PONDICHERRY ENGINEERING COLLEGE
PUDUCHERRY – 605 014

Bachelor of Technology
B.Tech., Electronics and Instrumentation Engineering
Revised
Regulations, Curriculum & Syllabus

Effective from the academic year 2013-2014

of

PONDICHERRY UNIVERSITY
PUDUCHERRY – 605 014.

PONDICHERRY UNIVERSITY
BACHELOR OF TECHNOLOGY PROGRAMMES
(EIGHT SEMESTERS)

REGULATIONS

1. Conditions for Admission:

(a) Candidates for admission to the first semester of the 8 semester B.Tech Degree programme should be required to have passed :

The Higher Secondary Examination of the (10+2) curriculum (Academic Stream) prescribed by the Government of Tamil Nadu or any other examination equivalent there to with minimum of 45% marks (40% marks for OBC and SC/ST candidates) in aggregate of subjects – Mathematics, Physics and any one of the following optional subjects: Chemistry / Biotechnology/ Computer Science / Biology (Botany & Zoology) or an Examination of any University or Authority recognized by the Executive Council of the Pondicherry University as equivalent thereto.

(B) For Lateral entry in to third semester of the eight semester B.Tech programme :

The minimum qualification for admission is a pass in three year diploma or four year sandwich diploma course in engineering / technology from an AICTE approved institution with at least 45% marks (40% marks for OBC and SC/ST candidates) in aggregate in the subjects covered from 3rd to final semester or a pass in B.Sc. degree from a recognized university as defined by UGC with at least 45% marks (40% marks for OBC and SC/ST candidates) and passed XII standard with mathematics as a subject.

Provided that in case of students belonging to B.Sc Stream shall clear the subjects of Engineering Graphics and Engineering Mechanics of the first year Engineering program along with the second year subjects.

Provided further that, the students belonging to B.Sc Stream shall be considered only after filling the supernumerary seats in this category with students belonging to the Diploma stream.

The list of diploma programs approved for admission for each of the degree programs is given in **Annexure A**.

2. Age Limit :

The candidate should not have completed 21 years of age as on 1st July of the academic year under consideration. For Lateral Entry admission to second year of degree programme , there is no age limit. For SC/ST candidates, the age limit is relaxable by 3 years.

3. Duration of Programme :

The Bachelor of Technology degree programme shall extend over a period of 8 consecutive semesters spread over 4 academic years – two semesters constituting one academic year. The duration of each semester shall normally be 15 weeks

4. Eligibility for the award of Degree:

No candidate shall be eligible for the award of the degree of Bachelor of Technology, unless he/she has undergone the course for a period of 8 semesters (4 academic years) / 6 semesters (3 academic years for Lateral Entry candidates) in the faculty of Engineering and has passed the prescribed examinations in all the semesters.

5. Branches of Study:

Brach I - Civil Engineering
Branch II - Mechanical Engineering
Branch III - Electronics & Communication Engineering
Branch IV - Computer Science & Engineering
Branch V - Electrical & Electronics Engineering
Branch VI - Chemical Engineering
Branch VII - Electronics & Instrumentation Engineering
Branch VIII - Information Technology
Branch IX - Instrumentation & Control Engineering
Branch X - Biomedical Engineering

or any other branches of study as and when offered. The branch allocation shall be ordinarily done at the time of admission of the candidate to the first semester.

6. Subjects of Study:

The subjects of study shall include theory and practical courses as given in the curriculum and shall be in accordance with the prescribed syllabus. The subjects of study for the first two semesters shall be common for all branches of study.

7. Examinations:

The theory and practical examinations shall comprise continuous assessment throughout the semester in all subjects as well as university examinations conducted by Pondicherry University at the end of the semester (November / December or April / May).

(a) Theory courses for which there is a written paper of 75 marks in the university examination**.**

The Internal Assessment marks of 25 has to be distributed as 10 marks each for two class tests and 5 marks for class attendance in the particular subject. The distribution of marks for attendance is as follows.

5 marks for 95% and above

4 marks for 90% and above but below 95%

3 marks for 85% and above but below 90%

2 marks for 80% and above but below 85%

1 mark for 75% and above but below 80%

In total, three tests are to be conducted and the better two are to be considered for assessment.

(b) Practical courses for which there is a university practical examination of 50 marks**:**

The internal assessment marks of 50 has to be distributed as 20 marks for the periodic practical works and records submitted thereof, 15 marks for an internal practical examination, 5 marks for an internal viva voce, and 10 marks for class attendance in the particular subject. The distribution of marks is as given below.

10 marks for 95% and above
8 marks for 90% and above but below 95%
6 marks for 85% and above but below 90%
4 marks for 80% and above but below 85%
2 marks for 75% and above but below 80%

8. Requirement for appearing for University Examination:

A candidate shall be permitted to appear for university examinations at the end of any semester only if:

(i) He / She secures not less than 75% overall attendance arrived at by taking into account the total number of periods in all subjects put together offered by the institution for the semester under consideration.

(Candidates who secure overall attendance greater than 60% and less than 75% have to pay a condonation fee as prescribed by University along with a medical certificate obtained from a medical officer not below the rank of Asst. Director)

(ii) He / She earns a progress certificate from the Head of the institution for having satisfactorily completed the course of study in all the subjects pertaining to that semester.

(iii) His / Her conduct is found to be satisfactory as certified by the Head of the institution.

A candidate who has satisfied the requirement (i) to (iii) shall be deemed to have satisfied the course requirements for the semester.

9. Procedure for completing the course:

A candidate can join the course of study of any semester only at the time of its normal commencement and only if he/she has satisfied the course requirements for the previous semester and further has registered for the university examinations of the previous semester in all the subjects as well as all arrear subjects if any.

However, the entire course should be completed within 14 consecutive semesters (12 consecutive semesters for students admitted under lateral entry).

10. Passing Minimum :

(i) A candidate shall be declared to have passed the examination in a subject of study only if he/she secures not less than 50% of the total marks (Internal Assessment plus University examination marks) and not less than 40% of the marks in University examination.

(ii) A candidate who has been declared "Failed" in a particular subject may reappear for that subject during the subsequent semesters and secure a pass. However, there is a provision for revaluation of failed or passed subjects provided he/she fulfills the following norms for revaluation.

(a) Applications for revaluation should be filed within 4 weeks from the date of declaration of results or 15 days from the date of receipt of marks card whichever is earlier.

(b) The candidate should have attended all the college examinations as well as university examinations.

(c) If a candidate has failed in more than four papers in the current university examination, his/her representation for revaluation will not be considered.

(d) The request for revaluation must be made in the format prescribed duly recommended by the Head of the Institution along with the revaluation fee prescribed by the University.

Further the University examination marks obtained in the latest attempt shall alone remain valid in total suppression of the University examination marks obtained by the candidate in earlier attempts.

11 Award of Letter Grades:

The assessment of a course will be done on absolute marks basis. However, for the purpose of reporting the performance of a candidate, letter grades, each carrying certain points, will be awarded as per the range of total marks (out of 100) obtained by the candidate, as detailed below:

Range of Total Marks	Letter Grade	Grade Points
90 to 100	S	10
80 to 89	A	9
70 to 79	B	8
60 to 69	C	7
55 to 59	D	6
50 to 54	E	5
0 to 49	F	0
Incomplete	FA	

'F' denotes failure in the course. 'FA' denotes absent / detained as per clause 8.

After results are declared, grade sheets will be issued to the students. The grade sheets will contain the following details:

(a) The college in which the candidate has studied.

(b) The list of courses enrolled during the semester and the grades scored.

(c) The Grade Point Average (GPA) for the semester and The Cumulative Grade Point Average (CGPA) of all enrolled subjects from first semester onwards.

(d) GPA is the ratio of sum of the products of the number of credits (C) of courses registered and the corresponding grades points (GP) scored in those courses, taken for all the courses and sum of the number of credits of all the courses

$$GPA = \left(Sum\ of\ \ (C \times GP) / Sum\ of\ \ C \right)$$

CGPA will be calculated in a similar manner, considering all the courses enrolled from first semester. FA grades are to be excluded for calculating GPA and CGPA.

The conversion of CGPA into percentage marks is as given below

$$\%\, Marks = (CGPA - 0.5) \times 10$$

12 Award of Class and Rank:

(i) A candidate who satisfies the course requirements for all semesters and who passes all the examinations prescribed for all the eight semesters (six semesters for lateral entry candidates) within a maximum period of 7 years (6 years for lateral entry candidates) reckoned from the commencement of the first semester to which the candidate was admitted shall be declared to have qualified for the award of degree.

(ii) A candidate who qualifies for the award of the degree passing in all subjects pertaining to semesters 3 to 8 in his/her first appearance within 6 consecutive semesters (3 academic years) and in addition secures a CGPA of 8.50 and above for the semesters 3 to 8 shall be declared to have passed the examination in **FIRST CLASS** with **DISTINCTION**.

(iii) A candidate who qualifies for the award of the degree by passing in all subjects relating to semesters 3 to 8 within a maximum period of eight semesters after his/her commencement of study in the third semester and in addition secures CGPA not less than 6.5 shall declared to have passed the examination in **FIRST CLASS**.

(iv) All other candidates who qualify for the award of degree shall be declared to have passed the examination in **SECOND CLASS**.

(v) For the Award of University ranks and Gold Medal for each branch of study, the CGPA secured from 1st to 8th semester alone should be considered and it is mandatory that the candidate should have passed all the subjects from 1st to 8th semester in the first attempt. Rank certificates would be issued to the first ten candidates in each branch of study.

13. Provision for withdrawal :

A candidate may, for valid reasons, and on the recommendation of the Head of the Institution be granted permission by the University to withdraw from writing the entire semester examination as one Unit. The withdrawal application shall be valid only if it is made earlier than the commencement of the last theory examination pertaining to that semester. Withdrawal shall be permitted only once during the entire course. Other conditions being satisfactory, candidates who withdraw are also eligible to be awarded DISTINCTION whereas they are not eligible to be awarded a rank.

14. Discontinuation of Course:

If a candidate wishes to temporarily discontinue the course for valid reasons, he/she shall apply through the Head of the Institution in advance and obtain a written order from the University permitting discontinuance. A candidate after temporary discontinuance may rejoin the course only at the commencement of the semester at which he/she discontinued, provided he/she pays the prescribed fees to the University. The total period of completion of the course reckoned from the commencement of the first semester to which the candidate was admitted shall not in any case exceed 7

years, including of the period of discontinuance.

15. Revision of Regulations and Curriculum:

The University may from time to time revise, amend or change the regulations of curriculum and syllabus as and when found necessary.

ANNEXURE – A

B.Tech courses in which admission is sought	Diploma courses eligible for admission
Civil Engineering	Civil Engineering Civil and Rural Engineering Architectural Assistantship Architecture Agricultural Engineering
Mechanical Engineering	Mechanical Engineering Automobile Engineering Agricultural Engineering Mechanical and Rural Engineering Refrigeration and Air-conditioning Agricultural Engineering & Farm Equipment Technology Metallurgy Production Engineering Machine Design & Drafting Machine tool maintenance and Repairs Printing Technology / Engineering Textile Engineering / Technology Tool Engineering
Electrical and Electronics Engineering Electronics & Communication Engineering Electronic and Instrumentation Engineering Instrumentation and Control Engineering	Electrical Engineering Electrical and Electronics Engineering Electronics and Instrumentation Engineering Instrumentation Engineering / Technology Electronics and Communication Engg. Electronics Engineering Medical Electronics Instrumentation and Control Engineering Applied Electronics
Bio Medical Engineering	Chemical Engineering Chemical Technology Petrochemical Technology Petroleum Engineering Ceramic Technology Plastic Engineering Paper & Pulp Technology / Polymer Technology
Information Technology Computer Science & Engineering	Computer Science and Engineering Computer Technology Electrical and Electronics Engineering Electronics & Communication Engineering Electronics & Instrumentation Engineering Instrumentation Engineering / Technology Information Technology

CURRICULUM & SYLLABUS
B.Tech (ELECTRONICS AND INSTRUMENTATION ENGINEERING)
(With effect from Academic year 2013-14)

SEMESTER I

CDE	SUBJECT	PERIODS			CREDITS	MARKS		
		L	T	P		IA	UE	TM
	THEORY							
T101	Mathematics – I	3	1	0	4	25	75	100
T102	Physics	4	0	0	4	25	75	100
T103	Chemistry	4	0	0	4	25	75	100
T110	Basic Civil and Mechanical Engineering	4	0	0	4	25	75	100
T111	Engineering Mechanics	3	1	0	4	25	75	100
T112	Communicative English	4	0	0	4	25	75	100
	PRACTICAL							
P104	Physics lab	0	0	3	2	50	50	100
P105	Chemistry lab	0	0	3	2	50	50	100
P106	Workshop Practice	0	0	3	2	50	50	100
	TOTAL	22	2	9	30	300	600	900

SEMESTER II

CODE	SUBJECT	PERIODS			CREDITS	MARKS		
		L	T	P		IA	UE	TM
	THEORY							
T107	Mathematics – II	3	1	0	4	25	75	100
T108	Material Science	4	0	0	4	25	75	100
T109	Environmental Science	4	0	0	4	25	75	100
T104	Basic Electrical and Electronics Engineering	3	1	0	4	25	75	100
T105	Engineering Thermodynamics	3	1	0	4	25	75	100
T106	Computer Programming	3	1	0	4	25	75	100
	PRACTICAL							
P101	Computer Programming Lab	0	0	3	2	50	50	100
P102	Engineering Graphics	0	0	3	2	50	50	100
P103	Basic Electrical & Electronics Lab	0	0	3	2	50	50	100
P107	NSS / NCC *	-	-	-	0	-	-	-
	TOTAL	20	4	9	30	300	600	900

To be completed in I and II semesters, under Pass/ Fail option only and not counted for CGPA calculation

SEMESTER III

CODE	SUBJECT	PERIODS			CREDITS	MARKS		
		L	T	P		IA	UE	TM
	THEORY							
MA T31	Mathematics III	3	1	0	4	25	75	100
EI T32	Electric Circuit Analysis	3	1	0	4	25	75	100
EI T33	Electronic Circuits-I	4	0	0	4	25	75	100
EI T34	Sensors and transducers	4	0	0	4	25	75	100
EI T35	Data Structures and Object oriented Programming	3	1	0	4	25	75	100
EI T36	Fluid Mechanics and Strength of Materials	4	0	0	4	25	75	100
	PRACTICAL							
EI P31	Electronic Devices and circuits Lab	0	0	3	2	50	50	100
EI P32	Fluid Mechanics & Strength of Materials	0	0	3	2	50	50	100
EI P33	Data Structures and Object oriented Programming	0	0	3	2	50	50	100
	TOTAL	21	3	9	30	300	600	900

SEMESTER IV

CODE	SUBJECT	PERIODS			CREDITS	MARKS		
		L	T	P		IA	UE	TM
	THEORY							
MA T41	Mathematics IV	3	1	0	4	25	75	100
EI T42	Electronic Circuits-II	4	0	0	4	25	75	100
EI T43	Digital Logic Theory and Design	3	1	0	4	25	75	100
EI T44	Electrical and Electronic Instruments	4	0	0	4	25	75	100
EI T45	Linear Integrated Circuits	3	1	0	4	25	75	100
EI T46	Electrical Machines	4	0	0	4	25	75	100
	PRACTICAL							
EI P31	Linear and Digital Integrated Circuits Lab	0	0	3	2	50	50	100
EI P32	Sensors and Transducers Lab	0	0	3	2	50	50	100
EI P33	Electrical Machines Lab	0	0	3	2	50	50	100
EI P34	Physical Education *	-	-	-	0	-	-	-
	TOTAL	21	3	9	30	300	600	900

*** Under pass/fail option only and not counted for CGPA calculation**

SEMESTER V

CODE	SUBJECT	PERIODS			CREDITS	MARKS		
		L	T	P		IA	UE	TM
	THEORY							
MA T51	Numerical Methods	3	1	0	4	25	75	100
EI T52	Control Systems Engineering	3	1	0	4	25	75	100
EI T53	Industrial Instrumentation-I	4	0	0	4	25	75	100
EI T54	Microprocessor and its Applications	3	1	0	4	25	75	100
EI T55	VLSI Design	3	1	0	4	25	75	100
EI E56	Elective-I	4	0	0	4	25	75	100
	PRACTICAL							
EI P51	VLSI Design lab	0	0	3	2	50	50	100
EI P52	Instrumentation Design Lab	0	0	3	2	50	50	100
EI P53	Microprocessors & its applications Lab	0	0	3	2	50	50	100
EI P54	General Proficiency – I	0	0	3	1	100	-	100
	TOTAL	20	4	12	31	400	600	1000

SEMESTER VI

CODE	SUBJECT	PERIODS			CREDITS	MARKS		
		L	T	P		IA	UE	TM
	THEORY							
EI T61	Process Control	4	0	0	4	25	75	100
EI T62	Industrial Instrumentation-II	4	0	0	4	25	75	100
EI T63	Digital Signal Processing	3	1	0	4	25	75	100
EI T64	Embedded System Design	3	1	0	4	25	75	100
EI T65	Communication Engineering	4	0	0	4	25	75	100
EI E66	ELECTIVE –II	4	0	0	4	25	75	100
	PRACTICAL							
EI P61	Process Control Lab	0	0	3	2	50	50	100
EI P62	Embedded System Design lab	0	0	3	2	50	50	100
EI P63	Virtual Instrumentation Lab	0	0	3	2	50	50	100
EI P64	General Proficiency – II	0	0	3	1	100	-	100
	TOTAL	22	2	12	31	400	600	1000

SEMESTER VII

CODE	SUBJECT	PERIODS			CREDITS	MARKS		
		L	T	P		IA	UE	TM
	THEORY							
EI T71	PLC and DCS	4	0	0	4	25	75	100
EI T72	Analytical Instrumentation	4	0	0	4	25	75	100
EI E73	ELECTIVE-III	4	0	0	4	25	75	100
EI E74	ELECTIVE-IV	4	0	0	4	25	75	100
	PRACTICAL							
EI P71	Industrial measurement and Control Lab	0	0	3	2	50	50	100
EI P72	Seminar	0	0	3	1	100	-	100
EI P73	Industrial Visit/Training	0	0	3	1	100	-	100
EI PW7	Project Work Phase I	0	0	3	4	100	-	100
	TOTAL	16	0	12	24	450	350	800

SEMESTER VIII

CODE	SUBJECT	PERIODS			CREDITS	MARKS		
		L	T	P		IA	UE	TM
	THEORY							
EI T81	Professional Ethics Practice	-	-	-	1	100	-	100
EI T82	Industrial Safety and Management	4	0	0	4	25	75	100
EI E83	ELECTIVE-V	4	0	0	4	25	75	100
EI E84	ELECTIVE-VI	4	0	0	4	25	75	100
	PRACTICAL							
EI P81	Process automation Lab	0	0	3	2	50	50	100
EI P82	Comprehensive Viva-Voce	-	-	-	1	50	50	100
EI PW8	Project Work Phase II	0	0	9	8	50	50	100
	TOTAL	12	0	12	24	325	375	700

TOTAL CREDITS	230

LIST OF ELECTIVES

SEMESTER V (ELECTIVE I)

CODE	SUBJECT	PERIODS			CREDITS
		L	T	P	
EI E51	Process Engineering Principles	4	0	0	4
EI E52	Industrial Electronics	4	0	0	4
EI E53	Telemetry and Telecontrol	4	0	0	4
EI E54	Visual Programming for Instrumentation Engineers	4	0	0	4
EI E55	Signals and Systems	3	1	0	4

SEMESTER VI (ELECTIVE II)

CODE	SUBJECT	PERIODS			CREDITS
		L	T	P	
EI E61	Web based Instrumentation	4	0	0	4
EI E62	Instrumentation Buses and Data Networks	4	0	0	4
EI E63	Optimization Techniques	4	0	0	4
EI E64	Micro Electro Mechanical Systems	4	0	0	4
EI E65	Biomedical Instrumentation	4	0	0	4

SEMESTER VII (ELECTIVE III & IV)

CODE	SUBJECT	PERIODS			CREDITS
		L	T	P	
EI E71	Applied soft Computing	4	0	0	4
EI E72	Robotics and Automation	4	0	0	4
EI E73	Power Plant Instrumentation	4	0	0	4
EI E74	Digital Image Processing	4	0	0	4
EI E75	Computer Networks	4	0	0	4
EI E76	Introduction to nano science and technology	4	0	0	4

SEMESTER VIII (ELECTIVE V & VI)

CODE	SUBJECT	PERIODS			CREDITS
		L	T	P	
EI E81	Operating Systems	4	0	0	4
EI E82	Design of Process Control System Components	4	0	0	4
EI E83	Fiber Optics and Laser Instrumentation	4	0	0	4
EI E84	Semiconducting materials and optoelectronics	4	0	0	4
EI E85	Instrumentation and Control in Petrochemical Industries	4	0	0	4
EI E86	System Identification and Adaptive Control	4	0	0	4

T101 MATHEMATICS – I

OBJECTIVES:

To introduce the idea of applying calculus concepts to problems in Engineering
To familiarize the student with functions of several variables.

To acquaint the student with mathematical tools needed in evaluating multiple integrals and their usage.

To introduce effective mathematical tools for the solutions of differential equations that model physical processes

UNIT I – CALCULUS

Curvature, radius of curvature, evolutes and involutes. Beta and Gamma functions and their properties.

UNIT II– FUNCTIONS OF SEVERAL VARIABLES

Partial derivatives, Total derivatives, Differentiation of implicit functions, Change of variables, Jacobians and their properties, Taylor's series for functions of two variables, Maxima and minima, Lagrange's method of undetermined multipliers.

UNIT III – MULTIPLE INTEGRALS AND APPLICATIONS

Multiple Integrals, change of order of integration and change of variables in double integrals (Cartesian to polar). Applications: Areas by double integration and volumes by triple integration (Cartesian and polar).

UNIT IV – DIFFERENTIAL EQUATIONS

Exact equations, First order linear equations, Bernoulli's equation, orthogonal trajectories, growth, decay and geometrical applications. Equations not of first degree: equations solvable for p, equations solvable for y, equations solvable for x and Clairaut's type.

UNIT V – DIFFERENTIAL EQUATIONS (Higher order)

Linear differential equations of higher order - with constant coefficients, the operator D, Euler's linear equation of higher order with variable coefficients, simultaneous linear differential equations, solution by variation of parameters method simple application to electric circuits.

Text Books

1. Venkataraman M.K, Engineering Mathematics-First year, National Publishing Company, Chennai, 2010(For Units I, III, IV & VI only)
2. Grewal B.S., Higher Engineering Mathematics, Khanna Publishers, New Delhi, 41st Edition, 2011. (For Unit II only)

Reference Books

1. Veerarajan T., Engineering Mathematics for first year, Tata McGraw-Hill, New Delhi, 2008.
2. Kandasamy P. et al, Engineering Mathematics, Vol.1 & 2, S. Chand & Co., New Delhi.
3. Ramana B.V., Higher Engineering Mathematics, Tata McGraw Hill New Delhi, 11th Reprint, 2010.
4. Erwin Kreyszig, Advanced Engineering Mathematics, John Wiley & Sons, New Delhi, 8th Edition.
5. Bali N. and Goyal M., Advanced Engineering Mathematics, Lakshmi Publications Pvt. Ltd., New Delhi, 7th Edition, 2010.

T102 PHYSICS

OBJECTIVES:

To understand the concepts of physics and its significant contributions in the advancement of technology and invention of new products that dramatically transformed modern-day society.

To expose the students to different areas of physics which have direct relevance and applications to different Engineering disciplines

To understand the concepts and applications of Ultrasonics, optics and some optical devices, Lasers and Fiber optics, Nuclear energy sources and wave mechanics

UNIT I – ACOUSTICS & NDT

ultrasonics - *U*ltrasonic Waves Productions (Piezoelectric & Magnetostriction method) – Detections (Acoustic Grating) *NDT applications – Ultrasonic* Pulse Echo Method - Liquid Penetrant Method

Acoustics - Factors affecting Acoustic of Buildings (Reverberation, Loudness, Focusing, Echo, Echelon Effect and Resonance) and their Remedies - Sabine's formula for Reverberation Time – Doppler effect and its applications to Radars.(elementary ideas)

UNIT II – OPTICS

Interference - Air Wedge – Michelson's Interferometer - Wavelength Determination – Interference Filter – Antireflection Coatings

Diffraction - Diffraction Grating – Dispersive power of grating - Resolving Power of Grating & Prism

Polarisation Basic concepts of Double Refraction - Huygens Theory of Double Refraction-Quarter and Half Wave Plates – Specific Rotary Power – Laurent Half Shade Polarimeter

UNIT III – LASERS & FIBER OPTICS

Lasers - Principles of Laser – Spontaneous and Stimulated Emissions - Einstein's Coefficients – Population Inversion and Laser Action – types of Optical resonators (qualitative ideas) –

Types of Lasers - NdYAG, CO_2 laser, GaAs Laser-applications of lasers

Fiber Optics - Principle and Propagation of light in optical fiber – Numerical aperture and acceptance angle – Types of optical fibers (material, refractive index, mode)-applications to sensors and Fibre Optic Communication

UNIT IV – WAVE MECHANICS

Matter Waves – de Broglie Wavelength – Uncertainty Principle – Schrödinger Wave Equation – Time Dependent – Time Independent – Application to Particle in a One Dimensional potential Box – Quantum Mechanical Tunneling – Tunnel Diode.

UNIT V – NUCLEAR ENERGY SOURCE

General Properties of Nucleus (Size, Mass, Density, Charge) – Mass Defect – Binding Energy - Disintegration in fission –*Nuclear Reactor:* Materials Used in Nuclear Reactors.

– PWR – BWR – FBTR. Nuclear fusion reactions for fusion reactors-D-D and D-T reactions, Basic principles of Nuclear Fusion reactors.

Text Books

1.V Rajendran, Engineering Physics, *2nd Edition*, TMH, New Delhi *2011* (For Units I to IV only)

2. Arthur Beiser, Concepts of Modern Physics, 6th Edition, TMH, New Delhi reprinted 2008. (For Unit V only)

Reference Books

1. Ajoy Ghatak, Optics, 5th Edition TMH, New Delhi, 2012.
2. K. Thyagarajan and Ajoy Ghatak, Lasers Fundamentals and Applications, 2nd Edition, Springer 2010.
3. R. Murugesan, Modern Physics, S. Chand & Co, New Delhi 2006.
4. K.R.Nambiar, Lasers, New Age International, New Delhi, 2008.
5. Science of Engineering Materials, 2nd Edition, C.M. Srivastava and C. Srinivasan, New Age Int. (P) Ltd, New Delhi, 1997
6. Avadhanulu M N , Engineering Physics, Vol-I, S. Chand & Co, 2009.

T103 CHEMISTRY

OBJECTIVES

To know about the importance of Chemistry in Engineering domain
To understand the chemistry background of industrial process
To apply chemistry knowledge for engineering disciplines

UNIT I – WATER (9 Hours)

Hardness of water - units and calcium carbonate equivalent. Determination of hardness of water-EDTA method. Disadvantages of hardwater – boiler scale and sludge, caustic embrittlement, priming & foaming and boiler corrosion. Water softening methods – internal & external conditioning – Lime-Soda process, Zeolite process and Ion-exchange process. Desalination – reverse osmosis & electrodialysis.

UNIT II – POLYMERS

(9 Hours)

Classification, types of polymerization reactions – mechanism of radical, ionic and Ziegler-Natta polymerizations. Polymer properties – chemical resistance, crystallinity and effect of temperature, Mn and Mw. Thermoplastics and thermosets. Preparation, properties and uses of PVC, TEFLON, Nylons, Bakelite, Polyurithane, Rubbers – vulcanization, synthetic rubber, BuNa-S, BuNa-N, silicone and butyl rubber. Conducting polymers – classification and applications. Polymer composites – FRP – laminar composites. Moulding constituents of plastic, moulding techniques – compression, injection, transfer and extrusion moulding.

UNIT III - ELECTROCHEMICAL CELLS (9 Hours)

Galvanic cells, single electrode potential, standard electrode potential, electromotive series. EMF of a cell and its measurement. Nernst equation. Electrolyte concentration cell. Reference electrodes – hydrogen, calomel, Ag/AgCl & glass electrodes. Batteries – primary and secondary cells, Leclanche cell, Lead acid storage cell, Ni-Cd battery & alkaline battery. Fuel cells – H_2-O_2 fuel cell.

