



**SRI CHANDRASEKHARENDRA SARASWATHI VISWA MAHAVIDYALAYA**

**SCSVMV UNIVERSITY**

**(University u/s 3 of UGC Act 1956)**

**Accredited with “B” Grade by NAAC**

**Enathur, Kanchipuram - 631561**



**CURRICULUM FOR**

**B.E (Electronics & Instrumentation Engineering)**

**FULL TIME PROGRAMME**

**CHOICE BASED CREDIT SYSTEM**

**(For Candidates admitted from the year 2014 onwards)**

**DEPARTMENT OF  
ELECTRONICS & INSTRUMENTATION ENGINEERING**



## **CHOICE BASED CREDIT SYSTEM FOR BE (EIE) FULL-TIME PROGRAMME**

### **CREDITS**

Theory courses: Courses with 4/3 credits will be assigned 3 Lectures and 2/1 Tutorial hours per week.

Practical courses: Courses with 2 credits will be assigned 3 hours of lab/practical work per week

Each semester curriculum shall normally have a blend of theory and practical courses. In the first year the total number of credits will be 25 for each Semester. For semester III to VII, the average credits per semester will be 25 and for semester VIII, the credits will be 18. For the award of the degree, a student has to earn a minimum of 196 credits.

### **DURATION OF THE PROGRAMME**

A student is normally expected to complete B.E (EIE) programme in four years and in any case, not more than seven years from the time of admission.

### **REGISTRATION FOR COURSES**

A newly admitted student will automatically be registered for all the courses prescribed for the first year, without any option.

All other students shall submit a completed registration form indicating the list of courses intended to be credited during the next semester. This registration will be done a week before the last working day of the current semester. Late registration, with the approval of the Dean on the recommendation of the Head of the Department, along with a late fee will be done, up to the last working day.

Registration for the project work shall be done only for the final semester.

### **ASSESSMENT**

The break-up of Assessment and Examination marks for Theory subjects are as follows.

Continuous Internal Assessment comprising of tests,

assignments, seminars, group discussion and attendance : 40 Marks

End semester Examination : 60 Marks

The break-up of the Assessment and Examination marks for Practical are as follows.

Continuous Internal Assessment comprising of tests,

Observation, Record work and attendance : 40 Marks

End semester Examination : 60 Marks

The project work will be assessed for 40 marks by a Committee consisting of the Guide and the Head of the Department. The Head of the Department said be the Chairman. 60 marks are allotted for the project viva voce examination at the end of the semester.

### **WITHDRAWAL FROM A COURSE**

A student can withdraw from the course at any time before a date fixed by the Head of the Department prior to the second assessment, with the approval of the Dean on the recommendation of the Head of the Department.

## **TEMPORARY BREAK OF STUDY**

A student can take a one-time temporary break of study covering the current year/semester and/or the next semester with the approval of the Dean on the recommendation of the Head of the Department, not later than seven days after the completion of the mid-semester test. However, the student must complete the entire program within the maximum period of seven years.

## **SUBSTITUTE ASSESMENT**

A student, who has missed, for genuine reasons accepted by the Head of the Department, one or more of the assessments of a course other than the end semester examination, may take a substitute assessment for any one of the missed assessments. The substitute assessment must be completed before the comment of the end semester before examination.

A student who wishes to have a substitute assessment for a missed assessment must apply to the Head of the Department within a week from the date of the missed assessment.

## **ATTENDANCE REQUIREMENTS**

To be eligible to appear for the examination in a particular course, a student must put in a minimum of 80% of attendance in the course. However, if the attendance is 70% or above but less than 80% in any course, the authorities can permit the student to appear for the examination in the course on payment of the prescribed condonation fee.

A student who withdraws from or does not meet the minimum attendance requirement in the course must re-register for and repeat the course.

## **PASSING AND DECLARATION OF EXAMINATION RESULTS**

All assessments of all the courses on the absolute mark basis will be considered and passed by the results passing board in accordance with the rules of the University. Thereafter, the Controller of Examinations shall convert the marks for each course to the corresponding letter grade as follows, compute the grade point average & cumulative grade point average and prepare the grade cards.

90 to 100 marks	-	Grade 'S'
80 to 89 marks	-	Grade 'A'
70 to 79 marks	-	Grade 'B'
60 to 69 marks	-	Grade 'C'
55 to 59 marks	-	Grade 'D'
50 to 54 marks	-	Grade 'E'
less than 50 marks	-	Grade 'F'
Insufficient attendance	-	Grade 'I'
Withdrawn from the course	-	Grade 'W'

A student who obtains less than 50 marks out of 100 in the subject or less than 24 out of 60 in External exam or is absent for the examination will be awarded Grade 'F'.

A student who earns a grade of S,A,B,C,D or E for a course is declared to have successfully completed that course and earned the credits for that course. Such a course cannot be repeated by the student.

A student who obtains letter grade F in a course has to reappear for the examination in that course.

The following grade points are associated with each letter grade for calculating the grade point average.

S – 10; A-9; B-8; C-7; D-6; E-5; F-0

A student can apply for reevaluation of one or more of his /her examination answer papers within a week from the date of issue of Grade sheet to the student on payment of the prescribed fee per paper. The application must be made to the Controller of Examinations with the recommendation of the Head of the Department.

After results are declared, Grade cards will be issued to the students. The Grade card will contain the list of courses registered during the year/semester, the grades scored and the grade point average (GPA) for the year/semester.

GPA is the sum of the products of the number of credits of a course with the grade point scored in that course, taken over all the courses for the Year/Semester, divided by the sum of the number of credits for all courses taken in that year/semester. CGPA is similarly calculated considering all the courses taken from the time of admission.

After successful completion of the program, the Degree will be awarded with the following classification based on CGPA:

For First Class with Distinction, the student must earn a minimum of 196 credits within four years from the time of admission, pass all the courses in the first attempt and obtain a CGPA of 8.25 or above.

For First Class, the student must earn a minimum of 196 credits within five years from the time of admission and obtain a CGPA of 6.5 or above.

For Second Class, the student must earn a minimum of 196 credits within seven years from the time of admission.

### **ELECTIVES**

Apart from the various Core courses offered in the curriculum of the branch of specialization, a student can choose a electives from a list of electives offered by the Department and from other Departments with the approval of the Head of the Department and the Head of the Department offering the course.

### **Examination Pattern for Sanskrit & Indian Culture paper**

There will not be any External examination for Sanskrit and Indian Culture paper. Performance of students will be assessed through tests and assignments conducted by the same Department. The internal assessment pattern is as follows.

First test		30 Marks
Second test		30 Marks
Assignment (G.D + Seminar + Attendance + Class test)		40 Marks
		-----
	Total	100 Marks
Total Marks		100Marks
Passing Minimum marks		50%

In the last semester (B.E. - VI) marks are allotted for test (50) and project work (50). A Candidate shall be declared to have passed the examination, if he/she has secured a minimum mark of 50

**SRI CHANDRASEKHARENDRA SARASWATHI VISWA MAHA VIDYALAYA UNIVERSITY**  
**COURSE CONTENT AND SCHEME OF EXAMINATION**  
**BE – ELECTRONICS AND INSTRUMENTATION ENGINEERING**

CURRICULAM FOR THE STUDENTS ADMITTED FROM 2014 – 15

**I SEMESTER**

SL.NO.	SUB CODE	SUBJECT	C	IA	E	TM	DE
1	EN1T1	English -I	3	40	60	100	3 Hrs
2.	MA1T2	Basic Mathematics For Engineering - I	3	40	60	100	3 Hrs
3.	PH1T3	Engineering Physics	3	40	60	100	3 Hrs
4.	EE1T4	Basic Electrical And Electronics Engineering	3	40	60	100	3 Hrs
5.	CS1T5	Computer Programming	3	40	60	100	3 Hrs
6.	SA1T1	Sanskrit And Indian Culture - I	1	100	-	100	2 Hrs
7.	ME1P6	Engineering Graphics ( Practical)	3	40	60	100	3 Hrs
8.	PH1P7	Physics Lab	2	40	60	100	3 Hrs
9.	CS1P8	Computer Programming Lab	2	40	60	100	3 Hrs
10.	EE1P9	Basic Electrical Workshop	2	40	60	100	3 Hrs
						<b>Total no of credits: 25</b>	

**II SEMESTER**

SL.NO.	SUB CODE	SUBJECT	C	IA	E	TM	DE
1	EN2T1	English -II	3	40	60	100	3 Hrs
2.	MA2T2	Basic Mathematics For Engineering - II	3	40	60	100	3 Hrs
3.	CH2T3	Engineering Chemistry	3	40	60	100	3 Hrs
4.	ME2T4	Basic Civil And Mechanical Engineering	3	40	60	100	3 Hrs
5.	EE2T5	Electric Circuit Theory	3	40	60	100	3 Hrs
6.	CH2T6	Environmental Science And Engineering	3	40	60	100	3 Hrs
7.	SA2T2	Sanskrit And Indian Culture - II	1	100	-	100	2 Hrs
8.	CH2P7	Chemistry Lab	2	40	60	100	3 Hrs
9.	EE2P8	Circuit Theory Lab	2	40	60	100	3 Hrs
10.	ME2P9	Basic Mechanical Workshop	2	40	60	100	3 Hrs
						<b>Total no of credits: 25</b>	

**C- Credits, IA - Internal Assessment, E - External Assessment, TM - Total Marks, DE – Duration of Examinations**

### III SEMESTER

SL.NO.	SUB CODE	SUBJECT	C	IA	E	TM	DE
1	MG3T1	Applied Mathematics for Instrumentation Engineers I	3	40	60	100	3 Hrs
2.	EC3T6	Principles of Communication	3	40	60	100	3 Hrs
3.	EC3T4	Electronic Devices and Circuits	3	40	60	100	3 Hrs
4.	EI3T2	Sensors And Transducers	3	40	60	100	3 Hrs
5.	EE3T3	Electrical Engineering	3	40	60	100	3 Hrs
6.	CS3T6	Object Oriented Programming Using C++	3	40	60	100	3 Hrs
7.	SA3T3	Sanskrit & Indian Culture - III	1	100	-	100	2 Hrs
8.	SS3P1	Soft Skills-I*	1*	-	-	-	-
9.	EI3P7	Electronic Devices and Circuits Lab	2	40	60	100	3 Hrs
10.	CS3P9	Object Oriented Programming Using C++ Lab	2	40	60	100	3 Hrs
11.	EE3P6	Electrical Engineering Lab	2	40	60	100	3 Hrs
<b>Total no of credits: 25</b>							

### IV SEMESTER

SL.NO.	SUB CODE	SUBJECT	C	IA	E	TM	DE
1	MG4T1	Applied Mathematics for Instrumentation Engineers II	3	40	60	100	3 Hrs
2.	EI4T2	Linear Integrated Circuits	3	40	60	100	3 Hrs
3.	EI4T3	Industrial Instrumentation	3	40	60	100	3 Hrs
4.	EE4T2	Digital Electronics	3	40	60	100	3 Hrs
5.	EC4T6	Signals and Systems	3	40	60	100	3 Hrs
6.	EE4T7	Measurements and Instrumentation	3	40	60	100	3 Hrs
7.	SA4T4	Sanskrit & Indian Culture - IV	1	100	-	100	2 Hrs
8.	SS4P2	Soft Skills-II*	1*	-	-	-	-
9.	EI4P9	Linear Integrated Circuits& Digital Lab	2	40	60	100	3 Hrs
10.	EE4P6	Measurements and Instrumentation Lab	2	40	60	100	3 Hrs
11.	EI4P8	Transducer and Industrial Instruments Lab	2	40	60	100	3 Hrs
<b>Total no of credits: 25</b>							

### V SEMESTER

SL.NO.	SUB CODE	SUBJECT	C	IA	E	TM	DE
1	MG5T1	Applied Mathematics for Instrumentation Engineers III	3	40	60	100	3 Hrs
2.	EC5T4	Control Systems	3	40	60	100	3 Hrs
3.	EI5T3	Power Plant Instrumentation	4	40	60	100	3 Hrs
4.	EC5T5	Digital Signal Processing	3	40	60	100	3 Hrs
5.	EI5T4	Power Electronics and Drives	3	40	60	100	3 Hrs
6.	ME5T6	Thermo Dynamics and Fluid Mechanics	3	40	60	100	3 Hrs
7.	SA5T5	Sanskrit & Indian Culture - V	1	100	-	100	2 Hrs
8.	SS5P1	Soft Skills-III*	1*	-	-	-	-
9.		Open Elective***	2***	40	60	100	3 Hrs
10.	ME5P6	Thermo Dynamics And Fluid Mechanics Lab	2	40	60	100	3 Hrs
11.	EC5P7	Power Electronics and Drives Lab	2	40	60	100	3 Hrs
12.	EE5P8	Control Systems Lab	2	40	60	100	3 Hrs
13.	PT5P1	Industrial Training Process**	1**	40	60	100	3 Hrs
<b>Total no of credits: 26</b>							

**VI SEMESTER**

SL.NO.	SUB CODE	SUBJECT	C	IA	E	TM	DE
1	MG6T1	Operational Research	3	40	60	100	3 Hrs
2.	EC6T3	Microprocessor and Microcontroller	3	40	60	100	3 Hrs
3.	EI6T3	Process Control Instrumentation	4	40	60	100	3 Hrs
4.	EI6T4	Industrial Chemical Process	3	40	60	100	3 Hrs
5.	EI6T5	Analytical Instrumentation	3	40	60	100	3 Hrs
6.	EI6T6	Fiber Optics and Laser Instrumentation	3	40	60	100	3 Hrs
7.	SA6T6	Sanskrit & Indian Culture - VI	1	100	-	100	2 Hrs
8.	SS6P4	Soft Skills-IV*	1*	-	-	-	-
9.		Open Elective***	1***	40	60	100	3 Hrs
10.	EC6P7	Microprocessor and Microcontroller Lab	2	40	60	100	3 Hrs
11.	EI6P8	Simulation Lab	2	40	60	100	3 Hrs
12.	EI6P9	Industrial and Process Control Lab	2	40	60	100	3 Hrs
13.	PT6T1	Industrial Training Process**	1**	40	60	100	3 Hrs
<b>Total no of credits: 26</b>							

**VII SEMESTER**

SL.NO.	SUB CODE	SUBJECT	C	IA	E	TM	DE
1	EC7T1	VLSI Design	3	40	60	100	3 Hrs
2.	EI7T2	Embedded Systems	3	40	60	100	3 Hrs
3.	EI7T3	Principle of Management & Professional Ethics	3	40	60	100	3 Hrs
4.	EI7T4	Computer Control of Process	4	40	60	100	3 Hrs
5.		Elective – I	3	40	60	100	3 Hrs
6.		Elective – II	3	40	60	100	3 Hrs
7.	EI7P7	Computer Control Lab	2	40	60	100	3 Hrs
8.	EI7P8	Virtual Instrumentation Lab	2	40	60	100	3 Hrs
9.	EI7Z1	Project Work Phase I	2	-	-	-	-
<b>Total no of credits: 25</b>							

**VIII SEMESTER**

SL.NO.	SUB CODE	SUBJECT	C	IA	E	TM	DE
1	EI8T1	Robotics and Automation	3	40	60	100	3 Hrs
2.	EI8T2	Bio Medical Instrumentation	3	40	60	100	3 Hrs
3.		Elective – III	3	40	60	100	3 Hrs
4.		Elective – IV	3	40	60	100	3 Hrs
5.	EI8Z2	Project Work Phase II	6	-	-	100	3 Hrs
<b>Total no of credits: 18</b>							

Total credit from semester III to Semester VIII is **145**

Total credit from semester I to Semester VIII is **195**

**C-Credits, IA-Internal Assessment, E-External, TM- Total Marks, DE-Duration of Exam.**



**Soft Skills\***

The syllabus and the course will be monitored by placement and training cell. It carries 1credit/Sem from III Semester to VI Semester which is not considered for CGPA calculation.

