Brown and Julius Mayor. These examples will highlight the fundamental importance of observations in any scientific inquiry.

Module 2. (3 hours)- Classification

Purpose: To convey that classification per se is not what biology is all about.The underlying criterion, such as morphological, biochemical or ecological be highlighted. Hierarchy of life forms at phenomenological level. A common thread weaves this hierarchy Classification. Discuss classification based on (a) cellularity- Unicellular or multicellular (b) ultrastructure- prokaryotes or eucaryotes. (c) energy and Carbon utilization -Autotrophs, heterotrophs, lithotropes (d) Ammonia excretion – aminotelic, uricoteliec, ureotelic (e) Habitata- acquatic or terrestrial (e) Molecular taxonomy- three major kingdoms of life. A given organism can come under different category based on classification. Model organisms for the study of biology come from different groups. E.coli, S.cerevisiae, D. Melanogaster, C. elegance, A. Thaliana, M.musculus

Module 3. (4 hours)-Genetics

Purpose: To convey that "Genetics is to biology what Newton's laws are to Physical Sciences" Mendel's laws, Concept of segregation and independent assortment. Concept of allele.Gene mapping, Gene interaction, Epistasis. Meiosis and Mitosis be taught as a part of genetics. Emphasis to be give not to the mechanics of cell division nor the phases but how genetic material passes from parent to offspring.Concepts of recessiveness and dominance.Concept of mapping of phenotype

to genes. Discuss about the single gene disorders in humans. Discuss the concept of complementation using human genetics.

Module 4. (4 hours)-Biomolecules

Purpose: To convey that all forms of life has the same building blocks and yet the manifestations are as diverse as one can imagine Molecules of life. In this context discuss monomeric units and polymeric structures. Discuss about sugars, starch and cellulose. Amino acids and proteins.Nucleotides and DNA/RNA.Two carbon units and lipids.

Module 5. (4 Hours). Enzymes

Purpose: To convey that without catalysis life would not have existed on earth

Enzymology: How to monitor enzyme catalyzed reactions. How does an enzyme catalyzereactions. Enzyme classification.Mechanism of enzyme action. Discuss at least two examples. Enzyme kinetics and kinetic parameters. Why should we know these parameters to understand biology? RNA catalysis.

Module 6. (4 hours)- Information Transfer

Purpose: The molecular basis of coding and decoding genetic information is universal Molecular basis of information transfer. DNA as a genetic material. Hierarchy of DNA structure- from single stranded to double helix to nucleosomes. Concept of genetic code.Universality and degeneracy of genetic code. Define gene in terms of complementation and recombination.

Module 7. (5 hours). Macromolecular analysis

Purpose: How to analyses biological processes at the reductionistic level Proteins-structure and function. Hierarch in protein structure.Primary secondary, tertiary and quaternary structure.Proteins as enzymes, transporters, receptors and structural elements.

Module 8. (4 hours)- Metabolism

Purpose: The fundamental principles of energy transactions are the same in physical and biological world. Thermodynamics as applied to biological systems. Exothermic and endothermic versus endergonic and exergoinc reactions.Concept of Keq and its relation to standard free energy.Spontaneity.ATP as an energy currency. This should include the breakdown of glucose to CO2 + H2O (Glycolysis and Krebs cycle) and synthesis of glucose from CO2 and H2O (Photosynthesis). Energy yielding and energy consuming reactions. Concept of Energy charge

Module 9. (3 hours)- Microbiology

Concept of single celled organisms.Concept of species and strains.Identification and classification of microorganisms.Microscopy.Ecological aspects of single celled organisms.Sterilization and media compositions.Growth kinetics.

Course Outcomes (COs)

1. Classify enzymes and distinguish between different mechanisms of enzyme action.
2. Identify DNA as a genetic material in the molecular basis of information transfer.
3. Analyze biological processes at the reductionist level
4. Apply thermodynamic principles to biological systems.
5. Identify and classify microorganisms.

Textbooks/ References:

1) Biology: A global approach: Campbell, N. A.; Reece, J. B.; Urry, Lisa; Cain, M, L.; Wasserman, S. A.; Minorsky, P. V.; Jackson, R. B. Pearson Education Ltd

2) Outlines of Biochemistry, Conn, E.E; Stumpf, P.K; Bruening, G; Doi, R.H., John Wiley and Sons

3) Principles of Biochemistry (V Edition), By Nelson, D. L.; and Cox, M. M.W.H. Freeman and Company

4) Molecular Genetics (Second edition), Stent, G. S.; and Calender, R.W.H. Freeman and company, Distributed by Satish Kumar Jain for CBS Publisher

5) Microbiology, Prescott, L.M J.P. Harley and C.A. Klein 1995. 2nd edition Wm, C. Brown Publishers

EI451	**Control Systems Engineering Lab**			
L T P CR		**Internal Marks**	**:**	**35**
0 0 2 1		**External Marks**	**:**	15
		Total	**:**	**100**
		Duration of Exam	**:**	**3 Hrs.**

List of Experiments

1. To study A.C. servo motor and to plot its torque speed characteristics.
2. To study D.C. servo motor and to plot its torque speed characteristics.
3. To study the magnetic amplifier and to plot its load current v/s control current characteristics for :
4. Series connected mod.e
5. Parallel connected mode.
6. To plot the load current v/s control current characteristics for self exited mode of the magnetic amplifier.
7. To study the synchro& to:
   (a) Use the synchro pair (synchro transmitter & control transformer) as an error detector.
   (b) Plot stator voltage v/s rotor angle for synchro transmitter i.e. to use the synchro transmitter as position transducer.
8. To use the synchro pair (synchro transmitter &synchro motor) as a torquetransmitter.
9. To demonstrate simple motor driven closed loop position control system.
10. To study and demonstrate simple closed loop speed control system.
11. To study the lead, lag, lead-lag compensators and to draw their magnitude and phase plots.
12. To study a stepper motor & to execute microprocessor or computer-based control of the same by changing number of steps, direction of rotation & speed.
13. To implement a PID controller for level control of a pilot plant.
14. To implement a PID controller for temperature control of a pilot plant.
15. To study the MATLAB package for simulation of control system design.

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

- Understand AC & DC servomotor & its characteristics.
- Understand the characteristics of characteristics of magnetic amplifier.
- Understand simple motor drives open loop & closed loop position and speed control system.
- Understand Lag & Lead compensator.
- Understand microprocessor control of stepper motor.
- Understand level and temperature control of plant using PID.
- Demonstrate the transient responses to step inputs for stable and unstable systems using MATLAB.
- Write experimental reports and work in a team in professional way.

EC452 **Analog Circuits Lab**

L T P CR

0 0 2 1

Theory : 35

Class Work : 15

Total : 50

Duration of Exam : 3 Hrs.

List of Experiments

1. Design & measure the frequency response of an RC coupled amplifier using discrete components.
2. Design a two stage RC coupled amplifier and determine the effect of cascading on gain and bandwidth.
3. Design & realize inverting amplifier, non-inverting and buffer amplifier using 741 Op Amp.
4. Verify the operation of a differentiator circuit using 741 op amp and show that it acts as a high pass filter.
5. Verify the operation of a integrator circuit using 741 op amp and show that it ac ts as a low pass filter.
6. Design and verify the operations of op amp adder and subtractor circuits.
7. To design & realize Schmitt trigger using op amp 741.
8. Design and realize Wein-bridge oscillator using op amp 741
9. To design & realize square wave generator using op amp 741.
10. To design & realize zero crossing detector using op amp 741

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

- Measure & verify the frequency response of RC coupled amplifier.
- Measure the effect of various types of feedback on amplifiers.
- Implement amplifiers, differentiator, Integrator and active filters circuit using op amp.
- Design op-amp as Wein-Bridge Oscillator, Square Wave Generator, Logarithmic Amplifier and Voltage Controlled Circuits.
- Write experimental reports and work in a team in professional way.

EI453	**Electrical Measurement And Measuring Instruments Lab**		
L T P CR	**Internal Marks**	**:**	**35**
0 0 2 1	**External Marks**	**:**	15
	Total	**:**	**50**
	Duration of Exam	**:**	**3 Hrs.**

List of Experiments

1. Measurement of displacement using LVDT.
2. Measurement of distance using LDR.
3. Measurement of temperature using R.T.D.
4. Measurement of temperature using Thermocouple.
5. Measurement of pressure using Strain Guage.
6. Measurement of pressure using Piezo-Electric Pick up.
7. Measurement of distance using Capacitive Pick up.
8. Measurement of distance using Inductive Pick up.
9. Measurement of speed of DC Motor using Magnetic Pick up.
10. Measurement of speed of DC Motor using Photo Electric Pick up.

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

- Operate and make the various measurements on LVDT, LDR, RTD and thermocouple.
- Measure the pressure experimentally using various methods.
- Measure the distance experimentally using various methods.
- Measure the speed contact of DC motor using various methods.
- Write experimental reports and work in a team in professional way

ES 402 **Electronics Workshop-II**

L T P CR			
0 0 6 3	**Theory**	**:**	**70**
	Class Work	**:**	**30**
	Total	**:**	**100**

List of Problems

1. Fabrication of all the gates using Diode & transistors and verification of truth table.
2. To design & realize combinational circuit using K-map & logic simplification.
3. To design 4 bit parallel adder/ subtractor/ for unsigned/ signed numbers.
4. To verify the operation of Multiplexer & to implement any given function with a MUX.
5. To verify the operation of DEMUX & decoder.
6. To indentify common cathode & common anode of seven segment display with its various segment.
7. Implement binary to BCD conversion.
8. To fabricate BCD to seven segment decoder
9. To verify the truth table of SR, JK, D & T Flip-Flop & conversion of one Flip-Flop to another FF.
10. To design Mod-8 Synchronous Counter using T Flip-Flop.
11. To design UP-DOWN decade counter using JK/T Flip-Flop & derive o/p into SSD.
12. To design a minute clock.
13. To verify the function of Universal Shift Register.
14. To design Ring & Johson counter using Universal shift Register.
15. To verify the function of RAM.
16. To verify the function of 4- bit ALU.
17. To study the operation of 8-bit A/D converter.
18. To design 4 bit DAC.
19. Mini project based on concepts of digital electronics.

EI501 **Sensors, Signal Conditioning and Telemetry**

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 characteristics of measurement systems.
- To introduce the Resistive sensors
- To introduce the Reactance variation and electromagnetic sensors.
- To introduce the Self-generating sensors
- To introduce the Digital sensors
- To introduce the various Modes of data transmission.

Syllabus

UNIT I: Introduction to measurement systems: general concepts and terminology, measurement systems, sensor classification, general input-output configuration, methods of correction performance characteristics: static characteristics of measurement systems, accuracy, precision, sensitivity, other characteristics: linearity, resolution, systematic errors , random errors, dynamic characteristics of measurement systems: zero-order, first-order, and second-order measurement systems and response

UNIT II: Resistive sensors: potentiometers, strain gages and types, resistive temperature detectors (rtds) , thermistors, magneto resistors, light-dependent resistors (ldrs); Signal conditioning for resistive sensors: measurement of resistance , voltage dividers , Wheatstone bridge. Balance and deflection measurements, sensor bridge calibration and compensation instrumentation amplifiers, interference types and reduction

UNIT III: Reactance variation and electromagnetic sensors : capacitive sensors – variable & differential, inductive sensors – reluctance variation, eddy current, linear variable differential transformers (lvdts) , variable transformers: synchros, resolvers, inductosyn , magneto elastic sensors, electromagnetic sensors – sensors based on faraday's law, hall effect sensors, Signal conditioning for reactance variation sensors : problems and alternatives, ac bridges, carrier amplifiers – application to the lvdt, variable oscillators, resolver-to-digital and digital-to-resolver converters

UNIT IV: Self-generating sensors: thermoelectric sensors, piezoelectric sensors, pyroelectric sensors, photovoltaic sensors, electrochemical sensors, Signal conditioning for self-generating sensors: chopper and low-drift amplifiers, offset and drifts amplifiers , electrometer amplifiers, charge amplifiers, noise in amplifiers

UNIT V: Digital sensors: position encoders, variable frequency sensors – quartz digital thermometer, vibrating wire strain gages , vibrating cylinder sensors, saw sensors, digital flow meters, Sensors based on semiconductor junctions : thermometers based on semiconductor junctions, magneto diodes and magneto transistors, photodiodes and phototransistors, sensors based on mosfet transistors, charge- coupled sensors – types of CCD imaging sensors , ultrasonic-based sensors , fiber-optic sensors.

UNIT VI: Modes of data transmission, DC telemetry system, voltage telemetry system, current telemetry system, AC telemetry system, AM, FM, Phase modulation, pulse telemetry system, PAM, Pulse frequency system, pulse duration modulation(PDM), digital

telemetry, pulse code modulation, transmission channels and media, wire line channels, radio channels, micro wave channels, power line carrier channels, multiplexing in telemetry systems, TDM.

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

- Understand the characteristics of measurement systems.
- Understand and application of the Resistive sensors
- Understand and application of the Reactance variation and electromagnetic sensors.
- Understand and application of the Self-generating sensors
- Understand and application of the Digital sensors
- Understand and application of the various Modes of data transmission.

REFERENCE BOOKS:

1. Ramon Pallás Areny, John G. Webster, "Sensors and Signal Conditioning", 2nd edition, JohnWiley and Sons, 2000
2. D.Patranabis, "Sensors and Transducers", TMH 2003
3. Jon Wilson , "Sensor Technology Handbook", Newne 2004.
4. Herman K.P. Neubrat, "Instrument Transducers – An Introduction to Their Performance and Design", Oxford University Press.
5. E.O. Doeblin, "Measurement System : Applications and Design", McGraw Hill Publications
6. D. Johnson, "Process Control Instrumentation Technology", John Wiley and Sons
7. Kevin James, PC Interfacing and Data acquisition, Elsevier, 2011
8. Graham Brooker, Introduction to Sensors for ranging and imaging, Yesdee, 200
   Ian Sinclair, Sensors and Transducers, Elsevier, 3rd Edition, 2011

EI502 **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 State Space Models for LTI systems, controllability and observability.
- To impart knowledge of discrete systems and methods to analyze LTI systems using discrete methods.
- To introduce State space models in discrete time.
- To Learn various design techniques in state space form.

Syllabus

Unit I: 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.

Unit II: State variable analysis of discrete time system: state space analysis of linear discrete time system, controllability and observability, multivariable system.

Unit III: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, introduction to digital control system with state feedback.