UNIT IV - CORROSION AND ITS CONTROL (9 Hours)

Chemical & electrochemical corrosion – Galvanic, pitting, stress and concentration cell corrosion. Factors influencing corrosion – corrosion control methods – cathodic protection and corrosion inhibitors. Protective coating – types of protective coatings – metallic coating – tinning and galvanizing, cladding, electroplating and anodizing.

UNIT V -PHASE RULE (9 Hours)

Definition and derivation of phase rule. Application to one component system – water and sulfur systems. Thermal analysis, condensed phase rule.Two component systems – Pb-Ag, Cu-Ni, and Mg-Zn systems.

Text book

1.P.C. Jain and Monika Jain, Engineering Chemistry, Dhanpat Rai and Sons, New Delhi 15th Ed, 2010.

Reference Books

1.S. S. Dara, A Textbook of Engineering Chemistry, 11th Ed, S.Chand & Co., Ltd. New Delhi, 2008.
2.B. K. Sharma, Engineering Chemistry, 3rd edition Krishna Prakashan Media (P) Ltd., Meerut, 2001.
3.P. Kannan and A. Ravi Krishnan "Engineering Chemistry" Hi-Tech Sri Krishna Publications, Chennai, 9th Ed, 2009
4.N. Krishnamurthy, P. Vallinayagam and D. Madhavan, Engineering Chemistry, 2nd Ed. PHI Learning PVT., LTD, New Delhi, 2008.

T104 BASIC ELECTRICAL AND ELECTRONICS ENGINEERING

OBJECTIVES

To understand and gain basic knowledge about magnetic and electrical circuits, single phase and three phase power measurement and the operating principles of stationary and rotating machines

To understand the basic operation, functions and applications of PN junction diode, transistor, logic gates and flip flops.

To gain knowledge on various communication systems and network models and the use of ISDN

PART A - ELECTRICAL

UNIT – I - DC CIRCUITS

Definition of Voltage, Current, Power & Energy, circuit parameters, Ohm's law, Kirchoff's law & its applications – Simple Problems - Division of current in Series & parallel circuits - star/delta conversion - Node and mesh methods of analysis of DC circuits

UNIT – II - AC CIRCUITS

Concepts of AC circuits – rms value, average value, form and peak factors – Simple RLC series circuits – Concept of real and reactive power – Power factor - Introduction to three phase system - Power measurement by two wattmeter method.

UNIT – III – ELECTRICAL MACHINES AND POWER PLANTS

Law of Electromagnetic induction, Fleming's Right & Left hand rule - Principle of DC rotating machine, Single phase transformer and single phase induction motor (Qualitative approach only) - Simple layout of thermal and hydro generation (block diagram approach only).Fundamentals of fuses and circuit breakers

PART B – ELECTRONICS

UNIT – IV ELECTRONIC CIRCUITS

V-I Characteristics of diode - Half-wave rectifier and Full-wave rectifier – with and without capacitor filter - Transistor - Construction & working - Input and output characteristics of CB and CE configuration - Transistor as an Amplifier - Principle and working of Hartley oscillator and RC phase shift oscillator - Construction and working of JFET & MOSFET.

UNIT – V DIGITAL ELECTRONICS

Boolean algebra – Reduction of Boolean expressions - De-Morgan's theorem - Logic gates -Implementation of Boolean expressions - Flip flops - RS, JK, T and D.
Combinational logic - Half adder, Full adder and Subtractors.
Sequential logic - Ripple counters and shift registers.

UNIT – VI COMMUNICATION AND COMPUTER SYSTEMS

Model of communication system - Analog and digital - Wired and wireless channel.

Block diagram of various communication systems - Microwave, satellite, optical fiber and cellular mobile system.

Network model - PAN, LAN, MAN and WAN - Circuit and packet switching - Overview of ISDN.

Text Books

1. Kothari D P and Nagrath I J , Basic Electrical Engineering , Tata McGraw Hill,2009. (For Units I to III)
2. Rajendra Prasad , " Fundamentals of Electronic Engineering", Cengage learning, New Delhi, First Edition, 2011 (For Unit IV)
3. Morris Mano, "Digital design", PHI Learning, Fourth Edition, 2008 (For Unit V)
4. Wayne Tomasi, "Electronic Communication Systems- Fundamentals Theory Advanced", Sixth Edition, Pearson Education, 2004. (For Unit VI)

Reference Books

1. R.Muthusubramaniam, S.Salivahanan and K.A. Mureleedharan, Basic Electrical Electronics and Computer Engineering, Tata McGraw Hill, 2004..
2. J.B.Gupta, A Course in Electrical Power, Katson Publishing House, New Delhi, 1993.
3. David. A. Bell, "Electronic Devices and Circuits", PHI Learning Private Ltd, India, Fourth Edition, 2008

4. Donald P Leach, Albert Paul Malvino and Goutam Saha, “Digital Principles and Applications,” 6th edition, Tata McGraw Hill Publishing Company Ltd., New Delhi,2008.

5. S.K. Sahdev, Fundamentals of Electrical Engineering and Electronics, Dhanpat Rai & Co, 2013.
6. Jacob Millman and Christos C. Halkias, “Electronic Devices and Circuits” Tata McGraw Hill,2008
7. R.L. Boylestad and L. Nashelsky, “Electronic Devices and Circuit Theory”, PHI Learning Private Limited, Ninth Edition, 2008.
8. M.S.Sukhija and T.K.Nagsarkar, “ Basic Electrical and Electronics Engineering”, Oxford University Press, 2012.

T105 THERMODYNAMICS

OBJECTIVES

To understand the basics of the thermodynamic principles

To establish the relationship of these principles to thermal system behaviors To develop methodologies for predicting the system behavior

To establish the importance of laws of thermodynamics applied to energy systems

To explain the role of refrigeration and heat pump as energy systems

To develop an intuitive understanding of underlying physical mechanism and a mastery of solving practical problems in real world

UNIT I - BASIC CONCEPTS AND DEFINITIONS

Energy conversion and efficiencies - System, property and state - Thermal equilibrium - Temperature - Zeroth law of Thermodynamics – Pure substance - P, V and T diagrams – Thermodynamic diagrams.

UNIT II - FIRST LAW OF THERMODYNAMICS

The concept of work and adiabatic process - First law of thermodynamics - Conservation of Energy principle for closed and open systems - Calculation of work for different processes of expansion of gases

UNIT III - SECOND LAW OF THERMODYNAMICS

Equilibrium and the second law - Heat engines - Kelvin-Planck statement of second law of thermodynamics - Reversible and irreversible processes - Carnot principle - Clausius inequality- Entropy

UNIT IV - GAS POWER CYCLES

Air standard cycles: The air standard Carnot cycle - Air standard Otto cycle, diesel cycle, dual cycle and Brayton cycles and their efficiencies

UNIT V - REFRIGERATION CYCLES AND SYSTEMS

Reverse Carnot cycle - COP - Vapor compression refrigeration cycle and systems (only theory) - Gas refrigeration cycle - Absorption refrigeration system – Liquefaction – Solidification (only theory).

Text Books

1. Nag, P. K., “Engineering Thermodynamics”, 4th edition, Tata Mc Graw Hill Publishing Co. Ltd., New Delhi, 2008.

Reference Books

1. Arora, C.P., “Thermodynamics” , Tata Mc Graw Hill Publishing Co. Ltd., New Delhi,2010
2. Burghardt, M.D., “Engineering Thermodynamics with Applications”, 4th edition, Harper & Row, N.Y.,2009.
3. Huang, F.F., “Engineering Thermodynamics” 2nd edition , Macmillan Publishing Co. Ltd., N.Y.,2011
4. Cengel, Y.A. and Boles, M.A., "Thermodynamics - An Engineering Approach", 5th edition, Mc-Graw Hill, 2008
5. Wark, K., “Thermodynamics”, 4th edition ,Mc Graw Hill, N.Y.,2009.

T106 COMPUTER PROGRAMMING

OBJECTIVES

- To introduce the basics of computers and information technology.
- To educate problem solving techniques.
- To impart programming skills in C language.
- To practice structured programming to solve real life problems.

UNIT – I

History of Computers – Block diagram of a Computer – Components of a Computer system –Classification of computers - Hardware – Software – Categories of Software – Operating System – Applications of Computers – Network structure – Internet and its services – Intranet – Study of word processor – Preparation of worksheets.

UNIT – II

Problem solving techniques – Program – Program development cycle – Algorithm design
– Flowchart - Pseudo code.

Introduction to C – History of C – Importance of C - C tokens – data types – Operators and expressions – I/O functions.

UNIT – III

Decision making statements – branching and looping – arrays – multidimensional arrays
– Functions – Recursion – Passing array to functions. Storage classes – Strings – String library functions.

UNIT – IV

Structures – Arrays and Structures – nested structures – passing structures to functions
– user defined data types – Union.

Pointers – pointers and arrays – pointers and functions - pointers and strings - pointers and Structures.

UNIT – V

Files – operations on a file – Random access to files – command line arguments. Introduction to preprocessor – Macro substitution directives – File inclusion directives – conditional compilation directives – Miscellaneous directives.

Text Books

1. Balagurusamy. E, “Programming in ANSI C”, Tata McGraw Hill, Sixth edition, 2012.

Reference Book

1. Vikas Verma, “A Workbook on C “,Cengage Learning, Second Edition,2012

2. Ashok N Kamthane, “Computer Programming”, Pearson education, Second Impression, 2008.

P101 COMPUTER PROGRAMMING LAB

OBJECTIVES

To study and understand the use of OS commands
To gain a hands on experience of compilation and execution of 'C' programs

LIST OF EXERCISES:

1. Study of OS Commands
2. Write a C program to find the Area of the triangle.
3. Write a C program to find the total and average percentage obtained by a student for 6 subjects.
4. Write a C program to read a three digit number and produce output like

   1 hundreds

   7 tens

   2 units

   for an input of 172.
5. Write a C program to check whether a given character is vowel or not using Switch – Case statement.
6. Write a C program to print the numbers from 1 to 10 along with their squares.
7. Write a C program to find the sum of 'n' numbers using for, do – while statements.
8. Write a C program to find the factorial of a given number using Functions.
9. Write a C program to swap two numbers using call by value and call by reference.
10. Write a C program to find the smallest and largest element in an array.
11. Write a C program to perform matrix multiplication.
12. Write a C program to demonstrate the usage of Local and Global variables.
13. Write a C program to perform various string handling functions: strlen, strcpy, strcat, strcmp.
14. Write a C program to remove all characters in a string except alphabets.
15. Write a C program to find the sum of an integer array using pointers.

16. Write a C program to find the Maximum element in an integer array using pointers.
17. Write a C program to create student details using Structures.
18. Write a C program to display the contents of the file on the monitor screen.
19. Create a File by getting the input from the keyboard and retrieve the contents of the file using file operation commands.
20. Write a C program to pass the parameter using command line arguments.

P102 ENGINEERING GRAPHICS

OBJECTIVES

To convey the basics of engineering drawing

To explain the importance of an engineering drawing
To teach different methods of making the drawing

To establish the importance of projects and developments made in drawing that are used in real systems

To explain the role of computer aided design _Auto Cad

To develop an intuitive understanding of underlying significance of using these drawings

UNIT

Introduction to Standards for Engineering Drawing practice, Lettering, Line work and Dimensioning

UNIT I

Conic sections, Involutes, Spirals, Helix. Projection of Points, Lines and Planes

UNIT II

Projection of Solids and Sections of Solids.

UNIT III

Development of surfaces - Intersection of surfaces (cylinder-cylinder, cylinder-cone)

UNIT IV

Isometric projections and Orthographic projections

UNIT V

Computer Aided Drafting: Introduction to Computer Aided Drafting hardware - Overview of application software - 2D drafting commands (Auto CAD) for simple shapes - Dimensioning.

Text Books

1. K.R. Gopalakrishna and Sudhir Gopalakrishna, Engineering Graphics, Inzinc Publishers, 2007.

Reference Books

1. N.D. Bhatt, Engineering Drawing, 49th edition, Chorotar Publishing House, 2006.
2. K. Venugopal, Engineering Drawing and Grahics + Auto CAD, 4th edition, New Age International Publication Ltd., 2004 .
3. David I cook and Robert N Mc Dougal, Engineering Graphics and Design With computer applications, Holt – Sounders Int. Edn. 1985.
4. James D Bethune and et. al., Modern Drafting, Prentice Hall Int., 1989.
5. K.V. Natarajan, A Text Book of Engineering Drawing, Dhanalakshmi Publishers, 2006.
6. BIS, Engineering Drawing practice for Schools & College, 1992.

P103 BASIC ELECTRICAL AND ELECTRONICS LAB

OBJECTIVES

To get an exposure on the basic electrical tools, applications and precautions

To gain training on different types of wiring used in domestic and industrial applications.

To detect and find faults in electrical lamp and ceiling fan

To get an exposure on the measurements of voltage and phase using CRO, basic operation and applications of devices such as PN junction diode and transistor

To gain a practical knowledge on the functions and application of basic logic gates and flip flops

ELECTRICAL LAB

LIST OF EXPERIMENTS

1. Electrical Safety, Precautions, study of tools and accessories.
2. Practices of different joints.
3. Wiring and testing of series and parallel lamp circuits.
4. Staircase wiring.
5. Doctor's room wiring.
6. Bed room wiring.
7. Godown wiring.
8. Wiring and testing a ceiling fan and fluorescent lamp circuit.
9. Study of different types of fuses, circuits breakers and A.C and D.C meters.

ELECTRONICS LAB

LIST OF EXPERIMENTS

1. Study of CRO

   (A) Measurement of AC and DC voltages

   (B) Frequency and phase measurements (using Lissajou's figures)

2. Verification of Kirchhoff's Voltage and Current Laws

   Determine the voltage and current in given circuits using Kirchhoff"s laws theoretically and verify the laws experimentally.

3. Characteristics and applications of PN junction diode. Forward and Reverse characteristics of PN junction diode.

   Application of Diode as Half wave Rectifier – Measurement of ripple factor with and without capacitor filter

4. Frequency Response of RC Coupled Amplifiers

   Determination of frequency response of given RC coupled amplifier - Calculation of bandwidth.

5. Study of Logic Gates

   (A) Verification of Demorgan's theorems

   (B) Verification of truth tables of OR, AND, NOT, NAND, NOR, EX-OR, EX-NOR gates and Flipflops - JK, RS, T and D

   (C) Implementation of digital functions using logic gates and Universal gates.

T107 MATHEMATICS – II

OBJECTIVES

To develop the use of matrix algebra techniques for practical applications.

To introduce the concepts of Curl, Divergence and integration of vectors in vector calculus which is needed for many application problems.

To introduce Laplace transform which is a useful technique in solving many application problems and to solve differential and integral equations.

To acquaint the students with Fourier transform techniques used in wide variety of situations in which the functions used are not periodic.

UNIT I – MATRICES

Eigenvalues and Eigen vectors of a real matrix, Characteristic equation, Properties of Eigenvalues and Eigenvectors. Cayley-Hamilton Theorem, Diagonalization of matrices. Reduction of a quadratic form to canonical form by orthogonal transformation. Nature of quadratic forms.

UNIT II – VECTOR CALCULUS

Gradient, divergence and curl, their properties and relations. Gauss divergence theorem and Stoke's theorem (without proof). Simple application problems.

UNIT III – LAPLACE TRANSFORM

Definition, Transforms of elementary functions, properties. Transform of derivatives and integrals. Multiplication by t and division by t. Transform of unit step function, transform of periodic functions. Initial and final value theorems.

UNIT IV – APPLICATIONS OF LAPLACE TRANSFORM

Methods for determining inverse Laplace Transforms, convolution theorem, Application to differential equations and integral equations. Evaluation of integrals by Laplace transforms.

UNIT V – FOURIER TRANSFORM

Fourier Integral theorem (statement only), Fourier transform and its inverse, properties. Fourier sine and cosine transforms, their properties, convolution and Parseval's identity.

Text books

1. Venkataraman M.K., Engineering Mathematics, National Publishing Company, Chennai, 2012
2. Kandasamy P. et al, Engineering Mathematics, Vol.2 & 3, S. Chand & Co., New Delhi.

Reference Books

1. Veerarajan T., Engineering Mathematics for first year, Tata McGraw-Hill, New Delhi, 2008.
2. Grewal B.S., Higher Engineering Mathematics, Khanna Publishers, New Delhi, 41st Edition, 2011.
3. Ramana B.V., Higher Engineering Mathematics, Tata McGraw Hill New Delhi, 11th Reprint, 2010.
4. Erwin Kreyszig, Advanced Engineering Mathematics, John Wiley & Sons, New Delhi.
5. Bali N. and Goyal M., Advanced Engineering Mathematics, Lakshmi Publications Pvt. Ltd., New Delhi, 7th Edition, 2010.

T108 MATERIAL SCIENCE

OBJECTIVES:

To understand the importance of Material Science as a subject that revolutionized modern day technologies

To understand the significance of material science in the development of new materials and devices for all branches of Engineering

To impart knowledge to the Engineering students about some of the important areas of Materials Science so as to enable them perceive the significant contributions of the subject in Engineering and Technology

UNIT I - CRYSTAL STRUCTURE AND LATTICE DEFECTS

Crystal structure - Bravais Lattices , Crystal Systems - Coordination Number, Atomic Radius, Packing Factor for FCC & HCP structures – Miller Indices- Powder X Ray Diffraction Method

Lattice defects – Qualitative ideas of point, line, surface and volume defects

UNIT II – DIELECTRIC PROPERTIES

Dielectric Polarization and Mechanism –Temperature dependence of polarization, Internal or local Field - Clausius-Mossotti relation. Basic ideas of Dielectric loss - frequency dependence of dielectric constant – Measurement of Dielectric constant and loss using Scherring bridge – Elementary ideas of Piezoelectrics, Ferroelectrics and Pyroelectric materials and Applications

UNIT III – MAGNETIC PROPERTIES

Origin of atomic magnetic moment – Bohr magneton-Elementary Ideas of classification of magnetic materials (Dia, Para, Ferro, antiferro & Ferri). – Quantum theory of Para & Ferro Magnetism – Domain Theory of Hysteresis – Heisenberg Theory of Exchange Interaction (without derivation) – Qualitative ideas of Anti ferromagnetic Ordering – Structure and Properties of Ferrites – Properties of Soft & Hard Magnetic Materials – Applications. Magnetic data storage – Magnetic tapes, Hard disks, Magneto optical recording

UNIT IV – SEMICONDUCTORS AND SUPERCONDUCTORS

Semiconductors -Derivation of Carrier concentration in intrinsic Semiconductors –Basic ideas of Electrical conductivity in intrinsic and extrinsic semiconductors (without derivations) -temperature dependence of carrier concentration and electrical conductivity in semiconductors (qualitative ideas), Hall effect in Semiconductors -- Application of Hall Effect, Basic Ideas of Compound Semiconductors (II-VI & III-V)

Superconductivity - Basic concepts – transition temperature – Meissener effect – Type I and II superconductors – High Temperature Superconductors – 123 superconductor – Applications of superconductors.

UNIT V – ADVANCED MATERIALS

Liquid Crystals – Types – Application as Display Devices

Metallic Glasses – preparation by melt spinning. Twin roller system, properties and applications

Shape Memory alloys (SMA), Shape memory effect, Properties and applications of SMA *Nanomaterials*- Nano materials (one, Two & three Dimensional) –Methods of synthesis (PVD, CVD, Laser Ablation, Solgel, Ball-milling Techniques), Properties and applications of nanomaterials. carbon nanotubes– synthesis, Properties and applications.

Text books

1. V Rajendran, Engineering Physics, *2nd Edition*, TMH, New Delhi *2011.*

Reference Books

1. Ali Omar M, Elementary Solid State Physics, Addison Wesley Publishing Co., 2009.
2. William D Callister Jr., Material Science and Engineering, 6th Edition, John Wiley and sons, 2009.
3. Charles Kittel, Introduction to Solid State Physics, 7th Edition, John Wiley & sons, Singapore, 2007.
4. V Raghavan , Materials Science and Engineering- A First Course, 5th Edition, Prentice Hall of India, 2008.
5. B.S. Murty, P. Shankar, Baldev Raj, B.B. Rath, and James Murday, Text book of Nanoscience and Nanotechnology, Universities Press, Hyderabad 2012
6. M.N. Avadhanulu, Enginerring Physics- Volume-II, S.Chand &Co, New Delhi, 2009
7. Pillai S.O, Solid State Physics, 6th Edition – New Age International, 2005.

T109 ENVIRONMENTAL SCIENCE

OBJECTIVES

To know about the environment
To understand about environmental pollution
To apply the knowledge in understanding various environmental issues and problems

UNIT I – ENVIRONMENT AND ENERGY RESOURCES

Environmental segments – atmosphere, hydrosphere, lithosphere and biosphere. Atmospheric layers. Pollution definition and classification. Pollutants classification. Forest resources – use and over exploitation, deforestation, forest management. Water resources – use and conflicts over water, dams – benefits and problems. Mineral resources – mineral wealth of India, environmental effects of extracting and using mineral resources. Food resources – world food problems, environmental impact of modern Agriculture – fertilizer and pesticides. Energy resources – growing needs, renewable and non-renewable energy resources and use of alternate energy sources. From unsustainable to sustainable development.

UNIT II - ECOSYSTEM AND BIODIVERSITY

Concept of an ecosystem - structure and function of an ecosystem.Producers, consumers, and decomposers.Energy flow in the ecosystem. Food chains, food webs and ecological pyramids. Introduction, types, characteristic features, structure and function of forest, grassland, desert and aquatic (fresh water, esturine and marine) ecosystems. Biodiversity – definition, genetic species and ecosystem diversity. Value of biodiversity - consumptive use, productive use, social, ethical, aesthetic and option values. Hot spots of biodiversity. Threats to biodiversity, habitat loss, poaching of wildlife, human wildlife conflicts. Endangered and endemic species. Conservation of biodiversity – in-situ and ex-situ conservation of biodiversity.

UNIT III - AIR POLLUTION

Definition and classification. Chemical and photochemical reaction in different layers of atmosphere. Causes, sources, effects and control measures of air pollutants - oxides of Nitrogen, oxides of Carbon, oxides of Sulfur, hydrocarbons, chloro-fluoro carbons and particulates. Mechanism and effects of air pollution phenomenon – Global Warming, Ozone Depletion, Acid Rain, Sulfurous Smog and Photochemical Smog.

UNIT IV- WATER AND LAND POLLUTION

Water pollution – causes and effects of organic water pollutants – pesticides, insecticides, detergents and surfactants. Causes and effects of inorganic water pollutants – heavy metal pollution due to Hg, Pb, Cr & Cu. Water pollution control and monitoring – DO, COD, BOD & TOC. Land Pollution – Solid waste management – causes, effect and control measures of urban and industrial wastes. Thermal and radioactive pollution.

UNIT V -POLLUTION CONTROL AND MONITORING

Basic concepts and instrumentation of IR, UV-VIS, atomic absorption spectrometry, Gas Chromatography and Conductometry. Analysis of air pollutants – NO_x, CO_x, SO_x, H_2S, Hydrocarbons and particulates.

Text Books:

1. K. Raghavan Nambiar, "Text Book of Environmental Studies" 2nd Ed, Scitech Publications (India) Pvt Ltd, India, 2010 (For Units I & II)
2. A. K. De, "Environmental chemistry" 7th Ed; New age international (P) Ltd, New Delhi, 2010. (For Units III, IV & IV)

Reference Books:

1. B.K. Sharma, "Environmental chemistry" 11th Ed, KRISHNA Prakashan Media (P) Ltd, Meerut, 2007.
2. S.S.Dara, and D.D. Mishra "A text book of environmental chemistry and pollution control, 5th Ed, S.Chandand Company Ltd, New Delhi, 2012.
3. Richard T. Wright, Environmental Science: Toward a Sustainable Future, 10th edition, Prentice Hall, 2008
4. G. S. Sodhi, Fundamental concepts of environmental chemistry, I Ed, Alpha Science International Ltd, India, 2000.

T110 BASIC CIVIL AND MECHANICAL ENGINEERING

OBJECTIVES

To be able to differentiate the types of buildings according to national building code.

To understand building components and their functions as well as different types of roads, bridges and dams

To explain the concepts of thermal systems used in power plants and narrate the methods of harnessing renewable energies

To explain the role of basic manufacturing processes

To develop an intuitive understanding of underlying working principles of mechanical machines and systems.

PART-A CIVIL ENGINEERING

UNIT I - BUILDINGS, BUILDING MATERIALS

Buildings-Definition-Classification according to NBC-plinth area, Floor area, carpet area, floor space index-construction materials-stone, brick, cement, cement-mortar, concrete, steel- their properties and uses.

UNIT II - BUILDINGS AND THEIR COMPONENTS

Buildings: Various Components and their functions. Soils and their classification. Foundation: function and types. Masonry- function and types. Floors: definition and types of floors. Roofs: definition f and types.

UNIT III - BASIC INFRASTRUCTURE

Surveying: classification, general principles, types, Uses, instruments used. Roads-types: components, types and their advantage and disadvantages. Bridges: components and types of bridges. Dams: Purpose, types of dams. Water supply-sources and quality requirements, need and principles of rainwater harvesting.

PART - B MECHANICAL ENGINEERING

UNIT - IV INTERNAL AND EXTERNAL COMBUSTION SYSTEMS

IC engines – Classification – Working principles - Diesel and petrol engines: two stroke and four stroke engines – Merits and demerits.

Steam generators (Boilers) – Classification – Constructional features (of only low pressure boilers) – Boiler mountings and accessories – Merits and demerits - Applications.

UNIT - V POWER GENERATION SYSTEMS

Conventional and Non-Conventional: Hydraulic – Thermal – Nuclear power plants – Schemes and layouts (Description Only)
Solar – wind –Geothermal - Wave – Tidal and Ocean Thermal Energy Conversion systems – Basic power plant schemes and layouts (Description only).

UNIT - VI MANUFACTURING PROCESSES

Machines – Lathe – Drilling – Bending – Grinding – Shearing (Description only)
Machining Processes – Turning – Planning – Facing – Blanking – Drilling – Punching – Shearing – Bending – Drawing – Filing – Sawing – Grinding.

Moulding and Metal Joining - Pattern making – Green and dry sand moulding – Arc and Gas welding – Brazing – Soldering (process description only).

Text Books

1. Natarajan, K V, Basic Civil Engineering, 11th Edition, Dhanalakshmi Publications Chennai, 2011. (For Units I to III)
2. Venugopal , K and Prabhu Raja, Basic Mechanical Engineering, Anuradha Publisher , 2012(For Units IV to VI)

Reference Books

1. Purushothama Raj.P., Basic civil engineering, 3rd Edn., Dhanam Publications, Chennai, 2001
2. Rajput, R K, Engineering Materials, S Chand & Co. Ltd., New Delhi, 2012.
3. Punmia, B.C., et. al., Surveying , Vol-I, Laxmi Publishers, New Delhi, 2012.
4. Punmia, B.C., et.al Building Construction, Laxmi Publishers, New Delhi ,2012.
5. El.Wakil, M.M., Power Plant Technology, Mc Graw Hill Book Co.,1985.
6. Hajra Choudhry, et. al., Workshop Technology Vol I and II, Media Promoters Publishers Pvt. Ltd., Bombay, 2004.
7. Lindberg, R.A.Process and Materials of Manufacture, PHI, 1999.
8. H.N.Gupta, R.C.Gupta and Arun Mittal, Manufacturing Processes, New Age Publications, 2001
9. Nagpal, Power Plant Engineering, Khanna Publishers, Delhi, 1998.

T111 ENGINEERING MECHANICS

OBJECTIVES

To understand the vector and scalar representation of forces and moments, static equilibrium of particles and rigid bodies in two dimensions

To comprehend the effect of friction on equilibrium

To understand the laws of motion, the kinematics of motion and the interrelationship and to learn to write the dynamic equilibrium equation

To emphasis the concepts through solved examples

UNIT I - FUNDAMENTAL OF MECHANICS

Basic Concepts Force System and Equilibrium, Definition of Force, Moment and Couple, Principle of Transmissibility, Varignon's theorem, Resultant of force system – Concurrent and non concurrent coplanar forces, Condition of static equilibrium for coplanar force system, stability of equilibrium, , applications in solving the problems on static equilibrium of bodies.

UNIT II – PRACTICAL APPLICATION OF FORCE SYSTEM

Structural member: definition, Degree of freedom, concept of free body diagrams, types of supports and reactions, types of loads, Analysis of Trusses-method of joints, method of sections.

Friction: Introduction, Static dry friction, simple contact friction problems, ladders, wedges.

UNIT III - PROPERTIES OF SURFACES

Properties of sections – area, centroids of lines, areas and volumes, moment of inertia first moment of inertia, second moment of inertia and product moment of inertia, polar moment of inertia, radius of gyration, mass moment of inertia.