**Industrial Training Practice\*\***

For Industrial Practice, students have to go for Industrial Training for a prescribed period. It carries 1credit that is not considered for CGPA calculation.

**Open Elective\*\*\***

Students have to take one course from other department (from non engineering department only). Faculties from other department will handle this paper. It carries 1credit which is not considered for CGPA calculation.

**B.E. /B.Tech. Open elective****Semester – V**

S.No	Sub. Code	Subject	Credit
1	OE5TA	ASTRO-PHYSICS	1
2	OE5TB	BIOINFORMATICS	1
3	OE5TC	BUSINESS ADMINISTRATION	1
4	OE5TD	COMMUNICATION SKILLS	1
5	OE5TE	FINANCE FOR NON FINANCE MANAGERS	1
6	OE5TF	FRENCH PRIMER	1
7	OE5TG	FUEL CELL & BATTERIES	1
8	OE5TH	GERMAN PRIMER	1
9	OE5TI	HINDI LITERATURE	1
10	OE5TJ	HR MANAGEMENT	1
11	OE5TK	INSTRUMENTAL METHODS OF CHEMICAL ANALYSIS	1
12	OE5TL	JAPANESE	1
13	OE5TM	KEYBOARD	1
14	OE5TN	LOGISTICS AND SUPPLY CHAIN	1
15	OE5TO	NANO TECHNOLOGY	1
16	OE5TP	NUCLEAR AND PARTICLE PHYSICS	1
17	OE5TQ	PSYCHOLOGY	1
18	OE5TR	PANINI GRAMMAR	1
19	OE5TS	STATISTICAL METHODS WITH EXCEL	1
20	OE5TT	VIOLIN	1
21	OE5TU	VOCAL MUSIC	1

**Department of Electronics and Instrumentation Engineering**

**LIST OF ELECTIVES (REGULAR)**

**SEVENTH SEMESTER**

<b>S.No</b>		<b>Sub.Code</b>	<b>Subject</b>	<b>Credit</b>
1	Elective - I	EI7E1	Advanced Instrumentation and Process control for Food Processing	3
2		EI7E2	Instrumentation and Control in Paper Industries	3
3		EI7E3	Advanced Control System	3
4		EI7E4	Virtual Instrumentation	3
5			Mechatronics	3
1	Elective - II	EI7EA	Instrumentation and Control in Petrochemical Industries	3
2		EI7EB	Instrumentation in Iron and Steel Industries	3
3		EI7EC	Neural Networks and Fuzzy Logic Control	3
4		EI7ED	Computer Aided Instrumentation	3
5		EI7EE	Nuclear Instrumentation	3

**EIGHTH SEMESTER**

<b>S.No</b>		<b>Sub.Code</b>	<b>Subject</b>	<b>Credit</b>
1	Elective - III	EI8E1	Digital Control Systems	3
2		EI8E2	Wireless Sensor Networks	3
3		EI8E3	Aircraft Instrumentation	3
4		EI8E4	Digital Instrumentation	3
5		EI8E5	Nanomaterials Based Sensors	3
1	Elective - IV	EI8EU	Automotive Instrumentation	3
2		EI8EV	MEMS and Nano Technology	3
3		EI8EW	Optimal Control System	3
4		EI8EX	Advanced Digital Process Control	3
5		EI8EY	Adaptive Control	3

# **SYLLABUS**



# **I - SEMESTER**



**Department of Electronics and Instrumentation**

Course: **BE**

Branch: **EIE**

Semester: **I**

Sub. Code: **EN1T1**

Credit: **3**

**ENGLISH – I**  
**(For Students admitted from 2014 onwards)**

**UNIT - I      TECHNICAL WORDS, PHOBIA WORDS AND MANIA WORDS**  
{List Enclosed}

**UNIT- II      FUNCTIONAL GRAMMAR**  
Parts of Speech, Articles, Prepositions, Verbs, Adverbs, Sentence Analysis, Tenses, Basic Patterns, Prefixes and Suffixes, Syllabification and Spelling

**UNIT -III      ESSAYS**

1. Spoken English and Broken English G.B. Shaw
2. Arguing - Robert Lynd
3. The Verger - Somerset Maugham
4. The Beauty Industry Aldous Huxley

**UNIT –IV** Paragraph writing relating to Charts, Tables and graphs and Acronyms.

**UNIT - V** Dialogue Writing, Advertisement

**VOCABULARY**

**Technical Words:**

Collateral	Sanctuary
Amalgamation	Repository
Permeability	Panorama
Volatile	Heritage
Defy	Innovation
Paradox	Nuances
Plague	Vicissitudes
Douse	Nodal
Fantasy	Viable
Malevolent	Deluge
Benevolent	Amphibian
Myth	Ornithologist
Crux	Pulmonary
Vagaries	Retard
Ballast	Impediment
	Rapport

**Mania - Words:**

1. Bibliomania
2. Dipsomania
3. Egomania
4. Kleptomania
5. Megalomania
6. Pyromania

**Phobia - Words**

1. Acrophobia
2. Gynophobia
3. Hydrophobia
4. Claustrophobia
5. Ergophobia
6. Zoophobia
7. Agoraphobia
8. Arachnophobia
9. Triskaidekaphobia
10. Xenophobia

**Department of Electronics and Instrumentation**

Course: **BE**

Branch: **EIE**

Semester: **I**

Sub. Code: **MAIT2**

Credit: **3**

**BASIC MATHEMATICS FOR ENGINEERS – I**  
**(For Students admitted from 2014 onwards)**

**UNIT – I NUMERICAL SOLUTION OF ALGEBRAIC, TRANSCENDENTAL EQUATION**

Solution of algebraic and transcendental equations - Bisection method Method of successive approximation-Method of false position (Regula-Falsi Method) - Newton-Raphson method-Honer's method-Secant method. Matlab applications.

**UNIT- II EIGEN VALUES, EIGEN VECTORS**

Rank of matrix Elementary transformation Elementary matrices-solution of linear system of equations-Cramer's rule-Matrix inversion method-Consistency of linear system of equations; Linear Transformations Linear dependence of vectors Eigen values and Eigen vectors Properties of Eigenvalues Cayley Hamilton theorem (without proof). Matlab applications

**UNIT- III DIFFERENTIAL CALCULUS AND DIFFERENTIAL EQUATION**

Function of two or more variables Partial derivatives Total derivative Taylor's expansion Maxima and Minima of functions of two variables Jacobians Homogenous functions - Euler's theorem for homogeneous function Operator D Rules for finding Complementary function Inverse operator Rules for finding particular Integral Working procedure to solve the equation. - Method of undetermined coefficients

**UNIT-IV LINEAR DIFFERENTIAL EQUATIONS**

Method of variation of parameters- Equations reducible to linear equations with constant coefficients: Cauchy's homogeneous linear equation , Legendre's linear equation - Linear dependence of solutions - Simultaneous linear equations with constant coefficients

**UNIT -V VECTOR DIFFERENTIATION**

Differentiation of vectors - Curves in space - Velocity and acceleration - Scalar and vector point functions vector operator Del- Del applied to scalar point functions : Gradient - Del applied to vector point functions : Divergence and curl - Physical interpretation of divergence and curl-irrotational and solenoidal vectors Del applied twice to point functions - Del applied to products of point functions-Conservative vector field.

**Note:** Questions are to be set on problem solving and not on the theoretical aspects.

**TEXT BOOKS:**

1. Grewal B.S, Higher Engineering Mathematics, 41st Edition, Khanna Publishers, New Delhi, 2011.

**REFERENCE BOOKS:**

1. Alan Jeffrey, Advanced Engineering Mathematics, Academic Press
2. Erwin Kreyszig, Advanced Engineering Mathematics, John Wiley & Sons
3. Gerald C.F and Wheatley P.O, Applied Numerical Analysis, Addison-Wesley Publishing Company



## Department of Electronics and Instrumentation

Course: **BE**

Branch: **EIE**

Semester: **I**

Sub. Code: **PHIT3**

Credit: **3**

### **ENGINEERING PHYSICS** (For Students admitted from 2014 onwards)

#### **UNIT- I                      PROPERTIES OF MATTER**

##### **Elasticity**

Stress - Strain - Hooke's law - Elastic Behavior of Material - Factors affecting elasticity - Young's modulus by cantilever depression - Non-uniform bending - Application -I-shaped girders. Torsional Pendulum - Couple per unit twist of a wire- Time period-Application- Determination of Rigidity Modulus.

#### **UNIT- II TECHNICAL ACOUSTICS Acoustics**

Acoustics of buildings - Reverberation - Weber Fechner law- Factors affecting acoustics of a building and remedies - Noise Pollution - Noise control in machines - Sabine's formula for standard reverberation time-Absorption coefficient.

##### **Ultrasonics**

Generation - Piezoelectric method - Magnetostriction method - Application of Ultrasonics in industries NDT.

#### **UNIT- III PHOTONICS LASER**

Properties- Population inversion- Einstein's theory of stimulated emission of radiation - Different types of Lasers Nd:YAG laser, CO2 laser Application of Lasers in holography.

##### **Fiber Optics**

Types of Optical Fibers (material, mode, index) - Fiber losses - acceptance angle - Numerical aperture - applications in engineering (communication).

#### **UNIT -IV                      CRYSTAL PHYSICS**

Crystalline and amorphous solids - lattice and unit cell - seven crystal systems and Bravais lattices - crystal planes and directions- Miller indices-Expression for interplanar distance - Atomic radius, Coordination number and packing factor for simple structures: SC, BCC, FCC and HCP.

#### **UNIT -V PHYSICS OF MATERIALS Dielectric materials**

Definition - Dielectric Breakdown - Dielectric loss - Internal field - Claussius Mossotti relation.

##### **Superconducting materials**

Introduction - Meissner effect - Type I & Type II superconductors - BCS theory-Applications.

##### **Nanomaterials**

Introduction - Synthesis of nano materials - Top - down and Bottom - up approach- Ball milling- PVD method-Applications.

#### **TEXT BOOKS**

1. Applied Physics for Engineers K.Venkatramanan, R.Raja, M.Sundarrajan (Scitech)
2. Applied Engineering Physics Rajendran & Marikani (Tata McGraw Hill)
3. Modern Engineering Physics R.K.Gaur & S.L.Gupta, Dhanpat Rai publications.
4. Modern Engineering Physics A.S.Vasudeva S.Chand & Company Ltd.
5. Engineering Physics Bhattacharya, Bhaskaran Oxford Publications.
6. Engineering Physics I & II G.Senthilkumar, VRB publications.

#### **REFERENCE BOOKS**

1. Properties of Matter - D.S.Mathur (Unit I)
2. Sound - Brijilal & Subramanian (Unit II)
3. Engineering Physics - M.N.Avadhanulu (Unit III)
4. Fiber Optics - R.Agarwal (Unit III)
5. Solid state Physics C.Kittel (Unit IV)
6. Modern Physics - R.Murugesan (Unit IV, V)
7. Fundamentals of Physics, 6th Edition, D. Halliday, R. Resnick and J. Walker, John Wiley and Sons, New York.

**Department of Electronics and Instrumentation**

Course: **BE**

Branch: **EIE**

Semester: **I**

Sub. Code: **EE1T4**

Credit: **3**

**BASIC ELECTRICAL AND ELECTRONICS ENGINEERING**

(For Students admitted from 2014 onwards)

**UNIT -I ELECTRICITY AND MAGNETISM**

Electric current - Ohms law - Temperature coefficient of resistance-Kirchhoff's laws Electromagnetic induction: Relation between magnetism and electricity - Production of induced E.M.F and current - Faraday's laws of electromagnetic induction - Direction of induced E.M.F and current-Fleming's Right rule-Lenz's law-Induced E.M.F Dynamically induced E.M.F-Statically induced E.M.F-Self inductance-Coefficient of self inductance (L)- Mutual inductance Coefficient of mutual inductance(M) -Coefficient of magnetic coupling-Inductances in series.

**UNIT -II COMPLEX ALGEBRA AND A.C CIRCUITS**

Mathematical representation of vectors - Symbolic notation - Significance of operator j Conjugate complex numbers - Trigonometrical form of vector representation - Exponential form of vector representation - Polar form of representation - Addition and subtraction of complex quantities - Multiplication and division of complex quantities - Powers and roots of vectors - Complex algebra applied to series circuits - Complex algebra applied to parallel circuits Series Parallel circuits.

**UNIT- III THREE PHASE CIRCUITS**

Generation of three phase voltages - Phase sequence Numbering of phases-Inter connection of three phases Star or wye(Y) connections Voltages and currents in Y-connection - Neutral current in unbalanced star-connection Delta(  $\Delta$  ) or mesh connection - Balanced Y/  $\Delta$  and  $\Delta$  / Y conversions Comparison: star and delta connections Comparison between single and three phase supply system - Power factor improvement - Power factor correction equipment - Power measurement in three phase circuits Three wattmeter method, Two wattmeter method (Balanced and unbalanced load), Two wattmeter method Balanced load, Reactive power One wattmeter method.

**UNIT- IV DIGITAL ELECTRONICS**

Binary number system - Logic gates Boolean algebra - Half and Full adders - Flip Flops - Registers and counters - A/D and D/A conversion - (Basics only), Junction diodes basic types - transistors basic types.

**UNIT- V FUNDAMENTALS OF COMMUNICATION ENGINEERING**

Types of signals: Analog and digital signals Modulation and demodulation: Principles of amplitude and frequency modulation. Communication systems: Radio, T.V, Fax, Microwave, Satellite and Optical fiber (Block diagram approach only).

**TEXT BOOKS**

1. B.L.THERAJA-Fundamentals of Electrical Engineering and Electronics - 2012 Edition, S.Chand Publishers.
2. T.L.THYGARAJAN-Fundamentals of Electrical Engineering and Electronics - 2012 Edition, Scitech Publishers.
3. V.K.MEHTA Principle of Electronics - 2012 Edition S.Chand Publishers.

**Department of Electronics and Instrumentation**

Course: **BE**

Branch: **EIE**

Semester: **I**

Sub. Code: **CS1T5**

Credit: **3**

**COMPUTER PROGRAMMING**  
**(For Students admitted from 2014 onwards)**

**UNIT - I**

Introduction to digital computer ALU Memory Unit, Control Unit-Types of Computers-Number Systems-Conversion Problems. DOS commands - Computer Languages - High Level, machine Level and Assembly Level language - Algorithm Flow Chart.