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

- Develop and analyze state Space Models for LTI systems, controllability and observability.
- Understand discrete systems and methods to analyze LTI systems using discrete methods.
- Develop and analyze State space models in discrete time.
- Apply Design techniques in state space form.

Text books:

1. Control System by B. C. Kuo.
2. Digital and non linear control by M. Gopal
3. Control System by Nagrath and Gopal.

ECC03	**Microprocessors and Microcontrollers**		
L T P CR	**Theory**	**:**	**75**
3 0 0 3	**Class Work**	**:**	**25**
	Total	**:**	**100**
	Duration of Exam	**:**	**3 Hrs.**

Course Objectives:

- To study and familiarise with building blocks of micro computers systems and Assembly programming of 8086.
- To apply the fundamental of programming and Interfacing through 8051.
- To know about virtual, cache and architecture of advance processors.
- To know fundamentals of RISC and ARM microcontrollers and interfaces design.

Syllabus

Unit 1: Overview of microcomputer systems and their building blocks, memory interfacing, concepts of interrupts and Direct Memory Access, 8086 Instruction, addressing modes, instruction set of Microcontroller (with examples of 8085 and 8086)

Unit 2: Peripherals and Interfacing with Microprocessor (8086)-PPI-8255, Timers-8253/8254, Programmable Interrupt Controller 8259, Interfacing of Microprocessor with I/O, A/D, D/A, Switches & LEDs

Unit 3: Microcontroller 8051, Architecture, programming, interfacing with peripherals - timer, serial I/O, parallel I/O, A/D and D/A converters, Arithmetic Coprocessors, System level interfacing design

Unit 4: Concepts of virtual memory, Cache memory, advanced coprocessor Architectures- 286, 486, Pentium

Unit 5: Introduction to RISC processors, PIC, ARM microcontrollers, architectures

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

- Do assembly language programming
- Do interfacing design of peripherals like, I/O, A/D, D/A, timer etc.
- Develop systems using different microcontrollers
- Understand RSIC processors and design ARM microcontroller based systems

Text/Reference Books:

1. R. S. Gaonkar, Microprocessor Architecture: Programming and Applications with the 8085/8080A, Penram International Publishing, 1996.
2. D A Patterson and J H Hennessy, "Computer Organization and Design The hardware and software interface. Morgan Kaufman Publishers.
3. Douglas Hall, Microprocessors Interfacing, Tata McGraw Hill, 1991.
4. Kenneth J. Ayala, The 8051 Microcontroller, Penram International Publishing, 1996.

EIEL501 **Power 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 the students about various types of power devices & their characteristics.
- To introduce the students about controlled rectifiers, choppers & inverters.
- To impart the knowledge regarding the analysis of inverters.
- To impart the knowledge regarding switching power supplies & their applications.

Syllabus

Unit 1: Characteristics of Semiconductor Power Devices: Thyristor, power MOSFET and IGBT Treatment should consist of structure, Characteristics, operation, ratings, protections and thermal considerations. Brief introduction to power devices viz, TRIAC, MOS controlled thyristor (MCT), Power Integrated Circuit (PIC) (Smart Power), Triggering/Driver, commutation and snubber circuits for thyristor, power MOSFETs and IGBTs (discrete and IC based), Concept of fast recovery and schottky diodes as freewheeling and feedback diode.

Unit 2: Controlled Rectifiers: Single phase, Study of semi and full bridge converters for R, RL, RLE and level loads. Analysis of load voltage and input current, Derivations of load form factor and ripple factor, Effect of source impedance, Input current Fourier series analysis of input current to derive input supply power factor, displacement factor and harmonic factor.

Unit 3: Choppers: Quadrant operations of Type A, Type B, Type C, Type D and type E choppers, Control techniques for choppers, TRC and CLC, Detailed analysis of Type A chopper, Step up chopper, Multiphase Chopper.

Unit 4: Single-phase inverters: Principle of operation of full bridge square wave, quasi-square wave, PWM inverters and comparison of their performance. Driver circuits for above inverters and mathematical analysis of output (Fourier series) voltage and harmonic control at output of inverter (Fourier analysis of output voltage). Filters at the output of inverters, Single phase current source inverter.

Unit 5: Switching Power Supplies: Analysis of fly back, forward converters for SMPS, Resonant converters need, concept of soft switching, switching trajectory and SOAR, Load resonant converter series loaded half bridge DC-DC converter. Applications: Power line disturbances, EMI/EMC, power conditioners, Block diagram and configuration of UPS, salient features of UPS, selection of battery and charger ratings, sizing of UPS, Separately excited DC motor drive, P M Stepper motor Drive.

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

- Build and test circuits using power devices such as SCR.
- Analyze and design controlled rectifier, DC to DC converters, DC to AC inverters.
- Learn how to analyze these inverters and some basic applications.
- Design SMPS and UPS.

Text /Reference Books:

1. Muhammad H. Rashid, “Power electronics” Prentice Hall of India.
2. Ned Mohan, Robbins, “Power electronics”, edition III, John Wiley and sons.
3. P.C. Sen., “Modern Power Electronics”, edition II, Chand& Co.
4. V.R.Moorthi, “Power Electronics”, Oxford University Press.
5. Cyril W., Lander,” Power Electronics”, edition III, McGraw Hill.

6. G K Dubey, S R Doradla,: Thyristorised Power Controllers", New Age International Publishers. SCR manual from GE, USA.

EIEL502 **Industrial Instrumentation**

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

Course Objective :-

1. To get an adequate knowledge about various techniques used for various parameters of measurement in Industries.
2. To provide exposure to various measuring techniques for vibration, density.
3. To acquire knowledge about the principles of humidity, moisture and viscosity measurements.
4. To learn the working of different types of temperature and pressure transducers.
5. To understand, analyze and design various measurement schemes that meet the desired specifications and requirements of real time processes

Syllabus

UNIT 1: Temperature Measurements: Importance, advantage and limitation of different instruments ,Seeback effect, peltier effect used for temperature measurement, thermocouples, Advantage and limitation of- Vapour filled, gas filled, Liquid filled, mercury in glass, Bimetallic, Pressure spring thermometer, pyrometers, thermistors, IC based metering, Low temperature and high temperature measurement schemes. **Level Measurements:** Importance, advantage and limitation of different instruments, visual level indicators, float type, Purge method of measuring level, Buoyancy method, Resistance and capcitance probes for level measurement, limit switches, level measurement in pressurized vessels, solid level measurement techniques, modern techniques for level measurements and their applications.

UNIT 2: Pressure Measurements: Principle of measurement of absolute/gauge/ Vaccuum, Different type of manometers, Pressure switches, pirani gauge.
Flow Measurements: Mechanical flow meter, Interferential type, Rotating vane, propeller type, orifice plate, venturi tube, flow nozzle, pivot tube, variable area flow meters, rotameters, Electromagnetic and ultrasonic flow meters, mass flow meters, and turbine flow meters, selection of flow meters and typical application scheme for very low flow and highly viscous fluid.
Force and Torque Measurement: Various measuring methods, Mechanical weighing systems, Ballistic Weighing, Hydraulic and pneumatic system, Torque Measurement, Transmission Dynamometers, Combined Force and Moment Measurement.

UNIT 3: Density Measurement: Displacement and float type densitometry, hydrometer, hydrostatic densitometry, miscellaneous densitometry, oscillating densitometer, radiation densitometer, vibrating densitometer & gas densitometer.
Displacement, Linear Velocity Measurement: Gauge blocks, surface plates, use of comparators, optical methods, displacement transducer and typical applications.

UNIT 4: Moisture and Humidity Measurement: Wet analysis and Dry analysis based methods, Principle Moisture sensing devices- electrical conductivity/capacitance methods/ impendence sensors/radio frequency/microwave/Infrared absorption meters, vibrating quartz crystal moisture sensors, principle of operational instrument for measurement of humidity, modern techniques for measurement of humidity.

Vibration and Noise Measurements: Importance and harmful effects, liming/permissible value under various types of industrial environments, modern measurement techniques.

Course Outcome:-

The theory lectures and practical should be planned in such a manner that students can acquire different learning outcomes in cognitive, psychomotor and affective domain to demonstrate following course outcomes. After learning the course the students should be able to:-

- Select a transducer based on its operating characteristics for the required application.
- Check various available techniques available and select appropriate to obtain satisfactory task for the parameter to be measured.
- Know advantages and limitations of selected techniques.
- Interpret the measurement results and cause of any possible error.

Text Books:

1. K. Krishnaswamy, S. Vijaychitra, "Industrial Instrumentation", New Age International Publishers, 2nd Edition, 2010
2. A.K.Ghosh,"Introduction to Measurements and Instrumentation", 4th Edition, PHI

EIEL503 **Virtual/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.

MC03 **Environmental Sciences**

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

Course Objective

- The prime objective of the course is to provide the students a detailed knowledge on the threats and challenges to the environment due to developmental activities.
- The students will be able to identify the natural resources and suitable methods for their conservation and sustainable development.
- The focus will be on awareness of the students about the importance of ecosystem and biodiversity for maintaining ecological balance.
- The students will learn about various attributes of pollution management and waste management practices.
- The course will also describe the social issues both rural and urban environment and environmental legislation.

Syllabus

Unit 1: THE MULTIDISCIPLINARY NATURE OF ENVIRONMENTAL STUDIES Definition, scope and importance. Need for public awareness.

Unit 2: NATURAL RESOURCES: RENEWABLE AND NON-RENEWABLE RESOURCES Natural resources and associated problems, ***Forest resources***: Use and over-exploitation, deforestation, case studies. Timber extraction, mining, dams and their effects on forests and tribal people. ***Water resources***: Use and over-utilization of surface and ground water, floods, drought, conflicts over water, dams-benefits and problems. ***Mineral resources***: Use and exploitation, environmental effects of extracting and mineral resources, case studies. ***Food resources***: World food problems, changes caused by agriculture and overgrazing, effects of modern agriculture, fertilizer-pesticide problems, water logging, salinity, case studies. ***Energy resources***: Growing energy needs, renewable and non- renewable energy sources, use of alternate energy sources. Case studies. Land resources: Land as a resource, land degradation, man induced landslides, soil erosion and desertification., Role of an individual in conservation of natural resources. Equitable use of resources for sustainable lifestyles.

Unit 3: ECOSYSTEMS Concept of an ecosystem Structure and Concept of an ecosystem, Structure and function of an ecosystem. Producers, consumers and decomposers, Energy flow in the ecosystem. Ecological succession. Food chains, food webs and ecological pyramids, Introduction, types, characteristic features, structure and function of the following ecosystem: a) Forest ecosystem b) Grassland ecosystem c) Desert ecosystem d) Aquatic ecosystems (ponds, streams, lakes, rivers, oceans, estuaries).

Unit 4: BIODIVERSITY AND ITS CONSERVATION Definition: genetic, species and ecosystem diversity, Biogeographical classification of India. Value of biodiversity: consumptive use, productive use, social, ethical, aesthetic and option values. Biodiversity at global, National and local levels. India as a mega-diversity nation. Hot-spots of biodiversity. Threats to biodiversity: habitat loss, poaching of wildlife, man-wildlife conflicts. Endangered and endemic species of India. Conservation of biodiversity: insitu and ex-situ conservation of biodiversity.

Unit 5: ENVIRONMENTAL POLLUTION Definition, Causes, effects and control measures of: Air pollution b) Water pollution c) Soil pollution d) Marine pollution e) Noise pollution f) Thermal pollution g) Nuclear hazards, Solid waste Management: Causes, effects and control measures of urban and industrial wastes. Role of an individual in prevention of pollution. Pollution case studies. Disaster management: floods, earthquake, cyclone and landslides.

Unit 6: SOCIAL ISSUES AND THE ENVIRONMENT

From Unsustainable to Sustainable development Urban problems related to energy. Water conservation, rain water harvesting, watershed management. Resettlement and rehabilitation of people; its problems and concerns. Case studies, Environmental ethics: Issues and possible solutions. Climate change, global warming, acid rain, ozone layer depletion, nuclear accidents and holocaust. Case studies. Wasteland reclamation. Consumerism and waste products, Environment Protection Act. Air (Prevention and Control of Pollution) Act. Water (Prevention and Control of Pollution) Act , Wildlife Protection Act. Forest Conservation Act. Issues involved in enforcement of environmental legislation , Public awareness.

Unit 7: HUMAN POPULATION AND THE ENVIRONMENT Population growth, variation among nations. Population explosion, Family Welfare Programme, Environment and human health, Human Rights, Value Education. HIV/AIDS. Women and Child Welfare. Role of Information Technology in Environment and human health. Case Studies.

Unit 8: FIELD WORK: Visit to a local area to document environmental assets-river, forest, grassland, hill, mountain, Visit to a local polluted site, Urban, Rural, Industrial, Agricultural, Study of common plants, insects, birds. Study of simple ecosystems, pond, river, hill slopes, etc.

TEXT/ REFERENCES

1. "Perspectives in Environmental Studies" by A. Kaushik and C. P. Kaushik, New age international publishers.
2. "Environmental Studies by Benny Joseph", Tata McGraw Hill Co, New Delhi
3. "Environmental Science: towards a sustainable future" by Richard T. Wright. 2008 PHL Learning Private Ltd. New Delhi.
4. "Environmental Engineering and science" by Gilbert M. Masters and Wendell P. Ela 2008 PHI Learning Pvt Ltd.
5. "Environmental Science" by Daniel B. Botkin& Edwards A. Keller, Wiley INDIA edition.
6. "Fundamentals of Ecology" by Odum, E.P., Barrick, M. and Barret, G.W. Thomson Brooks/Cole Publisher, California, 2005.

OE501 **Computer Architecture**

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

Course Objects:

- To study the basic of computer system.
- To study general system architecture.
- To study memory hierarchy & I/O techniques.
- To study basic non-pipelined CPU architecture & how its performance can be enhanced using pipelining.

Syllabus

Unit 1: Basic Structure of Computers, Functional units, software, performance issues software, machine instructions and programs, Types of instructions, Instruction sets: Instruction formats, Assembly language, Stacks, Ques, Subroutines.

Unit 2: Processor organization, Information representation, number formats.