UNIT IV - KINEMATICS AND KINETICS OF PARTICLES

Equations of motion - Rectilinear motion, curvelinear motion, Relative motion, D'Alembert's principle, work- Energy equation – Conservative forces and principle of conservation of energy, Impulse – momentum, Impact – Direct central impact and oblique central impact.

UNIT V - KINEMATICS AND KINETICS OF RIGID BODIES

Plane motion, Absolute motion, Relative motion, translating axes and rotating axes, work and energy, impulse and momentum

Text Books

1. Rajesekaran, S and Sankara Subramanian., G., Engineering Mechanics, Vikas Publishing House Private Ltd., 2012.

Reference Books

1. Palanichamy, M.S. Nagan, S., Engineering Mechanics – Statics & Dynamics, Tata McGraw-Hill,2011.

2. Beer, F.P and Johnson Jr. E.R, Vector Mechanics for Engineers, Vol. 1 Statics and Vol.2 Dynamics, McGraw – Hill International Edition, 1997.

3. Bhavikatti,S.S and K.G.Rajashekarappa, Engineering Mechanics, New Age International (P) Ltd, New Delhi,2010

T112 COMMUNICATIVE ENGLISH

OBJECTIVES

To improve the LSWR skills of I B.Tech students

To instill confidence and enable the students to communicate with ease

To equip the students with the necessary skills and develop their language prowess

UNIT I – BASIC COMMUNICATION THEORY

Importance of Communication – stages of communication, modes of communication – barriers to communication – strategies for effective communication – Listening: Importance, types, barriers – Developing effective listening skills.

UNIT II – COMPREHENSION AND ANALYSIS

Comprehension of technical and non-technical material – Skimming, scanning, inferring-Note making and extension of vocabulary, predicting and responding to context-Intensive Reading and Reviewing

UNIT III – WRITING

Effective sentences, cohesive writing, clarity and conciseness in writing – Introduction to Technical Writing – Better paragraphs, Definitions, Practice in Summary Writing – Four modes of writing – Use of dictionaries, indices, library references – making bibliographical entries with regard to sources from books, journals, internet etc.

UNIT IV – BUSINESS WRITING / CORRESPONDENCE

Report writing – Memoranda – Notice – Instruction – Letters – Resumes – Job applications

UNIT V – ORAL COMMUNICATION

Basics of phonetics – Presentation skills – Group Discussions – Dialogue writing – Short Extempore – Debates-Role Plays-Conversation Practice

Text Book

1. Robert J.Dixson. ,Complete Course in English, Prentice-Hall of India Pvt. Ltd., New Delhi,2006.

Reference Books

1. Ashraf M.Rizvi., Effective Technical Communication. Tata-McGraw, 2005.
2. Boove, Courtland R et al., Business Communication Today. Delhi. Pearson Education,2002.
3. Meenakshi Raman and Sangeeta Sharma., Technical Communication Principles And Practice,OUP, 2007.
4. Robert J.Dixson., Everyday Dialogues in English, Prentice-Hall of India Pvt. Ltd., New Delhi,2007.
5. Sethi,J and Kamalesh Sadanand., A Practical Course in English Pronunciation, Prentice-Hall of India Pvt. Ltd, New Delhi,2007.

P104 PHYSICS LABORATORY

OBJECTIVES

To provide a practical understanding of some of the concepts learnt in the theory course on Physics.

LIST OF EXPERIMENTS (ANY 10 EXPERIMENTS)

1. Thermal conductivity – Lee's DISC
2. Thermal conductivity - Radial flow
3. Spectrometer – Prism or Hollow prism
4. Spectrometer – Transmission grating
5. Spectrometer - Ordinary & Extraordinary rays
6. Newton's rings
7. Air – wedge
8. Half shade polarimeter – Determination of specific rotatory power
9. Jolly's experiment – determination of α
10. Magnetism: i – h curve
11. Field along the axis of coil carrying current
12. Vibration magnetometer – calculation of magnetic moment & pole strength
13. Laser experiment: wavelength determination using transmission grating, reflection grating (vernier calipers) & particle size determination
14. Determination of optical absorption coefficient of materials using laser
15. Determination of numerical aperture of an optical fiber
16. Electrical conductivity of semiconductor – two probe / four probe method
17. Hall effect in semiconductor

P105 CHEMISTRY LABORATORY

OBJECTIVES

To gain a practical knowledge of Engineering Chemistry in relevance to Industrial applications

LIST OF EXPERIMENTS (ANY 10 EXPERIMENTS)

1. Determination of dissolved oxygen in water.
2. Determination of total hardness of water by EDTA method.
3. Determination of carbonate and bicarbonate in water.
4. Estimation of chloride content in water.
5. Estimation of magnesium by EDTA.
6. Estimation of acetic acid in vinegar.
7. Estimation of ferrous by permanganometry.
8. Estimation of ferrous and ferric iron in a solution mixture by dichrometry.
9. Estimation of available chlorine in bleaching powder.
10. Estimation of copper in copper sulphate solution.
11. Estimation of calcium by permanganometry.
12. Estimation of iron by colorimetry.

DEMONSTRATION EXPERIMENTS (ANY TWO OF THE FOLLOWING)

1. Determination of COD of water sample.
2. Determination of lead by conductometry.
3. Percentage composition of sugar solution by viscometry.

P106 WORKSHOP PRACTICE

OBJECTIVES

To convey the basics of mechanical tools used in engineering To establish hands on experience on the working tools

To develop basic joints and fittings using the hand tools

To establish the importance of joints and fitting in engineering applications To explain the role of basic workshop in engineering

To develop an intuitive understanding of underlying physical mechanism used in mechanical machines.

Sl. No.	Trade	List of Exercises
1.	Fitting	Study of tools and Machineries. Exercises on symmetric joints and joints with acute angle.
2.	Welding	Study of arc and gas welding equipment and tools – Edge preparation – Exercises on lap joint and V Butt joints – Demonstration of gas welding
3	Sheet metal work	Study of tools and Machineries – exercises on simple products like Office tray and waste collection tray.
4.	Carpentry	Study of tools and Machineries – Exercises on Lap joints and Mortise joints

LIST OF EXERCISES

I Fitting

1. Study of tools and Machineries
2. Symmetric fitting
3. Acute angle fitting

II Welding

1. Study of arc and gas welding equipment and tools
2. Simple lap welding (Arc)
3. Single V butt welding (Arc)

III Sheet metal work

1. Study of tools and machineries
2. Frustum
3. Waste collection tray

IV Carpentry

1. Study of tools and machineries
2. Half lap joint
3. Corner mortise joint.

P107 NCC / NSS

NCC/NSS training is compulsory for all the Undergraduate students

1. The above activities will include Practical/field activities/Extension lectures.
2. The above activities shall be carried out outside class hours.
3. In the above activities, the student participation shall be for a minimum period of 45 hours.
4. The above activities will be monitored by the respective faculty incharge and the First Year Coordinator.
5. Pass /Fail will be determined on the basis of participation, attendance, performance and behavior. If a candidate Fails, he/she has to repeat the course in the subsequent years
6. Pass in this course is mandatory for the award of degree.

Subject Code	Subject Name	Lectures (Periods)	Tutorial (Periods)	Practical (Periods)
MA T31	**MATHEMATICS III (Common to all branches of B.Tech.)**	3	1	-

Course Objectives:

- To provide the concepts of functions of a complex variable, conformal mapping, complex integration, series expansion of complex functions, Harmonic analysis and Fourier series.
- To make the students understand and work out problems of constructing analytic functions, conformal mapping, bilinear transformation, contour integration and expanding functions into Fourier series including Harmonic analysis.

Course Outcomes:

On successful completion of the module students will be able to:

- Understand the concepts of function of a complex variable and complex integrationand apply these ideas to solve problems occurring in the area of engineering and technology.
- Expand functions into Fourier series which are very much essential for application in engineering and technology.

UNIT I

Function of a complex variable: Continuity, derivative and analytic functions – Necessary conditions– Cauchy-Riemann equations (Cartesian and polar form) and sufficient conditions (excluding proof) – Harmonic and orthogonal properties of analytic function– Construction of analytic functions.

UNIT II

Conformal mapping – Simple and standard transformations like w= z+c, cz, z^2, e^z, sin z,cosh z and z+1/z –Bilinear transformation and cross ratio property (excluding Schwarz-Christoffel transformation).Taylor's and Laurent'stheorem (without proof) –Series expansion ofcomplex valued functions –classification of singularities.

UNIT III

Complex Integration: Cauchy's integral theorem and its application, Cauchy's integral formula and problems.Residues and evaluation of residues – Cauchy's residue theorem – Contour integration: Cauchy's and Jordan's Lemma (statement only)– Application of residue theorem to evaluate real integrals – unit circle and semicircular contour (excluding poles on boundaries).

UNIT IV

Fourier Series: Dirichlet's conditions – General Fourier series – Expansion of periodic function into Fourier series – Fourier series for odd and even functions – Half-range Fourier cosine and sine series – Change of interval – Related problems.

UNIT V

Root Mean Square Value – Parseval's theorem on Fourier Coefficients. Complex form of Fourier series – Harmonic Analysis.

Text Books:

1. Veerarajan T., Engineering Mathematics for first year, Tata-McGraw Hill, 2010.
2.Venkataraman M.K., Engineering Mathematics, Vol. II & III, National Publishing Company, Chennai, 2012.

Reference Books:

1. Kandasamy P. et al, Engineering Mathematics, Vol. II & III, S. Chand & Co., New Delhi, 2012.
2. Bali N.P., Manish Goyal, "Engineering Mathematics, 7th Edition, Laxmi

Publications, 2007.
3. Grewal B.S., Higher Engineering Mathematics, 40th Edition, Khanna Publishers, Delhi 2007.
4. Erwin Kreyszig, Advanced Engineering Mathematics, 7Th Edition, Wiley India, 2007.

Code	Subject Name	Lectures (Periods)	Tutorial (Periods)	Practical (Periods)
EI T32	ELECTRIC CIRCUIT ANALYSIS **(Common to ICE and BME)**	**3**	**1**	**0**

Course Objectives:

- To analyze electrical circuits using KCL and KVL
- To learn network theorems and apply them for circuit analysis
- To study resonance and coupled circuits
- To study two port parameters
- To study transient analysis of RC,RL,RLC circuits

Course Outcomes: .

- Analyse DC And AC circuits
- Design resonant and tuned circuits
- Find the transient response of RC, RL and RLC circuits
- Find the two port parameters of the circuits

Syllabus:

UNIT 1

BASICS OF CIRCUIT ANALYSIS: Voltage– Current relationship for passive elements- Review of Kirchhoff's laws- Network reduction techniques, Steady state analysis of R, L and C (in series, parallel and series parallel combinations) with sinusoidal excitation- power factor, Real and Reactive powers, Complex and Polar forms of representation, Complex power.

UNIT II

NETWORK THEOREMS FOR DC AND AC CIRCUITS: Review of loop and nodal methods of analysis, star-to-delta or delta-to-star transformation, Source transformation, Superposition theorem, Thevenin's theorem, Norton's theorem, reciprocity theorem, compensation theorem, Maximum power transfer theorem, Millman's theorem and Tellegen's theorem applied to dc and ac circuits

UNIT – III

RESONANCE, COUPLED CIRCUITS, AND THREE PHASE CIRCUITS:

Resonance – Series and parallel resonance circuits- Concept of band width and Q factor.

Coupled Circuits: Faraday's laws of electromagnetic induction – Concept of self and mutual inductance – dot convention – coefficient of coupling**.**

Three phase circuits: Phase sequence – Star and delta connection – Relation between line and phase voltages and currents in balanced systems – Analysis of balanced and Unbalanced 3 phase circuits – two watt meter method to measure power and power factor.

UNIT – IV

TRANSIENT ANALYSIS: Initial conditions in elements, Transient response of R-L, R-C, R-L-C circuits (Series combinations only) step and sinusoidal excitations -Solution using differential equation approach and Laplace transform methods of solutions

UNIT – V

NETWORK FUNCTIONS AND PARAMETERS: Network functions: The concept of complex frequency- concept of transformed network- driving point impedance and admittance-transfer function-poles and zeros. RC filters-lowpass, highpass , band pass and band reject filters-frequency response- Z, Y, ABCD, hybrid parameters and their relations– 2-port network parameters using transformed variables.

Text Books:

1. P. Ramesh Babu, "Circuit theory" Second Edition, Scitech Publications Pvt. Ltd, 2014.
2. M.E.Van Valkenburg "Network Analysis", Third Edition, Prentice-Hall, 1980.

Reference Books:

1. William Hayt and Jack E. Kimmerly, "Engineering circuit analysis" McGraw Hill Company, 8th edition, 2013.
2. N.C. Jagan & C.Lakshminarayana, 'Network Theory' B.S Publications, 2006.
3. Kuriakose, "Circuit Theory", PHI Learning, 2005

Code	Subject Name	Lectures (Periods)	Tutorial (Periods)	Practical (Periods)
EI T33	**ELECTRONIC CIRCUITS-I** (Common to ICE branch)	**4**	**0**	**0**

Course Objectives:

- Understand the working of diodes, transistors.
- Understand the application of different electronic devices and simple circuits.

Course Outcomes

On successful completion of the module students will be able to:

- Analyse the function of various semiconductor devices.
- Analyze and design amplifier circuits, oscillators and filter circuits employing BJT, FET devices

UNIT-I

SEMICONDUCTOR DIODES

Atomic Structures-Semiconductors, Conductors and Insulators-Covalent Bonds-Conduction in Semiconductors-N Type and P Type Semiconductors-The Diode-Biasing the Diode- VI Characteristics of a Diode- Diode Models- Testing a Diode. Applications of Diodes: Avalanche and Zener break down - Zener Diode- Applications of Zener Diode- Half-wave and Full-wave rectifiers-Power Supply Filters and Regulators-Clipping and Clamping Circuits-Voltage Multipliers.

UNIT-II

BIPOLAR JUNCTION TRANSISTORS (BJT)

Transistor Structure-Basic Transistor Operation-CE, CB and CC configurations-Transistor Characteristics and parameters-Applications of Transistor as a switch, as an amplifier. The DC Load Line and operating point, Types of BJT Biasing, analysis and Design, Biasing stability, Temperature compensation, Thermal runway.

UNIT-III

BJT AMPLIFIER

Amplifier Operation, Amplifier AC and DC equivalent circuits, The common Emitter Amplifier, The Common Collector Amplifier, The Common Base amplifier, Multistage Amplifier. Small signal transistor amplifier circuits: h-parameter representation of a transistor, Analysis of single stage transistor amplifier using h-parameters: voltage gain, current gain, Input impedance and Output impedance. Comparison of transistor configurations in terms of A_I,R_i,A_V,R_o.

UNIT-IV

FIELD EFFECT TRANSISTORS (FET)

The JFET- Characteristics and Parameters - JFET Biasing-JFET amplifiers - common source, common Drain, common Gate amplifiers - The MOSFET-Enhancement and Depletion mode MOSFETs - MOSFET characteristics and Parameters - MOSFET biasing and applications. Power MOSFET

UNIT-IV

SPECIAL PURPOSE DIODES AND OTHER DEVICES

Tunnel Diode-PIN Diode- Varactor Diode-Schottky Diode- Gunn Diode- Light Emitting diode-Photo Diode- Photo Transistors, Solar cell, Basic Four Layer Device - Silicon Controlled Rectifier (SCR)-Applications of SCR- The DIAC and TRIAC, The Silicon -Controlled Switch(SCS), Uni-junction Transistor(UJT), The Light Activated SCR(LASCR)-Optocouplers.. LCD, CCD.

TEXT BOOK

1. J.Millman, C.C.Halkias, and Satyabratha Jit, "Electronic Devices and Circuits" Tata McGraw Hill, 3rd Ed., 2012.

REFERENCE BOOKS

1.Floyd, "Electronic Devices", Pearson Education, 7th Edition , 2008 .

2. R.L. Boylestad and Louis Nashelsky , Electronic Devices and Circuits , Pearson/Prentice Hall, 9th Edition,2006.

3. P. Ramesh Babu, "Electronic Devices and Circuits" Scitech Publications Pvt, Ltd., 2012.

4.Nagrath, ""Electronic Devices and Circuits" PHI Learning, 2006.

Code	Subject Name	Lectures (Periods)	Tutorial (Periods)	Practical (Periods)
EI T34	**SENSORS AND TRANSDUCERS** (Common to ICE branch)	**4**	**0**	**0**

Course Objectives:

- To get the basic idea of measurements and the errors associated with measurement.
- To differentiate between the types of transducers available.
- To gain information about the function of various measuring instruments and using them

- **Course Outcomes:** To get the basic idea of measurements and the errors associated with measurement.
- To differentiate between the types of transducers available
- To gain information about the function of various measuring instruments and using them

Syllabus:

UNIT – I

INTRODUCTION: Generalized scheme of a measurement system – basic methods of measurements- Errors in measurements –types of errors-Statistical analysis of measurement data-mean, standard deviation – probability of errors – probable error, limiting errors. Reliability of measurement systems – failure rate – reliability improvement, Availability, redundancy. Different types of noises in measurements and its Suppression methods.

UNIT – II

STATIC AND DYNAMIC CHARACTERISTICS: Static characteristics of instruments – generalized mathematical model of measurement systems – dynamic characteristics – Modelling of Transducers – operational transfer function – zero, first and second order instruments – impulse, step, ramp and frequency response of the above instruments.

UNIT – III

RESISTANCE TRANSDUCERS: Resistance potentiometer – loading effect – strain gauges – gauge factor – types of strain gauges – rosettes – semiconductor strain gauges – installation of strain gages – strain measuring circuits - quarter bridge, half bride and full bridge circuits– Resistance thermometers, materials, construction, characteristics – Thermo wells – Thermistors and photo resistors (LDR) – hot wire anemometer – constant current and constant temperature operation – Humidity sensors. Signal conditioning circuits for RTD and Thermistor. Linearization techniques for Thermistors.

UNIT – IV

INDUCTIVE, CAPACITIVE AND PIEZOELELCTRIC TRANSDUCERS: Inductive transducers – variable reluctance transducers – Inductive proximity pick up and Capacitive proximity pickup– Synchros operation and applications – LVDT construction - signal conditioning circuit, Phase sensitive demodulator circuit – applications – RVDT. Capacitive transducers – variable area type – variable air gap type – variable permittivity type – signal conditioning circuit – Blumlein bridge – Capacitor microphone – frequency response. Piezoelectric transducers – piezoelectric crystals – charge amplifier.

UNIT – V

MISCELLINEOUS AND SMART TRANSDUCERS : Eddy current transducers. Hall effect transducers – Photo electric detector, different types and characteristics – Magneto-strictive Transducer, Optical sensors, IC sensor for temperature – signal conditioning circuits, Introduction to Fiber optic sensors – Temperature, pressure, flow and level measurement using fiber optic sensors. Intelligent and smart transducers- principle- design approach, interface design, configuration support, communication in smart transducer networks. SQUID sensors, Film sensors, MEMS – Nano sensors.

Text Books:

1. S. Renganathan, "Transducers Engineering", Pearson Education, Third Edition, 2008.
2. John. P. Bentley, "Principles of Measurement systems", Longman Publishers, 1983.

Reference Books:

1. J.W. Dally.W.F. Riley and K.G. Mc Connell, "Instrumentation for Engineering measurements", John Wiley & sons Inc., 1993.
2. H.K.P.Nubert, "Instruments Transducers: An Introduction to their performance and design" 1st Edition, 2003.
3. C.D. Johnson, "Process control Instrumentation Technology", PHI, 7thedition,
4. R.K.Jain, "Mechanical measurements", Khanna Publishers, 2002.

Code	Subject Name	Lectures (Periods)	Tutorial (Periods)	Practical (Periods)
EI T35	**DATA STRUCTURES AND OBJECT ORIENTED PROGRAMMING** (Common to ICE and BME branches)	**4**	**0**	**0**

Course Objectives

- To acquaint students with data structures used when programming for the storage and manipulation of data.
- The concept of data abstraction and the problem of building implementations of abstract data types are emphasized.
- To understand the concepts of object oriented programming
- To expertise the programming skills through C++ language

Course Outcomes:

On successful completion of the module students will be able to:

- Select of relevant data structures and combinations of relevant data structures for the given problems in terms of memory and run time efficiency.
- Apply data abstraction in solving programming problems.
- An ability to conceptualize the problem in terms of object oriented features
- An ability to use the OO programming techniques(C++) in developing applications.
- An ability to design and develop a complete object oriented applications

UNIT-I : SEARCHING AND SORTING

Introduction to Algorithm – Programming principles – Creating programs- Analyzing programs. Arrays: One dimensional array, multidimensional array. Pointers - Searching: Linear search, Binary Search. Sorting techniques: Internal sorting - Insertion Sort, Selection Sort, Shell Sort, Bubble Sort, Quick Sort, Merge Sort and Radix Sort.

UNIT II - STACK, QUEUE and LINKED LIST

Stacks: Definition – operations - applications of stack. Queues: Definition - operations - Priority queues - De queues – Applications of queue. Linked List: Singly Linked List, Doubly Linked List, Circular Linked List, linked stacks, Linked queues, Applications of Linked List.

UNIT III : DYNAMIC STORAGE MANAGEMENT

- Trees: Binary tree, Terminology, Representation, Traversals, Applications
Graph: Terminology, Representation, Traversals – Applications - spanning trees, shortest path Introduction to Hash tables.

UNIT IV: PRINCIPLES OF OBJECT ORIENTED PROGRAMMING

Principles of Object Oriented Programming - Beginning With C++ - Tokens-Expressions-control Structures – Functions in C++, classes and objects, constructors and destructors ,operators overloading and type conversions .

UNIT V: ADVANCED OBJECT ORIENTED PROGRAMMING

Inheritance: Extending classes, Pointers, Virtual functions and polymorphism, File Handling Operations

TEXT BOOKS

1. Ellis Horowitz and SartajSahni, “Fundamentals of Data Structures”, Galgotia Book Source, Pvt. Ltd., 2004
2. D. Samanta, “Classic Data Structures”, Second Edition, Prentice-Hall of India, Pvt. Ltd., India 2012.
3. E. Balagurusamy, “ Object Oriented Programming with C++”, McGraw Hill Education (India)Private Limited, 6th Edition 2013..

REFERENCES

1. 1. Robert Kruse, C.L. Tondo and Bruce Leung, “Data Structures and Program Design in C”, Prentice-Hall of India, Pvt. Ltd., Second edition, 2007.
2. Seymour, “Data Structures”, The McGraw-Hill, 2007.
3. Jean – Paul Tremblay & Paul G.Sorenson, An Introduction to data structures with applications, Tata McGraw Hill edition, II Edition, 2002.
4. Bjarne Stroustrup, The C++ Programming Language, Addison Wesley, 2000
5. Robert Lafore, Object oriented programming in C++, Galgotia Publication.

Code	Subject Name	Lectures (Periods)	Tutorial (Periods)	Practical (Periods)
EI T36	**FLUID MECHANICS AND STRENGTH OF MATERIALS** (Common to ICE branch)	**4**	**0**	**0**

Syllabus:

Unit I

DEFORMATION OF SOLIDS AND BENDING OF BEAMS: Concept of stress and strain – Normal and shear stresses – Simple and compound Stresses - Elasticity and elastic moduli – Poisson's ratio – Concept of Shear Force and Bending Moment – Bending moment and shear force diagrams for simply supported, cantilever and over hanging beams.

UNIT II

SHAFTS AND SPRINGS: Torsion – Shear stresses in circular solid and hollow shafts - Torque and power – Helical and leaf springs – Load, deflection, stress and stiffness relationships.

Unit III

FLUID PROPERTY AND FLOW CHARACTERISTICS : Fluid Property - Newton's law of Viscosity – Fluid pressure and its measurement – Types of Flow– Reynolds number – Continuity equation - Euler's Equation of Motion.

Unit IV

FLOW DYNAMICS AND PIPE FLOW: Bernoulli's Equations –Venturi meter and orifice meter - Pressure losses along the flow –Major and minor losses - Flow through circular pipes – Friction factor – Pipes in series and parallel - Hydraulic gradient.

Unit V

TURBINES AND PUMPS: Introduction and Classification of Turbines – Specific Speed – Turbine characteristics, Speed Governance – Classification of Centrifugal Pumps – Pump characteristics – Efficiency – Reciprocating Pumps –Air vessels.

Text Books:

1. R. K. Rajput, Strength of Materials, S. Chand & Company Ltd., 2008.
2. R.K., Bansal, A text book on Fluid Mechanics & Hydraulic Machinery,- M/s. Lakshmi Publications (P) Ltd, 2008.

Reference Books:

1. R.K., Bansal, Strength of Materials, M/s. Lakshmi Publications (P) Ltd, 2008.

2. R. K. Rajput, Fluid Mechanics and Hydraulic Machineries, S. Chand & Company Ltd., 2008**.**

3. R.S.Khurmi, Strength of Materials, S.Chand &company, 24th Edition, 2006.
4. Srivatsav, "Strength of materials" PHI Learning, 2007.

Code	Subject Name	Lectures (Periods)	Tutorial (Periods)	Practical (Periods)
EI P31	**ELECTRONIC DEVICES AND CIRCUITS LAB** (Common to ICE branch)	**0**	**0**	**3**

Syllabus:

Any ten experiments (including PSPICE simulation)

1. PN Junction diode and Zener diode characteristics
2. FET characteristics
3. SCR, DIAC and TRIAC characteristics
4. Measurement of h parameters of transistor in CB, CE, CC configurations
5. Rectifier with and without filters (Full wave & Half wave)
6. CE Amplifier and CC amplifiers
7. Single stage R-C coupled Amplifier.
8. FET amplifier (Common Source)
9. Clippers and Clampers
10 . RC wave shaping circuits

Equipments and Components required for a batch of 20 students

1.Semiconducter devices like Diode, Zener Diode, NPN Transistors, JFET, SCR, DIAC and TRIAC
2. Resistors, Capacitors and inductors
3. Function Generators 10
5. Regulated 3 output Power Supply 5, ± 15V 10V
6. CRO 10
7. Storage Oscilloscope 1
8. Bread boards 10
9. At least one demo module each for the listed equipments.
10. Component data sheets to be provided.
11. Digital Multimeter 10
12. Digital IC Tester (Analog) 2
13. Computer (PSPICE installed) 1

Code	Subject Name	Lectures (Periods)	Tutorial (Periods)	Practical (Periods)
EI P32	**FLUID MECHANICS AND STRENGTH OF MATERIALS LAB** (Common to ICE branch)	**0**	**0**	**3**

Syllabus:

List of Experiments:

Part – A: Fluid Mechanics Laboratory

Determination of Coefficient of discharge of Venturimeter, Orifice meter, Mouthpiece and Orifice.

Determination of Losses through pipes and pipe specials.

Determination of meta centric height of floating bodies.

Determination of force due to impact of jet on Vanes

Characteristic study on turbines

Characteristic study on pumps.

Part – B: Strength of Materials Laboratory

Tension test and Young's modulus of steel.

Hardness test : Rockwell, Brinell and Vicker's.

Torsion test : Rods and Flats.

Impact test : Charphy and Izod on metals.

Ductility test : Sheet metals (AI,GI and MS)

List of equipment required for Fluid machines lab for a batch of 20 students

Fluid Mechanics lab

1. Flow measuring test rig
2. Pipe friction and minor losses test setup
3. Meta centric height measurement test rig
4. Impact force measuring rig
5. Peiton, Francis & Keplan turbine testing rig
6. Centrifugal pump, jet pump, reciprocating pump test rigs

Strength of materials lab

1. Universal testing machine
2. Rockwell and Brinell and Vickers hardness tests
3. Torsion testing equipment
4. Impact test apparatus
5. Ductility test apparatus

Code	Subject Name	Lectures (Periods)	Tutorial (Periods)	Practical (Periods)
EI P33	**DATA STRUCTURES AND OBJECT ORIENTED PROGRAMMING LAB** (Common to ICE and BME branches)	**0**	**0**	**3**

DATA STRUCTURES AND OBJECT ORIENTED PROGRAMMING LAB
(The following experiments (1-8) are to be implemented only in C Language)

1. Searching Techniques
2. Sorting Techniques
3. Imp Linked List and doubly linked and its applications
4. Stack and its applications
5. Binary tree traversal
6. Graph traversal
7. Spanning Tree
8. Shortest path algorithms

(The following experiments (9-12) are to be implemented only in C++)

9. Programs to implement classes and objects with constructors and destructors
10. Programs to implement different types of inheritances like multiple, Multilevel and hybrid.
11. Programs to implement virtual functions to demonstrate the use of run time polymorphism
12. Programs to implement Queue and its applications

.**List of equipments required for a batch of 20 students**

1. Personal computer with C and C++ compilers- 20 No.s

Subject Code	Subject Name	Lectures (Periods)	Tutorial (Periods)	Practical (Periods)
MA T41	**MATHEMATICS IV (Common to all branches of B.Tech.)**	3	1	-

Course Objectives:

- Importance of problems in Partial Differential Equations
- Problem solving techniques of PDE
- To make the students knowledgeable in the areas of Boundary Value Problems like vibrating string (wave equation), heat equation in one and two dimensions.
- To acquaint the students with the concepts of Theory of sampling.