**UNIT- II**

Introduction to C - Character set, Constants, Variables, Data Types-Operators - Expression. Decision Making statement - Looping statements, break continue, goto functions.

**UNIT - III**

Arrays and its types - Functions - call by reference - storage classes in C Auto, Register, Static, Extern - Recursive function.

**UNIT - IV**

Structures and Unions, Introduction to Pointer, Pointer arithmetic, String operations.

**UNIT - V**

User defined data types - Introduction to Preprocessor, Macros, Files, Command line arguments

**TEXT BOOKS**

1. Let Us 'C' - Yashawant Kanetkar, (Unit 2 to 5), BPB publications, 10 Edition, 2010.
2. Ashok N Kamthane, "Computer Programming", Pearson education, Second Impression, 2008.
3. Venugopal.K and Kavichithra.C, "Computer Programming", New Age International Publishers, First Edition, 2007.

**REFERENCE BOOKS**

1. Kernighan B.W and Ritchie,D.M , The C programming language: second edition, Pearson education,2006
2. Fundamentals of Computing and Programming- V.Ramesh Babu, R.Samyuktha, M.Muniratham by VRB Publishers 2012 edition.
3. Balagurusamy. E, "Programming in ANSI C", Tata McGraw Hill, Third edition, 2006

**Department of Electronics and Instrumentation**

Course: **BE**

Branch: **EIE**

Semester: **I**

Sub. Code: **SA1T1**

Credit: **1**

**SANSKRIT & INDIAN CULTURE –I**  
**(For Students admitted from 2014 onwards)**

**UNIT - I**

1. An Introduction to Sanskrit Language
2. Meaning and definition, Significance of Sanskrit language
3. Relations between Sanskrit and other languages

**UNIT - II**

4. Introduction to Vedic literature, Origin of Vedas, Classification of Vedas
5. Structure of Vedas (Samhit , Br hman , ranyaka)
6. Introduction to Upaniṣads and its relavance

**UNIT - III**

7. Introduction to Upavedas and their classification & its significance
8. Introduction to yurveda,
9. Application of yurveda in present days

**UNIT - IV**

10. Introduction to Dhanurveda - the Indian Martial Art, History of Dhanurveda, Dhanurveda and its impacts in the regional styles
11. Introduction to G ndarvaveda
12. Text on dramaturgy and music

**UNIT - V**

13. Introduction to Artha stra - the Indian statecraft, economic policy and military strategy
14. Relevance of Artha stra to the present days
15. Message of Paramacharya

**REFERENCE BOOKS**

1. A text book of elementary Linguistics and Phonetics by Dr. R. Ravi S Sharma, New Delhi 2012
2. A history of Sanskrit literature by A. B. Keith New Delhi 1993
3. A history of Indian literature by Maurice Winternitz New Delhi 1990
4. Samskruta Sahitya Ka Itihas - by Baladev Upadyaya
5. A short history of Sanskrit Literature by T.K. Balachandra Iyer, Palaghat 1998

**Department of Electronics and Instrumentation**

Course: **BE**

Branch: **EIE**

Semester: **I**

Sub. Code: **ME1P6**

Credit: **3**

**ENGINEERING GRAPHICS (PRACTICAL)**  
**(For Students admitted from 2014 onwards)**

**UNIT - 0** (Not included for the examination)

**BASICS OF DRAWING**

Use of Drawing instruments - BIS conventions and specifications - size layout and folding of drawings sheets - lettering and dimensioning - studying the method of drawing ellipse, Parabola and Cycloids.

**VISUALIZATION CONCEPTS AND FREE HAND SKETCHING**

Visualization principles Representation of Three Dimensional objects Layout of views- Free hand sketching of multiple views from pictorial views of objects

**UNIT - I**

**PROJECTION OF POINTS**

Introduction to orthographic projections - Projection of points

**PROJECTION OF LINES**

Projection of straight lines in the first quadrant, lines parallel to both planes - inclined to one plane and parallel to other - inclined to both planes.

**UNIT - II**

**PROJECTION OF SOLIDS**

Projection of Simple solids like prism, pyramid, cylinder, cone and sphere - Auxiliary projections.

**UNIT - III**

**SECTION OF SOLIDS**

Section of solids like prism, pyramid, cylinder, cone and sphere in simple position - True shape of sections for the above.

**DEVELOPMENT OF SURFACES**

Surfaces like - Prism, Pyramid, Cylinder, Cone and Cut solids.

**UNIT - IV**

**ORTHOGRAPHIC PROJECTION**

Conversion of pictorial views to orthographic views of simple machine members.

**INTERPENETRATION OF SOLIDS**

Interpenetration of solids - Cylinder and cylinder, cone and cylinder

**UNIT - V**

**ISOMETRIC PROJECTIONS**

Isometric Projections of solids.

## **PERSPECTIVE PROJECTIONS**

Perspective projections of solids.

## **UNIT - VI (Not for examination)**

COMPUTER AIDED DRAFTING (DEMONSTRATION ONLY) Introduction to drafting packages and demonstration of their use.

## **TEXT BOOKS**

1 Engineering Drawing - K. Venugopal, Wiley Eastern Ltd., 1922. 2 A text book of Engineering Drawing - K.V. Natarajan.

## **REFERENCE BOOKS**

- 1 Elementary Engineering Drawing (First Angle Projection) N.D. Bhatt, Charotar publishing Co., Anand.
- 2 Engineering Drawing - S.M. Sekkilar & S. Tamarai Selvi, Anuradha Agencies, Kumbakonam.
- 3 Engineering Drawing and Graphics - Prof. K.Venkataraman.

## **Special points applicable to University Examinations on Engineering Graphics:**

- 1 There will be five questions, each of either or type covering all units of the syllabus.
- 2 All questions will carry equal marks of 20 each making a total of 100.
- 3 The answer paper shall consist of drawing sheets of A3 size only. The students will be permitted to use appropriate scale to fit solution within A3 size.
4. The examination will be conducted in appropriate sessions on the same day

**Department of Electronics and Instrumentation**

Course: **BE**

Branch: **EIE**

Semester: **I**

Sub. Code: **PH1P7**

Credit: **2**

**PHYSICS LAB**  
**(For Students admitted from 2014 onwards)**

**Any SIX**

1. Determination of Rigidity Modulus & Moment of Inertia using Torsional Pendulum.
2. Determination of Young's Modulus.
3. (a) Determination of Wavelength of Laser light using transmission grating.  
(b) Measurement of numerical aperture of an optical fiber.
4. Determination of refractive index of material of prism using i-d curve.
5. Determination of radius of curvature of the given lens using Newton's Rings.
6. Determination of Velocity of sound waves in liquid using Ultrasonic interferometer.
7. Determination of wavelength of prominent colours of mercury spectrum using Spectrometer and grating.
8. Determination of emissivity of the surface of a black body.
9. Determination of number of lines per meter of the grating using normal incidence method.
10. Basic logic gates- Verification of truth tables

**REFERENCE BOOKS FOR PHYSICS PRACTICALS**

1. Practical Physics - Ouseph and Rangarajan.
2. Engineering Practical Physics-K. Srinivasan.
3. Engineering Practical Physics - M.N. Avadhanulu.
4. Experimental Physics K.Venkatramanan, R.Raja, M.Sundarrajan (Scitech)

**Department of Electronics and Instrumentation**

Course: **BE**

Branch: **EIE**

Semester: **I**

Sub. Code: **CS1P8**

Credit: **2**

**COMPUTER PRACTICES LAB**  
**(For Students admitted from 2014 onwards)**

1. Evaluate Expressions using library Function.
  - a.  $pr^2$
  - b.  $(A+B+(2C/3A)+A^2+2B)$
  - c.  $S(S-A) (S-B) (S-C)$
  - d.  $\text{LOG} (x^3+y^3+z^3)$
2. Find Sum & Average of 'N' numbers.
3. Find the Biggest among 3 numbers.
4. Find the factorial of given number.
5. Check whether the number is prime or not.
6. Find the sum of digits using (i) For loop (ii) While loop
7. Program to add the first N odd numbers and even numbers.
8. Generate the Fibonacci series and Evaluate Sine series.
9. Arithmetic operations using Switch - Case Statements.
10. Find the biggest & smallest among "N" numbers.
11. Sort "N" numbers in ascending order.
12. Matrix addition and Multiplication.
13. Display the student information & marks using Structure & Unions.
14. Evaluate the Binomial coefficient.
15. Swapping of numbers using call by value, call by reference.
16. Number system Conversions
17. Basic File Operations
18. Preprocessor directives usage.
19. Pointer Arithmetic and Array access using Pointers.
20. Introduction to graphics.



**Department of Electronics and Instrumentation**

Course: **BE**

Branch: **EIE**

Semester: **I**

Sub. Code: **EE1P9**

Credit: **2**

**BASIC ELECTRICAL WORKSHOP**  
**(For Students admitted from 2014 onwards)**

**Course objectives:**

To understand the concepts of industrial & domestic wiring

To train students on logic gates.

**Course Outcomes:**

Learners should be familiar with the concepts of Domestic & Industrial Wiring.

Should be able to do simple exercise and measurements using CRO.

Should able to do PCB Fabrication and measurements using Multimeter.

**LIST OF EXPERIMENTS:**

1. House Wiring Series, Parallel, 3 Pin Plug Socket, etc.
2. Staircase Wiring.
3. Tube Light / CFL Wiring.
4. Circuit Tester.
5. Single Phase & Three Phase Energy meters.
6. To Study the use of Megger.
7. To Study The Applications Of CRO.
8. Logic Gate Trainer.
9. Soldering Practice for fabrication of DC power Supply.
10. Different faults in Domestic Electrical equipments.
11. Power wiring for three phase induction motor.
12. Power wiring for single phase induction motor.
13. To Study the use of Multimeter, Tong- tester.



# **II – SEMESTER**



**Department of Electronics and Instrumentation**

Course: **BE**

Branch: **EIE**

Semester: **II**

Sub. Code: **EN2T1**

Credit: **3**

**ENGLISH – II**

**(For Students admitted from 2014 onwards)**

**Unit I : Words for social Interaction { List Enclosed**

**Unit II: Functional Grammar**

Noun Group, Verbal Group, Modal Verbs, Conditionals, Connectives, Passivity, Gerund and Infinitives, Reported Speech, Synonyms and Antonyms, Concord and Error detection.

**Unit III : Essays**

1. On Habits A.G. Gardiner
2. How to Make a Speech - Edgar Baker
3. Springtime - O.Henry
4. Dangers of Drug Abuse Hardin Jones

**Unit IV :** Letter Writing, Report Writing, Essay Writing (Essays on Sports Social Issues, Science and Technology and Proverb Expansions) and Comprehension.

British English and American English With Emphasis on Vocabulary and

**Unit V :** Spelling (From Reader's Digest's Publication)

**REFERENCE BOOKS**

1. Bikaram K. Das : Functional Grammar and Spoken and Written communication in English (Orient Blackswan Chennai - 600002)
  2. T. M.Farhathullah : English Practice Book (Emerald Publishers)
- The prescribed Essays will be compiled and edited by the staff of the Department of English.

**Words for Social Interaction**

- |                    |                  |
|--------------------|------------------|
| 1. Euthanasia      | 24. Utopia       |
| 2. Bier            | 25. Dystopia     |
| 3. Charlatan       | 26. Philanthropy |
| 4. Cynosure        | 27. Plagiarism   |
| 5. déjà vu         | 28. Euphemism    |
| 6. Myopia          | 29. Autarky      |
| 7. Epicentre       | 30. White Paper  |
| 8. Oedipus complex | 31. Theocracy    |
| 9. Electra complex | 32. Ombudsman    |
| 10. Halitosis      | 33. Anthology    |
| 11. Imbroglia      | 34. Dialectic    |
| 12. Impasse        | 35. Asphyxiation |
| 13. Paranoia       | 36. Doggy bag    |
| 14. Id             | 37. Somnambulism |
| 15. Ego            | 38. Dermatitis   |
| 16. Super Ego      | 40. Biopsy       |
| 17. Psychopath     | 41. Anti-biotic  |
| 18. Guarantee      | 42. Vendetta     |

- 19. Warranty
- 20. Neologism
- 21. Nepotism
- 22. Oligarchy
- 23. Anarchy

- 43. Virago
- 44. Prefixes pseudo, quasi, bi, mono, poly, semi, retro, circum, intro, intra and inter

**Department of Electronics and Instrumentation**

Course: **BE**

Branch: **EIE**

Semester: **II**

Sub. Code: **MA2T2**

Credit: **3**

**BASIC MATHEMATICS FOR ENGINEERS – II**

(For Students admitted from 2014 onwards)

**UNIT- I NUMERICAL SOLUTION OF SIMULTANEOUS EQUATIONS**

Solution of linear simultaneous equations - Direct methods of solution: Gauss elimination method , Inversion of a matrix using Gauss Elimination method- Gauss Jordan method Method of Factorization-Crout's method, Iterative methods of solution : Jacobi's method , Gauss Seidel method.

**UNIT- II ORTHOGONAL REDUCTION**

Orthogonal transformation-Reduction to diagonal form Similarity matrices Powers of a matrix - Reduction of quadratic form to canonical form Nature of a quadratic form Hermitian, Skew Hermitian and Unitary matrices Outline of applications of Eigen values and Eigen vectors in engineering

**UNIT -III INTEGRAL CALCULUS AND ITS APPLICATIONS**

Reduction formulae reduction formulae[without proof] and Bernoulli's formula. Definite integrals , length of the curve. Double integrals - Change of order of integration - Double integrals in polar coordinates - Areas enclosed by plane curves - Triple integrals - Volume as triple integral

**UNIT- IV BETA AND GAMMA FUNCTIONS**

Change of variables in double integrals and Triple integrals Area of a curved surface Beta function - Gamma function Reduction formula for - Relation between Beta and Gamma functions Outline of applications of multiple integrals

**UNIT -V VECTOR INTEGRATION**

Integration of vectors - Line integral-circulation-work - Surface integral - Green's theorem in the plane (without proof) - Stoke's theorem (without proof) - Volume integral - Gauss divergence theorem (without proof) - Irrotational fields Outline of applications of vector calculus in engineering.

**Note:** Questions are to be set on problem solving and not on the theoretical aspects.

**TEXT BOOKS:**

Grewal B.S, Higher Engineering Mathematics, 41st Edition, Khanna Publishers, New Delhi, 2011.

**REFERENCE BOOKS**

1. Alan Jeffrey, Advanced Engineering Mathematics, Academic Press.
2. Erwin Kreyszig, Advanced Engineering Mathematics, John Wiley & Sons
3. Gerald C.F and Wheatley P.O, Applied Numerical Analysis, Addison-Wesley Publishing Company

**Department of Electronics and Instrumentation**

Course: **BE**

Branch: **EIE**

Semester: **II**

Sub. Code: **CH2T3**

Credit: **3**

**ENGINEERING CHEMISTRY**  
**(For Students admitted from 2014 onwards)**

**UNIT-I                      CHEMICAL THERMODYNAMICS**

Entropy - entropy changes in isothermal expansion of an ideal gas - reversible and irreversible processes - work & free energy functions - Helmholtz and Gibbs free energy functions - Gibbs-Helmholtz equation - Gibbs-Duhem equation - Clausius-Clapeyron equation & its applications - Van't Hoff isotherm and its applications.