Unit 3: Multiplication & division, ALU design, Floating Point arithmetic, IEEE 754 floating point Formats Control Design, Instruction sequencing, Interpretation, Hard wired control-Design methods, and CPU control unit. Microprogrammed Control-Basic concepts, minimizing microinstruction size, multiplier control unit. Microprogrammed computers-CPU control unit

Unit 4: Memory organization, device characteristics, RAM, ROM, Memory management, Concept of Cache & associative memories, Virtual memory. System organization, Input-Output systems, Interrupt, DMA, Standard I/O interfaces

Unit 5: Concept of parallel processing, Pipelining, Forms of parallel processing, interconnect network

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

- Understand how computers work.
- Understand basic principles of computer's working.
- Understand and analyze the performance of computers.
- Understand and know how computers are designed and built.
- Understand issues affecting modern processors (caches, pipelines etc.).

Text/Reference Books:

1. V.Carl Hammacher, "Computer Organisation", Fifth Edition.
2. A.S.Tanenbum, "Structured Computer Organisation" , PHI, Third edition.
3. Y.Chu, "Computer Organization and Microprogramming", II, Englewood Chiffs, N.J., Prentice Hall Edition.
4. M.M.Mano, "Computer System Architecture", Edition.
5. C.W.Gear, "Computer Organization and Programming", McGraw Hill, N.V. Edition.
6. Hayes J.P, "Computer Architecture and Organization", PHI, Second edition.

OE502 **Data Structures**

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

Course Objectives:

- To study in detail the concept of Loops, Conditional statements, Arrays, Functions, pointers, structures, file handling file concepts, file organization in C language.
- To study link list, Header Link list, Multiway link list and perform various data structure operations.
- To study the concept of stack and Queues and implement the same using array and link list form.
- To implement Binary Trees type and implement the same in array and link list form.
- To study the Graphs using set, linked and matrix representation.
- To study and implement file handling concepts.

Syllabus

Unit 1: Overview of 'C': Introduction, Flow of Control, Input output functions, Arrays and Structures, Functions.

Unit 2: Data structures and Algorithms an overview: concept of data structure, choice of right data structures, types of data structures, basic terminology Algorithms, how to design and develop an algorithm, stepwise refinement, use of accumulators and counters, algorithm analysis, complexity of algorithms Big-oh notation, Arrays, Searching Sorting, Introduction, One Dimensional Arrays,

Unit 3: Operations Defined: traversal, selection, searching, insertion, deletion, and sorting, Multidimensional arrays, address calculation of a location in arrays. Searching: Linear search, Recursive and Non recursive binary Search. Sorting: Selection sort, Bubble sort, Insertion sort, Merge sort, Quick sort, Shell sort, Heap sort

Unit 4: Stacks and queues: Stacks, array representation of stack, Applications of stacks, Queues, Circular queues, array representation of Queues, Deque, priority queues, Applications of Queues.

Unit 5: Pointers and Linked Lists: Pointers, Pointer variables, Pointer and arrays, array of pointers, pointers and structures, Dynamic allocation. Linked Lists: Concept of a linked list,. Circular linked list, doubly linked list, operations on linked lists. Concepts of header linked lists. Applications of linked lists, linked stacks, linked Queues.

Unit 6: Tree and Graphs: Trees: Introduction to trees, binary trees, representation and traversal of trees, operations on binary trees, types of binary trees, threaded binary trees, B Trees, Application of trees. Graphs: Introduction, terminology, set, linked and matrix representation, Graph traversal techniques: BFS, DFS, operations on graphs, Minimum spanning trees, Applications of graphs.

Unit 7: File Handling and Advanced data Structure Introduction to file handling, Data and Information, File concepts, File organization, files and streams, working with files. AVL trees, Sets, list representation of sets, applications of sets, skip lists

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

- Understand the programming of C language from basic to advance level.
- Understand the Concept of link list, stack, queue, binary tree its usage in real life.
- Understand the Working of binary trees and graph with their applications.
- Understand the concept of files and their organization of memory.

Text Books:

1. Data Structures using C by A. M. Tenenbaum, Langsam, Moshe J. Augentem, PHI Pub.
2. Data Structures using C by A. K. Sharma, Pearson

Reference Books:

1. Data Structures and Algorithms by A.V. Aho, J.E. Hopcroft and T.D. Ullman, Original edition, Addison-Wesley, 1999, Low Priced Edition.
2. Fundamentals of Data structures by Ellis Horowitz & SartajSahni, Pub, 1983,AW
3. Fundamentals of computer algorithms by Horowitz Sahni and Rajasekaran.
4. Data Structures and Program Design in C By Robert Kruse, PHI,
5. Theory & Problems of Data Structures by Jr. SymourLipschetz, Schaum‘s outline by TMH.
6. Introduction to Computers Science -An algorithms approach , Jean Paul Tremblay, Richard B. Bunt, 2002, T.M.H.

OE503 **Basics of Communication Engineering**

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

Course Objectives:

- To study the concepts of signal & system as well as various modes and media's of Communication.
- To introduce the various Analog modulation techniques.
- To introduce the concept of Sampling Theorem and Pulse Modulation Techniques.
- To introduce the concept of different digital modulations schemes
- To introduce various types of Noise

UNIT1. INTRODUCTION TO COMMUNICATION SYSTEMS: The essentials of a Communication system, modes and media's of Communication, Classification of signals and systems, Fourier analysis of signals.

UNIT2. AMPLITUDE MODULATION: Amplitude modulation, Generation of AM waves, Demodulation of AM waves, DSBSC, Generation of DSBSC waves, Coherent detection of DSBSC waves, single side band modulation, generation of SSB waves, demodulation of SSB waves, vestigial sideband modulation (VSB).

UNIT3. ANGLE MODULATION: Basic definitions: Phase modulation (PM) & frequency modulation (FM), narrow band frequency modulation, wideband frequency modulation, generation of FM waves, Demodulation of FM waves.

UNIT4. PULSE MODULATION: Sampling theory, pulse amplitude modulation (PAM), pulse time modulation., Elements of pulse code modulation,Quantization, Uniform & nonuniform Quantization, Necessicity of nonuniform quantization, A law of Companding, μ law of companding, Quantization error in PCM, transmission BW of PCM, Differential Pulse Code Modulation, Delta Modulation, Adaptive Delta Modulation, TDM, FDM.

UNIT5. DIGITAL MODULATION TECHNIQUES: ASK, Generation and detection of ASK, FSK Generation and detection of FSK, BPSK , Generation & detection of BPSK, QPSK, generation and detection of QPSK, DPSK, M-ary PSK.

UNIT6. INTRODUCTION TO NOISE: External noise, internal noise, S/N ratio, noise figure, noise temperature.

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

- Undestand the concepts of signal & system as well as various modes and media's of Communication.
- Apply Analog modulation techniques on the basis of requirement.
- Understand Sampling Theorem and Pulse Modulation Techniques.
- Understand the concept of different digital modulations schemes
- Understand various types of Noise

TEXT BOOKS:

1. Communication systems (4th edn.): Simon Haykins; John wiley & sons.
2. Communication systems: Singh & Sapre; TMH.

REFERENCE BOOKS:

1 Electronic Communication systems: Kennedy; TMH.
2 Communication Electronics: Frenzel; TMH.
3 Communication system: Taub & Schilling; TMH.
4 Communication systems: Bruce Carlson.

OE504 **Financial Management**

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

Course Objective:

- To develop understanding among the students regarding nature of finance and its interaction with other Management functions and the objectives of Financial Management. Detailed contents.

Unit 1: Financial management: Scope finance functions and its organisation, objectives of financial management, time value of money, sources of long term finance.

Unit 2: Investment decisions importance, difficulties, determining cash flows, methods of capital budgeting with excel, risk analysis (risk adjusted discount rate method and certainty equivalent method), cost of different sources of raising capital, weighted average cost of capital.

Unit 3: Capital structure decisions: Financial and operating leverage, EBIT/EPS Analysis, capital structure theories, NI, NOI, traditional and M-M theories, determinants of dividend policy and dividend models, Walter, Gordon & M.M. models.

Unit 4: Working Capital: meaning, need, determinants, estimation of working capital need, management of cash, inventory and receivables.

Course Outcome

- It creates understanding among the students regarding the key decisions like Investment, Financing and dividend Decisions of financial Management.
- They are able to understand the usage and applications of leverages in financial decisions. The students are able to use their best knowledge in finance towards the value creation for the organization.
- The students will be made aware of working capital management concept.

TEXT/REFERENCE BOOKS

1. Pandey, I.M., "*Financial Management*", Vikas Publishing House, New Delhi
2. Khan M.Y, and Jain P.K., "*Financial Management*", Tata McGraw Hill, New Delhi
3. Keown, Arthur J., Martin, John D., Petty, J. William and Scott, David F, "*Financial Management",* Pearson Education
4. Chandra, Prasanna, "*Financial Management*", TMH, New Delhi
5. Van Horne, James C., "*Financial Management and Policy*", Prentice Hall of India
6. Brigham & Houston, "*Fundamentals of Financial Management"*, Thomson Learning, Bombay.
7. Kishore, R., "*Financial Management*", Taxman"s Publishing House, New Delhi

ECC51	**Microprocessors and Microcontroller Lab**		
L T P CR	**Theory**	**:**	**35**
0 0 2 1	**Class Work**	**:**	**15**
	Total	**:**	**50**

List of Experiments

1. Study of architecture of 8085 & familiarization with its hardware , commands & operation of Microprocessor kit.
2. Write a program using 8085 and verify for :

   (i) Addition of two 8-bit numbers.

   (ii) Addition of two 8-bit numbers (with carry).
3. Write a program using 8085 and verify for :

   (i) 8-bit subtraction (display borrow)

   (ii) 16-bit subtraction (display borrow)
4. Write a program using 8085 for multiplication of two 8- bit numbers by repeated addition method. Check for minimum number of additions and test for typical data.
5. Write a program using 8085 for multiplication of two 8- bit numbers by bit rotation method and verify.
6. Write a program using 8085 for division of two 8- bit numbers by repeated subtraction method and test for typical data.
7. Write a program using 8085 for dividing two 8- bit numbers by bit rotation method and test for typical data.
8. Write a program using 8086 and verify for:

   (i) Finding the largest number from an array.

   (ii) Finding the smallest number from an array.
9. Write a program using 8086 for arranging an array of numbers in descending order and verify.
10. Write a program using 8086 for arranging an array of numbers in ascending order and verify.
11. Write a program for finding square of a number using look-up table and verify.
12. Write a program to interface microprocessor with 8253 to generate square wave. Use 8085/8086 microprocessor.
13. Write a program to interface microprocessor with 8253 to generate interrupt on terminal count. Use 8085/8086 microprocessor.
14. Write a program to interface a two digit number using seven-segment LEDs. Use 8085/8086 microprocessor and 8255 PPI.
15. Write a program to control the operation of stepper motor using 8085/8086 microprocessor and 8255 PPI.

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

- Identify various modules embedded on the kit.
- Write the assembly code for various operations on 8-bit and 16-bit numbers.
- Interface various peripherals with microprocessor and to write the program for same.
- Interface various devices such as seven segment LEDS & stepper motor with microprocessor through 8255 and to write the program for same.

EI 601 **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 students about process control system .
- To introduce the students about dynamic behavior of first order lag system with various types of processes.
- To introduce the students about P,I& D controllers.
- To introduce the students about designing feedback controller
- To introduce the students about control system with multiple loops.
- To introduce the students about interaction and de-coupling of control loop.
- To introduce the students about computer process interface for data acquisition and control

UNIT 1: BASIC CONSIDERATIONS: Introduction to process control system, control loop study-Generalisation with load-changes at arbitrary points in the loop ,offset and its analysis,modeling consideration for control purposes, degree of freedom and process controllers ,formulating the scope at modeling for process control.dynamic behaviour of first order lag system,process with variable time constant and gain.Dynamic behaviour of 1st order lag system,process with variable time constant and gain. Dynamic behaviour of first order lag system-multicapacity process,real time process,inverse response process,inytroduction to feedback control and effects P,I& D controllers.

UNIT 2: DESIGNING FEEDBACK CONTROLLER: Outline of the design problems,selection of type of feedback controller.Time-integral performance criterion, process reaction curve and frequency response characteristic,Ziegler-Nichole rule,effect of dead-time,dead time compensator inverse response compensator.

UNIT 3: CONTROL SYSTEM WITH MULTIPLE LOOPS: Cascade, split-range feedforward, ratio inferential and adaptive control.

UNIT 4:INTERACTION AND DE-COUPLING OF CONTROL LOOP: Interaction of control loops,relative gain array and selection of the loops,design of non-interacting current loop.

UNIT 5: COMPUTER PROCESS INTERFACE FOR DATA ACQUISITION AND CONTROL: Introduction to digital computer control of processes. Design of control system for complete plant.

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 and First order, second order, and integrating systems including dead time are treated with basic controller algorithms.
- Understand the dynamic behavior of processes and develop good understanding of their behavior in different situation and the key concepts in adaptive control system.
- Understand for defining controller structure with respect to controlled process and perform parameters tuning in order to assure required performance of the system.
- Understand the concepts involved in multiple single loops in various applications.

- Obtain theoretical and empirical mathematical models of different processes.Design different types of controllers

TEXT BOOK:

1 Chemical process control; George Stephanopoulos;PHI

REF BOOKS

1 Digital computer process control;C.L.Smith;Intext Educational publisher
2 Process control: F.G.Shinskey; McGraw Hill
3 Advanced process control: W.H.Ray: McGraw Hill]
4 Process system and analysis and control: D.R.Coushanour; T.M.H
5 Process instrument and control handbook: D.M.Considins; McGraw Hill

ECC04	**Digital Signal Processing**		
L T P CR	**Theory**	**:**	**75**
3 0 0 3	**Class Work**	**:**	**25**
	Total	**:**	**100**
	Duration of Exam	**:**	**3 Hrs.**

Course objectives:

- To study concept of basic signal and implementation of discrete line system.
- To introduce concept of Z-transform & discrete Fourier Transform and FFT.
- To give exposure to students about design of FIR digital filter.
- To familiar with the concept of multirate signal processing and spectral estimation.

Syllabus

Unit 1: Discrete time signals: Sequences, representation of signals on orthogonal basis, Sampling and reconstruction of signals, Discrete systems attributes, Analysis of LSI systems, frequency Analysis, Inverse Systems, Algorithm, Implementation of Discrete Time Systems

Unit 2: Z-Transform, Discrete Fourier Transform (DFT), Fast Fourier Transform

Unit 3: Design of FIR Digital filters: Window method, Park-McClellan's method, Design of IIR Digital Filters, Butterworth, Chebyshev and Elliptic Approximations, Low pass, Band pass, Band stop and High pass filters.