Course Outcomes:

On successful completion of the module students will be able to:

- Understand the different types of PDE and will be able to solve problems occurring in the area of engineering and technology.
  Know sampling theory and apply to solve practical problems in engineering and technology.

UNIT I – PARTIAL DIFFERENTIAL EQUATIONS:

Formation by elimination of arbitrary constants and arbitrary functions – General, singular, particular and integrals – Lagrange's linear first order equation – Higher order differential equations with constant coefficients

UNIT II: Solution of partial differential equation by the method of separation of variables – Boundary value problems – Fourier series solution – Transverse vibration of an elastic string.

UNIT III: Fourier series solution for one dimensional heat flow equation – Fourier series solutions for two dimensional heat flow equations under steady state condition – (Cartesian and Polar forms).

UNIT IV – APPLIED STATISTICS

Curve fitting by the method of least squares – fitting of straight lines, second degree parabolas and more general curves. Test of significance: Large samples test for single proportions, differences of proportions, single mean, difference of means and standard deviations.

UNIT V: Small samples – Test for single mean, difference of means and correlations of coefficients, test for ratio of variances – Chi-square test for goodness of fit and independence of attributes.

Text Books:

1. Venkataraman M. K, "Engineering Mathematics, Third year Part A& B", 12th Edition, The National Publishing Company, Madras 1996.
2. S. C. Gupta and V. K. Kapoor, "Fundamentals of Mathematical Statistics", Sultan Chand and sons, 1975.

Reference Books:

1. Kandasamy P. et al, Engineering Mathematics, Vol. II & III, S. Chand & Co., New Delhi, 2012.
2. Grewal.B.S., Higher Engineering Mathematics, 40th Edition, Khanna Publishers, Delhi 2007.
3. Bali N.P., Manish Goyal, " Engineering Mathematics, 7th Edition, Laxmi Publications, 2007.
4. Erwin Kreyszig, Advanced Engineering Mathematics, 7thEdition, Wiley India, 2007.
5. Ray Wylie C. , Advanced Engineering Mathematics, 6th Edition, Tata McGraw Hill, 2003

Code	Subject Name	Lectures (Periods)	Tutorial (Periods)	Practical (Periods)
EI T42	**ELECTRONIC CIRCUITS-II** (Common to ICE branch)	**4**	**0**	**0**

Course Objectives:

To familiarize the student with the analysis and design of basic transistor amplifier circuits, feedback amplifiers, wave shaping and multi vibrator circuits

Course Outcomes: .

On successful completion of the module students will be able to:

- Analyze the different types of diodes, operation and its characteristics
- Design and analyze the DC bias circuitry of BJT and FET
- Design circuits using the transistors, diodes and oscillators

UNIT I

TRANSISTOR AND FET AMPLIFIERS : Review of small signal transistor amplifier circuits, BJT Amplifier Frequency Response: The Decibel, Low Frequency Amplifier Response, High Frequency Amplifier Response, Total frequency response of Amplifier, Frequency response of multistage amplifiers, frequency response measurement, gain bandwidth product-cascade and cascode amplifiers- Darlington connection. Differential Amplifiers- Common mode and differential mode analysis – DC and AC analysis.

UNIT II

FEEDBACK AMPLIFIERS AND OSCILLATORS: Concept of feedback, Barkhausen criteria for oscillations ,Classification of feedback amplifiers, General characteristics of negative feedback amplifiers, Effect of Feedback on Amplifier characteristics, feedback topologies, practical feedback circuits- the oscillator-conditions for oscillations-RC phase shift oscillator, Wien bridge oscillator, Colpitt's oscillator, Hartley oscillator, clap oscillator, frequency and amplitude stability in oscillators, crystal oscillator.

UNIT III

NON SINUSOIDAL OSCILLATORS: Transistor as a switch**,** Transistor Switching times, Multivibrators – Astable, Monostable, Bistable modes of operation, Schmitt trigger, Blocking oscillator. RC wave shaping circuits-Integrator and differentiator – Time base circuits- Methods of Generating time base waveforms - Multivibrator using negative resistance devices (UJT), Miller and bootstrap time bases.

UNIT IV

POWER AMPLIFIERS: Class A power amplifier, maximum value of efficiency of Class A amplifier, transformer coupled amplifier, Class B and Class AB Push-Pull amplifiers, complimentary symmetry circuits (transformer less class B power amplifier), phase inverters, class C operation.

UNIT V

TUNED AMPLIFIERS: Analysis of Parallel Resonant Circuit, Single tuned voltage amplifier, Analysis of tuned amplifier, frequency response of single tuned voltage amplifier, Double tuned Voltage amplifier, Bandwidth of double tuned amplifier, applications of tuned amplifier , tuned class C amplifier, Maximum AC output power, stagger Tuned amplifiers.

TEXT BOOKS :

1. J. Millman and C.C. Halkias, Chetan D Parikh, Integrated Electronics, McGraw-Hill, Second Edition 2011.
2. Theodore F. Bogart Jr., J.S. Beasley and G. Rico, Electronic Devices and Circuits, Pearson Edition, 6th Edition, 2004

REFERENCES :

1. Robert L. Boylestad and Louis Nashelsky, Electronic Devices and Circuits Theory, Pearson/ Prentice Hall, 9th Edition, 2006.
2. Micro Electronic Circuits – Sedra A.S. and K.C. Smith, Oxford University Press, 5th edition
3. Kumar and Jain, " Electronic devices and Circuits" PHI learning, 2007
4. Floyd, "Electronic Devices", Pearson Education, 7th Edition , 2008

Code	Subject Name	Lectures (Periods)	Tutorial (Periods)	Practical (Periods)
EI T43	**DIGITAL LOGIC THEORY AND DESIGN** (Common to ICE and BME branches)	**3**	**1**	**0**

Course Objectives:

To introduce basic postulates of Boolean algebra and shows the correlation between Boolean expressions

- To introduce the methods for simplifying Boolean expressions
- To outline the formal procedures for the analysis and design of combinational circuits
- and sequential circuits
- To introduce the concept of memories and programmable logic devices.
- To illustrate the concept of synchronous and asynchronous sequential circuits

Course Outcomes: .

- The students will be able to understand and design of digital circuit and its principle
- The students will be able to explain the working of various sequential circuits
- Understand the digital Logic families and relevant ICs and its usages
- The student will understand algorthmic state machines and threshold logic and its usages

UNIT I MINIMIZATION TECHNIQUES AND LOGIC GATES

Number System and Boolean algebra: Review of Number systems and codes – Error detecting codes –Hamming Code- Boolean postulates and laws – De-Morgan's Theorem - Principle of Duality -Boolean expression - Minimization of Boolean expressions — Minterm – Maxterm - Sum of Products (SOP) –Product of Sums (POS) – Karnaugh map Minimization – Don't care conditions - Quine-McCluskey method ofminimization.

Logic Gates: AND, OR, NOT, NAND, NOR, Exclusive–OR and Exclusive–NOR-Implementations of Logic Functions using gates, NAND–NOR implementations– Multi level gateimplementations-

Multi output gate implementations. TTL and CMOS Logic and their characteristics – Tristate gates

UNIT II COMBINATIONAL CIRCUITS

Design procedure – Half adder – Full Adder – Half subtractor – Full subtractor - Parallel binary adder,parallel binary Subtractor – Fast Adder - Carry Look Ahead adder – Serial Adder/Subtractor - BCD adder –Binary Multiplier – Binary Divider - Multiplexer/ Demultiplexer – decoder - encoder – parity checker – parity generators - code converters - Magnitude Comparator.

UNIT III SEQUENTIAL CIRCUITS

Latches, Flip-flops - SR, JK, D, T, and Master-Slave – Characteristic table and equation –Application table – Edge triggering – Level Triggering – Realization of one flip flop using other flip flops – serial adder/subtractor- Asynchronous Ripple or serial counter – AsynchronousUp/Down counter - Synchronous counters – Synchronous Up/Down counters – Programmable counters –Design of Synchronous counters: state diagram- State table – State minimization –State assignment -Excitation table and maps-Circuit implementation - Modulo–n counter, Registers – shift registers -Universal shift registers

– Shift register counters – Ring counter – Shift counters - Sequence generators.

UNIT IV SYNCHRONOUS AND ASYNCHRONOUS SEQUENTIAL CIRCUITS

Synchronous Sequential Circuits: General Model – Classification – Design – Use of Algorithmic State Machine – Analysis of Synchronous Sequential Circuits

Asynchronous Sequential Circuits**:** Design of fundamental mode and pulse mode circuits – Incompletely specified State Machines– Problems in Asynchronous Circuits – Design of Hazard Free Switching circuits.

UNIT V MEMORY DEVICES

Classification of memories – ROM - ROM organization - PROM – EPROM – EEPROM – EAPROM, RAM –RAM organization – Write operation – Read operation – Memory cycle - Timing wave forms – Memorydecoding – memory expansion – Static RAM Cell- Bipolar RAM cell – MOSFET RAM cell – Dynamic RAM cell–

Programmable Logic Devices – Programmable Logic Array (PLA) - Programmable Array Logic (PAL) - FieldProgrammable Gate Arrays (FPGA) - Implementation of combinational logic circuits using ROM, PLA,PAL.

Text Books:

M. Morris Mano, M.Michael Ciletti, Digital Design, 5th Edition, Pearson Education(Singapore) Pvt. Ltd., New Delhi, 2013.

Reference Books:

1. John F.Wakerly, Digital Design, Fourth Edition, Pearson/PHI, 2006
2. John.M Yarbrough, Digital Logic Applications and Design, Thomson Learning, 2002.
3. Charles H.Roth. Fundamentals of Logic Design, Thomson Learning, 2003.
4. Donald P.Leach and Albert Paul Malvino, Digital Principles and Applications, 6th Edition, TMH, 2003.
5. William H. Gothmann, Digital Electronics, 2nd Edition, PHI, 1982.
6. Thomas L. Floyd, Digital Fundamentals, 8th Edition, Pearson Education Inc, New Delhi, 2003
7. Donald D.Givone, Digital Principles and Design, TMH, 2003.

Code	Subject Name	Lectures (Periods)	Tutorial (Periods)	Practical (Periods)
EI T44	**Electrical and Electronic Instruments** (Common to ICE and BME branches)	**4**	**0**	**0**

Course Outcomes:

make the students to gain a clear knowledge of the basic laws governing the operation of electrical instruments and the measurement techniques.

- To have an adequate knowledge in the measurement techniques for current, voltage, power and energy.
- Elaborate discussion about potentiometer & instrument transformers.
- Detailed study of resistance and impedance measuring methods.
- An exposure is given to the student about signal generation and analysis.
- In-depth knowledge is given to the student about cathode ray oscilloscope.
- Emphasis is laid on display and recording devices

Course Outcomes:

- The students will be able to understand and design of digital circuit and its principle
- The students will be able to explain the working of various sequential circuits
- Understand the digital Logic families and relevant ICs and its usages
- The student will understand algorithmic state machines and threshold logic and its usages

Syllabus:

UNIT I

MEASUREMENT OF VOLTAGE, CURRENT, POWER AND ENERGY

Galvanometers – Ballistic, D'Arsonval galvanometer – Theory, calibration, application – Principle, construction, operation and comparison of moving coil, moving iron meters, dynamometer, induction type & thermal type meter, rectifier type – Extension of range and calibration of voltmeter and ammeter– Errors and compensation Electrodynamometer type wattmeter – Theory & its errors – Methods of correction – LPF wattmeter – Phantom loading – Induction type KWH meter – Calibration of wattmeter, energy meter.

UNIT II

POTENTIOMETERS & INSTRUMENT TRANSFORMERS

DC potentiometer – Basic circuit, standardization – Laboratory type (Crompton's) – AC potentiometer – Drysdale (polar type) type – Gall-Tinsley (coordinate) type – Limitations & applications – Magnetic measurements – Ballistic Galvanometer, Grassot flux meter – testing of ring specimen – method of reversal and step by step method – testing of bar specimen – Hopkinson's permeameter – Iron loss measurement by Lloyd Fisher square. AC test on magnetic materials. Current Transformer and Potential Transformer construction, theory, operation, phasor diagram, characteristics, testing, error elimination – Applications.

UNIT III

RESISTANCE AND IMPEDANCE MEASUREMENT

Measurement of low, medium & high resistance – Ammeter, voltmeter method – Wheatstone bridge – Kelvin double bridge – Series and shunt type ohmmeter –High resistance measurement – Megger – Direct deflection methods – Price's guard-wire method – Loss of charge method – Earth resistance measurement. A.C bridges– Measurement of inductance, capacitance – Q of coil – Maxwell Bridge – Wein's bridge – Hey's bridge – Schering bridge – Anderson bridge – Campbell bridge to measure mutual inductance –Introduction to cable fault and eddy current measurement.

UNIT IV

SIGNAL GENERATORS AND ANALYZERS

Sine wave generator – Frequency synthesized sine wave generator. – Sweep frequency generator, pulse and square wave generator – Function generator – Wave analyzer – Applications. Simple function generator using LM566, Monolithic function generator using XR2206 – Harmonic distortion analyzer – Spectrum analyzer – Applications – Audio Frequency generator – Noise generator.

UNIT V

CATHODE RAY OSCILLOSCOPE, RECORDERS AND DISPLAYS

General purpose oscilloscope CRT -Dual beam & dual trace – Probes – Oscilloscope techniques – Special oscilloscopes – Storage oscilloscopes – Sampling oscilloscope. X-Y Plotters, magnetic tape recording, direct, digital recording, – Data loggers. Display devices : $3\frac{1}{2}$ digit 7 segment LED Display driver and decoder, Analog and digital millimeters, Principles of LED and LCD monitors – Annunciators- Numerics- Alphanumeric

TEXT BOOKS

1. David. A. Bell, Electronic Instrumentation and Measurement, Oxford University Press, Second Edition, 2009.

2. E.W.Golding & F.C.Widdis, 'Electrical Measurements & Measuring Instruments', Reem Publications Pvt. Ltd, 2011.

.

REFERENCE BOOKS

1.Patranabis, "Principles of Electronic Instrumentation" - PHI, 2007

2. Albert D. Helfrick & William D. Cooper, 'Modern Electronic Instrumentation & Measurement Techniques', Prentice Hall of India, 2002

3. B.M.Oliver and J.M.Cage, 'Electronic Measurements & Instrumentation', McGraw Hill International Edition, 1975.

4. A.K. Sawhney, 'Electrical & Electronic Measurements and Instrumentation', Dhanpath Rai & Co (P) Ltd, 2004

Code	Subject Name	Lectures (Periods)	Tutorial (Periods)	Practical (Periods)
EI T45	**LINEAR INTEGRATED CIRCUITS** (Common to ICE and BME branches)	**3**	**1**	**0**

Course Objectives:

1. To introduce the basic building blocks of linear integrated circuits.
2. To teach the linear and non-linear applications of operational amplifiers.
3. To introduce the theory and applications of analog multipliers and PLL.
4. To teach the theory of ADC and DAC
5. To introduce the concepts of waveform generation and introduce some special function ICs

.

Course Outcomes: On successful completion of the module students will be able to:

1. Design simple circuits like amplifiers using Opamps.
2. Design waveform generating circuits
3. Design simple filters circuits for particular application.
4. Gain knowledge in designing stable voltage regulators.

Syllabus:

UNIT I

INTEGRATED CIRCUITS : Classification, chip size and circuit complexity, Fundamentals of Monolithic IC technology, basic planar processes, Fabrication of a typical circuit, Active and passive components of ICs, fabrication of FET, Thin and thick film technology.

OPERATION AMPLIFIER: basic information of Op-amp, ideal and practical Op-amp, Op-amp characteristics, 741 op-amp and its features, modes of operation-inverting, non-inverting, differential mode.

UNIT II

OP-AMP APPLICATIONS : Basic application of Op-amp, instrumentation amplifier, ac amplifier, V to I and I to V converters, Precision rectifiers, log and antilog amplifiers, sample & hold circuits, multipliers and dividers, Differentiators and Integrators, Comparators, Schmitt trigger, Multivibrator, Triangular wave generator.

UNIT III

ACTIVE FILTERS, OSCILLATORS AND REGULATORS: Introduction-Low pass and High pass filters- Design of first and second order Butterworth lowpass and high pass filters Band pass, Band reject and all pass filters- Oscillator types and principle of operation – RC, Wien bridge oscillators triangular, saw-tooth, square wave and VCO- Introduction to voltage regulators, features of 723, Three Terminal IC regulators- DC to DC Converter- Switching Regulators-UPS-SMPS.

UNIT IV

TIMERS & PHASE LOCKED LOOPS : Introduction to 555 timer, functional diagram, monostable and astable operations and applications, Schmitt Trigger. PLL - introduction, block schematic, principles and description of individual blocks of 565-PLL applications, Analog and digital phase detectors.

UNIT V

D-A AND A- D CONVERTERS : Introduction, basic DAC techniques, weighted resistor DAC, R-2R ladder DAC, Different types of ADCs - parallel comparator type ADC, counter type ADC, successive approximation ADC, dual slope ADC and Sigma delta ADC. DAC and ADC specifications. DAC 0800 and ADC 0804 pin diagram and applications

Text Books:

1 D. Roy Chowdhury, "Linear Integrated Circuits" New Age International (p) Ltd, 2011.

Reference Books:

REFERENCES :

1. R.F. Coughlin & Fredrick F. Driscoll. Operational Amplifiers & Linear Integrated Circuits, PHI, 6th Edition, 2003
2. Ramakanth A. Gayakwad, Op-Amps & Linear ICs –PHI, 4th Edition 2004.

Code	Subject Name	Lectures (Periods)	Tutorial (Periods)	Practical (Periods)
EI T46	**ELECTRICAL MACHINES** (Common to ICE branch)	**4**	**0**	**0**

Course Objectives:

To expose the students to the concepts of various types of electrical machines and applications of electrical machines.

Course Outcomes: .

- Constructional details, principle of operation, Performance, starters and speed control of DC Machines
- Constructional details, principle of operation of Transformers.
- Constructional details, principle of operation of AC Machines
- Constructional details, principle of operation of Special Machines.
- Utilization of electrical Energy.

Syllabus:

UNIT-I

Magnetic Circuit: Magnetomotive force, magnetic field strength-permeability of free space, relative permeability-reluctance-comparison of electric and magnetic circuits-composite magnetic circuit-magnetic leakage and fringing Kirchhoff's Laws for the magnetic circuits-magnetization curve-hysterisis loop-current-ring theory of magnetism- hysterisis loop-minimum volume of a permanent magnet-load line of a permanent magnet-barium ferrite magnets-magnetic field of a long solenoid-magnetic energy in a non-magnetic medium-magnetic pull. Inductance of a coil and factors determining inductance of a coil. Magnetic relays and contactors. Earth leakage circuit breakers.

UNIT-II

DC Machines: Construction details of machine-operation of DC generators-EMF equation-characteristics of different types of generators-operation of DC motors-torque equation-characteristics of different types of DC motors. Starters-braking and speed control of DC motors. Applications of DC motors and generators

UNIT-III

Transformers: Principle-types, general constructional features of single phase and three phase transformers-phasor diagram and equivalent circuit-regulation and efficiency-open circuit and short circuit tests-autotransformers. Application of three phase, single phase and autotransformers.

UNIT-IV

Induction Machines: Types- constructional features- slip- torque characteristics-starters-braking and speed control methods-principle of operation and types of single phase induction motors. Application of three and single phase induction motors, AC servomotor

UNIT-V

Synchronous Machines: Principle-types and general constructional features-synchronous generators-characteristics-emf equation-armature reaction-regulation-phasor diagram of synchronous motor –V curve – starting methods. Application of synchronous generators and motors.

Text Books:

1. D.P.Kothari and I.J.Nagrath, Electric Machines**,** McGraw Hill Education (India) Private Limited, 2006

2. B.L.. Thereja and Thereja "A text book of Electrical Technology"-Vol-I, S.Chand &Co.Ltd., 23rd Revised Edition, 2006

Reference Books:

1. Stephen.J.Chapman, "Electrical machinery Fundamentals", McGraw-Hill Higher Education, 2004, 4th Edition.
2. Bandhopadyay, " Electrical Machines", PHI, 2005

Code	Subject Name	Lectures (Periods)	Tutorial (Periods)	Practical (Periods)
EI P41	**LINEAR AND DIGITAL INTEGRATED CIRCUITS LAB (Common to ICE and BME)**	**0**	**0**	**3**

Part A (IC Application Lab):

1. OP AMP Applications – Adder, Subtractor, Integrator and Differentiator Circuits using IC 741.
2. Active Filter Applications – LPF, HPF (first order)
3. IC 741 Oscillator Circuits – Phase Shift and Wien Bridge Oscillators.
4. Function Generator using OP AMPs.
5. IC 555 Timer – Monostable and Astable Operation Circuit.
6. IC 565 – PLL Applications, IC 566 – VCO Applications.
7. Voltage Regulator using IC 723, Three Terminal Voltage Regulators – 7805, 7809, 7912.
8. 4 bit DAC using OP AMP.

Part B

1. D Flip-Flop 7474 and shift registers-7495
2. Decade counter-7490
3. 3-8 Decoder -74138
4. 4 bit Comparator-7485
5. 8 x 1 Multiplexer -74151 and 2x4 Demultiplexer-74155
6. RAM (16x4)-74189 (Read and Write operations)
7. Decoder drives for LED

Equipments and Components Required for a batch of 20 students

Equipments for Analog Lab CRO (30MHz) – 10 Nos. Signal Generator /Function Generators (3 MHz) – 10 Nos. Dual Regulated Power Supplies (0 – 30V) – 10 Nos.. Transistor/FET (BJT-NPN-PNP and NMOS/PMOS) – 50 Nos. Dual power supply/ single mode power supply - 10 No.s Digital IC Trainer Kit - 10 No.s Bread Boards -10 Nos. Multimeter -15 Nos. ICs each 40 No.s 741/555/565/566/7400/ 7402 / 7404 / 7486 / 7408 / 7432 / 7483 / 74150 / 74151 / 74147 / 7445 / 7476/7491/ 7494 / 7447 / 74189 / 7485 / 7473 / 74138 / 7411 / 7474, IC tester - 5 No.s

Code	Subject Name	Lectures (Periods)	Tutorial (Periods)	Practical (Periods)
EI P42	**SENSORS AND TRANSDUCERS LAB (Common to ICE)**	**0**	**0**	**3**

Syllabus:

SENSORS AND TRANSDUCERS LABORATORY

1. Characteristic of Temperature transducers (LDR, thermistor and thermocouple).
2. Measurement of Displacement using capacitive transducer, LVDT, inductive transducer and potentiometric transducer.
3. Measurement of strain, Load and Level using strain gauges
4. Measurement of torque and Pressure using strain gauges
5. Measurement of Voltage, current and power using Hall Effect transducer.
6. Characteristics of Optical Transducers (LDR, Phototransistor, Photovoltaic and photoconductive cells)
7. Measurement of speed using Magnetic and photo electric pickup transducers.
8. Ramp response characteristic of filled in system thermometer.
9. Online Modeling of RTD and thermocouple using Data loggers.
10. Characteristics of P/I and I/P converters.
11. Measurement of Pressure and Temperature using ICs (LM 35,LM 335 and AD 590)
12. Measurement of Position using synchro Transmitter and receiver
13. . Measurement of pH using single glass electrode.
14. Measurement of Flow, Level and Temperature.

Equipments and Components Required for a batch of 20 students

RTD-PT100 - 5 no.s, Thermistor- 5 no.s, Thermocouple- K and J type -5no.s each, Hot water bath-2 no.s

Muffle furnace -2 no.s, Regulated Power supply-10 No.s, Digital Multimeter -10 No.s, Oscilloscope-10 No.s, LVDT kit- 1No. Inductive Transducers Kit-1No. Potentiometer-1No. Load cell trainer-1No. Strain gauge trainer-1No. Level measurement trainer-1No. Torque measurement trainer-1No. Pressure measurement trainer-1No. Hall voltage and Hall current transducer -1No. LDR kit-1No. Photo transistor TIL 081-10.No.s, Optical transducers trainer kit (Photovoltaic and photoconductive cells) -1No. Opto-i nterruptor IC MOC 7811-1No. Electro pneumatic converter-1No. Pressure gauges-5No.s Data Logger Dr.DAQ-1No. I/P and P/I converters-2No.s, IC Pressure transducer-10 No.s, IC temperature transducer10 No.s, pH single glass electrode-10 No.s, pH buffer tablet values 4,7 and 9.2-10 No.s, FET Op amp CA 3140 10 No.s, Synchros trainer-1No., Flow measurement trainer-1No.,Pressure measurement trainer-1No., Level measurement trainer-1No.,Bread board-10.No.s,Thermometer-10 No.s, resistors and capacitors- available values – 25 each, Personal Computer with data logger software

Code	Subject Name	Lectures (Periods)	Tutorial (Periods)	Practical (Periods)
EI P43	**ELECTRICAL MACHINES LAB (Common to ICE)**	**0**	**0**	**3**

Syllabus:

1. Power measurement using Two wattmeter method for the following:
a) Load with UPF
b) Load with Lagging PF
c) Load with Leading PF
2. OCC of Shunt generator.
3. Predetermination of Transformer parameters.
4. Swinburn's Test.
5. Load test on single phase Induction motor.
6. Blocked rotor test.
7. Load test on single phase Alternator.
8. Load test on three phase transformer.
9. Load test on shunt motor.
10. Variation of starting torque with rotor resistance of a slip ring induction motor.

List of equipment required for a batch of 20 students

1. single phase induction motor and three phase induction motor -2No.s Each
2. Ammeter(0-5A, 0-10 A, 0 – 20 A,0 - 1 A) Both MI and MC-10No.s.Each
3. Voltmeter(0 – 300 V), (0- 600V)-10 No.s each
4. single phase and three phase Auto transformer -3 No.s Each
5. Tachometer(0 to 1500 rpm)- 5 No.s Each
6. Wattmeter (UPF, LPF, 10A,500V)- 10No.s.Each
7. Rheostat (290 ohms and 2.8 A)- 10No.s.Each
8. D.C. Shunt motor, DC Shunt generator-each 2 No.s
9. single phase transformer (230V/197.8V, 2 KVA), Three phase transformer
10. 3 phase Synchronous motor-2No.s each
11. Single Phase Resistive Loading Bank – 2 nos
12. Three Phase Resistive Loading Bank. – 2 nos
13. SPST switch – 2 nos

EI P 44 Physical Education

Physical Education is compulsory for all the Undergraduate students

1. The activities will include games and sports / extension lectures.
2. Two Hrs. / Week will be allocated for physical education in the third and fourth semesters. The student participation shall be for a minimum period of 45 hours in both the semesters put together.
3. These activities will be monitored by the Director of Physical Education.
4. Pass /Fail will be determined on the basis of participation, attendance, and performance. If a candidate Fails, he/she has to repeat the course in the subsequent years
5. Pass in this course is mandatory for the award of degree.

Code	**Subject Name**	**Lectures (Periods)**	**Tutorial (Periods)**	**Practical (Periods)**
MA T51	**NUMERICAL METHODS** (Common to ICE branch)	**3**	**1**	**0**

Syllabus:

UNIT – I

SOLUTION OF ALGEBRAIC AND TRANSCENDENTAL EQUATION AND EIGEN VALUE PROBLEM:

Solution of algebraic and transcendental equation by the method of bisection, the method of false position, Newton-Raphson method and Graeffe's Root squaring method. Eigen value problem by power method and Jacobi method.

UNIT – II

SOLUTION OF SYSTEMS OF EQUATIONS AND MATRIX INVERSION: Solution of linear algebraic equation: Gauss and Gauss-Jordan elimination methods-Methods of triangularization and Crout's reduction. Iterative methods: Gauss-Jacobi, Gauss-Seidel and Relaxation methods. Matrix inversion by Gauss-Jordan elimination and Crout's methods.