**UNIT-II                      CHEMICAL KINETICS AND CATALYSIS**

Kinetics of second and third order reactions half life period - saponification of ester - kinetics of opposing, parallel and consecutive reactions and its examples - effect of temperature on reaction rate - theory of absolute reaction rate. Classification and characteristics of catalysts autocatalysis steady state principle - enzyme catalysis - Michaelis menton equation (derivation) acid base catalysis (derivation).

**UNIT-III                    THERMAL AND SPECTROSCOPIC TECHNIQUES**

Thermogravimetry (TGA) schematic and block diagram - characteristics of thermo-balance design - methods expressing TG results - applications in qualitative analysis, composition of alloys and mixtures, study of polymers. Differential thermal analysis (DTA) - schematic and block diagram representation of DTA data - qualitative application (calcium oxalate monohydrate only). Electromagnetic spectrum - Beer Lambert's law (Derivation) - principle, theory, instrumentation and simple applications of: Flame photometry - UV-visible spectroscopy - IR spectroscopy.

**UNIT -IV                    CORROSION - THEORY & PROTECTION**

Electrochemical cells - standard electrode potential - electrochemical series - principles of chemical and electrochemical corrosion - factors influencing corrosion - types of corrosion - galvanic corrosion - differential aeration corrosion - stress corrosion - corrosion control - cathodic protection and sacrificial anode - corrosion inhibitors - protective coatings - constituents, functions and uses of paints and varnishes.

**UNIT-V                      POLYMERS AND NANOMATERIALS**

Polymer Chemistry: Monomers - functionality - polymers - degree of polymerization - effect of polymer structure on properties - addition, condensation, co-polymerization - mechanism of addition polymerization (free radical polymerization only). Nanomaterials: Introduction - synthesis of nano materials by physical and chemical methods - ball milling - chemical vapour deposition -sol-gel method - applications of nano materials.

**TEXT BOOKS:**

1. Engineering Chemistry, P.C. Jain and Monika Jain, Dhanpat Rai Publishing Co Pvt. Ltd., New Delhi, 2008.

**REFERENCE BOOKS**

1. Principles of Physical Chemistry, B.R. Puri, L.R. Sharma and Madan S. Pathania, Shoban Lal Nagin Chand & Co., Jalandhar, 2000.
2. Physical Chemistry for Engineers, P.C. Jain and Renuka Jain, Dhanpat Rai & sons, New Delhi, 2001.
3. Applied Chemistry, K. Sivakumar, Anuradha Publications, Chennai, 2009.
4. Chemistry in Engineering & Technology, J.C. Kuriacose and J. Rajaram, Vol. 1, Tata McGraw-Hill, New Delhi, 1996



**Department of Electronics and Instrumentation**

Course: **BE**

Branch: **EIE**

Semester: **II**

Sub. Code: **ME2T4**

Credit: **3**

**BASIC CIVIL AND MECHANICAL ENGINEERING**

**(For Students admitted from 2014 onwards)**

**PART A      CIVIL ENGINEERING**

**UNIT - I**

**BUILDING MATERIALS:** Construction Materials and foundation Properties and uses of construction materials such as stone, bricks, cement, concrete, steel.

**BUILDING COMPONENTS:** Selection of site - simple foundations such as well footing- isolated footing. Combined footing. Pile foundation - foundations of machinery. Superstructure Brick and stone masonry - beams. Columns and lintel RCC roofing - simple steel roof trusses and AC roofing - Flooring types such as granolithic. Concrete, mosaic, tile, terrazzo, marble etc., - plastering.

**VALUATION :** Valuation by plinth area method -simple problems.

**UNIT - II**

**MECHANICS** Units - Simple stresses and strains for uniform section - Moduli of elasticity - Factor of safety - centre of gravity and moment of inertia - simple problems.

**DAMS** Selection of site - Brief idea of different types of dams - their purpose.

**BRIDGES** Components of bridge - classification - slab bridge - T-beam bridge.

**UNIT - III**

**SURVEYING** - Different types of surveying - chain survey - calculation of area by Simpson's rule and trapezoidal rule - compass - conversion on bearings - simple leveling - reduction of levels - simple problems.

**ROAD** Classification - brief description of earthen road. Water bound macadam. Bituminous. Concrete roads - traffic signs and signals.

**ENVIRONMENTAL ENGINEERING** Protected water supply - sewage treatment - septic tanks.

**PART B      MECHANICAL ENGINEERING**

**UNIT - I**

**BOILERS** Classification - Principles of Low pressure steam generators simple Vertical Boiler, Cochran Boiler, Locomotive Boiler, Lancashire Boiler, Bab-cock Wilcox Boiler

**POWER PLANTS** Layout of Steam, Gas Turbine, Diesel, Nuclear and Hydropower Plants.

**NEW SOURCES OF ENERGY** Study of different types of alternative energy sources - Solar, Wind, Wave, Tidal and Geo - thermal.

**UNIT - II**

**INTERNAL COMBUSTION ENGINES-** Working principles of Petrol and Diesel Engines - Two stroke and Four stroke cycles-Function of main components - single jet carburation - ignition. Cooling and lubrication systems - fuel pump and injector.

**METAL CASTING PROCESS** Patterns - Types of patterns - Pattern materials - pattern allowances - Molding sand - Properties of molding sand - types of molding - preparation of Green sand mould for casting - melting of cast iron in cupola furnace only - casting defects.

**UNIT - III**

**METAL FORMING PROCESS-** Principles of Forging. Rolling, Drawing and Extrusion.

**METAL JOINING PROCESS** Principles of welding - fundamental of Arc welding. Gas welding and gas cutting - Brazing and soldering.

METAL MACHINING PROCESS Types of lathes - Main components and the functions of a centre lathe - operations - cutting tools - Drilling machines.

**TEXT BOOKS**

- 1 Basic Civil Engineering- V. Ramesh Babu, Anuradha Agencies, Kumbakonam.
- 2 Basic Civil Engineering- K.V. Natarajan, Madras.
- 3 Basic Mechanical Engineering - K. Venugopal, Anuradha agencies, Kumbakonam.

**REFERENCE BOOKS**

- 1 Basic Civil Engineering - N. Arunachalam, Pratheeba Pub. Coimbatore.
2. Basic Civil and Mechanical Engineering - G. Shanmugam and M.S. Palanichamy, Tata McGraw Hill Publishing Co., 1993.

**Department of Electronics and Instrumentation**

Course: **BE**

Branch: **EIE**

Semester: **II**

Sub. Code: **EE2T5**

Credit: **3**

**ELECTRIC CIRCUIT THEORY**  
**(For Students admitted from 2014 onwards)**

**UNIT - I**

**BASIC CIRCUIT CONCEPTS** Lumped circuits - Kirchhoff's Laws - V-I-relationships of R, L and C - Independent sources - Dependent sources Simple resistive circuits - Network reduction - voltage division - current division - source transformation.

**UNIT - II**

**SINUSOIDAL STEADY STATE ANALYSIS** Phasor - sinusoidal steady state response - concepts of impedance and admittance - analysis of simple circuits - power and power factor - series resonance and parallel resonance-bandwidth and Q factor - Solution of three-phase balanced circuits - power measurements by two-wattmeter methods - solution of three-phase unbalanced circuits.

**UNIT - III**

**MESH-CURRENT AND NODE-VOLTAGE METHODS** Formation of matrix equations and analysis of complex circuits using mesh-current and nodal-voltage methods mutual inductance - coefficient of coupling - Ideal transformer.

**UNIT - IV**

**NETWORK THEOREMS AND APPLICATIONS** Superposition theorem - Reciprocity theorem - Compensation theorem - Substitution theorem - Maximum Power transfer theorem - Thevenin's theorem - Norton's theorem and Millman's theorem with applications.

**UNIT - V**

**TRANSIENT ANALYSIS** Forced and free response of RL, RC and RLC circuits with D.C. and sinusoidal excitations.

**TEXT BOOK:**

1. Paranjothi S.R., "Electric Circuit Analysis", New Age International Ltd., Delhi, 2nd Edition.
2. Hyatt W.H. and Kemmerly, "Engineering Circuits Analysis", McGraw- Hill International Editions, 1993.

**REFERENCES:**

1. Edminister J.A., "Theory and Problems of Electric Circuits", Schaum's outline series McGraw Hill Book Company, 2nd Edition, 1983.
2. Sudhakar A and Shyam Mohan S.P., "Circuits and Network Analysis and Synthesis", Tata McGraw-Hill Publishing Ltd., New Delhi, 1994.

**Department of Electronics and Instrumentation**

Course: **BE**

Branch: **EIE**

Semester: **II**

Sub. Code: **CH2T6**

Credit: **3**

**ENVIRONMENTAL SCIENCE AND ENGINEERING**

**(For Students admitted from 2014 onwards)**

**UNIT – I INTRODUCTION TO ENVIRONMENT AND ENVIRONMENTAL STUDIES**

Introduction to environment - components - nature of environment - need of awareness - reasons for environmental problems - anthropocentric and eco centric views.

Environmental studies - multidisciplinary nature - scope and aim - sustainable development - principles - RRR concept-Indian environmental movements - environmental calendar.

**UNIT- II ECOSYSTEM AND BIODIVERSITY**

Ecosystem - structure - functions - simplified ecosystem models (food chain and food webs and their types, energy flow) - forest - grassland - pond ecosystems - ecological succession - ecological pyramids - Bio-geochemical cycles of water oxygen-carbon-phosphorous and sulphur.

Biodiversity - definition - types - species - genetic and ecosystem diversities - values of biodiversity - threats to biodiversity - conservation of biodiversity - endemism - biodiversity hotspots - Indian biodiversity - endemic species of India - IUCN lists -red-green and blue data books.

**UNIT- III NATURAL RESOURCES**

Natural resources - definition - types - forest resources - uses - deforestation- reasons - effects - water resources dams - effects of dams - food resources - modern agriculture ill effects -energy resources- types hydel - nuclear - solar - wind and biomass energy - world scenario - Indian scenario.

Population and environment - reasons for over exploitation of resources - population - demography - population curves - population explosion - effect - consumerism - effects - urbanization - reasons and effects- role of an individual.

**UNIT –IV ENVIRONMENTAL POLLUTION**

Pollution - definition - types - air pollution - causes and effects - effects of CO<sub>2</sub> - CO - NO<sub>x</sub> - SO<sub>x</sub> - particulates - control of air pollution - water pollution-causes - effects - remedies - soil pollution - solid waste management - e-waste - ill effects of e-waste - proper recycling- Noise pollution - reasons effects - control - nuclear pollution - cases - effects and control - thermal pollution causes - effects and remedies.

Legal provisions for protecting environment - article 48 A - 51 A (g)-Environment act 1986 - Air act 1981 - Water act 1974 - wild life protection act - Forest act 1980- problems in implementation-reasons.

**UNIT –V SOCIAL ISSUES AND ENVIRONMENTAL ETHICS**

Present environmental scenario - green house effect - climate change - The Kyoto Protocol - ozone layer depletion -The Montreal Protocol - acid rain - causes - effects - disparity among the nations - The Copenhagen UNFCCC summit - carbon currency- virtual water- genetically modified organisms, Disaster management.

Environmental ethics - introduction - people - getting affected - resettlement and rehabilitation issues involved - Sardhar Sarovar project - Tawa Matsya sang - Melting icebergs of Arctic.

**Text Book**

1. Anubha Kaushik and C.P. Kaushik, "Prospects of Environmental Science", New Age International publishers, 2013.

**Reference books**

1. Environmental Studies, N. Nandini, N. Sunitha and Sucharita Tandon, Sapna Book House, 2007.
2. Text book of Environmental Science, Ragavan Nambiar, Scitech Publications, 2009.
3. Text book of Environmental Chemistry and Pollution Control, S.S.Dara, S.Chand and Co., 2002.
4. Environmental Chemistry, Colin Baird, W.H.Freeman and company, New York, 1999.
5. Environmental Chemistry, Gary W. VanLoon and Stephen J.Duffy, Oxford University Press, 2000.
6. New Trends in Green Chemistry, V.K. Ahluwalia and M. Kidwai, Anamaya Publishers, 2006.

**Department of Electronics and Instrumentation**

Course: **BE**

Branch: **EIE**

Semester: **II**

Sub. Code: **SA2T2**

Credit: **1**

**SANSKRIT & INDIAN CULTURE – II**  
(For Students admitted from 2014 onwards)

**Unit - I**

1. Introduction to Ved űngas
2. Introduction to űk , Vy karaņa, Chandas
3. Introduction to Nituktam, Jyotiřa, Kalpa

**Unit - II**

4. Introduction to classical literature
5. Introduction to Epics
6. Introduction to Pur űnas

**Unit - III**

7. Introduction to Sanskrit poets any five
8. Introduction to K vyaas and their classifications, Pañcamah k vyaas and their significance in Sanskrit literature
9. Significance of K lidasa and his contribution

**Unit - IV**

10. Introduction to Dramas
11. Introduction to Subh řitas
12. Tales and fables

**Unit - V**

13. Introduction to System of Indian philosophy, Six Dar űanas and their profounder, principles of Ny űya and Vai eřika schools
14. Valid means of S űńkya philosophy and its significance, Yoga and Patañjali, Ařř űngayoga and its application
15. Introduction to (Manu and Y gņyavalkya)

**Reference Books**

1. A history of Sanskrit literature by A. B. Keith New Delhi 1993
2. Samskruta Sahitya Ka Itihas - by Baladev Upadyaya
3. A short history of Sanskrit Literature by T.K. Balachandra Iyer, Palaghat 1998

**Department of Electronics and Instrumentation**

Course: **BE**

Branch: **EIE**

Semester: **II**

Sub. Code: **CH2P7**

Credit: **2**

**CHEMISTRY LAB**  
**(For Students admitted from 2014 onwards)**

**List of experiments (ANY SIX of the following)**

1. Estimation of  $\text{Na}_2\text{CO}_3$  present in washing soda sample.
2. Estimation of alkalinity of the given water sample.
3. Estimation of total hardness of the given water sample- EDTA method
4. Conductometric titration Strong acid Vs Strong base.
5. Conductometric titration Strong base Vs mixture of acids
6. Potentiometric titration - Strong acid Vs Strong base.
7. Potentiometric titration  $\text{Fe}^{2+}$  Vs  $\text{KMnO}_4$ .
8. Determination of  $K_{\text{SP}}$  of a sparingly soluble salt concentration cell method
9. Construction of phase diagram for a simple eutectic system.
10. Rate and order of reaction between  $\text{K}_2\text{S}_2\text{O}_8$  and KI Clock reaction method.