Unit 4: Effect of finite register length in FIR filter design, Parametric and non-parametric spectral estimation, Introduction to multirate signal processing, Application of DSP

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

- Represent signals mathematically in continuous and discrete time and frequency domain.
- Get the response of an LSI system to different signals.
- Design of different types of digital filters for various applications.
-

Text/Reference Books:

1. S.K.Mitra, Digital Signal Processing: A computer based approach.TMH.
2. A.V. Oppenheim and Schafer, Discrete Time Signal Processing, Prentice Hall, 1989.
3. John G. Proakis and D.G. Manolakis, Digital Signal Processing: Principles, Algorithms And Applications, Prentice Hall, 1997.
4. L.R. Rabiner and B. Gold, Theory and Application of Digital Signal Processing, Prentice Hall, 1992.
5. J.R. Johnson, Introduction to Digital Signal Processing, Prentice Hall, 1992.
6. D.J.DeFatta, J. G. Lucas andW.S.Hodgkiss, Digital Signal Processing, John Wiley& Sons, 1988.

EIEL601	**Internet of Things**		
L T P CR	**Theory**	**:**	**75**
3 0 0 3	**Class Work**	**:**	**25**
	Total	**:**	**100**
	Duration of Exam	**:**	**3 Hrs.**

Course objectives:

1. To assess the vision and introduction of IoT.
2. To Understand IoT Market perspective.
3. To Implement Data and Knowledge Management and use of Devices in IoT Technology.
4. To Understand State of the Art - IoT Architecture.
5. To classify Real World IoT Design Constraints, Industrial Automation in IoT.

Unit 1: The IoT Networking Core : Technologies involved in IoT Development: Internet/Web and Networking Basics: OSI Model, Data transfer referred with OSI Model, IP Addressing, Point to Point Data transfer, Point to Multi Point Data transfer & Network Topologies, Sub-netting, Network Topologies referred with Web, Introduction to Web Servers, Introduction to Cloud Computing IoT Platform overview, Overview of IoT supported Hardware platforms such as: Raspberry pi, ARM Cortex Processors, Arduino and Intel Galileo boards.Network Fundamentals:Overview and working principle of Wired Networking equipment's – Router, Switches,Overview and working principle of Wireless Networking equipment's – Access Points,Hubs etc. Linux Network configuration Concepts: Networking configurations in Linux Accessing Hardware & Device Files interactions.

Unit 2: IoT Architecture: History of IoT, M2M – Machine to Machine, Web of Things, IoT protocols Applications: Remote Monitoring & Sensing, Remote Controlling,Performance Analysis The Architecture The Layering concepts , IoT Communication Pattern, IoT protocol Architecture, The 6LoWPAN Security aspects in IoT

Unit 3: IoT Application Development: Application Protocols MQTT, REST/HTTP, CoAP, MySQL Back-end Application Designing Apache for handling HTTP Requests, PHP & MySQL for data processing, Mongo DB Object type Database, HTML, CSS & jQuery for UI Designing, JSON lib for data processing, Security & Privacy during development, Application Development for mobile Platforms: Overview of Android / IOS App Development tools

Unit 4: Case Study & advanced IoT Applications: IoT applications in home, infrastructures, buildings, security, Industries, Home appliances, other IoT electronic equipments. Use of Big Data and Visualization in Industry 4.0 concepts. Sensors and sensor Node and interfacing using any Embedded target boards (Raspberry Pi / Intel Galileo/ARM Cortex/ Arduino)

Course Outcomes:

- Interpret the vision of IoT from a global context.
- Determine the Market perspective of IoT.
- Compare and Contrast the use of Devices, Gateways and Data Management in IoT.
- Implement state of the art architecture in IoT.
- Illustrate the application of IoT in Industrial Automation and identify Real World Design Constraints.

TEXT BOOKS:

1. LoWPAN: The Wireless Embedded Internet, Zach Shelby, Carsten Bormann, Wiley
2. Internet of Things: Converging Technologies for Smart Environments and Integrated Ecosystems, Dr. Ovidiu Vermesan, Dr. Peter Friess, River Publishers
3. Interconnecting Smart Objects with IP: The Next Internet, Jean-Philippe Vasseur, Adam Dunkels, Morgan Kuffmann

EIEL602 **Digital Control**

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, Deadbeat controller design, Delayed system, controller design for delayed systems.

Unit 6: 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

EIEL603 **NUMERICAL METHODS**

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

Course Objectives:-

1. To be familiar with numerical solution of equations
2. To get exposed to finite differences and interpolation
3. To be familiar with the numerical Differentiation and integration
4. To find numerical solutions of ordinary differential equations
5. To find numerical solutions of partial differential equations

UNIT I - CURVE FITTING AND NUMERICAL SOLUTION OF EQUATIONS

Method of Least Squares – Fitting a straight line – Fitting a parabola – Fitting an exponential curve – Fitting a curve of the form y = axb – Calculation of the sum of the squares of the residuals.- Newton-Raphson method – Gauss Elimination method – Gauss Jacobi method – Gauss Seidel method.

UNIT II - FINITE DIFFERENCES AND INTERPOLATION

First and Higher order differences – Forward differences and backward differences and Central Differences – Differences of a polynomial – Properties of operators Factorial polynomials – Shifting operator E – Relations between the operators. Interpolation – Newton-Gregory Forward and Backward Interpolation formulae - Divided differences – Newton's Divided difference formula – Lagrange's Interpolation formula – Inverse interpolation.

UNIT III - NUMERICAL DIFFERENTIATION AND INTEGRATION

Numerical Differentiation and Integration: Newton's forward and backward differences formulae to compute first and higher order derivatives – The Trapezoidal rule – Simpson's one third rule and three eighth rule.

UNIT IV - NUMERICAL SOLUTIONS OF ORDINARY DIFFERENTIAL EQUATIONS

Solution by Taylor's series – Euler's method – Improved and modified Euler method – Runge-Kutta methods of fourth order (No proof) – Milne's Method - Adam's Bashforth method.

UNIT V - NUMERICAL SOLUTIONS OF PARTIAL DIFFERENTIAL EQUATIONS

Classification of Partial differential equations of the second order – Difference quotients – Laplace's equation and its solution by Liebmann's process – Solution of Poisson's equation – Solutions of Parabolic and Hyperbolic equations.

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

1. Understand numerical solution of equations
2. Understand finite differences and interpolation
3. Understand numerical Differentiation and integration
4. Understand numerical solutions of ordinary differential equations
5. Understand to find numerical solutions of partial differential equations

TEXT BOOKS

1. Grewal B.S., Numerical Methods in engineering and science, Khanna Publishers, 42nd edition, 2012.

REFERENCES

1. Dr. Venkataraman M.K., "Numerical Methods in Science and Engineering", National Publishing Co., 2005.
2. Sastry S.S., "Introductory Methods of Numerical Analysis", 4th edition,2005.
3. Balagurusamy E., "Computer Oriented Statistical and Numerical Methods" –Tata McGraw Hill., 2000.
4. Jain M.K., SRK Iyengar and R.L.Jain, "Numerical Methods for Scientific and Engineering Computation", Wiley Eastern Ltd., 4th edition, 2003.
5. Kandasamy etal P.., "Numerical Methods", S.Chand & Co., New Delhi, 2003.

EIEL604 **Computer Based Instrumentation and Control**

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

Course Objectives:-

1. To introduce the students about different components used for plant automation and Control
2. To introduce the students about the on-going contemporary issues in the field of control and Instrumentation used for plant automation.
3. To introduce the students about concept of distributed, centralized computer control schemes.
4. To introduce the students about the concept of sampling and different types of data transfer schemes and serial data communication standards.
5. To introduce the students about the need and concept of Modelling and Simulation for plant automation
6. To introduce the students about Programmable Logic Controllers (PLC
7. To introduce the students about distributed control systems (DCS) and supervisory control systems (SCADA) for control of manufacturing and processing systems

UNIT 1 : INTRODUCTION: Necessity and function of computers. Level of automation : Classical approach and computer based plant automation : On line and Off line. Centralized computer control and Distributed computer control.

UNIT 2 : INTERFACING: Sampling , Multiplexing, need of multiplexing, A/D converter, D/A converters, interfacing of A/D converter and D/A converters with microprocessor/microcomputer, programmable communication interface 8251 USART, Serial communication and serial communication standards: RS 232, MODEM, Bus arbitration, Current loop.

UNIT 3 : STRUCTURAL STUDY OF AUTOMATIC PROCESS CONTROL: Fundamentals of automatic process control, building blocks of automatic system, Distributed control system (DCS) : characteristics, functional levels/ system architecture, SCADA system. Direct digital control (DDC): structure, DDC software : position and velocity algorithm, Dual computer and basic concept of DDC,

UNIT 4 : PROGRAMMABLE LOGIC CONTROL: Evolution of PLC, Block diagram, Different components of PLC, Principle of operation, PLC Scan cycle, Programming of PLC : Instruction set including NO, NC, Set, Reset, Timer, Counter, data transfer, Mathematical and logical functions, LIFO, FIFO, Jump, Bit shift instructions etc., PLC selection Process, Application and software of PLCs.

UNIT 5 : MODELING AND SIMULATION FOR PLANT AUTOMATION: Basic concept, need of modeling and simulation, building of mathematical model of a plant, Modern tools for modeling and simulation.

UNIT 6 : INDUSTRIAL CONTROL APPLICATIONS : Plant automation: cement plant, thermal power plant, steel plant and water treatment plant.

Course Outcomes:-

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

1. Understand different components used for plant automation and control system, different types of control system i. e feedback, feedforward, inference, ratio, cascaded and modern control system, distributed, centralized computer control schemes.
2. Understand the concept of sampling, multiplexing, ADC, DAC and their need for plant automation and different types of data transfer schemes and serial data communication standards.
3. Understand Direct digital control (DDC), its software and their comparison, Distributed control systems (DCS) and supervisory control systems (SCADA) for control of manufacturing and processing systems.
4. Understand and utilize programmable logic controllers (PLC), its instruction set and programming.
5. Understand the need and concept of Modelling and simulation for plant automation.
6. Understand Control of thermal plant, steel plant, cement plant and water treatment plant

Recommended Books:

1. Anand, M.M.S., Electronic Instruments and Instrumentation technology, Prentice−Hall of India (2006).
2. Krishna Kant , Computer based industrial Control Prentice Hall of India.(2005)
3. Liptak B.G., Process control: Instrument engineers‘ Handbook, Butterwirth Heinemann (2003) 4th ed.

EIEL605 **Power Plant Instrumentation**

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

Course Objectives:-The objective of the course is to :-

- Introduce with Instrumentation used in power plant.
- Impart the Ability to demonstrate the standards used in power plants.
- Introduce the impact of power plant operation in environmental and societal context.

Unit 1: Introduction to Power Plant: Power plant terminologies and key terms, power plant classification: thermal, hydro, nuclear, co-generation, comparison of various power plants based on technology, usage, efficiency, and limitations.

Unit 2: Boiler Ancillaries: Various ancillaries used in steam generation units, viz. water treatment, electro-static precipitator, soot blower, economizer, de-aerator, super heater, chemical dosing systems, air pre-heater, coal and ash handling systems, fuel storage and distribution, bag house filters. IE- Power Plant Instrumentation

Unit 3: Boiler Control: Types of boilers, various control such as: combustion control, air to fuel ratio control, 3- element drum level control, steam temperature and pressure control, O2/CO2 in flue gases, furnace draft, boiler interlocks, sequence event recorder, supervisory control, data acquisition controls, burner management systems and controllers,start-up and shut-down procedures, boiler safety standards, boiler inspection procedures,Boiler load calculation, boiler efficiency calculation.

Unit 4: Turbine Instrumentation: Turbine instrumentation and control, start-up and shut-down, thermal stress control, turbine supervisory instrumentation, condition monitoring, generator, power distribution instrumentation.

Unit 5: Nuclear Power Plant Instrumentation: Classification of nuclear reactors, nuclear reactor control loops, fuel cycle, control and safety instrumentation, reliability aspects and various modes of operations. 11

Unit 6: Non-conventional energy sources and Power Distribution Schemes: Wind power, solar power, tidal power, diesel generator controls, sub station automation and smart grid, energy harvesting

Course Outcomes:-After the completion of course students will be able to :-

- Understanding of Instrumentation used in power plant.
- Ability to demonstrate the standards used in power plants.
- Understanding the impact of power plant operation in environmental and societal context.

Text Books:-

1. Sam. G. Dukelow, ―The Control of Boilers‖, ISA Press, New York, 2 nd ed., 1991.
2. David Lindsley, ―Boiler Control Systems‖, McGraw Hill, New York, 1st ed., 1991. Reference Books:
3. Manoj Kumar Gupta, ―Power Plant Engineering‖, PHI Learning Private Limited, 1st ed., 2012.
4. G.S. Sawhney, ―Non-Conventional Energy Resources‖, PHI Learning Private Limited, 1st ed., 2012
5. Gill A.B, ―Power Plant Performance‖, Butterworth, London, 1st ed., 1984

EIEL606 **Process Modeling & Optimization**

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

Course Objectives:

1. To introduce with models of physical and chemical processes.
2. To introduce the concepts of constrained and unconstrained optimization.

Unit I :- Mathematical models of Chemical systems

A. Applications of mathematical models and principles of formulation, Fundamental laws: Continuity equations, Energy equation, Equations of motion, Examples of models: Modeling of CSTR's (isothermal, non-isothermal, constant holdup, variable holdup), Batch reactor, Ideal binary distillation column, Heat exchanger, Boiler, Field controlled and Armature controlled D.C. Motors.

B. Types of models, Equations of state, Equilibrium, Chemical kinetics.

Unit II :- Numerical methods for solving algebraic and differential equations and curve fitting

A. Solution of algebraic equations: Interval halving method, Newton Raphson method Solution of differential equations: Euler method, Modified Euler method, Runge Kutta methods (2nd and 4th order), Adom Bashforth method.

Curve fitting: Lagrange interpolation method, Least squares method.

B.Vapor-liquid equilibrium bubblepoint calculation problem.

Unit III :Computer simulation of chemical and physical systems

A .Gravity flow tank, three isothermal CSTR's in series, non-isothermal CSTR, Batch reactor, Ideal binary distillation column, First and second order electrical systems.

B. Explicit convergence methods.

Unit IV: Basic concepts of optimization and unconstrained optimization

A. Continuity of functions, Concave and convex functions, Unimodal and Multimodal functions, Necessary and sufficiency condition for an extremum of an unconstrained function. Unconstrained single-variable optimization: scanning and bracketing procedures. Numerical methods: Newton, Quasi Newton and Secant methods. Unconstrained Multivariable optimization: Direct methods: Conjugate search directions, Powell's method. Indirect methods: Gradient methods, Conjugate gradient method, Newton's method.