UNIT – III

INTERPOLATION: Finite Differences, Relation between operators – Interpolation by Newton's forward and backward difference formulae for equal intervals. Newton's divided difference method and Lagrange's method for unequal intervals. Numerical differentiation in one variable. Numerical Integration by Trapezoidal and Simpson's rules with respect to one and two variables.

UNIT – IV

SOLUTION OF ORDINARY DIFFERENTIAL EQUATION: Single step methods: Taylor series method, Picard's method of successive approximation, Euler and Improved Euler methods, Runge-Kutta method of fourth order only. Multistep methods: Milne and Adams-Bashforth methods.

UNIT – V

SOLUTION OF PARTIAL DIFFERENTIAL EQUATIONS: Solution of Laplace and Poisson equations: Leibmann's iterative method. Diffusion equation: Bender-Schmitt method and Crank-Nicholson implicit difference method. Wave equation: Explicit difference method.

Text Books:

1. P.Kandasamy, K. Gunavathy and K.Thilagavathy, "Numerical Methods", S. Chand & Company Ltd., New Delhi, 2008.

Reference Books:

1. P.Kandasamy, "Numerical methods in Science and Engineering", National Publishing Company, Madras, 2008
2. B.S. Grewal, "Numerical methods in Engineering & Science", Khanna Publishers, New Delhi. (Fifth edition 2006).
3. S.Sastry, " Numerical Analysis" PHI, 2006

Code	Subject Name	Lectures (Periods)	Tutorial (Periods)	Practical (Periods)
EI T52	**CONTROL SYSTEMS ENGINEERING (Common to ICE branch)**	**3**	**1**	**0**

OBJECTIVES

- To understand the methods of representation of systems and their transfer function models.
- To provide adequate knowledge in time response of systems and steady state error analysis.
- To give basic knowledge in obtaining the open loop and closed–loop frequency responses of systems.
- To understand the concept of stability of control system and methods of stability analysis.
- To study the three ways of designing compensators for a control system.

Course Outcomes: .

On successful completion of the module students will be able to understand the basic concepts on behavior of controllers in any applications.

UNIT I

SYSTEMS AND THEIR REPRESENTATION

Basic elements in control systems – Open and Closed loop systems – Feedback characteristics – Effects of feedback – Mathematical modeling of physical systems:-Mechanical, Thermal, Hydraulic and Pneumatic systems - Transfer function – AC and DC servomotors – Block diagram reduction techniques – Signal flow graph – Control system components - Computer simulation (For assignments only).

UNIT II

TIME RESPONSE ANALYSIS

Time response – Types of test inputs - I and II order system responses – Error coefficients – Generalized error series - Steady state error - Time domain specifications - Computer simulation (For assignments only).

UNIT III

FREQUENCY RESPONSE ANALYSIS

Frequency response - Frequency domain specifications - Bode plot- Polar plot -Determination of phase margin and gain margin - Constant M and N circles – Nichols chart - Determination of closed loop response from open loop response – Computer simulation (For assignments only).

UNIT IV

STABILITY OF CONTROL SYSTEM

Concepts of stability – Location of roots in s-plane for stability – Routh Hurwitz criterion – Root locus techniques – Construction – Nyquist stability criterion -Computer simulation(For assignments only). PID controllers - Performance criteria - Selection of controller modes – Lag,

Lead, and Lag-Lead networks – Compensator design for desired response using Root locus and Bode diagrams.

UNIT V

STATE-VARIABLE ANALYSIS: Introduction of state, state variables and state model, derivation of state models from block diagrams, Relationship between state equations and transfer functions- Characteristic equation, eigenvalues, eigenvectors, canonical forms Diagonalization- solving the time invariant state equations- State Transition Matrix. Controllability and observability. Computer simulation (For assignments only).

.

Text Books:

1.R.Anandanatarajan, P.Ramesh Babu, "Control Systems Engineering", Scitech Publications, India, Fifth Edition, 2014.

2. Nagrath, I.J. and Gopal, M., "Control System Engineering", New-age International(P), 4th Edition Ltd., New Delhi, 2009.

Reference Books:

1. Gopal, M., "Control Systems, Principles and Design", Tata McGraw-Hill Pub. Co.,2nd Edition, New Delhi, 2006.

2. Ogata, K., "Modern Control Engineering", PHI., 5th Edition, New Delhi, 2010.

3. Kuo, B.C., "Automatic Control Systems", PHI., New Delhi,2003.

Subject Code	Subject Name	Lectures (Periods)	Tutorial (Periods)	Practical (Periods)
EI T53	INDUSTRIAL INSTRUMENTATION-I (Common to ICE) (	4	0	0

Course Objectives:

To equip the students with the knowledge of industrial measurements like load cells, torque, Temperature, speed, acceleration, density, viscosity and humidity measurements

Course Outcomes:

The student knows to apply the conveyor belt weighing for on line measurement.

instrument in various fields.

The student will be equip with the knowledge of industrial measurements like load cells, Ttorque, Temperature, Speed, Acceleration, Density, Viscosity and Humidity measurements

UNIT – I

INDUSTRIAL MEASUREMENTS : Measurement of straightness, flatness, roundness and roughness. Electric balance – different types of load cells – elastics load cell-strain gauge load cell- different methods of torque measurement, using strain gauge, relative regular twist-speed measurement – revaluation counter-capacitive tacho-drag up type tacho D.C and A.C tacho generators – stroboscopic methods.

UNIT – II

TEMPERATURE MEASUREMENT-I: Introduction - Definitions and standards – primary and secondary fixed points – Temperature scale – calibration of thermometers – different types of filled in system thermometer – sources of errors in filled in systems and their compensation – Bimetallic thermometers – Electrical methods of temperature measurement – signal conditioning of industrial RTDs and their characteristics – 3 lead and 4 lead RTDs – Improved bridge circuits.

UNIT – III

TEMPERATURE MEASUREMENT-II : Thermocouples – law of thermocouple – fabrication of industrial thermocouples – signal conditioning of thermocouple output – thermal block references functions – commercial circuits for cold junction compensation – response of thermocouple – Linearization of thermocouple and Thermistors – colour coding Testing and calibration and Installation procedures. Special techniques for measuring high temperature using thermocouples – Radiation methods of temperature measurement – radiation fundamentals – total radiation and selective radiation pyrometers – optical pyrometer – two colour radiation pyrometer.

UNIT – IV

MISCELLINEOUS MEASUREMENTS-I : Accelerometers - LVDT, piezo-electric, strain gauge and variable reluctance type accelerometers – mechanical type vibration

instruments – seismic instrument as an accelerometer and vibrometer – calibration of vibration pick ups – units of density, specific gravity and viscosity used in industries – Baume scale API scale – pressure head type densitometer – float type densitometer – ultrasonic densitometer Bridge type gas densitometer

UNIT – V

MISCELLINEOUS MEASUREMENTS-II : Viscosity terms – say bolt viscometer – rotameter type viscometer - Falling ball viscometer – industrial consistency meters – humidity terms – dry and wet bulb psychrometers – hot wire electrode type hygrometer – dew cell – electrolysis type hygrometer – commercial type dew point meter – moisture terms - different methods of moisture measurement – moisture measurement in granular materials, solid penetrable materials like wood, web type material.

TOTAL PERIODS: 60

TEXT BOOKS:

1. Ernest O.Doebelin, “Measurement systems Application and Design”, International Students Edition, Vi Edition, McGraw Hill Book Company, 2012.
2. R.K.Jain, “Mechanical and Industrial Measurements”, Khanna Publishers, New Delhi, 1999.

Reference Books:

REFERENCES:

1. D.Patranabis, “Principles of Industrial Instrumentation”, Tata McGraw Hill Publishing Ltd., New Delhi, 1999.
2. A.K.Sawhney, “A course in Electrical and Electronic Measurement and Instrumentation”, Dhanpat Rai and Sons, New Delhi, 1999.
3. P.Holman, “Experimental Methods for Engineers”, International Student Edition, McGraw Hill Book Company, 1971

Code	Subject Name	Lectures (Periods)	Tutorial (Periods)	Practical (Periods)
EI T54	**MICROPROCESSORS AND ITS APPLICATIONS** (Common to ICE and BME branches)	**4**	**0**	**0**

Course Objectives:

- To study 8085 programming
- To study interfacing devices like 8255, 8253, 8259 and 8251
- To study 8086 and programming
- To study the applications of 8085

Course Outcomes: .

- Write simple assembly language program in 8085
- Interface any i/o device and communicate using 8085
- Write simple assembly language programs in 8086
- Design a microprocessor based system for any application

Syllabus:

UNIT-I

INTRODUCTION TO 8085: Generic-8-bit microprocessor and its architecture-8085 functional block diagram-Architecture-functions of different sections-Memory mapping-Memory interfacing-Instruction format-addressing modes-instruction set of 8085 CPU-instruction cycle-timing diagram-different machine cycles-fetch and execute operations-estimation of execution time.

UNIT-II

PROGRAMMING 8085: data transfer instructions-arithmetic operations-logic and branch operations-writing assembly language programmes-looping, count indexing-16 bit arithmetic instructions-arithmetic operations related to memory-logical operations, rotate compare, counter and time delays-debugging techniques. Stack- subroutine- call and return instructions-parameter passing techniques-nested subroutine. Parallel input-output and interfacing applications-peripheral and memory mapped I/O. 8085 interrupts-Restart as software instructions

UNIT-III

INTERFACING DEVICES: 8255 programmable peripheral interface-8253 programmable interval timer-8259 programmable interrupt controller-direct memory access(DMA) and 8257 DMA controller-8155 multipurpose programmable devices-8279 programmable keyboard display interface-serial I/O and data communication-8251 USART-Interfacing data converters ADC and DAC.

UNIT-IV

INTRODUCTION TO 8086: Architecture of 8086 Microprocessor- Special functions of General purpose registers- 8086 flag register and function of 8086 flags- Addressing modes of 8086-Instruction set of 8086-, Assembly language programs involving logical, Branch & Call instructions, sorting, evaluation of arithmetic expressions, string manipulation- Pin diagram of 8086-Minimum mode and maximum mode of operation- Timing diagram- Memory interfacing to 8086 (Static RAM & EPROM).

UNIT-V

APPLICATIONS OF MICROPROCESSORS: Typical application of microprocessors: Seven segment display interface, LCD interface, stepper motor control, temperature control, frequency measurement., phase angle and power factor measurement, Measurement of strain, deflection and water level measurement, Microprocessor based traffic control .

Text Books:

1. Ramesh S Gaonkar, "Microprocessor Architecture, Programming and application with 8085", 6th Edition, Penram International Publishing, New Delhi, 2013. (Unit I, II, III and V)
2. A.K. Ray and K.M.Burchandi, and A.K.Ray," AdvancedMicrprocessor and Peripherals, McGraw Hill International Edition, 3rd Edition, 2012 (Unit-IV)
3. B. Ram, "Fundamentals of Microprocessors and Microcomputers, Dhanpat Rai Publications, 2001 (Unit V)

Reference Books:

1. N. Senthil Kumar, M.Saravanan and S.Jeevananthan, ―Microprocessor and Microcontrollers, OXFORD UNIVERSITY PRESS, November, 2010.

2. John Uffenbeck, "The 80x86 Family, Design, Programming and Interfacing", Third Edition, Pearson Education, 2002.

Code	Subject Name	Lectures (Periods)	Tutorial (Periods)	Practical (Periods)
EI T55	**VLSI DESIGN**	3	1	0

Course Objectives:

- To introduce Digital VLSI design concepts and to introduce IC designing using Field Programmable Gate Arrays.
- To impart skill set in VHDL Hardware Description Language and understand real time modeling of ICs with test benches.

Course Outcomes:

- Foundational skill set in CMOS technology and logic implementation using CMOS.
- Basics of VHDL hardware description language and VHDL levels of abstraction.
- Working knowledge of VHDL programming using concurrent architecture
- Designing complex digital systems using component instantiation.
- Working knowledge of test bench development.

Syllabus:

Unit – I

Introduction to IC Technology – MOS, PMOS, NMOS, CMOS & BiCMOS technologies- Pass transistor, NMOS Inverter, Various pull ups, CMOS Inverter analysis and design-Gate realization using CMOS-Introduction to Chip Design Process- Evolution of Computer Aided Digital Design - Hardware Description Languages- Introduction to Reconfigurable Hardware - FPGA and CPLD basics- Applications of VLSI.

Unit – II

VHDL basics - VHDL levels of abstraction – Structural , Behavioral and dataflow modes of implementation- The VHDL design flow - VHDL design entities - Entity declarations - Architectures –Concurrent signal assignments - Signal assignments with delays – Signal and variable assignments -Sequential statements - VHDL processes - Processes sensitivity lists Conditional statements – loops - selective signal assignments.

Unit – III

Subprograms – Functions – Procedures - Differences between functions and procedures - Subprogram declarations – Packages - Package declaration - Package body. Component declarations - Component instantiation - Named port mapping – Positional port mapping –- Modeling hardware in VHDL - VHDL models for multiplexers, Encoders, Decoders, Parity Generators – combinational circuit implementation - Test bench development and VHDL Synthesis.

Unit - IV

VERILOG HDL Design Flow-Module Description -Lexical Conventions - Description of Data types - Net - Register- Scalar Data Description - Vector Data Description -Parameters description - Array Description - Gate level Modeling -Dataflow modeling - Behavioral Modeling -Switch level Modeling.

Unit - V

Structured Procedural Statements-Always Statements-Initial Statements. Conditional statements Loops - Block Statements - Parallel block - Sequential block. VERILOG HDL

implementation for combinational and Sequential digital circuits – Test Bench Implementation – Synthesis using VERILOG.

TEXT BOOK :

1.J. Bhasker ,VHDL Primer, Prentice Hall, 2006.
2. J. Bhasker,Verilog HDL Synthesis-A Practical Primer,Star Galaxy Publications,1998.
3. 3. John M. Rabaey, Digital Integrated Circuits -, PHI, EEE, 1997.

REFERENCES:

1. John P.Uyemura,, Chip Design for Submicron VLSI: CMOS Layout & Simulation, - Thomson Learning. 2008
2. John .P. Uyemura, Introduction to VLSI Circuits and Systems -, JohnWiley, 2003.
3. Wayne Wolf,Modern VLSI Design - Pearson Education, 3rd Edition, 1997

Code	Subject Name	Lectures (Periods)	Tutorial (Periods)	Practical (Periods)
EI P51	**VLSI Design lab**	**0**	**0**	**3**

Syllabus:

1. Implementation of Basic Logic Gates, Half and Full Adders in FPGA and logic synthesis.
2. Implementation of Combinational logic circuits-Encoders, Decoders , Multiplexors , Demultiplexers, Comparators in FPGA
3. Implementation of Sequential logic Circuits - Flips Flops, Registers , Counters in FPGA.
4. Implementation of ALU in Structural , Behavioral and Dataflow modes. Validation of Logic outputs.
5. Peripheral Interfacing using FPGA - Switches, LEDs , Segment Displays.
6. Design of Motor Controller using FPGA/CPLD.
7. Design of Display controllers using FPGA/CPLD.
8. Design of Data Acquisition controllers using FPGA/CPLD.
9. Design of Programmable Signal generators using FPGA/CPLD.
10. Design of UART communication controller using FPGA/CPLD.

List of Equipments for a batch of 20 students

Sl Nr	Name of the Equipment	Quantity
1	Spartan3E XC3S250E FPGA Development Board	10
2	Altera Cyclone-II Development Board	10
3	LCD Interface Board(16x2)	4
4	Real time Clock Interface Board	4
5	LED and Switch Interface Board	4
6	ADC and DAC Interface Board	4
7	DC and Stepper Motor Interface Board	4
8	KeyPad and Relay Interface Board	4
9	Video and Memory Interface Board	4
10	SD card and TFT Interface Board	4
11	DSO - Quad Channel 100 MHz / Logic Analyzer	4

Code	Subject Name	Lectures (Periods)	Tutorial (Periods)	Practical (Periods)
EI P52	**INSTRUMENTATION DESIGIN LAB** (Common to ICE branch)	**0**	**0**	**3**

Syllabus:

1. 1. Design, Testing and calibration of 3½ Digit Digital Voltmeter using ICL 7107.
2. 2. Design, Testing and calibration of Monolithic function Generator using XR 2206 and LM566
3. Design, Testing and calibration of Regulator Power supplies.
4. Design, Testing and calibration of Batch counter using TTL ICs.
5. Design ,Testing and calibration of DAC and ADC (both passive and digital)
6. Design, Testing and calibration of Electronic P, PI, PID and ON/OFF controllers.
7. Design, Testing and calibration of Cold Junction compensation of a Thermocouple.
8. Design, Testing and calibration of Programmable Timers.
9. Design, Testing and calibration of pH meter using single glass electrode.
10. Design, Testing and calibration of Digital Thermometer.
11. Design, Testing and calibration of F to V and V to F converters.
12. Design and testing of advanced measurement circuits.

Equipments and Components Required for a batch of 20 students

ICL7107-10.No.s, Seven segment displays-10.No.s, Multifunction calibrator-1No. Resistors and capacitors-All available values -25 each, Potentiometers-10.No.s XR2206-10 No.s, Programmable timer XR2240-10 No.s, LM566-10 No.s, Fixed and variable voltage regulators-each 10 N0.s, LEDs-30. Decade counter IC TTL 7490-10 No.s, Decoder cum driver IC7447-10 no.s, Op-amps-30 N0.s, ADC 0801-10 No.s, DAC 0800-10 No.s, Cold junction compensation trainer-1 No., Function generator -10 N0.s, Oscilloscopes-10 N0.s, IC temperature transducer-10 N0.s, pH single glass electrode-10 N0.s,pH buffer tablet values 4,7 and 9.2-10 N0.s, Digital thermometer-% No.s, F to V and V to F converter ICs-10 No.s, Personal Computer with data logger software.

Code	Subject Name	Lectures (Periods)	Tutorial (Periods)	Practical (Periods)
EI P53	**MICROPROCESSORS AND ITS APPLICATIONS LAB** (Common to ICE and BME branches)	**0**	**0**	**3**

Syllabus:

1. Programming 8085 microprocessor kit
2. Programming 8086 microprocessor kit
3. Interfacing programmable interrupt controller
4. Interfacing of display devices
5. Interfacing of D/A and A/D converters
6. Interface of key board and display using programmable controllers
7. Interface of programmable timer
8. Stepper motor control using microprocessor
9. Interfacing of 8251 and 8257
10. Traffic light Controller Interface

LIST OF EQUIPMENT FOR A BATCH OF 20 STUDENTS:

1. 8085 Microprocessor Trainer with Power Supply- 10 No.s
2. 8086 Microprocessor Trainer Kit with power supply-10 No.s
3. 8255 Interface board -3 No.s
4. 8251 Interface board -3 No.s
5. 8259 Interface board -3 No.s
6. 8279 Keyboard / Display Interface board -3 No.s
7. 8254 timer counter -3 No.s
8. ADC and DAC card -3 No.s
9. Stepper motor Controller- 3 No.s
10. Traffic Light Control System- 3 No.s
11. Seven segment display interface- 3 No.s

Code	Subject Name	Lectures (Periods)	Tutorial (Periods)	Practical (Periods)
EI P54	**GENERAL PROFICIENCY-I**	**0**	**0**	**0**

Syllabus:

UNIT -I :

ART OF COMMUNICATION: Verbal and Non-verbal Communication – Barriers to Communication – Importance of Body Language – Effective Listening – Feedback

UNIT - II :

INTRODUCTION TO SOFT SKILLS: Attitude – Self-Confidence – Leadership Qualities – Emotional Quotient – Effective Time Management Skills – Surviving Stress – Overcoming Failure – Professional Ethics – Interpersonal Skills

UNIT – III :

WRITING: Importance of Writing – Written Vs Spoken Language – Formal and Informal Styles of writing – Resources for improving writing – Grammar and Usage – Vocabulary Building – SWOT analysis

UNIT – IV :

SPEAKING PRACTICE: Dialogue – Telephone Etiquette – Public Speaking – Debate – Informal Discussions – Presentations

UNIT – V :

APTITUDE: Verbal and Numerical aptitude

Reference Books:

1. Nicholls, Anne. Mastering Public Speaking. Jaico Publishing House,2003.
2. Aggarwal, R.S. Quantitative Aptitude. S.Chand &Co.,2004.
3. Leigh, Andrew and Michael Maynard. The Perfect Leader. Random House Business Books,1999.
4. Whetton .A.David and Kim S. Cameron. Developing Management Skills. Pearson Education, 2007.
5. K.R. Lakshminarayan. Developing Soft Skills. Scitech, 2009.
6. Sherfield M Robert. Developing Soft Skills Pearson Education, 2005.
7. Hair O' Dan, Friedrich W. Gustav and Lynda Dee Dixon. Strategic Communication in Business and the Professions. Pearson Education,2008.
8. Chaney Lilian and Jeanette Martin. Intercultural Business Communication, Fourth Edition. Pearson Education, 2008

Code	Subject Name	Lectures (Periods)	Tutorial (Periods)	Practical (Periods)
EI T61	**PROCESS CONTROL**	**4**	**0**	**0**

i. To study the basic characteristics of first order and higher order processes.
ii. To get adequate knowledge about the characteristics of various controller modes and methods of tuning of controller.
iii. To study about various complex control schemes.
iv. To study about the construction, characteristics and application of control valves.
v. To study the importance of state-space representation and stability analysis of discrete data system.
vi. To develop different types of algorithm for digital controllers.
vii. To provide adequate knowledge about the various ways of using computers for control.
To study the five selected unit operations and a case study of distillation column control.

Course Outcomes: .

To study the characteristics of various process characteristics
To understand the functions of process Control elements
To study the Characteristics of PID controller, Automanual transfer and tuning methods.
To study the various control schemes.
To understand the Multivariable Control

UNIT I
INTRODUCTION
Need for process control – mathematical model of first order level, pressure and thermal processes– higher order process – interacting and non-interacting systems – continuous and batch processes– self-regulation – servo and regulator operations.

UNIT II CONTROL ACTIONS AND CONTROLLERS
Basic control actions – characteristics of on-off, proportional, single-speed floating, integral and derivative control modes – P+I, P+D and P+I+D control modes – pneumatic and electronic controllers to realize various control actions. – Final control elements- Control valves--VFD-TPC-Characteristics of control valves – inherent and installed characteristics– cavitation and flashing.

UNIT III
OPTIMUM CONTROLLER SETTINGS
Evaluation criteria – IAE, ISE, ITAE and ¼ decay ratio – determination of optimum settings for mathematically described processes using time response and frequency response – Tuning – Process reaction curve method – Ziegler Nichols method – Damped oscillation method.
MULTILOOP CONTROL
Feed-forward control – ratio control- cascade control – inferential control – split-range control – introduction to multivariable control – examples from distillation column and boiler systems.

UNIT IV ANALYSIS OF DISCRETE DATA SYSTEMS
State-space representation of discrete data systems – Selection of sampling process – Selection of sampling period – Review of z-transform – Basic building blocks of computer control system – Pulse transfer function – Modified z-transform - Stability of discrete data system – Jury's stability test.

UNIT V DESIGN OF DIGITAL CONTROLLER

Digital PID – Position and velocity form – Deadbeat's algorithm – Dahlin's algorithm – Kalman's algorithm - Pole placement controller – Predictive controller.

Text Books:

1. . Stephanopoulis, G, Chemical Process Control, PHI learning, New Delhi, 2008.
2. Eckman. D.P., Automatic Process Control, Wiley Eastern Ltd., New Delhi, 2008

Reference Books:

1. . Pollard A.Process Control, Heinemann educational books, London, 1971.
2. Harriott. P., Process Control, Tata McGraw-Hill Publishing Co., New Delhi, 1991.
3. P.B. Deshpande, and R.H.Ash, 'Computer Process Control', ISA Publication, USA, 1995.
4. C.M.Houpis, G.B.Lamount, 'Digital Control Systems Theory, Hardware and Software',
5. Singh, 'Computer Aided Process Control', Prentice Hall of India, 2004.

Subject Code	Subject Name	Lectures (Periods)	Tutorial (Periods)	Practical (Periods)
EI T62	INDUSTRIAL INSTRUMENTATION-II (Common to ICE branch)	4	0	0

Course Objectives:

- To equip the students with the knowledge of industrial measurements like level, pressure, flow measurements and industrial safety specifications.

Course Outcomes:

- The student knows to calibrate the various instruments also he knows to apply the instrument in various fields.
- The student will be equip with the knowledge of industrial measurements like level, pressure, flow measurements
- The students will be equip with the knowledge of industrial hazards and safety specifications

UNIT – I

LEVEL MEASUREMENT : Gauge glass technique coupled with photo electric readout system – float type level indication – different schemes – level switches level measurement using displacer and torque tube – bubbler system. Boiler drum level measurement – differential pressure method – hydra step systems – electrical types of level gauges using resistance, capacitance, nuclear radiation and ultrasonic sensors.

UNIT – II

PRESSURE MEASUREMENT : Units of pressure – Types of pressure-Non-Electric type pressure measurement – manometers – different types – elastic type pressure gauges – Motion and force balance designs. Bourdon type bellows – diaphragms – Electrical methods – elastic elements with LVDT and strain gauges – capacitive type pressure gauge – piezo resistive pressure sensor – resonator pressure sensor – measurement of vacuum – McLeod gauge – Knudsen gauge – thermal conductivity gauges – Ionization gauge cold cathode and hot cathode types – Electrical pressure transmitter – testing and calibration of pressure gauges – dead weight tester.

UNIT – III

FLOW MEASUREMENT - MECHANICAL TYPE FLOWMETERS: Theory of fixed restriction variable head type flow meters-orifice plate – venturi tube – flow nozzle – dall tube – installation of head flow meters- piping arrangement for different fluids – pilot tube. Positive displacement flow meters – constructional details and theory of operation of mutating disc, reciprocation piston, oval gear and helix type flow meters-inferential meter turbine flow meter – rotameter – theory and installation – angular momentum mass flow meter – coriolis mass flow meters – thermal mass flow meter – volume flow meter plus density measurement – calibration of flow meters – dynamic weighing method.

UNIT – IV

FLOW MEASUREMENT - ELECTRICAL TYPE FLOWMETERS: Electrical type flow meter: Principle and constructional details of electromagnetic flow meter – different types of excitation – schemes used – different types of ultrasonic flow metera-laser Doppler anemometer systems – vortex shedding flow meter – target flow meter – solid flow rate measurement – guidelines for selection of flow meter.

UNIT – V

INDUSTRIAL SAFETY SPECIFICATIONS: EMC: Introduction, Interference coupling mechanism, basics of circuit layout and grounding, concepts of Interfaces, filtering and shielding. Safety: Introduction, electrical hazards, hazardous areas and classification, Non hazardous areas, enclosures – NEMA types, fuses and circuit breakers, protection methods: purging, explosion proofing and Intrinsic safety. Specification of instruments, preparation of project documentation, process flow sheet, Instrument index sheet, Instrument specification sheet, panel drawing and specifications

TEXT BOOKS:

1. Ernest O.Doebelin, "Measurement systems Application and Design", International Student Edition, IV Edition, McGraw Hill Book Company, 1998.
2. R.K.Jain, "Mechanical and Industrial Measurements", Khanna Publishers, New Delhi, 1999.

REFERENCES:

1. D.Patranabis, "Principles of Industrial Instrumentation", Tata McGraw Hill Publishing Ltd., New Delhi, 1999.
2. Andrew W.G, "Applied Instrumentation in Process Industries – A survey", Vol. 1 & Vol.2, Gulf Publishing Company, Houston, 1992

Code	Subject Name	Lectures (Periods)	Tutorial (Periods)	Practical (Periods)
EI T63	**DIGITAL SIGNAL PROCESSING**	**3**	**1**	**0**

Course Objectives:

- To find the output of a discrete-time system for the given discrete-time inputs
- To study about frequency analysis of discrete-time signals through DFT and FFT
- To study about the design of IIR and FIR filters
- To study the finite word length effects in digital filters
- To study about TMS320C50 DSP processor

Course Outcomes: .

- Analyze the response of a discrete-time system for different inputs
- Find the frequency components present in a signal
- Plot the frequency response of a discrete-time system
- Design IIR and FIR digital filters for the given application
- Write simple programs in DSP

UNIT – I

DISCRETE-TIME SIGNALS AND LINEAR SYSTEMS

Classification of signals: continuous and discrete, energy and power -representation of discrete-time signals, elementary discrete-time signals, classification of discrete-time signals, Classification of systems, Representation of a system with difference equation, impulse response and step response, FIR and IIR systems, Convolution sum and correlation, sampling techniques, quantization, quantization error, Nyquist rate, aliasing effect, reconstruction of analog signal from its samples.