**Department of Electronics and Instrumentation**

Course: **BE**

Branch: **EIE**

Semester: **II**

Sub. Code: **EE2P8**

Credit: **2**

**CIRCUITS THEORY LAB**  
(For Students admitted from 2014 onwards)

**LIST OF THE EXPERIMENTS:**

1. Verification of Kirchhoff's laws
2. Verification of Superposition theorem.
3. Verification of Thevenin's Theorem.
4. Verification of Norton's Theorem.
5. Verification of Maximum Power Transfer theorem.
6. Verification of Reciprocity theorem.
7. Verification of Compensation theorem.
8. Verification of Millman's theorem.
9. Three phase power and power factor Measurement by Two wattmeter method.
10. Series and Parallel resonance in RLC Circuits.
11. Verification of theorems using Digital simulation.
12. Circuit Transients by Digital simulation.



**Department of Electronics and Instrumentation**

Course: **BE**

Branch: **EIE**

Semester: **II**

Sub. Code: **ME2P9**

Credit: **2**

**BASIC MECHANICAL WORKSHOP**  
**(For Students admitted from 2014 onwards)**

**CARPENTRY**

Names and uses of tools used in carpentry - Handling of the tools. Practice in marking, sawing, planning and chiseling to size. Making simple joints such as half lap, mortises and Tenon joints.

**FITTING**

Name and uses of tools like files, chisels, hammer, tri square, calipers, hacksaw, etc., and handling of these tools. Practice in marking, chipping, fitting to size and drilling marking of simple mating, profiles such as Vee, Square.

**WELDING**

Study of Arc & Gas Welding, Tools and Equipments Simple welding exercises Butt welding and Lap Welding.

**TURNING**

Study of Centre Lathe, Accessories and tools Simple turning exercises Facing and Step turning - use of measuring Instruments for lathe work.

**DRILLING**

Study of drilling machines Drills, Taps, and reamers Demonstration of Drilling and Tapping operations.

Demonstration of the following ( not included for the examination)

1. Preparation of green sand mould.
2. Study of tool in smithy shop and making a square section from circular section.
3. Gas welding and cutting.
4. Brazing and soldering.
5. Sheet Metal Work.



# **III - SEMESTER**



**Department of Electronics and Instrumentation**

Course: **BE**  
Sub. Code: **MG3T1**

Branch: **EIE**

Semester: **III**  
Credit :**3**

Subject: **APPLIED MATHEMATICS FOR INSTRUMENTATION ENGINEERS I**

**UNIT I  
(INTERPOLATION AND NUMERICAL INTEGRATION)**

Interpolation with equal intervals – Newton’s forward interpolation formula – Newton’s backward interpolation formula - Interpolation with unequal intervals: Lagrange’s interpolation formula, Newton’s divided difference formula - Numerical integration: Trapezoidal rule - Simpson’s one-third rule - Simpson’s three-eighth rule – Outline of applications of interpolation and numerical integration in engineering.

**UNIT II(LAPLACE TRANSFORMS AND APPLICATIONS)**

Transforms of elementary functions :  $1, t^n, e^{at}, \sin at, \cos at, \sinh at, \cosh at$  - Properties of Laplace transforms: Linearity Property, First shifting property, Change of scale property –Transforms of derivatives - Transforms of integrals - Multiplication by  $t^n$  - Division by  $t$  - Evaluation of integrals by Laplace transform - Inverse transforms: Method of partial fractions – Other methods of finding inverse - Convolution theorem (Without proof) - Unit step function – Unit Impulse function - Application to differential equations – Outline of applications of Laplace transforms in engineering.

**UNIT III  
(FOURIER TRANSFORMS AND APPLICATIONS)**

Fourier integral theorem (without proof) - Fourier Sine and Cosine integrals – Complex form of Fourier integral - Fourier integral representation of a function - Fourier transform – Fourier sine and Cosine transforms – Properties of Fourier Transforms: Linear property, Change of scale property, Shifting property - Parseval’s identity for Fourier transforms (without proof) – Application of transforms to boundary value problems: Heat conduction, Vibrations of a string, Transmission lines.

**UNIT IV (DIFFERENCE EQUATIONS AND APPLICATIONS)**

Formation of difference equations – Linear difference equations – Rules for finding the complementary function – Rules for finding the particular integral – Simultaneous difference equations with constant coefficients – Outline of other applications of difference equations in engineering

**UNIT V (Z – TRANSFORM AND APPLICATIONS)**

Standard z-transforms of  $1, a^n, n^p$  – Linearity property – Damping rule – Shifting rules – Multiplication by  $n$  - Initial and final value theorems (without proof) – inverse z –transforms – Convolution theorem (without proof) – Convergence of z-transforms – Two sided z-transform – Evaluation of inverse z-transforms: Power series method, Partial fraction method, inversion integral method – Application to difference equations – Outline of applications of z-transform in engineering

**Note:** Questions are to be set on problem solving and not on the theoretical aspects.

**TEXT BOOK:**

Grewal B.S, Higher Engineering Mathematics, 41st Edition, Khanna Publishers, New Delhi, 2011.

**REFERENCES**

1. Erwin Kreyszig, Advanced Engineering Mathematics, John Wiley & Sons
2. Gerald C.F and Wheatley P.O, Applied Numerical Analysis, Addison-Wesley Publishing Company
3. Murrey R.Spiegel, Laplace Transforms, Schaum’s Outlines, McGraw Hill



**Department of Electronics and Instrumentation**

Course: **BE**  
Sub. Code: **EC3T4**

Branch: **EIE**

Semester: **III**  
Credit: **3**

Subject: **ELECTRONIC DEVICES AND CIRCUITS**

**(Common to EIE/MECHATRONICS)**

**Prerequisite:** Basic Electronics

**Aim**

The aim of this course is to understand the concepts and to familiarize the student with the principle of operation, capabilities and limitations of various electron devices so that he will be able to use these devices effectively.

**Objectives**

The course should enable the students to:

1. Understand the Diode operation and switching characteristics.
2. Understand the Operation of BJT, FET, MOSFET metal semiconductor rectifying and ohmic contacts,
3. Study the characteristics of special type semiconductor diodes.

**Outcome**

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

1. Develop through basic knowledge on the behavior and the characteristics of semiconductor junction,
2. Acquire knowledge on the applications of BJT, FET, MOSFET.
3. Learn the usage of different types of devices for various applications.

**UNIT -I SEMICONDUCTORS & DIODES**

Semiconductor fundamentals –Energy Band diagram – Intrinsic and Extrinsic Semiconductors- Working and description of a PN diode– Varactor Diode –Avalanche and Zener Breakdown – Zener diode –Photo diode – Photo voltaic cell – Light emitting diode – Liquid crystal display – Light dependant resistor.

**UNIT -II TRANSISTORS**

Principle of transistor action – Cut off, Active and saturation regions of a transistor – CE,CB,CC Configurations –Transistor as a switch – Use of a heat sink – Constructional features of a field effect transistor – theory of operation–MOSFET –Working and V-I Characteristics – Depletion and enhancement types –Working and V-I characteristics of UJT – SCR

**UNIT -III AMPLIFIERS**

Classification of amplifiers– Distortion in amplifiers– frequency response of an amplifier– operation of class A Power amplifier– push-pull amplifier–Class B amplifier, class C amplifiers –single tuned and double tuned amplifier - stagger tuned amplifier

**UNIT -IV OSCILLATORS & MULTI VIBRATORS**

Classification of oscillators – Barkhausen criterion - operation and analysis of RC phase shift – Hartley and colpitts oscillators – Multivibrators – astable, monostable and bistable multivibrators

**UNIT - V RECTIFIERS & POWER SUPPLIES**

Single –phase, half-wave and full-wave rectifiers – Bridge rectifiers – Ripple factor, rectification efficiency, Transformer utilisation factor and regulation – Performance characteristics of rectifiers with filters – Regulated power supply– switched mode power supplies.

**TEXT BOOKS**

1. Millman and Halkias, Electronic devices and Circuits, Tata McGraw Hill International, Edition 1994.
2. G.K.Mithal, Electronic Devices and Circuits, Khanna Publishers, 1999.

**REFERENCE BOOKS**

1. Salivahanan Electronic devices and Circuits, second edition Tata McGraw Hill International, 2011.
2. David A.Bell, Electron Devices and Circuits, Prentice Hall Of India, 3<sup>rd</sup> Edition, 1995.
3. Thomas L. Floyd, Electron Devices, Charles & Messil Publications, 1989.
4. Boylestad & Nashelsky, Electronic Devices & Circuit Theory, Eighth edition, Prentice Hall Of India (P) Ltd., 2003.
5. Sedha.R.S., A Text Book of Applied Electronics, Sultan chand Publishers, 1999.





**Department of Electronics and Instrumentation**

Course: **BE**  
Sub. Code: **EE3T3**

Branch: **EIE**

Semester: **III**  
Credit: **3**

Subject: **ELECTRICAL ENGINEERING**  
(Common to **EIE/ECE/ MECHATRONICS**)

**Prerequisite:** Circuit Theory.

**Aim**

To expose the Students to the Concepts of Various types of Electrical Machines, Transmission and Distribution Systems of Electrical Power

**Objectives**

The course will enable the students to:

1. Learn constructional details, principle of operation, performance, starters and testing of D.C.Machine.
2. Learn constructional details, principle of operation and performance of transformers.
3. Learn constructional details, principle of operation and performance of induction motors.
4. Learn constructional details and principle of operation of alternators and special machines.

**Outcome**

The students should have knowledge in the following:

1. Various types, Principle of Operation and Characteristics of DC Motors and DC Generators.
2. Construction and Principle of Operation, Testing, Regulation , equivalent circuit of Transformers
3. Construction, Types and Principle of operation of induction motors. Starting and speed control of Single - phase induction motors.
4. Synchronous Machines, Brushless alternators, Reluctance motor, Hysteresis motor and Stepper motor.

**UNIT – I**

**D.C. MACHINES**

Construction, principle of operation of D.C. motor and D.C. Generator, Various types of D.C. motors and generators. Performance characteristics of D.C. motors and D.C. generators. Starting and speed control.

**UNIT – II**

**TRANSFORMERS**

Construction details and principles of operation of single phase transformers - losses and efficiency. Special types of transformers - Servo stabilizer, pulse transformer, Isolation transformer

**UNIT – III**

**SYNCHRONOUS MACHINES**

Constructional features - operating principle of 3-phase alternator and synchronous motor principle and operation of synchronous motor

**UNIT – IV**

**INDUCTION MACHINE**

Constructional features - Operating principle of 3-phase induction motor [squirrel cage and slip ring] and single phase induction motor, Slip - Torque characteristics - Starters - Speed control methods.

**UNIT – V**

**SPECIAL MACHINES**

Tachogenerator - A.C and D.C. Servo motor, Stepper motor, synchronous– PWM Methods. Linear induction motor – switched reluctance motor, Brushless motors.

**Text Book:**

1. B.L.Theraja : Electrical Technology Vol.II 1993
2. Rajput: Electrical Machines 2004, Laxmi Publications

**REFERENCE BOOKS:**

1. M.G. Say and Taylor: D.C. Machines ELBS 1980.
2. M.G. Say: Alternating Current Machines ELBS 1980.
3. E.V. Armensky and G.B. Falk: Fractional Horsepower Electrical Machines.
4. B.R. Sharma: Utilization of Electrical Energy [Satyaprakashan Publications 1992]
5. B. Ravindranath and M. Chander: Power system Protection and Switchgear [Wiley Eastern Ltd.]
6. C.R. Paul, S.A. Nasar and L.E. Unnewehr: Introduction to Electrical Engineering, McGraw Hill Inc., 1992.

## Department of Electronics and Instrumentation

Course: **BE**

Branch: **EIE**

Semester: **III**

Sub. Code: **CS3T6**

Credit: **3**

Subject: **OBJECT ORIENTED PROGRAMMING USING C++**

**Prerequisite:** Basic Computer Science.

### **Aim**

To expand knowledge in computer languages and to introduce object oriented programming

### **Objectives**

The course will enable the students to:

1. Study the object oriented programming principles, tokens, and expressions, control a structures and functions.
2. Introduce the classes, objects, constructors and destructors.
3. Introduce the operator overloading, inheritance and polymorphism concepts in C++.
4. Introduce constants, variables, data types, operators, classes, objects, methods, arrays and strings in Java.
5. Introduce the programming approach in Java, interfaces and packages, multithreading, managing errors and exceptions and Applet programming.

### **Outcome**

After completion of the course the students are expected to be able to

1. Understand basic programming principles.
2. Write programs using concepts like overloading, inheritance and polymorphism.
3. Write programs in java.
4. Create their own package and can write programs using interface concept.
5. Write multithreaded program and manage exceptions.

### **UNIT – I**

Need for object oriented programming, Characteristics of object oriented language -objects, classes, Inheritance, Reusability, creating new data types, Polymorphism and overloading. C++ programming basis – Data types, Manipulators, Cin, Cout, Type conversion, arithmetic operators, Loops and decisions.

### **UNIT – II**

Class and objects : A simple class, C++ Objects as physical Objects, C++ Objects as Data Types, Constructors, destructors, objects as function arguments, overloaded constructors, member functions defined outside the class, inline functions, Returning objects from Functions.

### **UNIT – III**

Arrays: Defining & accessing Array elements, arrays as class member data, array of Objects. Operator Overloading: Overloading Unary Operators, Operator Arguments, Return Values, nameless Temporary objects, postfix notations. Overloading Binary Operators - Arithmetic operators, Concatenating Strings, Multiple overloading Comparison operators, Arithmetic Assignment Operators.

### **UNIT – IV**

Inheritance-Derived class and base class, derived class constructors, overriding member functions, Class Hierarchies, Abstract base class, Public and private inheritance, Levels of inheritance, Multiple inheritance. Memory management – new and delete operator, a string class using new, Pointers to Objects – Referring to Members, another Approach to new, An array of pointers to Objects.

### **UNIT – V**

Virtual Functions – Pure virtual functions, Late Binding, Abstract Classes, Virtual base classes. Friend Functions – Friend Classes, Friends for functional Notation. Static Functions , investigating destructors. Assignment and copy – initialization- overloading the assignment operator, the copy constructor, the this pointer. Templates,function templates, class template.

### **TEXT BOOKS :**

1. Object Oriented Programming in Microsoft c++ - Robert Lafore,Galgotia Publication Pvt Ltd.1998
2. Let us C++ - Yaswant Kanitkar(used for templates) ,BPB ,2002 Publication

### **REFERENCE BOOKS :**

1. Object Oriented Programming in C++ - C. Balagurusamy, Tata Mcgraw Hill.2/e 2001
2. Teach yourself C++ - Herbertshildt, OSBORNE/MH,1999.