B. Fibonacci method, Golden section method.

Unit V :Linear and nonlinear programming

A. Linear programming: Degeneracies, Graphical method, Simplex method, Sensitivity analysis, Karmarkar algorithm. Nonlinear programming: Lagrange multiplier method, Quadratic programming.

B. Generalized reduced gradient method.

Course Outcome: Upon completion of this course, student should able to:

1. Find models of physical and chemical processes.
2. Understand the concepts of constrained and unconstrained optimization.

Text Books

1. "Process, Modeling, Simulation and Control for Chemical Engineers", W. L. Luyben, McGraw Hill.
2. "Optimization of Chemical Processes", T.F.Edgar, D.M.Himmelblau, McGraw Hill.
3. "Advanced Practical Process Control", B.Roffel, B.H.L.Betlem, Springer.

Reference Books

1. "Higher Engineering Mathematics", B. S. Grewal, Khanna Publications.
2. "Practical Process Instrumentation and Control", J. Malley, McGraw Hill.
3. "System Simulation with digital Computer", Deo Narsingh, Prentice Hall India.

EIEL607 **Building Automation**

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

Course Objectives:

1. To Familiarize with elements of building automation for homes, hotels, restaurants and industry.
2. To understand about HVAC system, security, access, alarm management and energy management systems

Unit 1: Introduction : Concept and application of Building Management System (BMS) and Automation, requirements and design considerations and its effect on functional efficiency of building automation system, architecture and components of BMS.

Unit 2: HVAC system : Different components of HVAC system like heating, cooling system, chillers, AHUs, compressors and filter units and their types. Design issues in consideration with respect to efficiency and economics, concept of district cooling and heating.

Unit 3: Access control &security system : Concept of automation in access control system for safety, Physical security system with components, RFID enabled access control with components, Computer system access control – DAC, MAC, RBAC.

Unit 4: Fire &alarm system: Different fire sensors, smoke detectors and their types, CO and CO_2 sensors, Fire control panels, design considerations for the FA system concept of IP enabled fire&alarm system, design aspects and components of PA system.

Unit 5: CCTV system &energy management system: Components of CCTV system like cameras, types of lenses, typical types of cables, controlling system, concept of energy management system, occupancy sensors, fans & lighting controller.

Unit 6: EPBX System & BMS subsystem integration: Design consideration of EPBX system and its components, integration of all the above systems to design BMS.

Course Outcomes:

- Understanding of basic blocks and systems for building automation.
- Designing different systems for building automation and integrate those systems.

Text Book

1 Jim Sinopoli,‖Smart Buildings‖, Butterworth-Heinemann imprint of Elsevier,2 nd ed., 2010. Reference Book

2 Albert Ting-Pat So, WaiLok Chan, ―Intelligent Building Systems‖ Kluwer Academic publisher,3 rd ed., 2012.

EIEL608 **Analytical 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 and classify capabilities and limitations of analytical instruments.
- To impart knowledge of use of an analytical instrument in solving real world problem.

Unit 1 Introduction to Chemical instrumental analysis, advantages over classical methods, classification: Spectral, electro analytical and separative methods, Interaction of radiation with matter, Laws of photometry (Beer and Lambert's law), Deviation from Beer's law, working of filters, prism and grating monochromators, concept of design of analytical instrument

Unit 2: Colorimeters, online colorimeter for process applications, turbidity meter, UV-Visible spectrophotometers and its types with its optical system design, IR spectrophotometers, X-ray spectroscopy

Unit 3: Emission Spectra, Quantitative measurements, Flame Photometer and its applications, concept of design atomic absorption spectrophotometer, spectrum interpretation, interferences, applications of atomic absorption spectrophotometer

Unit 4: Classification of Chromatographic methods, Gas chromatography, Process Gas Chromatograph, Liquid Chromatography, High Performance Liquid Chromatography (HPLC)

Unit 5: Different types of gas analyzers for measurement of Oxygen, NO2,ammonia, carbon dioxide and hydrocarbons , Real world applications : Environmental monitoring system, real time gas leakage monitoring working principle and applications of laboratory instruments : centrifuge, oven, stirrers

Unit 6: Working principle, analyzers and detector types of mass spectrometer, applications

Text Books:

1. Willard, Merritt, John AurieDean, "Instrumental Methods of Analysis", CBS Publishers & Distributors, New Delhi, Seventh ed., 1988.
2. R. S. Khandpur, "Handbook of Analytical Instruments", Tata McGraw–Hill Publications, Second ed., 2006.

Reference Books:

1. Bela G Liptak, "Analytical Instrumentation Handbook", Chilton, Second ed., 1994.
2. Leslie S Ettre, Albert Zlatkis, "The Practice of Gas Chromatography", John Wiley and son's publication, First ed., 1967.
3. Skoog, Holler, Nieman, "Principles of Instrumental Analysis", Thomson bookscole publications, Sixth ed., 2006.

Course Outcomes:

- Summarize and classify capabilities and limitations of analytical instruments.
- Justify use of an analytical instrument in solving real world problem.
- Familiarize with current literature, research in analytical instrumentation.

EIEL609 **Control Systems Components**

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

Course Objectives:

1. To introduce selection and use the components for electrical systems
2. To impart knowledge to identify, formulate and solve a problem using pneumatic system in instrumentation and control engineering
3. To impart knowledge to identify, formulate and solve a problem using hydraulic system in instrumentation and control engineering .

Unit 1 Motors: Types, working principle, characteristic, and mathematical model of following: Motors AC/DC motors, stepper, servo, linear, Synchronous, Generators, and Alternator

Unit 2: Types, working principle, characteristics, and symbolic representation of following: Switches: Toggle, Slide, DIP, Rotary, Thumbwheel, Selector, Limit, Proximity, Combinational switches, zero speed, belt sway, pull cord. Relays: Electromechanical, Solid state relays, relay packages Contactors :Comparison between relay & contactor, contactor size and ratings Timers : On Delay, Off delay and Retentive

Unit 3: (Sequencing & Interlocking for motors: Concept of sequencing & Interlocking, Standard symbols used for Electrical Wiring Diagram, Electrical Wiring diagrams for Starting, Stopping, Emergency shutdown, (Direct on line, star delta, soft starter) Protection devices for motors: Short circuit protection, Over load Protection, Over/ under voltage protection, Phase reversal Protection, high temperature and high current Protection, over speed, Reversing direction of rotation, Braking, Starting with variable speeds, Jogging/Inching Motor Control Center: Concept and wiring diagrams

Unit 4: Pneumatic components: Pneumatic Power Supply and its components: Pneumatic relay (Bleed & Non bleed, Reverse & direct), Single acting & Double acting cylinder, Special cylinders: Cushion, Double rod, Tandem, Multiple position, Rotary Filter Regulator Lubricator (FRL), Pneumatic valves (direction controlled valves, flow control etc), Special types of valves like relief valve, pressure reducing etc. Hydraulic components: Hydraulic supply, Hydraulic pumps, Actuator (cylinder & motor), Hydraulic valves

Text Books:

- B. L. Theraja, "A text book of Electrical Technology", S. Chand & Company Ltd., IE - 09005 Control System Components Vol II First ed. 1959.
- S. R. Majumdhar, "Pneumatic Systems", Tata McGraw-Hill Publisher, 2009.

Reference Books:

- Meixner H and Sauer E, "Intro to Electro-Pneumatics", Festo didactic, First ed. 1989.
- Hasebrink J P and Kobler R, "Fundamentals of Pneumatic Control Engineering", FestoDidactic: Esslinger(W Germany),1989.
- Petruzella, "Industrial Electronics", McGraw-Hill International First ed., 1996.

Course Outcomes:

1. Ability to select and use the components for electrical systems
2. Ability to identify, formulate and solve a problem using pneumatic system in instrumentation and control engineering
3. Ability to identify, formulate and solve a problem using hydraulic system in instrumentation and control engineering .

EIEL610 **Optical Instrumentation**

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

Course Objective:-

1. To introduce Ray theory of transmission
2. To introduce Transmission characteristics of optical fiber
3. To introduce Optical sources and detectors and fiber dsensor

Unit 1: Optical fiber waveguide: Ray theory of transmission, total internal reflection, and electromagnetic mode theory of optical propagation, cylindrical fiber, classification of fibers, manufacturing of optical fiber.

Unit 2: Transmission characteristics of optical fiber: Attenuation, material absorption losses, scattering losses, nonlinear and linear scattering, fiber bend loss, dispersion, intermodal dispersion, dispersion modified single mode fiber, dispersion flattened fibers, polarization, nonlinear phenomena.

Unit 3: Optical sources and detectors: Optical emission from semiconductor, semiconductor LASER, non semiconductor LASER, LED as an optical source, optical detector principles, absorption, quantum efficiency, responsively, photo diodes, modulation.

Unit 4: Optical fiber sensors: Introduction to fiber optics sensors, sensors based on intensity modulation, application of optical fiber for displacement, strain, stress and pressure measurement. Active multimode FO sensors, micro-bend optical fiber sensors, current sensors, phase modulated, polarization modulated optical fiber sensors, fiber optic gyroscope.

Unit 5 LASER applications: Introduction, application of LASER in biomedical instrumentation, LASER interferometry, performance parameters, LASER telemeters, measurement of distance, LIDAR, holography: basic principle of holography, measurement of strain, stress, bending moments and vibrations using hologram.

Unit 6 Optical amplification and integrated optics: Optical amplifiers, integrated optics integrated optical devices: beam splitters, directional couplers, modulators, switches, optoelectronics integration and differentiation, analog arithmetic operations, digital optics.

Outcomes:

- Apply LASER and Optical fiber for various physical parameter measurements.
- Analyzing the optical sensor technology on various parameters of measurements.

Text Books:

1 Jose Miguel Lopez, ―Optical fiber sensing technology‖, John Wiley & Sons, 2002
2 AjoyGhatak, ―Optics‖, Tata Mc- Graw Hill Publishing, 5thed., 2012

Reference Book:

1 Joseph T Verdeyen, ―LASER Electronics‖, Prentice Hall of India, 3rded., 2003
2 John M. Senior, ―Optical fiber Communications Principles and Practice‖, PHI publication, 2nded., 2008

EIEL611 **VLSI Design**

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

Course Objectives:-

1. To introduce the students about Evolution of VLSI technology, VLSI Design Flow, Basic MOS Transistor.
2. To introduce the students about electrical properties of MOS
3. To introduce the students about design process of NMOS and CMOS technology, Stick diagrams, Lambda based design rules and layout
4. To introduce the students about MOS transistor switching characteristics
5. To introduce the students about Dynamic Logic Circuits, Scaling of MOS Circuits and Subsystem Design

UNIT I: REVIEW OF MOS TECHNOLOGY

Evolution of VLSI technology, VLSI Design Flow, Basic MOS Transistor: Enhancement and depletion mode, MOS structure, NMOS, PMOS and CMOS fabrication.

UNIT II: ELECTRICAL PROPERTIES OF MOS

Threshold voltage, MOSFET current voltage characteristics, second order effects, MOS inverters: VTC characteristics of NMOS inverter, CMOS inverter and BiCMOS inverter. Noise margins, Latch-up in CMOS circuits.

UNIT III: DESIGN PROCESS

Physical design of simple and complex logic gates using NMOS and CMOS technology, Stick diagrams, NMOS Design Style. CMOS Design Style, Lambda based Design Rules. Layout.

UNIT IV: MOS TRANSISTOR SWITCHING CHARACTERISTICS

Sheet resistance, area capacitance, inverter delay. Switching power dissipation of CMOS inverters.

UNIT V: DYANAMIC LOGIC CIRCUITS

CMOS Logic Structure: Complementary CMOS Logic, Pseudo NMOS Logic, Dynamic CMOS Logic, CMOS Domino Logic, Clocked CMOS Logic, Pass Transistor Logic, CMOS transmission gate Logic

UNIT VI SCALING OF MOS CIRCUITS

Scaling models, scaling factor for device parameters, Advantages and Limitations of scaling.

UNIT VII SUBSYSTEM DESIGN

Architectural issues in VLSI, Design of CMOS parity generator, Multiplexer, n-Bit Comparator, Incrementer/ Decrementer, ALU subsystem.

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

1. Understand about Evolution of VLSI technology, VLSI Design Flow, Basic MOS Transistor
2. Understand about electrical properties of MOS
3. Understand about design process of NMOS and CMOS technology, Stick diagrams, Lambda based design rules and layout
4. Understand about MOS transistor switching characteristics
5. Understand about Dynamic Logic Circuits, Scaling of MOS Circuits and Subsystem Design

TEXT BOOKS:

1. Kang and Leblebici "CMOS Digital integrated circuits" TMH 2003.
2. Pucknell D.A and Eshrachain K. "Basic VLSI Design Systems & circuits"(PHI)
3. Introduction to Digital Circuits: Rabaey (PH)

OE601 **Digital Communication**

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

Course Objectives:

1. To introduce with different type of signals
2. To introduce with digital communication system
3. To introduce with different types of filters

Unit 1: Analog to Digital Conversion: Sampling Theorem, Pulse Amplitude Modulation, Channel bandwidth for PAM signal, Natural sampling, Flat top sampling, quantization of signals, Quantization error, Pulse Code Modulation (PCM), The PCM system, Companding, Multiplexing PCM signals, Differential PCM, Delta Modulation, Adaptive Delta Modulation.

Unit 2: Digital Baseband Transmission: A baseband digital communication system, Digital Data formats, Line coding and its properties,Various PAM formats or line codes, Unipolar RZ and NRZ, Polar RZ and NRZ, Bipolar NRZ, Split Phase Manchaster format, Polar Quanternary NRZ format, The Optimum filter, Matched Filter, Calculation of Probablity of error for matched filter, Intersymbol Interference(ISI), Cause of intersymbol interference, Nyquist's criterion for distortion less baseband binary transmission.

Unit 3: Signal Space Analysis: Concept of Additive White Gaussian Noise (AWGN) Channel, Concept of Optimum Receiver, Geometric representation of signals, Gram – Schmidt Orthogonalisation procedure.