UNIT- II

DTFT and Z-transform

Discrete-time Fourier series, Frequency range, Discrete-time Fourier transform-properties, Frequency response , ideal filters, Z-transform and its properties- inverse z-transforms- system function- stability criterion- Solving difference equations using Z-transform.

Realization of IIR systems- direct form-I, direct form –II, cascade form and parallel forms. Realization of FIR systems-direct form, linear phase realization, cascade and parallel forms.

UNIT- III

DFT and FFT

Discrete Fourier Transform, Relationship of the DFT to other transforms, Properties of DFT, circular convolution, filtering long duration sequences, parameter selection to calculate DFT. Computation of DFT using FFT algorithm – DIT & DIF - FFT using radix 2 – Butterfly structure- FFT applications.

UNIT IV

Design of Digital Filters

FIR filter design: Linear phase characteristics- Windowing technique of designing FIR filter– Need and choice of windows, frequency sampling method.

IIR filter design: Analog filter design - Butterworth and Chebyshev filters, digital design using impulse invariant and bilinear transformation – Warping effect, prewarping

UNIT-V

FINITE WORD LENGTH EFFECTS: Number representation, quantization, rounding truncation. Input quantization error, Product quantization error, Coefficient quantization error, Overflow limit cycle oscillations, Zero input limit cycle oscillations.

DIGITAL SIGNAL PROCSSORS: Overview and selection of DSPs, pipelining, MAC unit, Architecture of TMS320C50, addressing modes.

Text Book:

1.J.G Proakis and D.G.Manolakis, 'Digital Signal Processing Principles, Algorithms and Applications', Pearson Education/ PHI, New Delhi, 2011.

2.P. Ramesh Babu, "Digital Signal Processing", Sixth edition, Scitech publications, 2014

Reference Books:

1. Alan V. Oppenheim, Ronald W. Schafer and John R. Buck, 'Discrete – Time Signal Processing', Pearson Education, New Delhi, 2003.

2 Johny R.Johnson :Introduction to Digital Signal Processing, Prentice Hall, 1984.

Code	Subject Name	Lectures (Periods)	Tutorial (Periods)	Practical (Periods)
EI T64	EMBEDDED SYSTEM DESIGN (Common to ICE and BME branches)	3	1	0

Course Objectives:

- To introduce system design concepts to students using microcontrollers with foundational concepts of microcontroller architecture and programming .
- To introduce hardware and software integration for real time systems using microcontrollers and thereby imparting real time system design knowledge to students.

Course Outcomes:

- Foundational knowledge in activating and using a generic microcontroller. Preliminary design considerations for system level implementation.
- Knowledge of 8051 Microcontroller hardware features and internal peripherals. Programming knowledge of 8051 microcontrollers.
- Knowledge of ARM Processor hardware features and internal peripherals. Programming knowledge of ARM Processors.
- Software design techniques to be followed for embedded system designing.
- Using real time operating systems for embedded systems.

EMBEDDED SYSTEM DESIGN

UNIT I

REVIEW OF EMBEDDED SYSTEMS: Introduction to Embedded Systems – Components of an Embedded System – Processor Specifications – Role of Microcontrollers in Embedded System design – Features of Microcontrollers – on Board peripherals – Processor Selection criteria – Microcontroller Design Specifications – Word length – Performance Issues - Power consumption – Package Types – Electrical requirements – Reset Hardware – oscillator Design – power Consideration -Development Tools –Firmware Development options – Assembly Language Vs High level Language Programming- Intel Hex File Format.

UNIT II

INTRODUCTION TO MCS51 MICROCONTROLLER: Intel MCS51 Architecture – Derivatives - Special Function Registers (SFR), I/O pins, ports and circuits, Instruction set, Addressing Modes, Assembly Language Programming, Timer and Counter Programming, Serial Communication, RS-232 implementation, Interrupts Programming, External Memory interfacing.

UNIT III

INTRODUCTION TO LPC2148 MICROCONTROLLER: ARM 7 Architecture – LPC2148 microcontroller introduction – Internal memory map - Peripheral details – Implementation of GPIO, Timer/Counter, UART, Interrupt architecture – ADC and DAC. SPI, I2C and USB features of LPC2148. Firmware development using Embedded C – introduction to data types – conditional statements – loops – simple programs using embedded ‘C’

UNIT IV

DESIGN OF SIMPLE EMBEDDED SYSTEMS:

Design of Simple I/O systems using Switches, LEDs, Buzzers - Current source and sink concepts - Interfacing Character and Graphical LCD Displays – RTC interfacing - Interfacing External ADC and DAC - DC Motor Speed Control System – Speed Measurement – Design of Digital Frequency meter - Stepper Motor Interfacing – Relays – Keypads - Interfacing SD cards and touch screens– Signal processing applications – PC based Control systems.

UNIT V

REAL TIME OPERATING SYSTEMS: Concept of Scheduling – Round Robin and Preemptive scheduling – Implementing a simple scheduler in 'C' - Task and Task States, tasks and data, semaphores and shared Data Operating system Services-Message queues- Events-Memory Management, Interrupt Routines in an RTOS environment, Implementing SD card – Graphical LCD system using RTOS.

TEXT BOOK:

1. David E Simon, " An embedded software primer ", Pearson education Asia, 2001 (UNIT V)
2. Mohammed Ali Mazidi and Janice Gillispie Mazidi, "The 8051 Microcontroller and Embedded System", Pearson Education Asia, New Delhi, 2006.(UNIT II)
3. Trevor Martin,"The Insider's Guide to the Philips ARM7-Based Microcontrollers",Hitex Pubications(UK),2005.(UNIT III)
4. Michael J Pont,"Patterns for Time-Triggered Embedded Systems",Addison-Wesley Professional,2001.(UNIT I, IV)),

REFERENCES:

1. Burns, Alan and Wellings, Andy, " Real-Time Systems and Programming Languages ", Second Edition. Harlow: Addison-Wesley-Longman, 1997.
2. Raymond J.A. Bhur and Donald L.Bialey, " An Introduction to real time systems: Design to networking with C/C++ ", Prentice Hall Inc. New Jersey, 1999.
3. Grehan Moore, and Cyliax, " Real time Programming: A guide to 32 Bit Embedded Development. Reading " Addison-Wesley-Longman, 1998.
4. Heath, Steve, " Embedded Systems Design ", Newnes 1997.
5. John B Peat man " Design with Microcontroller ", Pearson education Asia, 1998.
6. Jonartthan W. Valvano Brooks/cole " Embedded Micro computer Systems. Real time Interfacing ", Thomson learning 2001.
7. Grehan Moore, and Cyliax, " Real time Programming: A guide to 32 Bit Embedded Development. Reading " Addison-Wesley-Longman, 1998.
8. John B Peatman " Design with Microcontroller ", Pearson education Asia, 1998.

Code	Subject Name	Lectures (Periods)	Tutorial (Periods)	Practical (Periods)
EI T65	**Communication Engineering (Common to ICE)**	**4**	**0**	**0**

Course Objectives:

To study about the basics of analog and digital transmission and some forms of communication systems such as microwave and satellite communication systems, fiber optic communication systems and cellular mobile communication.

Course Outcomes:

At the end of the course the student acquires knowledge about the analog and digital modulation techniques, Nyquist sampling theorem, Generation and demodulation techniques of PAM, PWM and PPM, ASK , FSK and PSK and PCM techniques. They will also acquire knowledge about the fundamentals of microwave, satellite and fiber optic communication systems.

UNIT-I Analog Modulation Systems: Need for modulation - Amplitude modulation – Frequency spectrum of AM wave – Representation of AM – Power relation – generation of AM – DSB, DSB/SC, SSB, VSB AM - Frequency modulation – Frequency spectrum of FM wave – AM transmitter and Receiver – FM transmitter and Receiver

UNIT-II Pulse and Digital Modulation Systems: Principles of pulse modulation – sampling theorem, PAM – PWM – PPM– Conversion of PWM wave to PPM wave – Generation of PAM, PPM and PWM waves – Demodulation of PAM, PWM, PPM – An introduction to digital modulation systems –ASK, FSK and PSK, PCM.

UNIT- III Microwave and Satellite Communication Systems: Microwave communication systems - Introduction, block diagram of a microwave radio system – Propagation of waves, Terminal station and repeater station

Satellite Communication System: Satellite Orbits, Types of satellites, launch vehicles, look angles, satellite parameters, satellite link model, personal communication systems- GPS services.

UNIT- IV Fiber Optical Communication Systems: Need for fiber optics, Introduction to optical fiber, Principle of light transmission through a fiber, Fiber characteristics and Classification, Fiber losses- Light sources and photo detectors- Block diagram of a fiber optic system- Power budget analysis for a optical link-Recent applications of fiber optics.

UNIT –V Cellular Mobile Communication: Cellular concept, basic cellular concept and its operation, uniqueness of mobile radio environment- Performance metrics in cellular system- Elements of cellular mobile radio-Handoff- Frequency management and channel assignment- Introduction to various cellular standards like AMPS, GSM, GPRS, IS-95A, IS-95B, CDMA-2000 and WCDMA.

Text Books:

1. Kennedy Davis, “Electronic Communication Systems”, Tata McGraw Hill Publishing Company Limited, New Delhi, 1999.
2. Wayne Tomasi, “Electronic Communication Systems”, Pearson education Private Limited, Delhi, 2004.

Reference Books:

1. Roddy D and Coolen J, “Electronic Communications”, Prentice Hall of India Private Limited, fourth edition, 2007.
2. William C.Y. Lee, “Mobile Cellular Telecommunication Systems”, McGraw Hill International Edition, Second edition, 2006.
3. Gerd Keiser, “Optical fiber Communications”, McGraw Hill International Edition, Foutth edition, 2006.

Code	Subject Name	Lectures (Periods)	Tutorial (Periods)	Practical (Periods)
EI P61	**PROCESS CONTROL LAB**	**0**	**0**	**3**

AIM

To understand the practical issues of closed loop control of processes.

OBJECTIVES

i. To understand the process plant and Piping and Instrumentation diagrams.

ii. To get adequate knowledge about practical issues of various controller modes and methods of tuning of PID controller.

iii. To get adequate knowledge about practical issues of closed loop control of processes.

1. Study of Process Control Training System and Piping and Instrumentation diagram of a plant.
2. Study of Inherent and Installed Characteristics of Control Valves.
3. Tuning and Closed loop control of Level Process.
4. Tuning and Closed loop control of Flow Process.
5. Tuning and Closed loop control of Temperature Process.
6. Tuning and Closed loop control of Pressure Process.
7. Design and implementation of ON/OFF Controller for the Temperature Process.
8. Tuning PID Controller for soft processes. (Mathematically described processes).
9. Tuning and closed loop control of Electronic Processes.
10. PID Implementation Issues and configuring Industrial PID Controller.
11. Simulation study on PID Enhancements (Cascade and Feed-forward Control Schemes)

Equipment required for a batch of 20 students

1. Pilot Process plants: Level, Pressure, Flow and Temperature.
2. Industrial PID controllers : 4 Nos.
3. Temperature bath for water heating system, PT100 RTD, ON/OFF relay, bread board to design ON/OFF controller
4. Control valve set up consists of equal percentage, Quick opening and linear valves.
5. PC with MATLAB software : 4 Nos.
6. Level Process with facility to implement cascade control

Code	Subject Name	Lectures (Periods)	Tutorial (Periods)	Practical (Periods)
EI P62	**EMBEDDED SYSTEM DESIGN LAB**	**0**	**0**	**3**

Syllabus:

1.Parallel Port Interfacing Using MCS51.
2.Design of Real Time Clock using MCS 51 using segment Displays.
3.Design of PC interface Hardware with MCS51
4.Interfacing LCD Display using MCS51
5.Design of Single Channel Data Acquisition System Using MCS51.
6.Implementation of GPIO and Timer using ARM LPC2148.
7.Implementation of UART, ADC and DAC features of ARM LPC2148.
9.Interfacing SD card and Graphical LCD using LPC2148.
10. Implementation of USB communication using LPC2148.
11. Implementation of FFT Using TMS320C5401 DSP.
12. Design of Digital filters using TMS320C6745 DSP.

List of Equipments for a batch of 20 students

Sl Nr	Name of the Equipment	Quantity
1	MCS51-P89V51RD2 Microcontroller Development Board	10
2	ARM7-LPC2148 Microcontroller Development Board	10
3	PIC-16F877A Microcontroller Development Board	10
4	LCD Interface Board(16x2)	4
5	Real time Clock Interface Board	4
6	LED and Switch Interface Board	4
7	ADC and DAC Interface Board	4
8	DC and Stepper Motor Interface Board	4
9	KeyPad and Relay Interface Board	4
10	Video and Memory Interface Board	4
11	SD card and TFT Interface Board	4
12	DSO - Quad Channel 100 MHz	4
13	DMM - HH Meter	4

Code	Subject Name	Lectures (Periods)	Tutorial (Periods)	Practical (Periods)
EI P63	**VIRTUAL INSTRUMENTATION LAB**	**0**	**0**	**3**

Syllabus:

1. Graphical Programming using LabVIEW
2. SCPI - Instrument interfacing using GPIB communication
3. RS232 communication for Instrument Interfacing.
4. Design of Programmable Digital Voltmeter Hardware
5. Design of Programmable Digital Function Generator Hardware
6. Design of Distributed Measurement using Ethernet by LabVIEW
7. Design of Digital Filters using LabVIEW
8. Design of Virtual Voltmeter and Function Generator
9. Design of Digital & Virtual Frequency meters.
10. Design of Programmable Motion Drives.

LIST OF EQUIPMENT'S FOR A BATCH OF 20 STUDENTS

1. MICROCONTROLLER P89V51RD2 BOARDS - 10 Nos
2. ADC 0804 BOARDS - 10 Nos
3. DAC 0800 BOARDS - 10 Nos
4. GPIB CARDS - 10 Nos
5. GPIB COMPATIBLE INSTRUMENT - 10 Nos
6. GPIB CABLES - 10 Nos
7. ETHERNET CABLES - 10 Nos
8. RS232 CABLES - 10 Nos
9. LED 5mm RED BOARDS - 10 Nos
10. Power Adapters (12V/AC/1A) - 10 Nos
11. Digital Storage Oscilloscopes - 10 Nos
12. PC with LabVIEW, Matlab & KEIL installed - 10 Nos
13. DUAL AXIS STAGE CONTROLLER BOARDS - 10 Nos
14. 2 PIN CABLES - 20 Nos
15. 4 PIN CABLES - 20 Nos

Code	Subject Name	Lectures (Periods)	Tutorial (Periods)	Practical (Periods)
EI P64	**GENERAL PROFICIENCY – II**	**0**	**0**	**0**

Syllabus:

UNIT – I :
COMPOSITION ANALYSIS: Technical and Non-Technical Passages (GRE Based) – Differences in American and British English – Analyzing Contemporary issues – Expanding Terminology
UNIT – II :
WRITING: Job Application Letter Writing – Resume Writing
UNIT – III :
ORAL SKILLS: Group Discussion – Introduction and Practice – Team Work – Negotiation Skills – Organizing and Attending Meetings – Facing Interviews
UNIT – IV :
ADAPTING TO CORPORATE LIFE: Corporate Etiquette – Grooming and Dressing
UNIT – V :
APTITUDE: Verbal and numerical aptitude

Reference Books:

1. Pushplata and Sanjay Kumar. Communicate or Collapse : A Handbook of Effective Public Speaking, Group Discussions and Interviews. Prentice-Hall, Delhi,2007.
2. Thorpe, Edgar. Course in Mental Ability and Quantitative Aptitude. Tata McGraw-Hill, 2003.
3. Thorpe, Edgar. Test Of Reasoning. Tata McGraw-Hill,2003.
4. Prasad,H.M. How to prepare for Group Discussion and Interview. Tata McGraw-Hill,2001.
5. Career Press Editors.101 Great Resumes. Jaico Publishing House,2003.
6. Aggarwal, R.S. A Modern Approach to Verbal & Non-Verbal Reasoning. S. Chand & Co.,2004.
7. Mishra Sunita and Muralikrishna, Communication Skills for Engineers, First Edition. Pearson Education, 2004.

Code	Subject Name	Lectures (Periods)	Tutorial (Periods)	Practical (Periods)
EI T71	**PLC and DCS (Common to ICE)**	**4**	**0**	**0**

Course objectives

(i) To provide idea about various Data Networks.
(ii) To get an exposure to SCADA.
(iii) To learn about different PLC languages.
(iv) To study about Industrial DCS.
(v) To have an exposure to HART and Fieldbus.

UNIT I DATA NETWORK FUNDAMENTALS

Network hierarchy and switching – ISO/OSI Reference model – Data link control protocol:- HDLC – Media access protocol:-Command/response, Token passing and CSMA/CD
-
TCP/IP – Bridges – Routers – Gateways –Standard ETHERNET and ARCNET Configuration.

UNIT II PLC AND SCADA

Evolutions of PLCs – Sequential and Programmable Controllers – Architecture – Comparative study of Industrial PLCs. – SCADA:- Hardware and software, Remote terminal units, Master station, Communication architectures and Open SCADA protocols.

UNIT III PLC PROGRAMMING

PLC Programming:- Ladder logic, Functional block programming, Sequential function chart, Instruction list and Structured text programming.

UNIT IV DISTRIBUTED CONTROL SYSTEMS

Evolution - Different architectures - Local control unit - Operator Interface – Displays - Engineering interface - Study of any one DCS available in market - Factors to be considered in selecting DCS – Case studies in DCS.

UNIT V HART AND FIELDBUS

Introduction- Evolution of signal standard – HART communication protocol – Communication modes – HART Networks – HART commands – HART applications – Fieldbus:- Introduction, General Fieldbus architecture, Basic requirements of Field bus standard, Fieldbus topology, Interoperability and Interchangeability – Introduction to OLE for process control (OPC).

TEXT BOOKS:

1. Petrezeulla, “Programmable Controllers”, McGraw-Hill, 2004.
2. Lucas, M.P., “Distributed Control System”, Van Nastrand Reinhold Company, New York, 1986.
3. Clarke, G., Reynders, D. and Wright, E., “Practical Modern SCADA Protocols: DNP 3,
4. 60870.5 and Related Systems”, Newnes, 1st Edition, 2004.

REFERENCES:

1. Hughes, T., “Programmable Logic Controllers”, ISA Press, 2000.2. Bowden, R., “HART Application Guide”, HART Communication Foundation, 1999.
2. Mc-Millan, G.K., “Process/Industrial Instrument and Controls Handbook”, McGraw-Hill, NewYork, 1999.4.
3. Berge, J., “Field Buses for Process Control: Engineering, Operation, and Maintenance”, ISA Press, 2004.

Subject Code	Subject Name	Lectures (Periods)	Tutorial (Periods)	Practical (Periods)
EI T72	**ANALYTICAL INSTRUMENTATION** (Common to ICE branch)	4	0	0

Course Objectives:

- Provide a solid background in the fundamental concepts and methods of spectroscopy, chromatography & environmental pollution and an appreciation of issues in each of these fields in current research.

Course Outcomes:

On successful completion of the module students will be able to:

- Acquire knowledge about the interaction of electromagnetic radiations with matter and apply analytical techniques to accurately determine the elements present in the given sample.
- Select Instrument for a particular analysis with come idea of its merits, demerits and limitations
- Learn specific technique employed for monitoring different pollutants in air and water.
- They can understand the applications and usage of chromatography in real time industrial environments.

Syllabus:

UNIT I – SPECTROPHOTOMETERS

Electromagnetic radiation - Electromagnetic spectrum- Spectral methods of analysis.
Absorption spectroscopy – Emission Spectroscopy – Beer Lamberts Law.
UV – Visible spectrophotometers – Single beam and double beam instruments – Sources and detectors.
IR spectrophotometers – Sources and detectors – FTIR spectrometers – Raman Spectrometers

UNIT II – FLAME, NMR & MICROWAVE SPECTROSCOPY

Flame emission spectrometry – Atomic absorption spectrometry - NMR, ESR / EPR spectroscopy – basic principles – instrumentation techniques and applications.

UNIT III – MASS SPECTROMETERS & RADIATION MEASUREMENT

Ion sources – Types: Magnetic Deflection – Time of Flight – Quadrupole Mass Spectrometers - single focusing and double focusing mass spectrometers – principles and application
Ionization chamber - Proportional counter – GM counter - scintillation counter - solid state detector - Gamma ray spectrometers

UNIT IV - CHROMOTOGRAPHY

Gas chromatography – Methods of analysis in gas chromatography - Column details
Detectors: Thermal conductivity detectors- Flame ionization detectors - Flame photometric detectors - Electron capture detectors - Effect of temperature.
Liquid chromatography – Pre column - Separation column - Detectors - High pressure liquid chromatography.

UNIT V - ENVIRONMENTAL POLLUTION MONITORING INSTRUMENTS

Introduction to air and water pollution – primary and secondary pollutants - Conductivity and water purity meters – Carbon Monoxide, Sulphur dioxide, Hydrogen Sulphide & NO monitors – oxygen analyzers.

Text Books:

1. R.S.Khandpur, "Handbook of Analytical Instruments", Tata McGraw Hill Publishing, 9th Reprint, 2011

Reference Books:

1. H.H. Willard, L.L. Merrit, J.A. Dean and F.A. Settle, Instrumental methods of Analysis, 6th edition - CBS Publishers and Distributers, 1986.
2. D.A. Skoog and D.M. West, Principles of Instrumental Analysis, 2nd edition, Holt-Saunders, 1980.

Code	Subject Name	Lectures (Periods)	Tutorial (Periods)	Practical (Periods)
EI P71	**Industrial measurement and control lab (Common to ICE)**	**0**	**0**	**3**

AIM

To understand the practical issues of calibrating Process instruments, PC based control and other digital control strategies.

OBJECTIVES

i. To get adequate knowledge about practical issues of calibration of Process instruments
ii To get adequate knowledge about practical issues of various digital controllers.
iii. To get adequate knowledge about practical issues of closed loop control of processes using Digital Controllers

Part - A

1. Calibration of Pressure gauge using Dead weight Tester.
2. Calibration of manometers
3. Calibration of Control valves
4. Calibration of I to P and P to I converters
5. Calibration of Pressure Switch.
6. Calibration of RTD and Thermocouple.

Part-B

1. PC based Cascade control of level process
2. PC based control of interacting level process
3. Design and simulation of digital controller using Dahlin's algorithm
4. Design and simulation of digital controller using Dead beat algorithm
5. Parameter estimation of process from input output data
6. Control of a real time process using ADC/DAC interface between Simulink and Process Hardware.
7. Design and simulation of digital controller using Kalman's algorithm
8. PC based PID Control of 4^{th} order electronic process using C program

EI P72 SEMINAR

Each one of the students will be assigned a Seminar Topic in the current and frontier areas. The student has to conduct a detailed study/survey on the assigned topic and prepare a report. The student will make an oral presentation followed by a brief question and answer session. The Seminar (presentation and report) will be evaluated by an internal assessment committee for a total of 100 marks.

S.NO	EQUIPMENT	Quantity
1	Pressure calibration bench with Manometers,dead weight tester and pressure calibrator .	1
2	Valve calibration test bench	2
3	Temperature calibration test bench.	1
4	I to P and P to I calibration setup.	1
5	Pressure, temperature, level and flow processes with PC based control facility.	1
6	MIMO process to demonstrate interactions among PV's.	1
7	Personal computers with Process Simulation software (MATLAB, Ladder logic)	10

EI P73 INDUSTRIAL VISIT / TRAINING

During the course of study from 3rd to 7th semester each student is expected to undertake a minimum of four industrial visits or undertake a minimum of two weeks of industry/field training. The students are expected to submit a report, which shall be evaluated by an internal assessment committee at the end of seventh semester for 100 marks.

EI PW7 PROJECT WORK (PHASE I)

The objective of the project is to enable the students to work in groups of not more than four members in each group on a project involving analytical, experimental , design or combination of these in the area of Electronics and Instrumentation Engineering. Each project shall have a guide. The student is required to do literature survey, formulate the problem and form a methodology of arriving at the solution of the problem. The evaluation is based on continuous internal assessment by an internal assessment committee for 100 marks.

EI T81 PROFESSIONAL EHICS PRACTICE

The course should cover the following topics by way of Seminars, Expert Lectures and
Assignments:

1. Engineering Ethics – Moral issues, Ethical theories and their uses
2. Engineering as Experimentation – Code of Ethics
3. Engineer's responsibility for safety
4. Responsibilities and rights
5. Global issues of engineering ethics
6.

REFERENCE BOOKS

1. Charles D.Fleddermann, "Engineering Ethics", Prentice Hall, New Mexico, 1999

Code	Subject Name	Lectures (Periods)	Tutorial (Periods)	Practical (Periods)
EI T82	**INDUSTRIAL SAFETY AND MANAGEMENT (Common to ICE)**	**4**	**0**	**0**

Syllabus:

UNIT I

Energy conversion – world fossil fuel reserves – world energy consumption – historical lives of fossil fuels – global energy and environmental management – environmental aspects of fossil, nuclear, hydro and biomass energy conversion – gaseous emissions – solid waste – liquid waste.

UNIT II

Energy management – need for energy conservation – energy auditing – conducting real time continuous energy audits – data collection – automated data acquisition – data analysis – role of energy manager – energy audit instruments – gas analyzer – energy conservation in industries: boilers, pumps, fans, compressed air systems, refrigeration and air conditioning systems, DG sets, electrical motors, variable speed motors.

UNIT III

Air pollutants and global climate – air pollutant effects. Pollution control laws and regulation – national and international – role of environmental monitoring in environmental management systems – continuous emissions monitoring systems. Pollution control – review of pollution control methods in thermal power plants – industrial – nuclear – automobiles – disposal/treatment of solid and liquid wastes – alternate fuels.

UNIT IV

Safety and productivity – causes of accidents in industries – accidents reporting and investigation – measuring safety performance – workman compensation rules.

UNIT V

Safety codes and standards – general safety considerations in power plants, pressure vessels and pressurized pipe lines – operation and inspection of extinguishers – preventing the spread of fire – emergency exit facilities.

Text Books:

1. Blake Roland. P, “Industrial safety”, Prentice Hall of India, 1973.
2. Callaghan. P. O, “Energy Management”, McGraw Hill Book Co., 1993.

Reference Books:

1. Culp. A. W, “Principles of Energy Conservation”, McGraw Hill Book Co., 1991.
2. Noel de Nervers, “Air Pollution Control Engineering”, McGraw Hill Book Co., 2000.

	Subject Name	Lectures (Periods)	Tutorial (Periods)	Practical (Periods)
EI P81	**Process Automation Lab**	**0**	**0**	**3**

Process Automation Lab

AIM

To understand the advanced control strategies and applications of PLC and DCS.

OBJECTIVES

I To understand practical issues of applications of PLC hardware and programming a PLC.

ii To get adequate knowledge about practical issues of implementations of PLC and DCS.

1. Study of basic programming of PLC
2. Analog operation in PLC
3. Arithmetic operation, Timer, Counter operation using PLC
4. Annunciator design using PLC
5. PLC based control of Level Process , Temperature Process, Speed .
6. Study and Demonstration of DCS
7. Developing control logic using DCS
8. Application of DCS (Level Process, Pressure Process)
9. Application of DCS(Boiler Control, Distillation column control)
10. Virtual DCS
11. On-Line control using Distributed Control System.
12. Design of PID Controller and Auto tuning of PID Controller
13. a) Analysis of Multi-input Multi-output System(Four-tank System)
    b) Design of Multi-Loop PID Controller and Multivariable PID Controller.
14. Design of Gain scheduling controller
15. Design of Self-Tuning Controller
16. a) Design of Deterministic/stochastic State Observer
    b) Design of State Feedback Controller.
17. Design of Robust PID Controller.

Equipment required for a batch of 20 students

S.NO	EQUIPMENT	Quantity
1	Kv ladder PLC programming software	1
2	PLC	2
3	Single tank level process station	1
4	Temperature process station	1
5	Single phase induction motor	1
6	Pressure process station	1
7	Personal computer with latest configuration	10
8	Distributed control system(DCS)	1
9	Four tank level process station	1
10	Micro PLC Programing and simulation setup interfaced with computer	5
11	PLC Interfaced with computer and batch process.-	1
12	DCS interfaced with Level, Pressure, temperature and flow processes	1
13	Ladder logic simulation software	
14	MATLAB simulation software.	

EI P82 COMPREHENSIVE VIVA –VOCE

The student will be tested for his understanding of basic principles of the core Engineering subjects. The internal assessment for a total of 50 marks will be made by an internal assessment committee. The committee will conduct two written examinations of objective or short questions type from the all the core subjects. The external university examination, which carries a total of 50 marks, will be a Viva Voce examination conducted by a committee of one external examiner and one internal examiner appointed by the University.