**Department of Electronics and Instrumentation**

Course: **BE**

Branch: **EIE**

Semester: **III**

Sub. Code: **SA3T3**

Credit: **1**

Subject: **SANSKRIT & INDIAN CULTURE - III**

**Unit - I (G t )**

1. Introduction to Jñāyoga
2. Introduction to Bhaktiyoga
3. Introduction to Karmayoga

**Unit - II (Upaniṣadic principles )**

4. Introduction to aṅkara's Philosophy
5. Introduction to R m nuja's Philosophy
6. Introduction to M dhva's Philosophy

**Unit - III**

7. Amazing creations in Sanskrit (Varnacitras, Sth nacitras and Svaracitras, Gaticitras, Citrabandanas)
8. Intercity verses in Sanskrit, some intercity discoveries, Sanskrit and artificial intelligence beauty and charm of Sanskrit Poetry.
9. Stotrak vyas and its relevance

**Unit - IV**

10. Introduction to Maths
11. Introduction to Physics and Chemistry
12. Introduction to Environmental science

**Unit - V**

13. Introduction to Yoga
14. Introduction to Botany & Zoology
15. Introduction to Agriculture

**Reference Texts**

1. The wonder that was India by Arthur Llewellyn Basham - 1971
2. The wonder that is Sanskrit by Sampadananda Misra - 2002
3. Vedic Science & Technology by Sadasiva Biswal and Bidyut Lata Ray - 2009
4. Vedavijnanasree by Urmila Srivatsava – 2002

**Department of Electronics and Instrumentation**

Course: **BE**

Branch: **EIE**

Semester: **III**

Sub. Code: **EI3P7**

Subject: **ELECTRONIC DEVICES AND CIRCUITS LAB**

Credit: **2**

**LIST OF EXPERIMENTS**

1. V-I characteristics of PN & Zener diode.
2. Characteristics BJT (CE mode)
3. Characteristics of JFET
4. Characteristics of SCR
5. Characteristics of UJT
6. Characteristics of LED, Photo diode
7. Hartley oscillators & Colpilt's oscillators
8. Astable Multivibrator
9. Single Phase Half Wave Rectifier & Full Wave Rectifier
10. Bridge Rectifier.
11. Zener voltage regulator

**Department of Electronics and Instrumentation**

Course: **BE**  
Sub. Code: **CS3P9**

Branch: **EIE**

Semester: **III**  
Credit : **2**

Subject: **OBJECT ORIENTED PROGRAMMING USING C++ LAB**

1. Illustrate class & objects
2. To demonstrate the use of Switch –Case statement and to perform arithmetic operations.
3. To demonstrate the use of constructor and destructor.
4. To demonstrate the use of this pointer
5. To enter the records of n number of students and then display them using nested structure.
6. Illustrate the use of in line functions
7. Illustrate the use of Copy Constructor
8. Illustrate operator overloading
9. To demonstrate the concept of polymorphism applied to the member functions.
10. To demonstrate the use of Inheritance.
11. To demonstrate the use of Demonstration of New & Delete Operator
12. To demonstrate the Pure Virtual Function
13. To demonstrate the use of unary operator
14. To demonstrate the use of Binary operator
15. To demonstrate the use of Friend Function.
16. To demonstrate the use of class template.

**Department of Electronics and Instrumentation**

Course: **BE**  
Sub. Code: **EE3P6**

Branch: **EIE**

Semester: **III**  
Credit : **2**

Subject: **ELECTRICAL ENGINEERING LAB**

1. Series and parallel resonance
2. Measurement of Active power, Reactive power, PF using Wattmeter.
3. Measurement of R, L, C Using Bridge.
4. Load test on DC shunt motor
5. Load test on DC series motor
6. Speed control of DC shunt motor
7. Load test on DC shunt generator
8. Load test on 3 phase squirrel cage Induction motor
9. Load test on single phase transformer
10. Control of servomotor. (AC/DC)
11. Control of Stepper Motor.
12. Load test on Synchronous Generator.

# **IV - SEMESTER**





**Department of Electronics and Instrumentation**

Course: **BE**

Branch: **EIE**

Semester: **IV**

Sub. Code: **MG4T1**

Credit: **3**

Subject: **APPLIED MATHEMATICS FOR INSTRUMENTATION ENGINEERS II**

**UNIT- I**

**FOURIER SERIES**

Euler's Formulae (Without Proof) – Condition for Fourier expansion – Functions having points of discontinuity – Change of interval – Expansions of even and odd functions - Half-Range series – Parseval's formula (without proof) – Root mean square value (without proof) – Typical waveforms (Definition Only): Square wave form, Saw toothed waveform, Modified saw toothed waveform, Triangular waveform, Half wave rectifier, Full wave rectifier - Outline of applications of Fourier series in engineering

**UNIT –II**

**SERIES SOLUTION OF DIFFERENTIAL EQUATIONS**

Validity of series solution - Series solution when  $x=0$  is an ordinary point - Frobenius method (Series solution when  $x=0$  is a regular singularity) - Bessel's equation (Bessels functions of the first and second kind) - Recurrence formulae for  $J_n(x)$  - Expansions for  $J_0$  and  $J_1$  : Value of  $J_{1/2}$  - Generating function for  $J_n(x)$  - Equations reducible to Bessel's equation – Orthogonality of Bessel functions – Outline of applications of Bessel's functions in engineering.

**UNIT- IIINUMERICAL SOLUTION OF ORDINARY DIFFERENTIAL EQUATIONS**

Picard's method – Taylor series method - Euler's method – Modified Euler's method – Runge's method – Runge-Kutta method – Predictor-corrector methods: Milne's method, Adams Bashforth method – Outline of applications of numerical solutions of ordinary differential equations in engineering.

**UNIT- IV**

**PARTIAL DIFFERENTIAL EQUATIONS**

Formation of partial differential equations – Solution of a partial differential equation – Equations solvable by direct integration – Linear equations of first order – Non linear equations of the first order – Charpit's method - Homogeneous linear equations with constant coefficients –Rules for finding complementary functions – Rules for finding particular integral – Solution of homogeneous linear equation of any order.

**UNIT –V NUMERICAL SOLUTION OF PARTIAL DIFFERENTIAL EQUATIONS**

Classification of second order equations – Finite difference approximation to derivatives – Elliptic equations: Laplace Equation, Poisson's equation – Solution of Laplace's equation – Solution of Poisson's equation – Parabolic equations: Heat equation – Solution of heat equation – Hyperbolic equations: Wave equation – Solution of wave equation – Outline of applications of numerical solution of partial differential equations in engineering.

**Note:** Questions are to be set on problem solving and not on the theoretical aspects.

**TEXT BOOK:**

Grewal B.S, Higher Engineering Mathematics, 41st Edition, Khanna Publishers, New Delhi, 2011.

**REFERENCES**

1. Erwin Kreyszig, Advanced Engineering Mathematics, John Wiley & Sons
2. Gerald C.F and Wheatley P.O, Applied Numerical Analysis, Addison-Wesley Publishing Company
3. Peter V.O'Neil, Advanced Engineering Mathematics, Thomson

## Department of Electronics and Instrumentation

Course: **BE**  
Sub. Code: **EI4T2**

Branch: **EIE**

Semester: **IV**  
Credit: **3**

Subject: **LINEAR INTEGRATED CIRCUITS**  
(Common to **EIE/MECHATRONICS**)

**Prerequisite:** Basic knowledge in Electronic devices.

### **Aim**

To teach the basic concepts in the design of electronic circuits using linear integrated circuits and their applications in the processing of analog signals.

### **Objectives**

The course should enable the students to:

1. Learn the IC fabrication technology.
2. Know the Op -amp characteristics and its linear applications.
3. Learn comparator, Schmitt-Trigger circuits, Voltage regulator and some linear and nonlinear oscillators
4. Study how an Op-Amp can act as a filter on an electrical signal.
5. Learn the theory and applications of PLL, ADC and DAC.

### **Outcome**

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

1. Enumerate different steps involved in the process of fabrication of integrated circuit.
2. Distinguish clearly between an ideal and actual characteristics of an Op-amp. And to learn different linear applications.
3. Understand different nonlinear applications.
4. Understand the advantages of using active filters in place of passive filters.
5. Understand how an operational amplifier can be helpful in signal processing

### **UNIT-I IC FABRICATION**

IC classification, Fundamental of Monolithic IC technology, Basic Planar processes: epitaxial growth, masking and etching, diffusion of impurities. Assembly processing and packaging. Fabrication of diodes, capacitance, resistance and FETs.

### **UNIT-I CHARACTERISTICS OF OPAMP**

Ideal OP-AMP characteristics, DC characteristics, AC characteristics, offset voltage and offset current, CMRR, Slew rate, virtual ground concept, differential amplifier: Transfer characteristics, Inverting and Non-inverting amplifier, voltage follower, summer, multiplier, differentiator and integrator.

### **UNIT -III APPLICATIONS OF OPAMP**

Instrumentation amplifier, first order active filters, V/I & I/V converters, comparators, multivibrators, waveform generators, clippers, clampers, peak detector, S/H circuit, D/A converter (R-2R ladder and weighted resistor types), A/D converter - Dual slope, successive approximation and flash types.

### **UNIT -IV SPECIAL ICs**

555 Timer circuit – Functional block, characteristics & applications; 566-voltage controlled oscillator circuit; 565-phase lock loop circuit functioning and applications.

### **UNIT -V APPLICATION ICs**

IC voltage regulators - LM317, 723 regulators, 78xx, 79xx regulators, switching regulator, Power amplifier: MA 7840, LM 380, Function generator IC:XR2206, isolation amplifiers, Opto coupler.

### **TEXT BOOKS**

1. Ramakant A.Gayakward, 'Op-amps and Linear Integrated Circuits', IV edition, Pearson Education, 2003 / PHI. (2000)
2. D.Roy Choudhary, Sheil B.Jani, 'Linear Integrated Circuits', II edition, New Age, 2003.

### **REFERENCE BOOKS**

1. Jacob Millman, Christos C.Halkias, 'Integrated Electronics - Analog and Digital circuits system', Tata McGraw Hill, 2003.
2. Robert F.Coughlin, Fredrick F.Driscoll, 'Op-amp and Linear ICs', Pearson Education, 4<sup>th</sup> edition, 2002 / PHI.
3. David A.Bell, 'Op-amp & Linear ICs', Prentice Hall of India, 2nd edition, 1997

## Department of Electronics and Instrumentation

Course: **BE**  
Sub. Code: **EI4T3**

Branch: **EIE**

Semester: **IV**  
Credit: **3**

Subject: **INDUSTRIAL INSTRUMENTATION**

**Prerequisite:** Electron Devices and Circuits, Sensors and Transducers.

### **Aim**

To equip the students with relevant knowledge to suit the industrial requirements.

### **Objectives**

The course will enable the students to:

1. Learn about Tachometer, Load cells, Torque meter and various densitometers.
2. Have an adequate knowledge about pressure transducers.
3. Have an idea about the temperature standards, calibration, thermocouples; signal conditioning used in RTD's and pyrometer techniques.
4. Study about various types of flow meters and their installation.
5. Have sound knowledge about various types of viscometers, level measurements, humidity and moisture measurements adopted in industrial environment

### **Outcome**

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

1. Understand the various techniques used for the measurement of industrial parameters.
2. Explain the design and working of various instruments.
3. Understand the installation techniques of various systems.
4. Understand the concept of various transducers used in industries.
5. Work with signal conditioning circuit of various measuring equipments.

### **UNIT-I MEASUREMENT OF SPEED, FORCE, TORQUE, ACCELERATION**

Measurement of speed- Revolution counter, Drag cup tachometer, AC and DC tachogenerators, photo electric pickup. Measurement of force - Load cell, pneumatic load cell, hydraulic load cell. Measurement of Torque using strain gauges and magneto elastic principle, Measurement of acceleration - Elementary accelerometers, seismic accelerometers, practical accelerometers, calibration.

### **UNIT- II MEASUREMENT OF PRESSURE**

Manometers – different types of manometers, Elastic pressure transducers, Dead weight Tester, Electrical types, Vacuum gauges - McLeod gauge, Knudsen gauge, thermocouple gauge, ionization gauge, Differential pressure transmitter - electrical & pneumatic types

### **UNIT- III MEASUREMENT OF TEMPERATURE**

Temperature scales, Bimetallic thermometer, filled- in Thermometers, Vapour pressure thermometers, Resistance thermometers, Thermistor, Thermostat, Thermocouples - types and ranges, characteristics, laws of thermocouples, cold junction compensation, IC temperature sensors AD 590, Pyrometers - radiation and optical pyrometers.

### **UNIT -IV MEASUREMENT OF FLOW, LEVEL**

Orifice, Venturi, Pitot tube, flow nozzle rotameter, Positive displacement meter, turbine flowmeter, electromagnetic flow meter, ultrasonic flow meter, open channel flow measurement, solid flow measurement. Sight glass, float gauge, displacer, torque tube, bubbler tube, diaphragm box, Differential Pressure methods, electrical methods- resistance type, capacitance type, ultrasonic level gauging.

### **UNIT -V MEASUREMENT OF DENSITY, VISCOSITY, HUMIDITY**

Hydrometer – continuous weight measurement, liquid densitometer – float principle, air pressure balanced method, using gamma rays – gas density measurements – gas specific gravity measurements – Viscosity terms, saybolt viscometer, rotometer type viscometer, and Industrial consistency meters. Humidity terms – dry & wet bulb psychrometers – hot wire electrode type hygrometer, electrolytic hygrometer, Dew point hygrometer

### **TEXT BOOKS:**

1. D. Patranabis, “Principles of Industrial Instrumentation”, Tata McGraw Hill, 2nd Edition, New Delhi, Reprint 2009.
2. S. K. Singh, “Industrial Instrumentation & Control” 3rd Edition, Tata McGraw Hill, Reprint 2009.
3. K. Krishnaswamy & S. Vijayachitra, “Industrial Instrumentation” New age International, Reprint 2008.

### **REFERENCE BOOKS:**

1. Ernest O. Doebelin, Dhanish. N. Manik, “Measurement Systems Application & Design”, TMH, 5th Edition, 2004.
2. R.K.Jain, “Mechanical & Industrial Measurements”, Khanna Publishers, 11th Edition, 2004.

**Department of Electronics and Instrumentation**

Course: **BE**  
Sub. Code: **EE4T2**

Branch: **EIE**

Semester: **IV**  
Credit: **3**

Subject: **DIGITAL ELECTRONICS**  
(Common to **EIE/ECE/EEE/ MECHATRONICS**)

**Prerequisite:** Basic Electronics.

**Aim**

To have the Knowledge of Basic Digital Circuits and their Design

**Objectives**

The course should enable the students to:

1. Study various number systems and to simplify the mathematical expressions using Boolean functions - simple problems.
2. Study implementation of combinational circuits.
3. Study the design of various synchronous and asynchronous circuits.
4. Learn about the various hazards present in the circuit
5. Expose the students to various memory devices

**Outcome**

The students should be able to:

1. Understand the basic number system and Boolean algebra.
2. Understand the basics of combinational circuits.
3. Know about Flip flops and synchronous sequential circuits and their design.
4. Analyse about various hazards present in the circuit.

**UNIT - I                      NUMBER SYSTEMS AND CODES**

Review of Number systems: Binary, Octal and Hexadecimal. Representations of numbers and their conversions. Binary arithmetic's. Conversion algorithms. Weighted binary codes and Non-weighted binary codes. Error detecting and error correcting codes. Alphanumeric codes.

**UNIT - II                      BOOLEAN ALGEBRA AND LOGIC FUNCTIONS**

**Boolean Algebra:** Introduction to Boolean algebra - The AND, OR and NOT operations. Laws of Boolean algebra. Minimization of Boolean expression. Boolean expressions and logic diagrams. Universal building blocks. Negative logic.