Unit 4: Digital Modulation Techniques: Coherent binary modulation techniques, Coherent binary amplitude shift keying, Binary Phase Shift Keying (BPSK), Coherent Binary Frequency Shift Keying (BFSK), Noncoherent binary modulation, Differential Phase Shift Keying (DPSK), Quadrature Phase Shift Keying (QPSK), Minimum shift Keying (MSK), Calculation of probability of error of BPSK, BFSK, QPSK, Relationship between bit error rate, symbol error rate, Comparison of modulation techniques.

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

1. Understand & analyze of different type of signals
2. Understand Learn the baseband digital communication system
3. Understand the different types of filters

Text Books:

1. Taub and Schilling, "Principal of Communication System",TMH
2. S.Haykin, "Digital communication",Willey Pub.

Reference Books:

1. WayenTomasi, "Electronic Communication System" ,Pearson pub.
2. J.Dass, S.K.Mullick& P.K. Chatterjee, "Principal of Digital Communication" , Willey Eastern Pub

OE602 **Scientific Computing**

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

Course Objective :

- To introduce with the significance of computing methods, their strengths and application areas.
- To give the knowledge of the computations on various data using appropriate computation tools.

Unit 1: Introduction: Sources of Approximations, Data Error and Computational, Truncation Error and Rounding Error, Absolute Error and Relative Error, Sensitivity and Conditioning, Backward Error Analysis, Stability and Accuracy

Unit 2: Computer Arithmetic: Floating Point Numbers, Normalization, Properties of Floating Point System, Rounding, Machine Precision, Subnormal and Gradual Underflow, Exceptional Values, Floating-Point Arithmetic, Cancellation

Unit 3: System of liner equations: Linear Systems, Solving Linear Systems, Gaussian elimination,Pivoting, Gauss-Jordan, Norms and Condition Numbers, Symmetric Positive Definite Systems and Indefinite System, Iterative Methods for Linear Systems

Unit 4: Linear least squares: Data Fitting, Linear Least Squares, Normal Equations Method, Orthogonalization Methods, QR factorization, Gram-Schmidt Orthogonalization, Rank Deficiency, and Column Pivoting

Unit 5: Eigen values and singular values: Eigen values and Eigenvectors, Methods for Computing All Eigen values, Jacobi Method, Methods for Computing Selected Eigenvalues, Singular Values Decomposition, Application of SVD

Unit 6: Nonlinear equations: Fixed Point Iteration, Newton's Method, Inverse Interpolation Method Optimization, One-Dimensional Optimization, Multidimensional Unconstrained Optimization, Nonlinear Least Squares

Unit 7: Interpolation: Purpose for Interpolation, Choice of Interpolating, Function, Polynomial Interpolation, Piecewise Polynomial Interpolation

Unit 8: Numerical Integration And Differentiation: Quadrature Rule, Newton-Cotes Rule, Gaussian Quadrature Rule, Finite Difference Approximation, Initial Value Problems for ODES, Euler's Method, Taylor Series Method, Runga-Kutta Method, Extrapolation Methods, Boundary Value Problems For ODES, Finite Difference Methods, Finite Element Method, Eigenvalue Problems, Partial Differential Equations, Time Dependent Problems, Time Independent Problems, Solution for Sparse Linear Systems, Iterative Methods, Fast Fourier Transform, FFT Algorithm, Limitations, DFT, Fast polynomial Multiplication, Wavelets, Random Numbers And Simulation, Stochastic Simulation, Random Number Generators, Quasi-Random Sequences

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

- Understand the significance of computing methods, their strengths and application areas.
- Perform the computations on various data using appropriate computation tools.

Text/ Reference Books:

1. Heath Michael T., "Scientific Computing: An Introductory Survey" , McGraw-Hill, 2nd Ed., 2002.
2. Press William H., Saul A. Teukolsky, Vetterling William T and Brian P. Flannery, "Numerical Recipes: The Art of Scientific Computing", Cambridge University Press, 3rd Ed., 2007.
3. Xin-she Yang (Ed.)., "Introduction To Computational Mathematics", World Scientific Publishing Co., 2nd Ed., 2008.
4. Kiryanov D. and Kiryanova E., "Computational Science", Infinity Science Press, 1st Ed., 2006.
5. Quarteroni, Alfio, Saleri, Fausto, Gervasio and Paola, "Scientific Computing With MATLAB And Octave", Springer, 3rd Ed., 2010.

OE603 **Soft Computing**

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

UNIT 1: Neural Networks: History, overview of biological Neuro-system, Mathematical Models of Neurons, ANN architecture, Learning rules, Learning Paradigms-Supervised, Unsupervised and reinforcement Learning, ANN training Algorithmsperceptions, Training rules, Delta, Back Propagation Algorithm, Multilayer Perception Model, Hopfield Networks, Associative Memories, Applications of Artificial Neural Networks.

UNIT 2: Fuzzy Logic: Introduction to Fuzzy Logic, Classical and Fuzzy Sets: Overview of Classical Sets, Membership Function, Fuzzy rule generation.

UNIT 3: Operations on Fuzzy Sets: Compliment, Intersections, Unions, Combinations of Operations, Aggregation Operations.

UNIT 4: Fuzzy Arithmetic: Fuzzy Numbers, Linguistic Variables, Arithmetic Operations on Intervals & Numbers, Lattice of Fuzzy Numbers, Fuzzy Equations.

UNIT 5: Fuzzy Logic: Classical Logic, Multivalued Logics, Fuzzy Propositions, Fuzzy Qualifiers, Linguistic Hedges. Uncertainty based Information: Information & Uncertainty, Nonspecificity of Fuzzy & Crisp Sets, Fuzziness of Fuzzy Sets. Genetic Algorithms, Scope & application areas, solution of 0-1Knapsack problem using GA

References:

1. Fuzzy sets and Fuzzy Logic: Theory and applications‖,G.J. Klir,B.Yuan, PHI
2. Introduction to Fuzzy sets and Fuzzy Logic‖, M.Ganesh , PHI
3. An Introduction to Fuzzy Control‖, D Driankov, H Hellendoorn, M Reinfrank, Narosa Publishing Company
4. Neural Networks: A classroom approach‖, Satish Kumar , Tata McGraw Hill
5. Haykin S., ―Neural Networks-A Comprehensive Foundations‖, Prentice-Hall International, New Jersey, 1999.

OE604 **Industrial Economics**

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

Course Objects:

- The candidates are expected to understand the process of industrialization as a part of rapid economic development.
- Excepting a few references to the theoretical background the study aims at the analysis of the performance of the industrial economy of India on the backdrop of the contemporary development.

Syllabus

Unit 1: Industrial economics - Meaning, scope, need and significance of the study, Industrial Structure - private sector, large, medium and small scale industries, cottage industries, role, problems and future of public sector industries, Industrial Combinations- causes, mergers and amalgamations, industrial monopoly control of monopolies

Unit 2: Factors influencing location of industries, Theories of Industrial location, Weber, Sargent Florence, Need for balanced regional development of industries.- role of SIDC's

Unit 3: Industrial Productivity- norms and measurement, Factors affecting productivity and capacity utilization, Importance of productivity in the competitive environment Measures required for improving productivity and efficiency, Trends in India's industrial employment- Measures of generating industrial employment.

Unit 4: Meaning, scope, importance of industrial finance, Sources of industrial finance- private, public and cooperative sector, shares, debentures, bonds, deposits, loans etc., Foreign capital- need, government's policy, direct investment, foreign institutional investment, form of foreign Capital : Euro issues, GDR, ADR, External commercial borrowings

Unit 5: Industrial policy: Trends in industrial growth since 1991, Performance and problems of Micro, Small, Medium Enterprises, Role of MNC's in India, Problems of regional imbalance and industrial growth in India

EIEL701 **Embedded Systems**

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

Syllabus

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.

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.

EIEL702

PLC and SCADA

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

Course Objectives:

- To learn Programmable Logic Controller basics.
- To learn Fundamentals of logic.
- To learn Types of Timers
- To learn PLC And Electrical Safety
- To learn Need, Concept and Basic Features of SCADA

PLC and I/O processing: Programmable Logic Controller basics, overview of PLC systems – Architecture of PLC, Principle of Operation, input/output **Unit**s – power supplies and isolators, current sinking and current sourcing, types of PLC memory, fundamental PLC wiring diagram, relays ,switches, transducers, sensors –seal-in circuits.Input/output units Signal conditioning Remote connections Networks Processing inputs I/O addresses

Programming of PLC:

Fundamentals of logic, program scan, PLC programming languages, Ladder and functional block programming: Ladder diagrams,Ladder Diagram Instruction,Logic functions, Latching, Multiple outputs, Entering programs, Functional Blocks,Boolean Mnemonics,English like statements: relay logic Operations, latch and unlatch outputs, branch function, timers and counter operations– Arithmetic operations – Data Transfer and Manipulation Operations, flow control Operations – requirement of communication networks for PLC – connecting PLC to computer, Applications.

IL, SFC AND ST Programming Methods:

Instruction Lists:Instructions, Operators, Functions and function blocks, Sequential Function Charts: Introduction, Elements of sequential function chart, Transitions, Steps Structured Text: Expressions, Statements, Selection statements,Iteration statements.

Jump and Call, Timer and Counter

Jump, Subroutines Problems, Types of timers, Programming timers, Off-delay timers, Pulse timers, Forms of counter Programming, Up and down counting, Timers with counters, Sequencer Programming examples.

PLC And Electrical Safety: Need and Considerations Associated With PLC Safety, Electrical Shock, Electrical Properties Associated With PLCs, Grounding of PLCS and PLC Systems, Static Electrical Discharges, Personal Protective Equipment (PPE)

SCADA – Need, Concept and Basic Features of SCADA, Hardware and Software (Specification & Configuration), requirements for SCADA, Basics of Power & Control circuits, Identification of Control Inputs & Outputs for a System, Elements of SCADA system, applications: channel scanning, polling, Interrupt scanning, Distributed SCADA, Remote Terminal Unit (RTU) – discrete control – analog control – master terminal unit – (MTU) – operator interface, Networked Computing Issues,Telecommunications Services and Link Protocols, Types of SCADA Networks

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

- Understand Programmable Logic Controller basics.
- Understand Fundamentals of logic.
- Understand Types of Timers
- Understand PLC And Electrical Safety
- Understand Need, Concept and Basic Features of SCADA

Text Books:

1. W. Bolton, “Programmable Logic Controllers”, Fourth Edition,ELSEVIER, 2006.
2. FestoDidactic , “Programmable Logic Controllers Basic Level”Festo Text Book, 2002.
3. SCADA overview

EIEL703 **Instrumentation & System Design**

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

Course Objective:

- To learn the requirement of Instrument and systems.
- To learn Design various electronic circuits ,noises identification and appropriate elimination methods related to instrument and system.
- To learn and Select, design appropriate enclosure, cables, PCB.
- To learn the Estimate, analyze, improve the reliability of instrument and system.

Unit 1: Basic Concept of Instrumentation Design, Needs Analysis: with respect to systems deployed in; Medical, Industrial, Test and Measurement, Home Appliances, Military Functional requirements & Specifications, Impact on the design due to adverse Electrical, Thermal and Mechanical Operational Environments

Unit 2: Noise Sources, Electrical, Magnetic, RF, Static, Ground Loops, Shielding, near and far field, shielding effectiveness, absorption and reflection loss, shielding with magnetic material, contact protection, glow and arc discharges, loads with high inrush current, Inductive and resistive load contact protection networks for inductive loads, intrinsic noise sources

Unit 3: ESD, inductive charging human body model, ESD protection in equipment, software in ESD protection ,Sensitive devices, input filters, clamping suppressors

Unit 4: Electronic design guideline Noise in electronic circuits. Capacitive and inductive coupling IE - 09012 Instrument and System Design and effect of shield, shielding to prevent magnetic radiation, co-axial and twisted pair cable, grounding, safety ground, signal ground, single and multi point ground, Hybrid ground, grounding of cables shields, Ground loops and low frequency and high frequency analysis of common mode signals, guard shields

Unit 5: Enclosure Design Guidelines. NEMA, DIN, BSI, ANSI standards Index protection (IP), cable design guidelines; Printed circuit board design guideline, layout scheme, grid systems, PCB size, Design rules for digital circuits, and Design rules for analog circuits, single and multilayer PCB, CE / Underwrites Laboratories (UL) Compliance

Unit 6: Reliability, bath tub curve, Reliability for series parallel system, MTTF, MTTR, MTBF, availability, Redundancy and stand by systems.

Course Outcomes:

- Analyze the requirement of Instrument and systems.
- Design various electronic circuits ,noises identification and appropriate elimination methods related to instrument and system.
- Select, design appropriate enclosure, cables, PCB.
- Estimate, analyze, improve the reliability of instrument and system.

Text Books:

1. Henry OTT, “Noise reduction Techniques in Electronics Circuit”, Wiley International, Second ed., 2009.

Reference Book:

1. Balguruswamy, “Reliability Engineering”, TATA McGraw-hill Publication, Third ed., 2005
2. Walter C. Bosshart, “Printed Circuit Board”, Tata McGraw-Hill publication, Third ed., 2009.

EIEL704 **Introduction to 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 **Unit**s, 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 2: 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.

EIEL705 **Fuzzy Control System**

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

Course Objectives:

i. To provide basic knowledge of the Fuzzy control.
ii. To give the mathematical operations of fuzzy sets &fuzzy relations
iii. To explain FKBC architecture.

UNIT 1: INTRODUCTION: Fuzzy control from an industrial perspective, knowledge based controllers, knowledge representation in KBC's.

UNIT 2: THE MATHEMATICS OF FUZZY CONTROL:Vagueness, fuzzy logic v/s probability theory, fuzzy sets, their properties and operations on fuzzy sets, fuzzy relations and operations on fuzzy relations, the Extension principle, fuzzy propositions, the compositional rule of inference, different implications, representing a set of rules

UNIT 3: FKBC DESIGN PARAMETERS: The PKBC architecture, choice of variables and content of rules, derivation of rules, choice of membership functions, choice of scaling factors, choice of fuzzification procedure, choice of defuzzification procedure, comparison and evaluation of defuzzification methods.

UNIT 4: NON LINEAR FUZZY CONTROL: The control problem, the FKBC as a non-linear transfer element, types of FKBC such as PID-like FKBC, sliding mode FKBC, SUGENO FKBC.

UNIT 5: ADAPTIVE FUZZY CONTROL : Design and performance evaluation, approaches to design such as membership function tuning using gradient descent, membership function tuning using performance criteria, the self organizing controller, model based controller.

UNIT 6: STABILITY OF FUZZY CONTROL SYSTEMS: The state approach, stability and robustness indices, input output stability, circle criterion, the iconicity criterion.