EI PW8 PROJECT WORK (PHASE II)

Project work phase II will be an extension of the project work started in the seventh semester. On completion of the work, a project report should be prepared and submitted to the department. The project work and the report will be evaluated by an internal assessment committee for 50 marks. The external university examination, which carries a total of 50 marks, will have report evaluation and viva voce examination conducted by a committee of one external examiner and one internal examiner appointed by the University.

ELECTIVES (FIFTH SEMESTER)

Code	Subject Name	Lectures (Periods)	Tutorial (Periods)	Practical (Periods)
EI E51	PROCESS ENGINEERING PRINCIPLES	4	0	0

Course Objectives:

- Develop a mastery of the first principles involved in process engineering
- Perform analyses of process problems by applying the first principles
- Introduce the role of theoretical understanding in process industry
- Provide a fundamental understanding of process equipment's

Course Outcomes:

- An ability to apply knowledge of mathematics, science, and engineering
- An ability to use the techniques, skills, and modern engineering tools necessary for engineering practice
- An ability to implement the engineering background to other related areas

Syllabus:

UNIT-I:

INTRODUCTION - Chemical Process Industries - Batch and Continuous mode of operations – Process Flow Sheets – Material and Energy Balance Principles – Mass – Mole – Volume Conversions (Ideal Gas Law), Sensible and Latent Heat Calculations, Principles of Momentum, Heat and Mass Transport – Rate Laws (Newton's Law, Fourier's Law, Fick's law), Chemical Reactions – rate and equilibrium, Phase equilibrium, Vapour Pressures and Humidity.

UNIT-II:

FLUID TRANSPORT AND MECHANICAL OPERATION EQUIPMENTS – Laminar and Turbulent flow, Flow Characteristics of fluids – Newtonian and Non-Newtonian, Friction factor, Head loss due to fluid friction pumps – different types, pump characteristics, compressors.

Size reduction of solids – crushing (Jaw crusher) and grinding (Ball mill), Size separation (screening), solid – liquid separation – filtration, settling and sedimentation, centrifuge.

UNIT-III:

HEAT TRANSFER EQUIPMENTS – Modes of heat transfer – conduction, convection and radiation, heat transfer without and with phase change (evaporation, condensation), heat transfer coefficient. Heat Exchangers – double pipe and shell and tube, condensers – vertical and horizontal, evaporators – single effect and multiple effect, reboilers

UNIT-IV:

MASS TRANSFER EQUIPMENTS – molecular and turbulent transport of mass – mass transfer coefficient, mass transfer principles in separation, gas – liquid operations – absorption, distillation, humidification – packed and tray towers. Fluid – solid operations – adsorption, drying, leaching, crystallization. Liquid- liquid operations – extraction.

UNIT-V:

CHEMICAL REACTORS – single and multiple reactions – conversion, yield, selectivity batch and flow reactors(PFR,CSTR), catalyses, multiphase non-catalytic (gas – solid, gas – liquid) and catalytic reactors, fixed bed, fluidized bed, slurry reactors.

Process flow sheets for manufacture of standard chemicals - urea, sugar, crude distillation, cement, paper and pulp.

Text Books:

1. Walter. L Badger and Julius.T.Banchero, "Introduction to Chemical Engineering", Tata McGraw Hill.
2. Octave Levenspiel, 'Chemical Reaction Engineering', , Wiley Eastern Ltd., II Edition, 2000.

Reference Books:

1. W.L.Mc.Cabe, J.C.Smith and P.Harriot, 'Unit operations of chemical engineers', McGraw Hill International Edition, V Edition,1998.
2. N.Shreve, 'Chemical Process Industries', ,5th edition, McGraw Hill, New York, 1984.

Code	Subject Name	Lectures (Periods)	Tutorial (Periods)	Practical (Periods)
EI E52	INDUSTRIAL ELECTRONICS	4	0	0

Course Objectives:

This course will provide the community qualified graduates prepared to repair, install and maintain electrical and electronic equipment used in the manufacturing and service industries.

Course Outcomes: .

- Employ safety procedures presently being used in local manufacturing environments.
- Utilize the necessary equipment and tools to perform a given technical task.
- Communicate effectively using the appropriate written or oral techniques.
- Modify or repair currently used manufacturing systems to operate in accordance with industry requirements and standards.
- Perform maintenance and troubleshooting functions

Syllabus

UNIT 1

REGULATED SUPPLIES AND SCRS: Switched Mode voltage regulator, Comparison of Linear and Switched Mode Voltage Regulators, Servo Voltage Stabilizer, monolithic voltage regulators Fixed and Adjustable IC Voltage regulators, 3-terminal Voltage regulators, Current boosting .Principles of operation and characteristics of SCR, Triggering of Thyristors, Commutation Techniques of Thyristors, Classes A, B, C, D, E and F, Ratings of SCR.

UNIT II

APPLICATIONS OF SCRS-I: Static circuit breaker, Protection of SCR, Inverters, Classification, Single Phase inverters, Converters , single phase Half wave and Full wave. Chopper circuits, Principle, methods and Configurations, Diac and Triac, Triacs, Triggering modes, Firing Circuits, Commutation

UNIT-III

APPLICATIONS OF SCRS-II Voltage compensator – solid state DC voltage regulation – DC shunt motor – armature control and field control of motor speed – electronic control of DC motor – speed regulator action – full wave motor speed regulation by one SCR

UNIT-IV

INDUSTRIAL TIMERS : Industrial timers -Classification, types, Electronic Timers, Classification, RC and Digital timers, Time base Generators. Electric Welding , Classification, types and methods of Resistance and ARC wielding

UNIT –V

INDUSTRIAL HEATING APPLICATIONS : High Frequency heating, principle, merits, applications, High frequency Source for Induction heating. Dielectric Heating, principle, material properties, Electrodes and their Coupling to RF generator, Thermal losses and Applications. Ultrasonics, Generation and Applications.

Text Books:

1. G.K. Mithal and Maneesha Gupta, Industrial and Power Electronics, , Khanna Publishers, 19th Ed., 2003.

Reference Books:

1. M. Ramamurthy, Thyristors and applications, East-West Press, 1977.
2. S.K. Bhattacharya and S.chatterjee, Industrial electronics and control, Tata Me Graw Hill, 1995
3. Frank D. Petruzella, Industrial Electronics, McGraw Hill International Editions, 1996

Code	Subject Name	Lectures (Periods)	Tutorial (Periods)	Practical (Periods)
EI E53	**TELEMETRY AND TELECONTROL**	**4**	**0**	**0**

Syllabus:

UNIT – I

TELEMETRY FUNDAMENTALS AND CLASSIFICATION: Fundamental concepts – Significance, Principle, functional blocks of Telemetry and Telecontrol system-Methods of telemetry –Electrical, Pneumatic, Hydraulic and Optical Telemetry – State of the art-Telemetry standards.

UNIT – II

LANDLINE TELEMETRY: Electrical Telemetry-Current Systems – Voltage Systems – Synchro Systems – Frequency systems – Position and Pulse systems – Example of a landline telemetry system.

UNIT – III

RADIO TELEMETRY: Block diagram of a Radio Telemetry system – Transmitting and receiving techniques – AM, FM, PM, Multiplexing and demultiplexing – Transmitting and receiving techniques – Digital coding methods – Advantages of PCM, PWM, PM, FSK – Delta modulation – coding and decoding equipment – Example of a radio telemetry system.

UNIT – IV

OPTICAL TELEMETRY: Optical fibers for signal transmission – Sources for fiber optic transmission – Optical detectors – trends in fiber – optic device development – Exampleof an optical telemetry system.

UNIT – V

TELECONTROL METHODS: Analog and Digital techniques in telecontrol, telecontrol apparatus – Remote adjustment, Guidance and regulation – Telecontrol using information theory – Example of a telecontrol system.

Text Books:

1. Gruenberg. L “Handbook of telemetry and remote control”,McGraw Hill, New York, 1987.
2. Swobodoa. G., “Telecontrol methods and applications of Telemetry and Remote Control”, Reinhold Publishing Corp., London, 1988.

Reference Books

1. Young R.E., “Telemetry Engineering”, Little Books Ltd, London 1988.
2. Housley T, “Data communication and teleprocessing system”, Prenctice Hall International, Englewood Cliffs, New Jersey, 1987.

Code	Subject Name	Lectures (Periods)	Tutorial (Periods)	Practical (Periods)
EI E54	**VISUAL PROGRAMMING FOR INSTRUMENTATION ENGINEERS**	**4**	**0**	**0**

Course Objectives:

- To introduce visual programming applicable to instrumentation and for instrument control software development using .net
- To develop window based applications in multi language environments

Course Outcomes:

- Fundamentals of .net, vb.c# and vb.net
- Understanding of advanced concepts in c# and vb in .net
- Able to choose a platform and language for developing instrumentation software
- Creating sample applications for instrument control.

UNIT-I

.Net Frame work : Introduction – Components of .NET architecture –Principal Design features-web services

C# basics: Introduction –Data Types-Access Modifiers- Variables and Constants –Statements – OO concepts-arrays –strings-System collections-delegate and events –indexer-properties-versioning

UNIT-II

C# Using Libraries: Namespace System-Input and output- Multithreading-Windows Forms – data handling and Exception handing

UNIT –III

Advanced Features Using C#: Web services –Window service s-Messaging, Reflection and COM- Localization and Globalization- - XML- Unsafe Model- Graphical Device Interface

UNIT- IV

Introduction to VB.Net: Concepts and Simple Applications- variables, constants and Functions – processing decisions- Loop Structure and List

File and Database Application: File access-Daalog Boxes –exception handing , Menus in Vb.net- Connecting to databases

UNIT -V

Advanced Programming Constructs: Sub Procedures –Functions –Modules-Arrays-structure – Collection

.Net Architecture and Advanced Tools: OOP with nVB.net – Creating Distributed Web applications –Graphics, Printing ,Reporting

Case Study: Case studies in developing applications for Instrumentation

Text Book:

ISRD Group," Application of .net Technology " TaTa Mcgraw Hill Education Private Limited, 2011

Reference Books:

1. Balagurusamy E." Programming with C#". Tata Mcgraw Hill 2008
2. Chappell D " Understanding .NET Pearson Edition 2007

Code	Subject Name	Lectures (Periods)	Tutorial (Periods)	Practical (Periods)
EI E55	**Signals and systems**	**3**	**1**	**0**

OBJECTIVES:

- To understand the basic properties of signal & systems and the various methods of classification
- To learn Laplace Transform &Fourier transform and their properties
- To know Z transform & DTFT and their properties
- To characterize LTI systems in the Time domain and various Transform domains

OUTCOMES

- Analyze the properties of signals & systems
- Apply Laplace transform, Fourier transform, Z transform and DTFT in signal analysis
- Analyze continuous time LTI systems using Fourier and Laplace Transforms
- Analyze discrete time LTI systems using Z transform and DTFT

UNIT I

Introduction to Signals and Systems -Elementary Continuous-time signals and discrete-time signals - Representation of discrete-time signals-basic operation on signals-- classification of signals - Periodic and aperiodic, energy and power signals, odd and even-CT systems and DT systems- classification-linear and nonlinear, time-variant and time in variant systems, static and dynamic systems, causal and non-causal systems, stable and unstable systems- Mathematical model of CT and DT systems.

UNIT-II

Time response Analysis of CT and DT Systems

Continuous-time systems

Representation of arbitrary signal using impulses-convolution integral-correlation-Impulse and step response- Impulse response of interconnected systems -solution of differential equations

Discrete-time systems

Representation of arbitrary signal using unit sample sequence-convolution sum-correlation-Impulse and step response- Impulse response of interconnected systems -solution of difference equations

UNIT –III

Fourier Series and Fourier transform

Fourier series, properties of Fourier series, Dirichlet's conditions, Trigonometric Fourier series and Exponential Fourier series, Complex Fourier spectrum.

Deriving Fourier transform from Fourier series-Fourier transform of standard signals, Fourier transform of periodic signals, properties of Fourier transforms, Transfer function, frequency response.

UNIT IV

Laplace transform Analysis of Continuous-time systems

Review of Laplace transforms-Concept of region of convergence (ROC)- Laplace transform for basic signals-Properties of Laplace transforms -relation between Laplace transform and Fourier transform-transfer function- stability- Inverse Laplace transform- -Analysis of Continuous-time systems using Laplace transform.

UNIT V

Analysis of Discrete-time systems in frequency domain

Discrete Fourier series (DFS)- Frequency range-Discrete-Time Fourier Transform (DTFT)-sampling-Fourier transform of sampled signal-sampling theorem –Aliasing effect-construction of signal from its samples

Z transforms-Region of convergence-Properties of z-transform- relation between z- transform and DTFT -Inverse z-transform- System function-stability-Analysis of discrete-time systems using z-transform.

TEXT BOOK

1. P.Ramesh Babu & R.Ananda Natarajan, Signals and Systems, Fourth edition, Scitech Publications (India) Pvt. Ltd.,2010

REFERENCE BOOKS

1. Allan V.Oppenheim, “Signals and systems”, Prentice Hall of India
2. Robert A.Gael and Richard A Roberts, “Signals and Linear systems”, John Wiley and sons.
3. Roger E.Ziemer, “Signals and Systems Continuous and discrete”, McMillan.

Code	Subject Name	Lectures (Periods)	Tutorial (Periods)	Practical (Periods)
EI E61	WEB BASED INSTRUMENTATION	**4**	**0**	**0**

Course Objective:

1. To learn Internet and web concepts
2. To learn various application of Internet
3. To learn the language constructs of the programming language
4. To understand the basic concepts of the internet based control and measurement

Course Outcome:

1. Select the suitable Internet technology to implement Internet based control and measurement.
2. To write programs in Java to make it useful to develop internet based instrumentation and Control
3. To deploy internet application in Internet

UNIT - I

BASIC INTERNET CONCEPTS

Packet Switching - Internet: A Network of Networks-ISPs: Broadband and Wireless Access - Software to Create a Virtual Network -TCP: Software for Reliable Communication - Clients + Servers = Distributed Computing - Names for Computers- NAT: Sharing an Internet Connection

UNIT -II

INTERNET APPLICATION

Electronic Mail- Bulleting Board Service (Newsgroups)-Browsing the World Wide Web- World Wide Web Documents (HTML)-Advanced Web Technologies (Forms, Frames, Plugins, Java, JavaScript, Flash)-Group and Personal Web Pages (Wikis and Blogs)-Automated Web Search (Search Engines)-Text, Audio, and Video Communication (IM, VolP)-Faxes, File Transfer, and File Sharing (FTP)-Remote Login and Remote Desktops (TELNET)-Facilities for Secure Communication-Secure Access from a Distance (VPNs)-Internet Economics and Electronic Commerce-The Global Digital Library

UNIT –III

BASICS OF JAVA LANGUAGE:

Java Evolution-Overview of Java Language-Constants, Variables, and Data Types- Operators and Expressions - Classes, Objects and Methods- Arrays and Strings

UNIT –III

ADVANCE CONCEPTS IN JAVA LANGUAGE:

Interfaces: Multiple Inheritance - Packages: Putting Classes Together- Multithreaded Programming- Managing Errors and Exceptions- Applet Programming

UNIT – V

APPLICATION OF INTERNET MEASUREMENT AND CONTROL

Measurements through Internet: Web based data acquisition – Monitoring of plant parameters through Internet – Calibration of measuring instruments through Internet.

Internet based Control: Virtual laboratory – Web based Control – Tuning of controllers through Internet.

Case Study: Internet based Measurement and Control case studies using Java, JVM and

security – Over view of class library: I/O, AWT and NET – JDBC, Object serialisation – remote method invocation – Java script – Java vs C++.

UNIT – V

MISCELLANEOUS TOPICS **9**

Intranets – Internet commerce – Internet and VRML – Active X. Case study : Internet based measurement , Telemonitoring and Tele control in Biomedical , instrumentation Applications.

Text Books:

1. Douglas E. Comer," The Internet Book" 4th Edition, 2009 Princtice Hall (Unit 1 and Unit II)
2. Balagurusamy, "Object Oriented Programming Using C++ and JAVA , Tata Mcgraw Hill Education Private Limited,2012 (Unit III and Unit IV)
3. Alessandri Ferrero and Vincenzo Piuri, A simulation Tool for Virtual Laboratory Experiments in WWW environment, IEEE Transactions on IM, Vol. 48, 1999.
4. Kang B. Lee and Richard D. Schneeman, Internet-based Distributed Measurement and Control Application, IEEE magazine IM, June 1999.

Reference Books:

1. Deitel and Deitel, 'Java: How to Program' 9 th Edition Printice Hall 2012
2. TANENBAUM, "Computer Networks" 2012 5th Edition, DORLING KINDERSLEY (RS) publication

Code	Subject Name	Lectures (Periods)	Tutorial (Periods)	Practical (Periods)
EI E62	**INSTRUMENTATION BUSES AND DATA NETWORKS**	**4**	**0**	**0**

OBJECTIVES:

- To educate on the basic concepts of data networks
- To introduce the basics of inter networking and serial communications
- To provide details on HART and Field buses
- To educate on MODBUS, PROFIBUS and other communication protocol
- To introduce industrial Ethernet and wireless communication

OUTCOMES:

 Ability to understand and analyze Instrumentation systems and their applications to various industries

UNIT - I

Basic concepts on Busses , Interrupts , Interfacing PC systems – Interfacing Standards – comparison of different busses – PCI Bus – PCI operation , Bus arbitration – PCI pins – configuring address space – I/O addressing – ISA Bus – ISA operation – ISA pins –address space configuration.

UNIT - II

Motherboard Design – Introduction – TX mother board. IDE and Mass storage – Tracks and sectors – Floppy discs – drive specification – hard disc and CD ROM specifications – IDE interface – communication - SCSI- types, interface, operation, pointers- Message system description – SCSI commands.

UNIT - III

PCMCIA – Introduction, PCMCIA signals and registers. Introduction to USB and FIREWIRE ports – AGP – PCI and AGP, Bus transactions, Pin Description, AGP master configuration, Bus commands – Addressing modes and Bus commands – Register Description. Fiber channel – Introduction, channel Standards, cables hubs, adapters and connectors. RS -232 – Electrical characteristics – communication between two nodes-programming RS-232. Introduction to RS-422, RS-423,and RS-485.Line Drivers – RS232/485 converter.

UNIT - IV

Parallel Port-Introduction, PC connections, data handshaking, I/O addressing, Interrupt driven parallel port. Enhanced Parallel port- Introduction compatibility mode, Nibble mode, Byte mode-EPP, ECP.MODBUS- MODBUS protocol, Function codes, diagnostics. FIELDBUS-Types, Foundation FIELDBUS.WORLDFIP-Introduction, physical layer, data link layer. CAN BUS-introduction, Bus basics, Message transfer, Fault confinement, Bit timing, CAN open.

UNIT – V

IEEE 488,VME and VXI- Instruction, IEEE 488 bus, VME bus , VXI bus. TCP/IP – Introduction, Gateways and hosts, IP protocol, Internet diagram, TCP/IP internets, Domain naming system. Networks – Introduction- topologies, OSI model, Routers, Bridges and repeaters – Network cable types.

TEXT BOOKS:

1. Steve Mackay, Edwin Wrijut, Deon Reynders, John Park, Practical Industrial Data Networks Design, Installation and Troubleshooting' Newnes Publication, Elsevier First Edition, 2004

2.Computer Buses – William Buchanan – CRC press

Reference Books

1.IBM PC and CLONES – B.Govindarajulu – Tata McGraw – Hill Publishing Company.

2. A. Behrouz Forouzan ,Data Communications & Networking ,3RD edition, Tata Mc Graw hill,2006

Code	Subject Name	Lectures (Periods)	Tutorial (Periods)	Practical (Periods)
EI E63	**OPTIMIZATION TECHNIQUES**	**4**	**0**	**0**

Course Objectives:

- 1.To study one dimensional optimization techniques
- To study unconstrained gradient based optimization methods
- To study linear programming and its applications
- To study constrained optimization methods

Course Outcomes:

- Able to find an optimal solution to any process
- Apply optimization theory and methods in control theory

Syllabus:

UNIT I

MATHEMATICAL PRELIMINARIES: Vector Spaces, Vector Space Operations, Data Fitting, Eigenvalues and Eigenvectors Convergence in R^n, Calculus on R and R^n,Calculus for a Function of One Variable Calculus for a Function of Several Variables, Convex Analysis, Convex sets, Convex Functions

UNIT II

ONE-DIMENSIONAL OPTIMIZATION: Function Comparison Methods, Polynomial Interpolation Methods \Iterative Methods, Function Comparison Methods, Two Point Equal Interval Search Method of Bisection, Fibonacci Method, Golden Section Search, Polynomial Interpolation, Quadratic Interpolation, Cubic Interpolation; Iterative Methods, Newton's Method, Secant Method, Case studies

UNIT III

UNCONSTRAINED GRADIENT BASED OPTIMIZATION METHODS

Gradient and Conjugate Gradient Type Algorithms, Method of Steepest DescentConjugate Gradient Method (Method of Fletcher and Reeves), Newton Type Methods Newton's Method, Marquardt's Method, Quasi-Newton Algorithms, Case studies

UNIT IV

LINEAR PROGRAMMING

Simplex Method, Movement from One Extreme Point to another Algorithm, Revised Simplex Method, Finding Initial Solution, Two Phase Simplex Method, Duality Duality Theory, Dual Simplex Method, Case studies

UNIT V

CONSTRAINED OPTIMIZATION METHODS AND EVOLUTIONARY ALGORITHMS

Lagrange Multipliers, Kuhn-Tucker Conditions, Convex optimization, Transformation Methods, Penalty Function Techniques, Method of Multipliers Linearization Methods, Linearly Constrained Problems, Cutting Plane Method Direction Generation Methods, The Method of Feasible Directions, The Generalized Reduced Gradient Method, case studies

EVOLUTIONARY ALGORITHMS: Box Complex Method, Box Complex Method, Genetic Algorithm, Case studies.
Text Book: Mohan C Joshi, Kannan M Moudgalya "Optimization: Theory and practice" Narosa publishing House
Reference Book: S. S.Rao, "Engineering optimization: Theory and practice"-New Age International (P) Limited, 3rd edition, 1998.

Code	Subject Name	Lectures (Periods)	Tutorial (Periods)	Practical (Periods)
EI E64	**Micro-Electro Mechanical Devices**	**4**	**0**	**0**

COURSE OBJECTIVES

- To study about MEMS and parts of MEMS
- To study the design methodology of MEMS for various mechanics.
- To study about actuators in MEMS.
- To study about MEMS based circuits.
- To study about optical and RF based MEMS.

UNIT I INTRODUCTION TO MEMS

MEMS and Microsystems, Miniaturization, Typical products, Micro Sensors, Micro actuation, MEMS with micro actuators, Micro-accelerometers and Micro fluidics, MEMS materials, Micro Fabrication.

UNIT II MECHANICS FOR MEMS DESIGN

Elasticity, Stress, strain and material properties, Bending of thin plates, Spring configurations, torsional deflection, Mechanical vibration, Resonance, Thermo mechanics – actuators, force and response time, Fracture and thin film mechanics, material, physical vapor deposition (PVD), chemical mechanical polishing (CMP)

UNIT III ELECTRO STATIC DESIGN

Electrostatics: basic theory, electro static instability, Surface tension, gap and finger pull up, Electro static actuators, Comb generators, gap closers, rotary motors, inch worms, Electromagnetic actuators, bistable actuators.

UNIT IV CIRCUIT AND SYSTEM ISSUES

Electronic interfaces, Feed back systems, Noise, Circuit and system issues, Case studies – Capacitive accelerometer, Peizo electric pressure sensor, Thermal sensors, radiation sensors, mechanical sensors, bio-chemical sensors Modeling of MEMS systems, CAD for MEMS.

UNIT V INTRODUCTION TO OPTICAL AND RF MEMS

Optical MEMS, system design basics – Gaussian optics, matrix operations, Resolution, Case studies, MEMS scanners and retinal scanning, display, Digital Micro mirror devices, RF Memes – design basics, case study – Capacitive RF MEMS switch, Performance issues.

TEXT BOOK:

1. Stephen Santeria, “Microsystems Design “, Kluwer publishers, 2000.

REFERENCES

1. Nadim Maluf, “ An introduction to Micro electro mechanical system design”, Artech House, 2000.
2. Mohamed Gad-el-Hak, editor, “ The MEMS Handbook”, CRC press Baco Raton, 2000
3. Tai Ran Hsu, “MEMS & Micro systems Design and Manufacture” Tata McGraw Hill, New Delhi,
2002.
4. Julian w. Gardner, Vijay k. varadan, Osama O. Awadelkarim, micro sensors mems and smart devices, John Wiley & son LTD,2002
5. James J.Allen, micro electro mechanical system design, CRC Press published in 2005

Subject Code	Subject Name	Lectures (Periods)	Tutorial (Periods)	Practical (Periods)
EI E65	**BIOMEDICAL INSTRUMENTATION**	**4**	**0**	**0**

Course Objectives:

- To learn the physiology of the human body and the Instrumentation related to Biomedical Systems.

Course Outcomes:

On successful completion of the module students will be able to:

- To introduce the concepts of physiology and the Electrical Components of a Biomedical System.
- To discuss the measurement of physiological parameters.
- To understand the concepts of Imaging System and Telemetry and the various Therapeutic Equipments used in Medicine.

Syllabus:

UNIT – I PHSYIOLOGY

Cell Structure, Basic Cell functions, Sources of Biomedical signals, Physiology of Cardiovascular, Nervous system & Respiratory system. Special senses: Auditory & Vision System, Engineering Analogy of Physiological system, Difficulties faced in measuring a living system.

UNIT – II
BASIC COMPONENTS OF BIOMEDICAL SYSTEM

Bio potential electrodes, Electrode-electrolyte interface, Half cell Potential, Electrodes-Micro, needle and surface electrodes. Various biomedical transducers. Bio-signal Amplifiers - Differential amplifiers, Chopper amplifiers, Notch Filters - Electrical Safety of Medical Equipment and Patients.

UNIT – III
MEASUREMENT OF PHYSIOLOGICAL PARAMETERS

ECG– ECG Lead systems and recording methods - EEG- EMG – Measurement of blood pressure-Cardiac output - Heart sounds - Respiratory rate - Lung Volumes and Capacities – Pneumotachography, Flow rate of CO_2, O_2 in exhaust air - pH of blood, GSR measurements-Plethysmography

UNIT – IV
IMAGING SYSTEM AND TELEMETRY

Ultrasound scanner – X-Ray Imaging - CAT / CT scan –MRI Imaging – PET scan. Basic elements of a Biotelemetry system - Single / Multi channel Telemetry Systems – Implanted transmitters - Telemedicine

UNIT – V
ASSISTING AND THERAPEUTIC EQUIPMENTS

Electrotherapy – Diathermy – Pacemakers - Defibrillators – Heart Lung Machine - Audiometry - Hearing aid – Dialysis machine-Ventilators-Endoscopes.

TOTAL PERIODS: 60

Text Books:

1. John Webster, "Medical Instrumentation: Application and Design", 3rd Edition, Wiley Publishing, 2009.

Reference Books:

1. Leslie Cromwell, Fred. J. Weibell, "Biomedical Instrumentation and Measurements", 2nd Edition, PHI, 2003.
2. R. Anandanatarajan, "Biomedical Instrumentation and Measurements", PHI Learning, 2011.

Code	Subject Name	Lectures (Periods)	Tutorial (Periods)	Practical (Periods)
EI E71	Applied soft computing	4	0	0

Course Objectives:

OBJECTIVES:

- To expose the students to the concepts of feed forward neural networks.
- To provide adequate knowledge about feedback neural networks
- To provide adequate knowledge about fuzzy and neuro-fuzzy systems
- To provide comprehensive knowledge of fuzzy logic control to real time systems.
- To provide adequate knowledge of genetic algorithms and its application to economic dispatch and unit commitment problems.