**Logic Simplifications:** Truth tables and maps. Sum-of-products and product-of-sums. Simplification of logic functions using Karnaugh map Minimization and Quine-McCluskey method of minimization.

**UNIT - III                      COMBINATIONAL CIRCUITS**

Arithmetic circuits: Half Adder, Full Adder, Half Subtractor and Full Subtractor, Number complements. Multiplexer - Demultiplexer, Decoder and Encoder code converters – BCD to Excess3, Gray, Seven Segment Display Conversions – Parity Generator and Checkers.

**UNIT - IV                      SEQUENTIAL CIRCUITS**

**Synchronous sequential circuits:** Basic latch circuits - Flip-flops, truth table and excitation table. Shift Registers. Synchronous counter design using JK, T, D flip flops, Up-down counter, General BCD counter and Ring counters.

**Asynchronous Sequential Circuits** – State Reduction, Multiple Inputs.

**UNIT - V                      LOGIC FAMILIES AND PROGRAMMABLE LOGIC DEVICES**

**Logic Families:** BJT as a switch- Logic Specifications – RTL, DTL, IIL, TTL open Collector O/P, Totem pole O/P, Tristate O/P, Schottky TTL gate, ECL, MOS, CMOS Logic – Comparison of Logic Families.

**Programmable Logic Devices:** PAL, PLA, PROM.

**TEXT BOOKS:**

1. W.H. Gothmann: Digital Electronics - An Introduction, Theory and Practice, PrenticeHall of India. Second edition, 1992.
2. M. Morris Mano – Digital Logic & Computer Design – PHI, 2nd Edition, 1999.

**REFERENCE BOOKS:**

1. A. Anand Kumar: Switching Theory and Logic Design – PHI, 2008.
2. Heiser Man: Handbook of Digital IC applications, Prentice Hall. 1980.
3. D.J. Comer: Digital Logic and State Machine Design, HOLT-SAUNDERS, 3rd Edition, 1995.
4. T.L. Floyd: Digital Fundamentals, Prentice Hall of India. 3rd Edition, 1995.

**Subject: SIGNALS AND SYSTEMS**  
**(Common to EIE/ECE)**

**Prerequisite:** Calculus, Differential equations

**Aim**

To study and analyze characteristics of continuous, discrete time signals and systems.

**Objectives**

The course should enable the students to:

1. Understand the representation of Signals, classification of signals, signal transforms and their properties.
2. Understand the concepts in the analysis of continuous time signals and systems.
3. Understand Sampling Theorem and Z-Transform.
4. Understand the concepts of Discrete Time systems.
5. Understand the finite and infinite Impulse response.

**Outcome**

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

1. Understand the properties and representation of discrete and continuous signals.
2. Analyze and transform signals to different domains.
3. Perform sampling on the continuous signals along with the analysis of discrete systems using Z-transforms.
4. Perform the analysis and synthesis of discrete time systems
5. Perform the finite and infinite impulse response analysis of discrete time systems.

**UNIT – I                    CONTINUOUS AND DISCRETE TIME SIGNALS**

Continuous time signal – Discrete time signals – Representation of signals: step, ramp, pulse, impulse, exponential – Classification of continuous time signals and discrete time signals – periodic, aperiodic, random signals – Continuous time systems and Discrete time systems - classification of systems – Linear invariant systems.

**UNIT – II                    FOURIER SERIES ANALYSIS**

Fourier series Analysis – Representation of periodic signals in exponential and trigonometric forms – Spectrum of continuous time signals: Properties – Fourier Transform and Laplace Transforms in signal analysis, Hilbert Transform.

**UNIT – III                    SIGNAL ANALYSIS**

Differential Equation – Block diagram Representation, reduction techniques – Impulse response – Convolution Integral – Parseval's theorem – Frequency response, Fourier Methods and Laplace Transforms in analysis – State variable equations and Matrix.

**UNIT – IV                    SPECTRUM OF DISCRETE SIGNALS**

Spectrum of discrete time signals – Discrete Time Fourier Transform – Discrete Fourier Transform – Properties – Z-Transform in signal analysis.

**UNIT – V                    TRANSFORMS AND APPLICATIONS**

Difference equations, Block Diagram representation, Impulse response, Convolution sum, Frequency response, Fast Fourier Transform and Z – transform – Properties – Z -Transform in signal analysis, State variable equation and matrix.

**TEXT BOOK:**

1. Robert A.Gabel and Richard A.Roberts, Signals and Linear Systems John wiley and sons 3ed, 1987.

**REFERENCE BOOKS:**

1. Allam V. Oppenheim et al. Signals and systems , Prentice Hall of India Pvt.Ltd.,1992
2. Roger E.Ziemer et al, Signals and systems continuous and Discrete, Mc Millan 2ed, 1990.

## Department of Electronics and Instrumentation

Course: **BE**  
Sub. Code: **EE4T7**

Branch: **EIE**

Semester: **IV**  
Credit : **3**

### Subject: **MEASUREMENT AND INSTRUMENTATION** (Common to EIE/ECE/EEE, MECHATRONICS)

**Prerequisite:** Electric Circuits.

**Aim**

To introduce the concept of measurement and the related instrumentation requirement as a vital ingredient of electronics and communication engineering.

**Objectives**

The course should enable the students to:

1. Acquire the knowledge on basic measurement concepts
2. Acquire the knowledge on basic electronic measurements
3. Acquire the knowledge on recording devices
4. Acquire the knowledge on digital instruments

**Outcome**

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

1. Understand Measurement systems, Bridge measurements
2. Know the principles of cathode ray oscilloscopes and other measuring instruments
3. Compare analog and digital techniques, and measurement errors

#### **UNIT-1 SCIENCE OF MEASUREMENT AND CHARACTERISTICS OF TRANSDUCERS**

Functional elements of an instrument - Units and standards - calibration methods – errors in measurement - statistical methods - Static characteristics - accuracy, precision, sensitivity, linearity, Reproducibility, Repeatability and Noise - Dynamic characteristics – impulse, step, ramp and sinusoidal inputs.

Classification of transducers – Selection of Transducer – Applications of Transducer - Resistive Transducer: Strain gauges, Resistance Thermometers, Thermistor - Inductive Transducers: LVDT, RVDT- Capacitive Transducers – Piezoelectric Transducer.

#### **UNIT-2 POTENTIOMETERS AND ELECTRICAL INSTRUMENTS**

DC potentiometer - Loading effect – Application – Basic circuit - standardization – Laboratory type (Crompton's) – AC potentiometer – Drysdale (polar type) type – Gall-Tinsley (coordinate) type – Limitations & applications – Instrument Transformer - C.T and V.T construction, theory, operation, phasor diagram, characteristics, testing, error elimination – Applications – Single and three Phase Wattmeters and Energy meter.

#### **UNIT-3 MEASUREMENT OF RESISTANCE AND IMPEDANCE**

Low Resistance: Kelvin's double bridge – Ductor Ohmmeter - Medium Resistance: Voltmeter Ammeter method, Substitution method, Wheatstone bridge method – High Resistance: Megger, Direct deflection method, Megohm bridge method- Earth resistance measurement. Introduction to A.C. bridges – Sources and Detectors in A.C. bridges – Measurement of Inductance – Anderson Bridge. - Measurement of Capacitance: Schering's bridge, De-Sauty's bridge - Measurement of frequency using Wien's bridge- LCR meter- Q meter

#### **UNIT- 4 CRO AND RECORDING INSTRUMENTS**

**Oscilloscope:** CRO – CRT, Deflection System, Specifications, Controls, Phosphors -Dual Beam / Dual trace oscilloscope - Storage Oscilloscope, Digital Storage Oscilloscope and Sampling Oscilloscope.

**Recording Instruments:** Method of Recording – Frequency Modulated (FM) recording-Pulse Duration Modulation (PDM) Recording - Strip Chart Recorders, X-Y, UV Recorders, and Plotters.

#### **UNIT-5 ANALOG & DIGITAL INSTRUMENTS**

Operating Forces – Deflecting Force, Controlling Force, Damping Force - Galvanometer, PMMC & moving iron instruments – Principle of operation, construction and sources of errors and compensation – Dynamo meter – True RMS meter - electronic voltmeter – Digital Voltmeter – Multimeter – vector voltmeter.

**TEXT BOOKS:**

1. D. Patranabis, 'Sensors and Transducers', Prentice Hall of India, 1999
2. Helfrick & Cooper, Modern Electronic Instrumentation and Measurement Techniques, Prentice Hall of India, 5<sup>th</sup> Edition, 2002.
3. Joseph J Carr, Elements of Electronic Instrumentation & Measurement, Pearson, 3rd Edition 1995.
4. H.S.Kalsi, "Electronic Instrumentation", TMH Co., 1995.
5. Moorthy, D.V.S., "Transducers and Instrumentation", Prentice Hall of India Pvt. Ltd., 1995.
6. A.K Sawhney, 'A course in Electrical & Electronic Measurement and Instrumentation', Dhanpat Rai and Co (P) Ltd., 2004.
7. Oliver and Cage, "Electronics measurements & Instrumentation," TMH Co.

8. M.M.S.Anand,"Electronic instruments and instrumentation thcnology,"PHI, 2006.

**REFERENCE BOOKS:**

1. E.A. Doebelin, 'Measurement Systems – Applications and Design', Tata McGraw Hill, New York, 1990
2. A.K. Sawhney, 'A course in Electrical & Electronic Measurement and Instrumentation', Dhanpat Rai and Co (P) Ltd., 2004..
3. S. Ranganathan, 'Transducer Engineering', Allied Publishers Pvt. Ltd., 2003.
4. Stout M.B., "Basic Electrical Measurement", Prentice Hall of India, 1986.
5. Dalley,J.W., Riley, W.F. and Meconnel, K.G., "Instrumentation for Engineering Measurement", John Wiley & Sons, 1993.

**Subject SANSKRIT & INDIAN CULTURE - IV**

**Unit I** – (1) Introduction to Sindh Vedic Cultures; significance & how it is different from the other cultures. (2) Why we have to follow? Important features. (3) Chronology of Indian Cultures; origin & spread; general features.

**Unit II** – (4) Literary Heritage of India – significance of Indian Literature; (5 & 6) chronology of Indian literature; (7) Literature in Sanskrit and other languages;

**Unit III** – (8) Early Indian Education – significance & advantages. (9) Gurukulas and Guru-sishya parampara. Learning methods. (10) Evolution of script and languages; important early scripts and writing materials; (11) important early educational centers (*ghattikas*, universities) & their unique features.

**Unit IV** - (12 & 13) duties & responsibilities of human - *gruhya sutras*, *smritis* & *sruties* - significance in day to day life.

**Unit V** - (14 & 15) Scientific thoughts of Early Indian Sages;

**Reference Books**

1. Joshi, K. 1992(rp). The Veda and Indian Culture. Rastriya Veda Vidya Pratishthana.
2. New Delhi.
3. Majumdar, R.C. 1994 (rp). Ancient India. Motilal Banarsidas Publishers. Delhi.
4. Patel, I.S. (ed). 1984. Science and the Vedas. Bombay.
5. Sri Chandrasekarendra Sarasvati Swamiji. 1991. The Guru Tradition. Bharatiya Vidya Bhavan. Bombay.
6. Sri Jayendra Saraswatiji Maharaj. 1951. The Vedas and Vedangas. Prakashan Kendra. Lucknow.
7. Vartak, P.V. 1986. Scientific Knowledge in the Vedas. Delhi.
8. Winternize, M. 1996(rp). History of Indian Literature. Delhi.



**Department of Electronics and Instrumentation**

Course: **BE**

Branch: **EIE**

Semester: **IV**

Sub. Code: **EI4P9**

Credit : **2**

Subject: **LINEAR INTEGRATED CIRCUITS AND DIGITAL ELECTRONICS LAB**

**LIST OF EXPERIMENTS**

1. Applications of Op-amp-I-Inverting, Non-Inverting, Adder & Subtractor.
2. Applications of Op-amp II – Differential Amplifier, Comparator, Integrator & Differentiator.
3. Op-amp characteristics – Slew rate verifications, CMRR, Input-Offset voltage.
4. Study of Basic Digital – IC's – Verification of TT for AND, OR, EXOR, NOT, NOR & NAND.
5. Study of flip-flops - JK, RS, D & T FF.
6. Implementation of Boolean functions, Adder / Subtractor Circuits.
7. Counters: Design and implementation of 4-bit Ripple and Decade counter.
8. Shift registers – SISO, PIPO, PISO and SIPO.
9. Timer IC application – NE555 timer in Astable, Monostable operation.
10. Pspice simulation: Inverting /Non inverting amplifier, voltage follower, integrator, differentiator.

**Department of Electronics and Instrumentation**

Course: **BE**  
Sub. Code: **EE4P6**

Branch: **EIE**

Semester: **IV**  
Credit : **2**

Subject: **MEASUREMENTS AND INSTRUMENTATION LAB**

**LIST OF EXPERIMENTS**

1. Measurements of medium resistance using Wheatstone bridge.
2. DC Bridge - Kelvin double bridge & Megger.
3. Design of Wien's, Anderson and Schering Bridge
4. Instrumentation amplifiers.
5. A/D Converter D/A Converter.
6. Calculation of single phase energy meter.
7. Measurement of three phase power & P.F
8. Measurement of iron loss.(Using Maxwell bridge)
9. Calibration of Voltmeter and Ammeter.
10. Extension of Voltmeter and Ammeter.
11. Calibration of CT & PT.

**Department of Electronics and Instrumentation**

Course: **BE**

Branch: **EIE**

Semester: **IV**

Sub. Code: **EI4P8**

Credit: **2**

Subject: **TRANSDUCER AND INDUSTRIAL INSTRUMENTS LAB**

**LIST OF EXPERIMENTS:**

1. Characteristics of LVDT/LDR
2. Characteristics of Thermocouple, RTD, Thermistor.
3. Characteristics of Strain Gauge, Torque Sensor.
4. Characteristics of Capacitive transducer.
5. Measurement of flow using Venturi Meter/ orifice Meter/Rotameter.
6. Level measurement using d/p transmitter.
7. Pressure measurement using pressure transducer.
8. Measurement of Viscosity and Humidity.
9. Characteristics of Tacho- Generator and stroboscope
10. PH meter standardization and measurement of PH value of solutions.
11. Conductivity meter calibration and measurement of test solution.
12. Flow measurement using Electromagnetic flow meter and ultrasonic flow meter.



# **V - SEMESTER**

**Department of Electronics and Instrumentation**

Course: **BE**

Branch: **EIE**

Semester: **V**

Sub. Code: **MG5T1**

Credit: **3**

Subject: **APPLIED MATHEMATICS FOR INSTRUMENTATION ENGINEERS III**

**UNIT –I** **PROBABILITY THEORY**

Random experiment – Mathematical, statistical and axiomatic definitions of probability – Conditional probability – Independent events - Theorem of total probability – Theorem of probability of causes: Bayes's theorem – Bernoulli's trials – De Moivre-Laplace approximation – Generalization of Bernoulli's theorem multinomial distribution – Outline of applications of probability theory in engineering.