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

i. Understand the basic knowledge of the Fuzzy control and its advantages
ii. Understand the mathematical operations of fuzzy sets &fuzzy relations
iii. Understand FKBC architecture,
iv. Understand various approaches for adaptive fuzzy control design & performance evaluation.

TEXTBOOK

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

REFERENCE BOOKS

1. Fuzzy Control Systems; Abraham Kandel and Gideon Imngholz; Narosa

EIEL706 **Artificial Intelligence and Expert System**

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

Course Objectives:-

1. To make the students familiar with Expert system and their features
2. To introduce the Problem areas addressed by Expert System
3. To introduce the organization of Expert Systems.
4. To introduce the design and architectures of Expert Systems

Unit I: Introduction to Expert System: What are Expert Systems, Features of Expert System, features of good Expert System, Types of applications of Expert Systems; relationship of Expert Systems to Artificial Intelligence and to Knowledge-Based Systems. Problem areas addressed by ES, ES success factors. Role of human in Expert System, Expert System organization.

Unit II: Expert system development life: cycle Difference between expert system and conventional program, Basic activities of expert system and the areas in which they solve problems. Expert system development life cycle: Problem selection, Prototype construction, Formalization, Implementation, Evaluation.

Unit III: Expert System Tools: Knowledge representation in expert systems-using rules semantic nets, frames, Types of tools available for expert system building and how they are used, Stages in the development of expert system tools, Examples of knowledge engineering.

Unit IV: Building an Expert Systems: Necessary requirements for expert systems development, Task in building expert systems, Stages of expert system development, Examples of the expert system building process, Examples of expert system used in different areas, Architecture of Rule based Expert system, Non Rule based Expert system.

Unit V: Types of Expert System : An analysis of some classic expert systems, Limitations of first generation expert systems, Deep expert systems, Co-operating expert system, Neural Expert System, Fuzzy Expert System, Real Time Expert Systems, Applications of Expert System.

Course Outcomes: Upon successful completion of the course, the student will be able to understand:

1. The applications of Expert Systems and their relation with AI.
2. Expert system development life.
3. Necessary requirements for expert systems development
4. Types of Expert System.

Text/References Books

1. David W. Rolston: Principles of Artificial Intelligence and Expert System Development, McGraw Hill Book Company.
2. Peter Jackson: Introduction To Expert Systems, Addison WesleyElaine Rich and Kevin Knight: Artificial Intelligence and Expert Systems, McGraw Hill Book Company.
3. Elias M. Awad : Building Expert Systems, principles, procedures, and applications, west publishing co.1996.
4. Dan W. Patterson: Introduction to Artificial Intelligence and Expert Systems, Prentice Hall (April 1, 1990)

EIEL707	**Micro/Nano Devices and Sensors**		
L T P CR	**Theory**	**:**	**75**
3 0 0 3	**Class Work**	**:**	**25**
	Total	**:**	**100**
	Duration of Exam	**:**	**3 Hrs.**

Course Objective:-

- To learn Nanotechnology and MEMS
- To learn MEMS types and their applications
- To learn Magnetic MEMS and Bio MEMS
- To learn Nanosensors and Nanotechnology enabled devices

MEMS Technology: Introduction Nanotechnology and MEMS, MEMS design and fabrication technology, Lithography, Etching, MEMS material, Bulk micromachining, Surface micromachining, Microactuator, Electrostatic actuation , Microfluidics.

MEMS types and their applications: Mechanical MEMS: Strain and pressure sensors, Accelerometers etc., Electromagnetic MEMS – Micromotors, Wireless and GPS MEMS etc.

Magnetic MEMS: Hall effect sensors, SQUID magnetometers, Optical MEMS: Micromachined fiber optic component, Optical sensors, Thermal MEMS: Thermomechanical and thermo−electrical actuators, Peltier heat pumps.

Bio MEMS: Introduction to Bio-MEMS, Introduction to Cell Electrophysiology, Silicon Microfabrication, Microfluidics and Bio-MEMS applications. MEMS for Drug delivery.

Nano Sensors: Introduction to sensors. Characteristics and terminology - static and dynamic characteristics.Micro and nano-sensors, Fundamentals of sensors, biosensor, micro fluids, Packaging and characterization of sensors, Sensors for aerospace and defense. Organic and inorganic nanosensors.

Nano-Technology enabled devices: Nanomaterials and nanostructured films, Nanoscale electronic and ionic transport. Sensor for bio-medical applications. Bioelectronics, Nanoparticle-biomaterial hybrid systems for sensing applications. Gas sensor.

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

- Understand Nanotechnology and MEMS
- Understand MEMS types and their applications
- Understand Magnetic MEMS and Bio MEMS
- Understand Nanosensors and Nanotechnology enabled devices

Recommended Books

1. Gardner, J. W., Microsensors, Principles and Applications, John Wiley (2008).
2. Gregory T. Korvacs, Micromachined Transducer sourcebook, McGraw Hill (1998).
3. Turner, A.P.F., and Wilson, G.S., Biosensors−Fundamentals and applications, Oxford University Press (2005).
4. William T., Micromechanics and MEMS, IEEE Press (1997).

EIEL708	**Digital Image & Video Processing**		
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 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.

EIEL709 **Non Linear Control System**

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

Course Objectives:-

i. To introduce the students regarding Non linear components .
ii. To introduce the describing function analysis of non linear control system.
iii. To introduce the students regarding phase plane analysis of linear control system & non linear control system.
iv. To introduce the students about the methods of stability of linear systems & non linear systems

UNIT 1: INTRODUCTION:

Non linear components such as dead band, backlash, relay, saturation. Difficulties in non-linear modeling and control.

UNIT 2: PHASE LINE ANALYSIS:

Phase portraits of second order systems, method of isoclines, phase portrait of second order system with non linearities, limit cycles, singular points.

UNIT 3: DESCRIBING FUNCTION ANALYSIS:

Definition, limitations, use of DF for stability analysis, DF of ideal relay, relay with hysteresis, dead zone, saturation, Coulomb friction, backlash etc.

UNIT 4: LYAPUNOV STABILITY ANALYSIS:

Introduction, basic concepts, stability definitions, stability theorems, Lyapunov function for non-linear systems and linear systems. Model reference adaptive system, discrete time system.

UNIT 5: Non Linear Control Structures: Introduction to feedback linearization, MRAC, Self Tuning control and Sliding Mode Control.

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

i. Differentiate between Linear and Nonlinear system
ii. Various methods for analyzing the structure and behaviour of nonlinear feedback systems.
iii. Model and analyse a system in state space.
iv. Analyse the stability using Lyapunov design methods and feedback

TEXTBOOKS:

1. Control System Engg. (Third edition): I.J. Nagrath and M. Gopal; New Age International

REFERENCE BOOKS:

1. Control Systems Principles and Designs (second edition): M. Gopal; TMH
2. Digital Control and State Variable Methods: M. Gopal ; TMH

EIEL710 **Batch 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 with standards used for Batch process control.
- To learn the Development of control schemes for different batch process P&IDs.

Unit 1: **Introduction:** Introduction to batch control system, batch control system terminology, characteristics of batch processes, hierarchical batch model, control structure for batch systems.

Unit 2: S88 standard: Role of standards in batch control systems, study of international standards and practices such as S88, S 95, USA FDA regulation, 21CFR 11, etc.

Unit 3: Control of batch Process: General control requirements, safety interlocking, regulatory & discrete controls, sequential control of batch processes, control activities and process management, information handling for a batch process.

Unit 4: Design of batch control systems: Batch management, recipe management, and production scheduling & information management. batch control system design, system requirements, system hardware/reliability requirement.

Unit 5: Specifications and data management: Batch control system specifications and implementation, Information/display requirements, cost justification and benefits, data management.

Unit 6: Implementation & case studies: Generic implementation of batch processes, case study of batch control system implementation for applications in food and beverages, pharmaceuticals etc.

Course Outcomes:

- Acquired knowledge of standards used for Batch process control.
- Development of control schemes for different batch process P&IDs.

Text Books:

1 Thomas .G. Fisher William M. Hawkins, ―Batch Control Systems‖, ISA series, 1 st ed., 2008

2 Thomas .G. Fisher William M. Hawkins, ―Batch Control Systems‖, ISA series, 2nd ed., 2012.

EIEL711 **Stochastic Control**

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

Course Objectives:

i. To introduce the students to Stochastic Processes & limitation of deterministic control and processes.
ii. To introduce the students for various types of probabilities.
iii. To introduce the students for various types of random variables.
iv. To introduce the students to mean, variance, moments & conditional statistics.

UNIT 1: Probability : Set definitions and set operations, Axioms of probability Joint and conditional probability , Independent events Combined experiments Bernoulli trials , total probability and Bayes Theorem

UNIT 2: Random Variables The random variable ,concept CDF, PDF Some Important r.v.'s, Conditional distribution and density functions, Expectation ,Moments, Characteristic function, random process of one random variable Properties of joint distribution and joint density, Conditional distribution , Expected value of a function of r. v.'s , Joint characteristic functions

UNIT3: Random Processes – Concept of a random process, Stationarity and independence, Correlation functions and their properties Gaussian random process Poisson random process, Power Spectral Density and its properties ,Relationship between PSD and autocorrelation function

UNIT4: Estimation: Introduction, development of parameter estimators, estimation of stochastic processes, applications. Least –square estimation. Linear least squares problem, generalized least square problem. Sequential least squares, non-linear least squares theory.

UNIT 5: Characteristics of estimators: Sufficient statistics, Good estimators. Analysis of estimation errors. Mean square and minimum variance estimators.

UNIT 6: Maximum a posteriori and maximum likelihood estimators. Numerical solution of least –Maximum a posteriori and maximum likelihood estimators. Numerical solution of least – squares and maximum likelihood estimation problems. Sequential estimators

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.
• Understand and solve the problems by applying Asymptotic theorems, poison theorems & Bay's theorems
• Understand the random variables & solve the problems of mean, variance, moments and stationary process.
• Understand Bay's theorem, correlation & spectra.

TEXT BOOKS:

1. Childers, Probability and random processes, The McGraw-Hill companies Inc., 1997.
2. Harold W. Sorenson, Parameter Estimation, Principles and Problems, Marcel Dekker Inc., 1980.

EIEL712 **Electromagnetic compatibility for Instruments**

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

Course Objectives:

i. To learn the electromagnetic compatibility phenomena
ii. To know the electromagnetic compatibility in an installation
iii. To know various (EMC) standards, facilities and tests

Unit 1: Understanding electromagnetic compatibility phenomena:

Electromagnetic compatibility of a system: Electromagnetic compatibility: (EMC), Field of application
Types of electromagnetic interference: Definition of an electromagnetic disturbance, Origin of emitted electromagnetic interference , Low-frequency (LF) interference, High-frequency (HF) interference Harmonics , Transients , Electrostatic discharges (ESD) , LV mains interference
Sources of electromagnetic interference : Switching of inductive loads by dry contacts, Switching of inductive loads by semiconductors, Electric motors Fluorescent lighting , Spot welding, Spectral distribution of interference
Transmission modes of electromagnetic interference: Coupling - General information, Conductive coupling Coupling by radiation , Decoupling of interference
Earth: General definition, Roles of earth connection in electrical installations,Electrical earth connections, Typical earthing arrangement for an installation,Earth and electromagnetic compatibility.
Frame connections: General definition,Specific definition for electrical installations, Exposed conductive parts and safety of persons and property, Exposed conductive parts and electromagnetic compatibility, Loops between exposed conductive parts, Frame connection loops,, Avoid earthing exposed conductive parts in a star configuration)
Cables : Frequency behaviour of a conductor, Length and cross-sectional area of a conductor, Antenna effect of a conductor, Green/yellow PE/PEN conductor, Interconnection of exposed conductive parts.
Filters: Function of a filter, Various filter types
Ferrite cores
Unit 2: Obtaining electromagnetic compatibility in an installation:
The (EMC) procedure : Designing a new installation or extending an installation, Maintaining or upgrading an installation - Updating installed equipment, Improving an existing installation
Earthing system: Introduction, Building, Equipment/machine, Cabinet, Electrical connections, Daisychained interconnection of exposed conductive parts
Power supply: Analysis, Technical specifications, Isolation by transformer, Earthing arrangements,
Earthing arrangements: (EMC) performance, Distribution in the installation, Earthing of transformer screens
Cabinet: Analysis,Earth reference plane, Cable entrances , Routing of cables, Lighting, Layout of components
*Cables :*Classes of signals, Choice of cables, Performance of cables in terms of (EMC))
*Cable runs:*Cable troughs, Connection to cabinets, Positioning of cables, Connection of ends, Methods of cable laying not recommended ,Recommended methods of cable laying.
Connections: Type and length of connections, Making a connection, Pitfalls to avoid, Connection of shielding)
Filters : Layout in cabinet, Mounting of filters, Connection of filters
Surge arresters: Surge arresters or coil interference suppression **Unit**s: choice
Ferrite cores

Unit 3: (EMC) standards, facilities and tests
Standards: Introduction, There are 3 types of (EMC) standards, Standardising bodies, EMC facilities and tests

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

i. Understand the electromagnetic compatibility phenomena
ii. Understand the electromagnetic compatibility in an installation
iii. Understand various (EMC) standards, facilities and tests

Text Book:

1. Electromagnetic Compatibility by Merlin Gerin , Square D , Telemecanique Publication: Gropu Shneider

OE701 **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

OE702 **Banking System and Taxation**

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

Objective:
To impart the knowledge about the banks and its role, financial inclusion and contemporary issues in banking, It will also provide an overview of taxation, it will to acquaint the participant with the implications of tax structure and corporate tax planning in operational as well as strategic terms.

Unit I : Banking industry: Meaning, evolution, types, role, and overview ; Priority sector lending: targets, issues problems; Financial inclusion: Agriculture/SMEs/SHGs/SSI .; new products and services, credit cards/Home loans/Personal loans ancillary Services, Remittances safe deposit lockers

Unit II: Contemporary issues in banking: NPA, E banking, universal banking, Electronic products, Electronic payment system, Electronic fund transfer system: RTGS,NEFT, SWIFT etc. current trends and global developments.

Unit-III: Basic Concepts of Income Tax; Computation of Income under Different Heads of Income, Set off and Carry forward of Losses, Deductions and Exemptions; Additional Tax on Undistributed Profits.