Course Outcomes:

- The students will be able to understand neural network, fuzzy logic and it application and neuro fuzzy controller

Syllabus:

Unit-I Artificial Neural Network

Review of fundamentals – Biological neuron, Artificial neuron, activation function, single layer perceptron- limitation – multilayer perceptron- Back propagation algorithm –recurrent network- adaptive resonance theory based network – radial base function network- online learning algorithms, BP through time- RTRL algorithm reinforce learning

UNIT-II NEURAL NETWORKS FOR MODELING AND CONTROL

Modeling of non-linear systems using ANN- generation of training data – optimal architecture – model validation – control of non- linear systems using ANN – direct and indirect neuro control schemes – adaptive neuro controller – familiarization with neural network toolbox

UNIT-III FUZZY SET THEORY

Fuzzy set theory- fuzzy sets- operation on fuzzy sets- Scalar cardinality, fuzzy cardinality, union and intersection- complement (Yeger and sugeno), equilibrium points, aggregation, projection, composition, cylindrical extension, fuzzy relation- fuzzy membership functions

UNIT-IV FUZZY LOGIC FOR MODELING AND CONTROL

Modeling of non linear systems using fuzzy models – TSK model – fuzzy logic controller- fuzzification – knowledge base- decision making logic – defuzzification – adaptive fuzzy systems – Familiarization with fuzzy logic toolbox

UNIT- V HYBRID CONTROL SCHEMES

Fuzzification and rule base using ANN – Neuro fuzzy systems ANFIS – Fuzzy neuron – Introduction to GA – Optimization of membership function and rule base using Genetic algorithm – Introduction to support vector machine – particle swarm optimization – case study familiarization with ANFIS toolbox

Text Books:

1. Laurene V.Fausett, “Fundamentals of Neural Networks, Architecture, Algorithms, and Applications”, Pearson Education, 2008.
2. Timothy J.Ross, “Fuzzy Logic with Engineering Applications”, Wiley, Third Edition, 2010.
3. David E.Goldberg, “Genetic Algorithms in Search, Optimization, and Machine Learning”, Pearson Education, 2009

Reference Books:

1. George J.Klir and Bo Yuan, “Fuzzy Sets and Fuzzy Logic: Theory and Applications”, Prentice HallI, First Edition, 1995.
2. W.T.Miller, R.S.Sutton and P.J.Webrose, “Neural Networks for Control”, MIT Press, 1996.
3. C.Cortes and V.Vapnik, "Support-Vector Networks, Machine Learning”, 1995.

Code	Subject Name	Lectures (Periods)	Tutorial (Periods)	Practical (Periods)
EI E72	ROBOTICS AUTOMATION	4	0	0

Course Objectives:

- Introduction to the design of multi degree-of-freedom robots and mobile platforms.
- Review of the latest technology available to design robotic systems.
- Use of professional engineering tools to design robots.
- Programming of microcontrollers to control a robotic system.
- Hands-on experience to design a robotic system.

Course Outcomes: .

Students will be able to design a robot starting with the conceptual design, develop the concept into a model, analyze the model on computer using engineering software packages, complete the structural design, and be able to build a prototype, present results in terms of a PowerPoint presentation, develop an engineering report and demonstrate the robot's performance.

UNIT – I

INTRODUCTION : Robotics – Basic components – Classification – Performance characteristics – Actuators- Electric actuator- DC motor horse power calculation, magnetostrictive hydraulic and pneumatic actuators. Sensors and vision systems: Different types of robot transducers and sensors – Tactile sensors – Proximity and range sensors – ultrasonic sensor-touch sensors-slip sensors-sensor calibration- vision systems – Image processing and analysis – image data reduction – segmentation feature extraction – Object recognition.

UNIT – II

ROBOT CONTROL : Control of robot manipulators- state equations-constant solutions-linear feedback systems-single axis PID control- PD gravity control- computed torque control- variable structure control- Impedance control .

UNIT – III

END EFFECTORS : End effectors and tools– types – Mechanical grippers – Vacuum cups – Magnetic grippers – Robot end effectors interface, work space analysis work envelope-workspace fixtures-pick and place operation- continuous path motion-interpolated motion-straight line motion.

UNIT – IV

ROBOT MOTION ANALYSIS : Robot motion analysis and control: Manipulator kinematics –forward and inverse kinematics- arm equation-link coordinates-Homogeneous transformations and rotations and Robot dynamics .

UNIT – V

ROBOT APPLICATIONS : Industrial and Non industrial robots, Robots for welding, painting and assembly – Remote Controlled robots – Robots for nuclear, thermal and chemical plants – Industrial automation – Typical examples of automated industries.

Text Books:

1. Mikel P. Grover , et. Al. "Industrial Robots – Technology Programming and Applications", McGraw Hill, 1980.
2. Robert J.Schilling, Fundamentals of Robotics-Analysis and Control, PHI,2007. (Unit-II and Unit-III)

Reference Books:

1. K.S.Fu,R.C.Gonzalez, CSG. Lee, Robotics,control sensing vision and Intelligence, Tata Mcgraw-Hill, 2008

Code	Subject Name	Lectures (Periods)	Tutorial (Periods)	Practical (Periods)
EI E73	POWER PLANT INSTRUMENTATION	4	0	0

Course Objectives:

- Be able to interpret and formulate design specifications for instrumentation systems that meet accuracy and sampling speed requirements.
- Be able to design, construct, and verify an instrumentation system to meet desired
- specifications,
- Be familiar with safety issues concerning design of instrumentation, including the
- Effects of electric current through tissue and defibrillation.

Course Outcomes: .

Upon completion of this subject, student should be able to design:

- Flow diagram all power plant.
- Safety system and interlock requirement in plant.
- Know overview of all power generation plant.
- Selection of instrumentation system to power plant.

Syllabus:

UNIT I

INTRODUCTION : Piping and instrumentation diagram of a thermal power plant, basic process on a boiler, Fuel measurement- review of pressure and temperature measurement steam and water flow measurement – instrument applications in power stations: review of indicating and recording instrument applications in power stations: review of indicating and recording instruments, water level gauge for boiler drums, closed circuit television instrument, gas analysis meters, smoke instruments, dust monitor-measurement of impurities in feed water and steam generator coolant controls and instruments-instrument maintenance aspects.

UNIT II

BOILER CONTROL-I: Boiler control objectives-combustion of fuels (gaseous liquid, and solid), excess air, combustion chemistry and products of combustion, requirement for excess combustion, air-circulation of efficiency of boiler: input/output method-stream temperature control systems super heaters and de-superheaters.

UNIT III

BOILER CONTROL-II: Feed water supply and boiler water circulation system-drum level control systems-boiler draft systems-measurement and control of furnace draft-measurement and control of combustion-draft and air flow control related functions.

UNIT IV

FLUE GAS ANALYSIS TRIMMING OF COMBUSTION CONTROL SYSTEMS : combustion control for liquid and gaseous fuel boilers coal or solid fuel strokes-combustion control for stoker-fired boilers- pulverised coal-fired boilers. Turbine monitoring and control: speed, vibration, shell temperature monitoring.

UNIT V

NUCLEAR POWER PLANT INSTRUMENTATION: piping and instrumentation diagram of different types of nuclear power plants-radiation detection instruments-process sensors for nuclear power plants-spectrum analyzers-nuclear reactor control systems and allied instrumentation.

Text Books:

2. B.G.Liptak, Instrumentation in process industries, Vol. I and II, Chilton books co, 1973.
3. Sam G. Dukelow. The control of boilers, Instrument Society of America press.

Reference Books:

A.Sherryet. Al. (Editors), Modern power station practice, Vol.6 (Instrumentation controls and testing), Pergamon Press, 1971.

Code	Subject Name	Lectures (Periods)	Tutorial (Periods)	Practical (Periods)
EI E74	**DIGITAL IMAGE PROCESSING**	**4**	**0**	**0**

Syllabus:

UNIT I
DIGITAL IMAGE FUNDAMENTALS AND TRANSFORMS
Elements of visual perception – Image sampling and quantization Basic relationship between pixels – Basic geometric transformations-Introduction to Fourier Transform and DFT – Properties of 2D Fourier Transform – FFT – Separable Image Transforms -Walsh – Hadamard – Discrete Cosine Transform, Haar, Slant – Karhunen – Loeve transforms.

UNIT II
IMAGE ENHANCEMENT TECHNIQUES*:*
Spatial Domain methods: Basic grey level transformation – Histogram equalization – Image subtraction – Image averaging –Spatial filtering: Smoothing, sharpening filters – Laplacian filters – Frequency domain filters : Smoothing – Sharpening filters – Homomorphic filtering.

UNIT III
IMAGE RESTORATION*:*
Model of Image Degradation/restoration process – Noise models – Inverse filtering -Least mean square filtering – Constrained least mean square filtering – Blind image restoration – Pseudo inverse – Singular value decomposition.

UNIT IV
IMAGE COMPRESSION
Lossless compression: Variable length coding – LZW coding – Bit plane coding- predictive coding-DPCM.
Lossy Compression: Transform coding – Wavelet coding – Basics of Image compression standards: JPEG, MPEG,Basics of Vector quantization.

UNIT V
IMAGE SEGMENTATION AND REPRESENTATION
Edge detection – Thresholding - Region Based segmentation – Boundary representation: chair codes- Polygonal approximation – Boundary segments – boundary descriptors: Simple descriptors-Fourier descriptors - Regional descriptors –Simple descriptors- Texture

Text Books:

1. Rafael C Gonzalez, Richard E Woods 2nd Edition, Digital Image Processing - Pearson Education 2003.

Reference Books:

1. William K Pratt, Digital Image Processing John Willey (2001)
2. Image Processing Analysis and Machine Vision – Millman Sonka, Vaclav hlavac, Roger Boyle, Broos/colic, Thompson Learniy (1999).
3. A.K. Jain, PHI, New Delhi (1995)-Fundamentals of Digital Image Processing.
4. Chanda Dutta Magundar – Digital Image Processing and Applications, Prentice Hall of India, 2000

Code	Subject Name	Lectures (Periods)	Tutorial (Periods)	Practical (Periods)
EI E75	COMPUTER NETWORKS	4	0	0

Course Objectives:

The objective of the course is to study about the various network models, protocols and standards that provide guidelines to manufacturers, vendors ,government agencies and other service providers to ensure the kind of inter-connectivity necessary in today's marketplace and in international communications.

Course Outcomes: .

At the end of the course a knowledge of the seven layer ISO/OSI model, types of connections like, transmission media available such as coax and fiber optic cables, line coding, modems, RS-232 interfaces at the physical layer is acquired.

Also an exposure to the various error correction and detection techniques, flow and error control protocols and the various LAN topologies , the different switching , routing and addressing methods are also obtained.

Syllabus:

UNIT I DATA COMMUNICATIONS

Components – Direction of Data flow – networks – Components and Categories – types of Connections – Topologies –Protocols and Standards – ISO / OSI model – Transmission Media – Coaxial Cable – Fiber Optics – Line Coding – Modems – RS232 Interfacing sequences.

UNIT II DATA LINK LAYER

Error – detection and correction – Parity – LRC – CRC – Hamming code – low Control and Error control - stop and wait – go back-N ARQ – selective repeat ARQ- sliding window – HDLC. - LAN - Ethernet IEEE 802.3 - IEEE 802.4 - IEEE 802.5 - IEEE 802.11 – FDDI - SONET – Bridges.

UNIT III NETWORK LAYER

Internetworks – Packet Switching and Datagram approach – IP addressing methods – Subnetting – Routing – Distance Vector Routing – Link State Routing – Routers.

UNIT IV TRANSPORT LAYER

Duties of transport layer – Multiplexing – Demultiplexing – Sockets – User Datagram Protocol (UDP) – Transmission Control Protocol (TCP) – Congestion Control – Quality of services (QOS) – Integrated Services.

UNIT V APPLICATION LAYER

Domain Name Space (DNS) – SMTP – FTP – HTTP - WWW – Security – Cryptography.

Text Books:

1. Behrouz A. Forouzan, "Data communication and Networking", Tata McGraw-Hill, 2004.

Reference Books:

1. James F. Kurose and Keith W. Ross, “Computer Networking: A Top-Down Approach Featuring the Internet”, Pearson Education, 2003.
2. Larry L.Peterson and Peter S. Davie, “Computer Networks”, Harcourt Asia Pvt. Ltd., Second Edition.
3. Andrew S. Tanenbaum, “Computer Networks”, PHI, Fourth Edition, 2003.
4. William Stallings, “Data and Computer Communication”, Sixth Edition, Pearson Education, 2000.

Code	Subject Name	Lectures (Periods)	Tutorial (Periods)	Practical (Periods)
EI E76	**INTRODUCTION TO NANOSCIENCE and TECHNOLOGY**	**4**	**0**	**0**

UNIT I

NANOSCALE SYSTEMS:

Length, energy, and time scales - Quantum confinement of electrons in semiconductor nanostructures: Quantum confinement in 3D, 2D, 1D and zero dimensional structures -Size effect and properties of nanostructures- Landauer-Buttiker formalism for conduction in confined geometries - Top down and Bottom up approach**.**

UNIT II

QUANTUM DOTS:

Excitons and excitonic Bohr radius – difference between nanoparticles and quantum dots - Preparation through colloidal methods - Epitaxial methods- MOCVD and MBE growth of quantum dots - current-voltage characteristics - magneto tunneling measurements - spectroscopy of Quantum Dots: Absorption and emission spectra - photo luminescence spectrum - optical spectroscopy - linear and nonlinear optical spectroscopy.

UNIT III

SYNTHESIS OF NANOSTRUCTURE MATERIALS:

Gas phase condensation – Vacuum deposition -Physical vapor deposition (PVD) - chemical vapor deposition (CVD) – laser ablation- Sol-Gel- Ball milling –Electro deposition- electroless deposition – spray pyrolysis – plasma based synthesis process (PSP) - hydrothermal synthesis

UNIT IV

CHARACTERIZATION:

Principle and working of Atomic Force Microscopy (AFM) and Scanning tunneling microscopy (STM) - near-field Scanning Optical Microscopy – Principle of Transmission Electron Microscopy (TEM) – applications to nanostructures – nanomechanical characterization – nanoindentation

UNIT V

NANOTECHNOLOGY APPLICATIONS:

Applications of nanoparticles, quantum dots, nanotubes and nanowires for nanodevice fabrication – Single electron transistors, coulomb blockade effects in ultra-small metallic tunnel junctions - nanoparticles based solar cells and quantum dots based white LEDs – CNT based transistors – principle of dip pen lithography.

.

Text Books:

1. "Nanotechnology" G. Timp. Editor, AIP press, Springer-Verlag, New York, 1999
2. "Nanostructured materials and nanotechnology'', Concise Edition, Editor:- Hari Singh Nalwa; Academic Press, USA (2002

Reference Books:

1. Hand book of Nanostructured Materials and Technology'', Vol.1-5, Editor:- Hari Singh Nalwa; Academic Press, USA (2000).
2. "Hand book of Nanoscience, Engineering and Technology (The Electrical Engineering handbook series), Kluwer Publishers, 2002
3. "Sol-Gel Science", C.J. Brinker and G.W. Scherrer, Academic Press, Boston (1994).
4. Nanoscale characterization of surfaces & interfaces, N John Dinardo, Weinheim Cambridge: Wiley-VCH, 2nd ed., 2000.

Code	Subject Name	Lectures (Periods)	Tutorial (Periods)	Practical (Periods)
EI E81	Operating Systems	4	0	0

Objectives:

The student should be made to:

- Study the basic concepts and functions of operating systems
- Understand the structure and functions of OS
- Learn about Processes, Threads and Scheduling algorithms
- Understand the principles of concurrency and Deadlocks
- Learn various memory management schemes
- Study I/O management and File systems
- Learn the basics of Linux system and perform administrative tasks on Linux Servers

OUTCOMES:

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

- Design various Scheduling algorithms
- Apply the principles of concurrency
- Design deadlock, prevention and avoidance algorithms.
- Compare and contrast various memory management schemes
- Design and Implement a prototype file systems
- Perform administrative tasks on Linux Servers

UNIT I

OPERATING SYSTEMS OVERVIEW

Computer System Overview-Basic Elements, Instruction Execution, Interrupts, Memory Hierarchy,Cache Memory, Direct Memory Access, Multiprocessor and Multicore Organization. Operating system overview-objectives and functions, Evolution of Operating System.- Computer System Organization- Operating System Structure and Operations- System Calls, System Programs, OS Generation and System Boot.

UNIT II

PROCESS MANAGEMENT

Processes-Process Concept, Process Scheduling, Operations on Processes, Interprocess Communication; Threads- Overview, Multicore Programming, Multithreading Models; Windows 7 -Thread and SMP Management. Process Synchronization - Critical Section Problem, Mutex Locks, Semophores, Monitors; CPU Scheduling and Deadlocks.

UNIT III

STORAGE MANAGEMENT

Main Memory-Contiguous Memory Allocation, Segmentation, Paging, 32 and 64 bit architecture
Examples; Virtual Memory- Demand Paging, Page Replacement, Allocation, Thrashing; Allocating Kernel Memory, OS Examples.

UNIT IV

I/O SYSTEMS

Mass Storage Structure- Overview, Disk Scheduling and Management; File System Storage-File Concepts, Directory and Disk Structure, Sharing and Protection; File System Implementation-File System Structure, Directory Structure, Allocation Methods, Free Space Management; I/O Systems.

UNIT V

CASE STUDY

Linux System- Basic Concepts; System Administration-Requirements for Linux System Administrator, Setting up a LINUX Multifunction Server, Domain Name System, Setting Up Local Network Services; Virtualization- Basic Concepts, Setting Up Xen,VMware on Linux Host and Adding Guest OS.

TEXT BOOK:

1. Abraham Silberschatz, Peter Baer Galvin and Greg Gagne, "Operating System Concepts", 9th Edition, John Wiley and Sons Inc., 2012.

REFERENCES:

1. William Stallings, "Operating Systems – Internals and Design Principles", 7th Edition, Prentice Hall, 2011.
2. Andrew S. Tanenbaum, "Modern Operating Systems", Second Edition, Addison Wesley, 2001.
3. Charles Crowley, "Operating Systems: A Design-Oriented Approach", Tata McGraw Hill Education", 1996.
4. D M Dhamdhere, "Operating Systems: A Concept-Based Approach", Second Edition, Tata McGraw-Hill Education, 2007

Code	Subject Name	Lectures (Periods)	Tutorial (Periods)	Practical (Periods)
EI E82	**DESIGN OF PROCESS CONTROL SYSTEM COMPONENTS**	**4**	**0**	**0**

Course Objectives:

1. Understand the health and safety implications of working with process control Systems
2. Appreciate the operation of typical instrumentation systems
3. Identify the various methods of signal transmission
4. Correctly connect electrical or air-powered devices

Course Outcomes: .

1. Be able to interpret and formulate design specifications for instrumentation systems that meet accuracy and sampling speed requirements.
2. Be able to design, construct, and verify an instrumentation system to meet desired specifications,
3. Be familiar with safety issues concerning design of instrumentation, including the Effects of electric current through tissue and defibrillation.

Syllabus:

UNIT – I

Orifice meter – design of orifice for given flow condition – design of rotameter – design of RTD measuring circuit – design of cold junction compensation circuit for thermocouple using RTD – Transmitters – Zero and span adjustment in D/P transmitters and temperature transmitters.

UNIT – II

Bourdon gauges – factors affecting sensitivity – design of Bourdon tube – Design of Air purge system for level measurement. Electronic P+I+D controllers – design – adjustment of setpoint, bias and controller settings.

UNIT – III

Control valves – design of actuators and positioners – types for valve bodies – valve characteristics – materials for body, and trim – sizing of control valves – selection of body, materials and characteristics of control valves for typical applications.

UNIT – IV

Types of pumps – pump – performance – pipe work calculation – characteristics of different pumps – pump operation maintenance – instruments used in pumping practice pump noise and vibration – selection of pumps.

UNIT - V

Design of logic circuits for alarm and annunciator circuits, interlocks – design of microprocessor based P+I+D controller.

Text Books:

1. N.A. Anderson, “Instrumentation for Process Measurement and Control”, Chillton Company, 1980.
2. D.M. Considine, “Process Instruments and Controls Handbook”, McGraw Hill Book Co. 1985.

Reference Books:

1. R.H. Warring, “Pumping Manual”, Gulf Publishing Co., 1984.
2. C.D. Johnson, “Process Control Instrumentation Technology”, Prentice Hall Inc. 1988.

Code	Subject Name	Lectures (Periods)	Tutorial (Periods)	Practical (Periods)
EI E 83	FIBRE OPTICS AND LASER INSTRUMENTATION	4	0	0

Course Objectives:

1.To study in detail about optical fibers and its applications:
2.To study in detail about lasers and their applications
.

UNIT - I
OPTICAL FIBRES AND THEIR PROPERTIES

Principles of light propagation through a fibre - Different types of fibres and their properties, fibre characteristics – Absorption losses – Scattering losses – Dispersion – Connectors & splicers – Fibre termination – Optical sources – Optical detectors.

UNIT - II
NDUSTRIAL APPLICATION OF OPTICAL FIBRES Fibre optic sensors–Fibre optic instrumentation system – Different types of modulators – Interferometric method of measurement of length – Moire fringes – Measurement of pressure, temperature, current, voltage, liquid level and strain.

UNIT - III
ASER FUNDAMENTALS Fundamental characteristics of lasers – Three level and four level lasers – Properties of laser – Laser modes – Resonator configuration – Q-switching and mode locking – Cavity damping – Types of lasers – Gas lasers, solid lasers, liquid lasers, semiconductor lasers.

UNIT - IV
NDUSTRIAL APPLICATION OF LASERS Laser for measurement of distance, length, velocity, acceleration, current, voltage and atmospheric effect – Material processing – Laser heating, welding, melting and trimming of material – Removal and vaporization.

UNIT – V
HOLOGRAM AND MEDICAL APPLICATIONS
Holography – Basic principle - Methods – Holographic interferometry and application, Holography for non-destructive testing – Holographic components – Medical applications of lasers, laser and tissue interactive – Laser instruments for surgery, removal of tumours of vocal cards, brain surgery, plastic surgery, gynaecology and oncology.

Text Books:

1. J.M. Senior, 'Optical Fibre Communication – Principles and Practice', Prentice Hall of India, 1985.
2. J. Wilson and J.F.B. Hawkes, 'Introduction to Opto Electronics', Prentice Hall of India, 2001.

Reference Books:

1. Donald J.Sterling Jr, 'Technicians Guide to Fibre Optics', 3rd Edition, Vikas Publishing House, 2000.
2. M. Arumugam, 'Optical Fibre Communication and Sensors', Anuradha Agencies, 2002.
John F. Read, 'Industrial Applications of Lasers', Academic Press, 1978.
Monte Ross, 'Laser Applications', McGraw Hill, 1968
G. Keiser, 'Optical Fibre Communication', McGraw Hill, 1995.
6. Mr. Gupta, 'Fiber Optics Communication', Prentice Hall of India, 2004.

Code	Subject Name	Lectures (Periods)	Tutorial (Periods)	Practical (Periods)
EI E84	**Semiconductor materials and optoelectronics**	**4**	**0**	**0**

UNIT I

Semi conducting materials

Introduction- band structure of semiconductors – element and compound semiconductors – intrinsic and extrinsic semiconductors – electron density – hole density – electrical conductivity - hall effect.

UNIT II

Quantum wells, wires, dots, self assembly and catalysis

Quantum wells, wires, dots - introduction – preparation of quantum nanostructures – size effects - excitons – single electron tunneling – applications.

Self assembly – Process - Semiconductors islands - monolayers – catalysis – nature – surface area of Nanoparticles – porous materials - pillared clays - colloids.

UNIT III

Light Emitting diodes, Semiconductor lasers, Photodetectors

Introduction – Light Emitting diodes (LED) – radiative transition - semiconductor laser diodes – Photoconductor, Photodiode – Avalanche Photodiode – Phototransistors.- white LEDs

UNIT IV

Solar cells

Introduction – basic principle – I-V characteristics – spectral response – Photovoltaic effect in a pn junction, Schottky barrier, thin film and cascade solar cells - materials and design considerations – application.

UNIT V

Optoelectronics Modulation and switching devices

Introduction – analog and digital modulation, Franz – Keldysh and stark effect modulators – quantum well electro-absorption modulators – electro optic modulators - optical switching and logic devices.

Reference Books:

1. Semiconducting Optoelectronics devices, Pallab Bhattacharya, prentice hall international editions, 1997.
2. Solid state physics, S O Pillai, 5th edition, New Age International (P) Ltd. (2004)
3. Optical Electronics, Ajay Ghatak & K.Thiyagarajan, Cambridge University Press, 1994.
4. Solid State physics, M A Wahab, Narosa Publishing House, 2005.
5. Physics of Semi conducting devices, S M sze, 2nd Edition, John – Wiley &Sons, 2005.
6. Optoelectronics, Jasprit Singh, McGrew Hill international Editors, 1996.
7. Semiconductor Optoelectronics, Jasprit Singh, McGrew Hill International Editors, 1996.

Code	Subject Name	Lectures (Periods)	Tutorial (Periods)	Practical (Periods)
EI E85	**INSTRUMENTATION AND CONTROL IN PETROCHEMICAL INDUSTRIES**	**4**	**0**	**0**

Course Objectives:

1. To give a brief introduction to Petro chemical industries
2. To introduce the different Measurements in refineries and petrochemical industries

Course Outcomes: .

1. The student will be able to understand working of Petro chemical industries
2. The student will be able understand and explain different Measurements in refineries and petrochemical industries

Syllabus:

UNIT – I
Petroleum Exploration – Petroleum recovery techniques –oil-gas separation-Processing of wet gases – refining of crude oil.

UNIT – II
Unit operations in petroleum industry – Thermal cracking – Catalytic cracking – Catalytic reforming – Polymerization – Alkylation – Isomerization – production of ethylene acetylene and propylene from petroleum.

UNIT – III
Chemicals from petroleum – Methane derivatives – Acetylene derivatives – ethylene derivatives – Propylene derivatives – other products.

UNIT – IV
Measurements in refineries and petrochemical industries – selection and maintenance of measuring instruments – special measurement problems.

UNIT – V
Process control in refineries and petrochemical industries – Control of distillation column – control of Catalytic crackers and pyrolysis unit – Automatic control of polyethylene production – Control of Vinyl chloride and PVC production.

Reference Books:

1. Waddams A.L, “Chemicals from Petroleum”,Butter and Tanner Ltd., 1968.
2. Balcen J.G. and Mumme K.I., “Process Control Structures and Applications”, New York. 1968.
3. Austin G.T. Shreves, “Chemical Process industries”, McGraw Hill international student edition Singapore. 1985.

Code	Subject Name	Lectures (Periods)	Tutorial (Periods)	Practical (Periods)
EI E86	**SYSTEM IDENTIFICATION AND ADAPTIVE CONTROL**	**4**	**0**	**0**

Course Objectives:

- To introduce Non parametric methods
- To impart knowledge on parameter estimation methods
- To impart knowledge on Recursive identification methods
- To impart knowledge on Adaptive control schemes
- To introduce stability, Robustness and Applications of adaptive control method

Course Outcomes:

- Ability to apply advanced control theory to practical engineering problems.

UNIT I NON PARAMETRIC METHODS

Non parametric methods: Transient analysis–frequency analysis–Correlation analysis–Spectral analysis.

UNIT II PARAMETER ESTIMATION METHODS

Least square estimation – best linear unbiased estimation under linear constraints – updating the parameter estimates for linear regression models–prediction error methods: description of prediction methods – optimal prediction – relation between prediction error methods and other identification methods – theoretical analysis - Instrumental variable methods: Description of instrumental variable methods – Input signal design for identification.

UNIT III RECURSIVE IDENTIFICATION METHODS

The recursive least square method – the recursive instrumental variable methods- the recursive prediction error methods – Maximum likelihood. Identification of systems operating in closed loop: Identifiability considerations – direct identification – indirect identification

UNIT IV ADAPTIVE CONTROL SCHEMES

Introduction – Types of adaptive control–Gain scheduling controller–Model reference adaptive control schemes–Self tuning controller–MRAC and STC: Approaches–The Gradient approach – Lyapunov functions – Passivity theory – pole placement method – Minimum variance control – Predictive control.

UNIT V ISSUES INADAPTIVE CONTROL AND APPLICATIONS

Stability – Convergence – Robustness –Applications of adaptive control.

TEXT BOOKS:

1. Soder storm T and Peter Stoica, System Identification, Prentice Hall International, 1989.
2. Astrom,K.J. and Wittenmark,B., “Adaptive Control”, Pearson Education, 2nd Edition, 2001.
3. Sastry,S. and Bodson, M.,“ Adaptive Control– Stability, Convergence and Robustness”, PrenticeHall inc., New Jersey, 1989.

REFERENCE BOOKS:

1. Ljung L, System Identification: Theory for the user, Prentice Hall, Engle wood Cliffs,1987.
2. Bela.G.Liptak., “Process Control and Optimization”., Instrument Engineers’ Handbook., volume2, CRC press and ISA, 2005.
3. William S.Levine, “Control Systems Advanced Methods, the Control Handbook, CRC Press 2011.