Unit-IV: Meaning and Scope of Tax Planning, Difference between Tax planning Tax Evasion and Tax Avoidance. Filling of Returns and Assessments, Penalities and Porsecutions, Appeals and Revisions.

Course Outcome:

- The course creates understanding among the students regarding the concept of taxation, different heads of income.
- The students will understand the difference between tax evasion and avoidance.
- The students will be able to have a clear view of current scenario of banking Industry.
- The beneficiaries will have a view about contemporary issues in banking.

Reference Books:

1. Principles and practices of banking by Indian institute if Banking and finance, Macmillan Publication
2. Singhania, V K. and Singhania, Monica, Students’ Guide to Income Tax, Taxmann.
3. Shekhar, K.C. and Shekhar, Lekshmy**,** Banking Theories and practices, Vikas Publication
4. Money, Banking and international Trade, KPM Sundram, Sultan Chand and sons
5. Financial Intermediation, Indian Institute of Banking and Finance
6. Insurance and Banking , Gupta P.K. Himalaya Publications
7. Iyengar, A C. Sampat, Law of Income Tax, Bharat House.
8. Ahuja, G & Gupta, Ravi, Simplified Approach to Corporate Tax Planning and Management, Bharat Law House private limited

OE703 **Operational Research**

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 Different types of o.r. models.
- To introduce the students about Linear Programming problem-Formulation and graphical solution.
- To introduce the students about Dual simplex method. Sensitivity analysis.
- To introduce the students about Network minimisation, shortest route problem, Maximum flow problem and project of scheduling by PERT, CPM.
- To introduce the students about Critical path calculations.
- To introduce the students about Dynamic Programmingand examples of D.P.models.

Syllabus

Unit 1: Different types of o.r. models, their construction and general methods of solution. Linear Programming problem-Formulation and graphical solution. The standard form of the L.P.model. The simplex method, The dual of L.P.P, Primal-dual relationship, Dual simplex method, Sensitivity analysis, Transportation problem, its solution and applications, The assignment model, Travelling salesman problem.

Unit 2: Network minimization, Shortest route problem, Maximum flow problem, Project of scheduling by PERT, CPM.

Unit 3: Critical path calculations, Construction of the time chart and resource leveling, Integer programming-examples, method of and algorithms, cutting plane algorithm only.

Unit 4: Dynamic Programming, Examples of D.P.models, Bellman‘s Principle of optimality and method of recursive optimization, simple problems only involving upto one constraint.

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

- Understand about Different types of o.r. models, LP model and Dual Simplex Method
- Understand about Network minimization, shortest route problem, Maximum flow problem and project of scheduling by PERT, CPM
- Understand about Critical path calculations
- Understand about Dynamic Programmingand examples of D.P.models

TEXT BOOKS:

1. Taha H.A Operations Research-An Introduction, PHI
2. Wanger H.M, Principles of Operation Research, PHI

OE704	**Human Resource Management**		
L T P CR	**Theory**	**:**	**75**
3 0 0 3	**Class Work**	**:**	**25**
	Total	**:**	**100**
	Duration of Exam	**:**	**3 Hrs.**

Course Objective:
The primary concern of this course is to sensitize students to the various facts of managing people and to create an understanding of the various policies and practices of human resource management. Detailed contents:

Unit 1: Human Resource Management: concept, evolution and scope; Strategic objectives of HR management; Roles, responsibilities and competencies of HR manager; Challenges to HR professionals;Human Resource Planning & Forecasting: significance and process; Human Resource Information System.

Unit 2: Sourcing and Recruitment; Selection: process, Placement; Induction and Socialization.Job Analysis: job Description and job Specification; Job Design: approaches and methods;Job Evaluation-concept &methods;Performance Management System: appraisal and counselling.

Unit 3: Training process, training need analysis (TNA): training methods and techniques; Designing Training programs; Training evaluation; Career planning and Development; Potential Appraisal and Succession planning; Employee Compensation: basic concepts & determinants; New trends in compensation management.

Unit 4: Industrial Relations and Grievance Handling: Employee welfare; Dispute Resolution; International Human Resource Management; Contemporary Issues in HRM: knowledge Management, HR Audit &Accounting, HR in virtual organizations, ethics &corporate social responsibility. Course Outcome: a. The course will help to understand the basics of HRM with roles and responsibilities of a HR manager. b. This course enables the students to meet HR challenges in present scenario c. It will facilitate them in employing, maintaining and promoting a motivated force in an organization. d. Students will be aware about contemporary issues of human resource management.

TEXT/REFERENCE BOOKS

1. K. Aswathapa, “Human resource Management: Text and cases”, 6th edition, Tata McGraw Hill, New Delhi.
2. Uday Kumar Haldar & Juthika Sarkar, “Human resource Management”, New Delhi, Oxford University Press.
3. De Cenvo, Da & Robbins S.P., “Fundamentals of Human Resource Management”, 9th edition, New York, John Wiley & Sons.
4. Gary Dessler, “Human Resource Management”, 11th edition New Delhi: Pearson Prentice Hall.
5. TanujaAgarwala, “Strategic Human resource Management”, Oxford University Press

OE705 **Mobile Communication and Networks**

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

Course Objectives:

- To introduce working principles of mobile communication system.
- To introduce various technologies of mobile communication.
- To introduce various analysis techniques of communication systems.
- To introduce various multiple access techniques for mobile communication.

Syllabus

Unit 1: Cellular concepts: Cell structure, frequency reuse, cell splitting, channel assignment, handoff, interference, capacity, power control, Wireless Standards, Overview of 2G and 3G cellular standards.

Unit 2: Signal propagation: Propagation mechanism, reflection, refraction, diffraction and scattering, large scale signal propagation and lognormal shadowing. Fading channels-Multipath and small scale fading, Doppler shift, statistical multipath channel models, narrowband and wideband fading models, power delay profile, average and rms delay spread, coherence bandwidth and coherence time, flat and frequency selective fading, slow and fast fading, average fade duration and level crossing rate.

Unit 3: Capacity of flat and frequency selective channels. Antennas: Antennas for mobile terminal monopole antennas, PIFA, base station antennas and arrays.

Unit 4: Multiple access schemes: FDMA, TDMA, CDMA and SDMA, Modulation schemes, BPSK, QPSK and variants, QAM, MSK and GMSK, multicarrier modulation, OFDM.

Unit 5: Receiver structure: Diversity receivers, selection and MRC receivers, RAKE receiver, equalization, linear-ZFE and adaptive, DFE, Transmit diversity-Altamonte scheme.

Unit 6: MIMO and space time signal processing, spatial multiplexing, diversity/multiplexing tradeoff, Performance measures, Outage, average snr, average symbol/bit error rate. System examples, GSM, EDGE, GPRS, IS-95, CDMA 2000 and WCDMA.

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

- Understand the working principles of the mobile communication systems.
- Understand the relation between the user features and underlying technology.
- Analyze mobile communication systems for improved performance.
- Understand various multiple access techniques.

Text/Reference Books:

1. WCY Lee, Mobile Cellular Telecommunications Systems, McGraw Hill, 1990.
2. WCY Lee, Mobile Communications Design Fundamentals, Prentice Hall, 1993.
3. Raymond Steele, Mobile Radio Communications, IEEE Press, New York, 1992.
4. AJ Viterbi, CDMA: Principles of Spread Spectrum Communications, Addison Wesley, 1995.
5. VK Garg &JE Wilkes, Wireless & Personal Communication Systems, Prentice Hall, 1996.

OE706 **Wireless Sensor Networks**

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

Course Objectives:

- To introduce designing of wireless sensor network applications.
- To introduce various research areas in wireless sensor networks.
- To introduce various MAC protocol used in WSN.
- To teach students how to explore new protocols for WSN.

Syllabus

Unit 1: Introduction to Sensor Networks, unique constraints and challenges, Advantage of Sensor Networks, Applications of Sensor Networks, Types of wireless sensor networks.

Unit 2: Mobile Ad-hoc Networks (MANETs) and Wireless Sensor Networks, Enabling technologies for Wireless Sensor Networks. Issues and challenges in wireless sensor networks.

Unit 3: Routing protocols, MAC protocols: Classification of MAC Protocols, S-MAC Protocol, B-MAC protocol, IEEE 802.15.4 standard and ZigBee.

Unit 4: Dissemination protocol for large sensor network, Data dissemination, data gathering, and data fusion; Quality of a sensor network; Real-time traffic support and security protocols.

Unit 5: Design Principles for WSNs, Gateway Concepts Need for gateway, WSN to Internet Communication, and Internet to WSN Communication.

Unit 6: Single-node architecture, Hardware components & design constraints,

Unit 7: Operating systems and execution environments, introduction to TinyOS and nesC.

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

- Design wireless sensor networks for a given application
- Understand emerging research areas in the field of sensor networks
- Understand MAC protocols used for different communication standards used in WSN
- Explore new protocols for WSN

Text/Reference Books:

1. Waltenegus Dargie , Christian Poellabauer, “Fundamentals Of Wireless Sensor Networks Theory And Practice”, By John Wiley & Sons Publications ,2011
2. Sabrie Soloman, “Sensors Handbook" by McGraw Hill publication. 2009
3. Feng Zhao, Leonidas Guibas, “Wireless Sensor Networks”, Elsevier Publications,2004
4. Kazem Sohrby, Daniel Minoli, “Wireless Sensor Networks”: Technology, Protocols and Applications, Wiley-Inter science
5. Philip Levis, And David Gay "TinyOS Programming” by Cambridge University Press 2009

OE707 **Industrial Safety**

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

Course Objective:

i. This course will provide effective use of chemical industries utilities.
ii. This course also emphasis on the knowledge of loss prevention, personal safety, industrial safety, hazard analysis, toxicology and personal proactive equipments.

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.

Course Outcomes:-

i. Understanding of Safety principles.
ii. Ability to do Hazard analysis.
iii. Ability to do event tree and fault tree analysis.

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.

OEL708	**Cyber Laws and Security**		
L T P CR	**Theory**	**:**	**75**
3 0 0 3	**Class Work**	**:**	**25**
	Total	**:**	**100**
	Duration of Exam	**:**	**3 Hrs.**

Unit 1: History of Information Systems and its Importance, basics, Changing Nature of Information Systems, Need of Distributed Information Systems, Role of Internet and Web Services, Information System Threats and attacks, Classification of Threats and Assessing Damages Security in Mobile and Wireless Computing- Security Challenges in Mobile Devices, authentication Service Security, Security Implication for organizations, Laptops Security Basic Principles of Information Security, Confidentiality, Integrity Availability and other terms in Information Security, Information Classification and their Roles.

Unit 2: Security Threats to E Commerce, Virtual Organization, Business Transactions on Web, E Governance and EDI, Concepts in Electronics payment systems, E Cash, Credit/Debit Cards. Physical Security- Needs, Disaster and Controls, Basic Tenets of Physical Security and Physical Entry Controls, Access Control- Biometrics, Factors in Biometrics Systems, Benefits, Criteria for selection of biometrics, Design Issues in Biometric Systems, Interoperability Issues, Economic and Social Aspects, Legal Challenges.

Unit 3: Model of Cryptographic Systems, Issues in Documents Security, System of Keys, Public Key Cryptography, Digital Signature, Requirement of Digital Signature System, Finger Prints, Firewalls, Design and Implementation Issues, Policies Network Security- Basic Concepts, Dimensions, Perimeter for Network Protection, Network Attacks, Need of Intrusion Monitoring and Detection, Intrusion Detection Virtual Private Networks- Need, Use of Tunneling with VPN, Authentication Mechanisms, Types of VPNs and their Usage, Security Concerns in VPN.

Unit 4: Security metrics- Classification and their benefits Information Security & Law, IPR, Patent Law, Copyright Law, Legal Issues in Data mIning Security, Building Security into Software Life Cycle Ethics- Ethical Issues, Issues in Data and Software Privacy Cyber Crime Types & overview of Cyber Crimes.

References:

1. Godbole,― Information Systems Security‖, Willey
2. Merkov, Breithaupt, ― Information Security‖, Pearson Education
3. Yadav, ―Foundations of Information Technology‖, New Age, Delhi
4. Schou, Shoemaker, ― Information Assurance for the Enterprise‖, Tata McGraw Hill Sood,―Cyber Laws Simplified‖, Mc Graw Hill
5. Furnell, ―Computer Insecurity‖, Springer 7. IT Act 2000

HSMC01 **Effective Technical Communication**

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

Unit 1: Module 1: Information Design and Development- Different kinds of technical documents, Information development life cycle, Organization structures, factors affecting information and document design, Strategies for organization, Information design and writing for print and for online media.

Unit 2: Module 2: Technical Writing, Grammar and Editing, Technical writing process, forms of discourse, Writing drafts and revising, Collaborative writing, creating indexes, technical writing style and language. Basics of grammar, study of advanced grammar, editing strategies to achieve appropriate technical style. Introduction to advanced technical communication, Usability, Hunan factors, Managing technical communication projects, time estimation, Single sourcing, Localization.

Unit 3: Module 3: Self Development and Assessment: Self assessment, Awareness, Perception and Attitudes, Values and belief, Personal goal setting, career planning, Self-esteem, Managing Time, Personal memory, Rapid reading, Taking notes, Complex problem solving, Creativity

Unit 4: Module 4: Communication and Technical Writing- Public speaking, Group discussion, Oral; presentation, Interviews, Graphic presentation, Presentation aids, Personality Development. Writing reports, project proposals, brochures, newsletters, technical articles, manuals, official notes, business letters, memos, progress reports, minutes of meetings, event report.

Unit 5: Module 5: Ethics- Business ethics, Etiquettes in social and office settings, Email etiquettes, Telephone Etiquettes, Engineering ethics, Managing time, Role and responsibility of engineer, Work culture in jobs, Personal memory, Rapid reading, Taking notes, Complex problem solving, Creativity.

Text/Reference Books:

1. David F. Beer and David McMurrey, Guide to writing as an Engineer, John Willey. New York, 2004.
2. Diane Hacker, Pocket Style Manual, Bedford Publication, New York, 2003. (ISBN 0312406843).
3. Shiv Khera, You Can Win, Macmillan Books, New York, 2003.
4. Raman Sharma, Technical Communications, Oxford Publication, London, 2004.
5. Dale Jungk, Applied Writing for Technicians, McGraw Hill, New York, 2004. (ISBN: 07828357-4).
6. Sharma, R. and Mohan, K. Business Correspondence and Report Writing, TMH New Delhi 2002.
7. Xebec, Presentation Book, TMH New Delhi, 2000. (ISBN 0402213).