**UNIT- II** **ONE DIMENSIONAL RANDOM VARIABLES**

Discrete random variable – Probability mass functions of Binomial, Poisson, Pascal and Geometric distributions - Continuous random variable – Probability density function of Uniform, Normal, Gamma, Erlang, Rayleigh, Maxwell and Laplace distributions - Cumulative distribution function – Outline of applications of one dimensional random variables in engineering.

**UNIT- III** **TWO DIMENSIONAL RANDOM VARIABLES**

Two dimensional random variables – Probability mass function – Joint probability density function – Cumulative distribution function – Marginal probability distribution – Conditional probability distribution – Independent random vectors – Function of random variable - Outline of applications of two dimensional random variables in engineering.

**UNIT –IV** **STATISTICAL AVERAGES**

Measures of central tendency – Mathematical expectation and moments – Measures of dispersion – Coefficient of variation – Skewness – Kurtosis – Pearson's shape coefficients – Expected values of a two dimensional random variables – Linear correlation – Correlation coefficient – Rank correlation coefficient – Regression – Equation of the regression line – Outline of applications of statistical averages in engineering.

**UNIT –V** **STATISTICAL INEQUALITIES**

Characteristic function – Moment generating function – Cumulative generating function – Bounds on probability: Tchebycheff, Bienayme's, Schwartz and Cauchy-Schwartz inequalities (without proof) – Convergence concepts and central limit theorem – Outline of applications of statistical inequalities in engineering.

**Note:** Questions are to be set on problem solving and not on the theoretical aspects.

**TEXT BOOK:**

1. Veerarajan. T.,” Probability, Statistics and Random Processes, Third Edition, Tata McGraw-Hill Publishers, New Delhi 2008.

**REFERENCES:**

1. Gubner, John, Probability and random process for electrical and computer engineers, Cambridge
2. Gupta S.P, Statistical methods, Sultan Chand & Sons
3. Papoulis, Probability, Random Variables and Stochastic Processes, McGraw Hill.



## Department of Electronics and Instrumentation

Course: **BE**

Branch: **EIE**

Semester: **V**

Sub. Code: **EI5T3**

Credit: **4**

**Subject: POWER PLANT INSTRUMENTATION**

**Prerequisite:** Basic Electronics.

### **Aim**

To provide basic knowledge about various Power Plant Instruments and their Applications

### **Objectives**

The course will enable the students to:

1. Acquire knowledge about the principles Power Generation.
2. Learn about measurement of various parameters in power plant.
3. Emphasis on characteristics and response of various analyzers in power plant.
4. Acquire adequate knowledge Turbine monitoring and boiler control.

### **Outcome**

The students should be able to:

1. Understand the basic principles of Power Generation.
2. Understand about measurement of various parameters in power plant.
3. Know the various analyzers in power plant.
4. Understand Turbine monitoring and boiler control.

## **UNIT- I                      OVERVIEW OF POWER GENERATION**

Brief survey of methods of power generation – hydro, thermal, nuclear, solar and wind power – importance of instrumentation in power generation – thermal power plants – building blocks – details of boiler processes UP&I diagram of boiler – cogeneration.

## **UNIT –II                      MEASUREMENTS IN POWER PLANTS**

Electrical measurements – current, voltage, power, frequency, power – factor etc. – non electrical parameters – flow of feed water, fuel, air and steam with correction factor for temperature – steam pressure and steam temperature – drum level measurement – radiation detector – smoke density measurement – dust monitor.

## **UNIT –III                      ANALYZERS IN POWER PLANTS**

Flue gas oxygen analyzer – analysis of impurities in feed water and steam – dissolved oxygen analyzer – chromatography – PH meter – fuel analyzer – pollution monitoring instruments.

## **UNIT –IV                      CONTROL LOOPS IN BOILER**

Combustion control – air/fuel ratio control – furnace draft control – drum level control – main stem and reheat steam temperature control – super heater control – at temperature – deaerator control – distributed control system in power plants – interlocks in boiler operation. Nuclear power plant instrumentation - radiations detection instruments - process sensors - Spectrum Analyzer - nuclear reactor control systems and allied instrumentation.

## **UNIT- V                      TURBINE – MONITORING AND CONTROL**

Speed, vibration, shell temperature monitoring and control – steam pressure control – lubricant oil temperature control – cooling system

### **TEXT BOOKS**

1. Sam G. Dukelow, The control of Boilers, instrument Society of America, 1991.
2. Modern Power Station Practice, Vol.6, Instrumentation, Controls and Testing, Pergamon Press, Oxford, 1971.
3. Liptak B.G., Instrumentation in Process Industries, Chilton, 1973
4. P.Tamilmani, power plant instrumentation, sams publishers,chennai , ISBN : 978-81-908165-5-7

### **REFERENCES**

1. Elonka,S.M.and Kohal A.L.Standard Boiler Operations, McGraw Hill, New Delhi, 1994.
2. R.K.Jain, Mechanical and industrial Measurements, Khanna Publishers, New Delhi, 1995.



## Department of Electronics and Instrumentation

Course: **BE**

Branch: **EIE**

Semester: **V**

Sub. Code: **EC5T5**

Subject: **DIGITAL SIGNAL PROCESSING**  
(Common to EIE/ECE)

Credit: **3**

**Prerequisite:** Signals and systems.

### **Aim**

To provide the knowledge about various signal processing techniques and their importance in communication field.

### **Objectives**

The course should enable the students to:

1. Study the DFT and FFT
2. Study the IIR Filters.
3. Study the FIR filter and Finite Word Length Problems.
4. Study the Sampling rate conversion.
5. Study the fundamentals of Digital Signal Processors.

### **Outcome**

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

1. Understand the concept of Discrete Fourier Transform Technique and its efficient computation.
2. Understand the design techniques of IIR and FIR filter types
3. Understand the limitations of Digital processors and to handle various Quantization noises due to finite word length problems.
4. Understand to Decimate and interpolate the signal to convert the sampling rate of the known signal.
5. Know the various type of Digital Signal Processors and their special hardware descriptions.

### **UNIT - I**

#### **DFT and FFT**

Discrete convolutions - Linear and circular. [Discrete Fourier Transform DFT and its properties. Relationship between z - transform & L-Transform, DTFT and DFT. Introduction to radix-2 Fast Fourier Transform [FFT]. Decimation in-time radix-2 FFT. Decimation-in-frequency radix -2 FFT. Computation of Inverse DFT through FFT.

### **UNIT - II**

#### **FINITE-IMPULSE RESPONSE [FIR] FILTERS**

Introduction to Digital Filters, Advantages and Disadvantages of FIR Filters, Poles-Zeros of Linear Phase sequence, Magnitude response and phase response of digital filters. Linear phase response. Design techniques for FIR filters - Fourier series method and Frequency sampling method. Linear phase designs. Windows - Rectangular, Hamming, Hanning and Kaiser.

### **UNIT - III INFINITE IMPULSE-RESPONSE[IIR] DIGITAL FILTERS**

Review of the properties of Butterworth and Chebychev filters of the continuous - time type . IIR digital filter design from continuous-time filters using Impulse Invariance technique and Bilinear transformation, Advantages and Disadvantages of IIR filters.

### **UNIT - IV FINITE WORD-LENGTH EFFECTS IN DIGITALFILTERS**

Fixed-point arithmetic. Effect of Quantization of the input data due to finite word-length. Coefficient in accuracy. Product round off. Need for scaling. Zero - input limit-cycle oscillation. Limit cycle oscillations due to overflow of address. Table - look up implementation to avoid multiplications.

### **UNIT - V**

#### **ADSP – 2181 FAMILY PROCESSOR**

Core Architecture- Computational Units – ALU, MAC, Barrel Shifter & Program Sequencer – Buses – On-chip Peripherals, Serial Ports, Timer, DMA Ports – Instruction Sets – Simple Programs – Addition, Subtraction, Circular Addressing, ASK etc.

### **TEXT BOOK:**

1. Digital Signal Processing – Nagoor Kani, RBA Publishing.
2. ADSP – 218X DSP Hardware Reference – Analog Devices Manual. First Edition. February 2001.

### **REFERENCE BOOKS:**

1. Oppenheim and Schaffer: Digital Signal Processing [PHI] 1994
2. Rabiner and Gold: Digital Signal Processing - Theory and Applications. [PHI] 2001
3. Antoniou: Digital Filter Design, TMH.2/e
4. Stanley: 'Digital Signal Processing', RESTON



## Department of Electronics and Instrumentation

Course: **BE**

Branch: **EIE**

Semester: **V**

Sub. Code: **ME5T6**

Credit: **3**

### **Subject: THERMO DYNAMICS AND FLUID MECHANICS**

**Prerequisite:** Basic Mechanical Engineering

#### **Aim**

This course provides the basic knowledge about thermodynamics and its application I.C. Engines, steam and gas turbines and fluid mechanics.

#### **Objectives**

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

1. Understand and apply the basic concepts of first law second law of Thermo Dynamics.
2. Know about the basic principles of IC engines, Gas Turbines and fluid mechanics

#### **Outcome**

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

1. Develop through basic knowledge about thermodynamics.
2. Acquire knowledge on the applications IC engines.
3. Learn the usage of different types of Gas Turbines and flow of fluid mechanics.

### **UNIT – I BASIC CONCEPTS AND LAWS OF THERMODYNAMICS**

Classical approach: Thermodynamic systems – Boundary - Control volume - System and surroundings – Properties - State-process – Cycle – Equilibrium - Work and heat transfer – Point and path functions - First law of thermodynamics for open and closed systems - First law applied to a control volume - SFEE equations [steady flow energy equation] - Second law of thermodynamics - Heat engines - Carnot cycle - Carnot theorem - Clausius inequality - Concept of entropy

### **UNIT – II IC ENGINES AND GAS TURBINES**

Air standard cycles: Otto and diesel cycles - comparison of efficiency - Working Principle of four stroke and two stroke engines - Working principle of spark ignition and compression ignition engines - Applications of IC engines - Normal and abnormal combustion Open and closed cycle gas turbines – Ideal and actual cycles - Brayton cycle - Cycle with reheat, intercooling and regeneration ( only description )– Applications of gas turbines for aviation and power generation.

### **UNIT – III REFRIGERATION AND AIR CONDITIONING**

Formation of steam - Properties of steam – Use of steam tables and charts – Steam power cycle (Rankine) Unit of refrigeration - Basic functional difference between refrigeration and air conditioning – Various methods of producing refrigerating effects (RE) – Vapour compression cycle: P-H and T-S diagram - Saturation cycles - Effect of subcooling and super heating - (qualitative treatment only) Airconditioning systems – Basic psychrometry - Simple psychrometric processes - Types of airconditioning systems -Selection criteria for a particular application (qualitative treatment only).

### **UNIT – IV BASIC CONCEPTS, PROPERTIES AND FLOW OF FLUIDS**

Fluid – definition, distinction between solid and fluid - Units and dimensions - Properties of fluids - density, specific weight, specific volume, specific gravity, temperature, viscosity, compressibility, vapour pressure, capillary and surface tension Fluid statics: concept of fluid static pressure, absolute and gauge pressures - pressure measurements by manometers and pressure gauges Fluid dynamics - equations of motion - Euler's equation along a streamline - Bernoulli's equation – applications

### **UNIT – V DIMENSIONAL ANALYSIS AND PUMPS**

Dimensional analysis - Buckingham's  $\pi$  theorem- applications - similarity laws and models. Pumps: Definition - classifications and working principles of Centrifugal pump, Jet pump, Reciprocating pump and Submergible pump

#### **TEXT BOOKS**

1. P.K. Nag, 'Basic and Applied Engineering Thermodynamics', Tata McGraw Hill, New Delhi, 2002. B.K. Sachdeva, 'Fundamentals of Engineering Heat and Mass Transfer (SI Units)', New Age International (P) Limited, Chennai, 2003.
2. Streeter, V.L., and Wylie, E.B., "Fluid Mechanics", McGraw-Hill, 1983.
3. Kumar, K.L., "Engineering Fluid Mechanics", Eurasia Publishing House (P) Ltd, New Delhi (7<sup>th</sup> edition), 1995.
4. Vasandani, V.P., "Hydraulic Machines - Theory and Design", Khanna Publishers.1992

#### **REFERENCE BOOKS**

1. Rogers and Mayhew, 'Engineering Thermodynamics – Work and Heat Transfer', Addison Wesley, New Delhi, 1999.
2. Eastop and McConkey, 'Applied Thermodynamics', Addison Wesley, New Delhi. 1999.
3. M.L. Mathur and F.S. Metha, 'Thermal Engineering', Jain Brothers, New Delhi, 1997.
4. B.K. Sankaar, "Thermal Engineering", Tata McGraw Hill, New Delhi, 1998.
5. Bansal, R.K., "Fluid Mechanics and Hydraulics Machines", (5<sup>th</sup> edition), Laxmi publications (P) Ltd, New Delhi, 1995
6. White, F.M., "Fluid Mechanics", Tata McGraw-Hill, 5<sup>th</sup> Edition, New Delhi, 2003.
7. Ramamirtham, S., "Fluid Mechanics and Hydraulics and Fluid Machines", Dhanpat Rai and Sons, Delhi, 1998.

8. Som, S.K., and Biswas, G., "Introduction to Fluid Mechanics and Fluid Machines", Tata McGraw-Hill, 2<sup>nd</sup> Edition, 2004.

**Department of Electronics and Instrumentation**

Course: **BE**

Branch: **EIE**

Semester: **V**

Sub. Code: **SA5T5**

Subject: **SANSKRIT & INDIAN CULTURE - V**

Credit: **1**

**Unit I** – (2) Samskaras or Sacraments – Important occasions & significance; Sixteen important Samskaras in due course of human life.

**Unit II** – (1) Responsibilities of Human - four Ashrama Dharmas .

**Unit III** – (2) significance of social gatherings & celebrations of different occasions. – Worship – personal and public rituals & their significance; (2) socio-cultural significance of festivals and impact on culture. (1) Significance of sound science – *Gandharvaveda* (Music) & Dance.

**Unit IV** – (2) Significance of Yoga in daily life.

**Unit V** – (2) Scientific heritage - importance and significance of Upavedas. (3) Special reference to Ayurveda and Arthashastra.

**Reference Books**

1. Acharya, D. 1999. *Dharnurveda* (sub-Veda of Yajurveda). Hindi. Vijaya Kumar Govindram Harsanand. Delhi.
2. Kangle, R.P. 1992 (rp). *The Kautilya Arthashastra*. Delhi.
3. Rao, S.K.R. 1994. *Nityarchana*. Agama-kosha (Agam Encyclopaedia). Kalpatharu Research Academy Publications. Vol X. Bangalore.
4. Ray, P. (tr). 1997. *Vasistha's Dhanurveda Samhita*. J.J. Publishing House. Delhi.
5. Shalini, K. 1997. *Vedic Leguminous Plants* (Medical and Microbiological Study). Classical Publishing Company. New Delhi.
6. Swami Satyananda Saraswati. 1997 (rp). *Asanas Pranayama Mudra Bandha*. Bihar Yoga Bharati. Bihar.

**Department of Electronics and Instrumentation**

Course: **BE**

Branch: **EIE**

Semester: **V**

Sub. Code: **ME5P6**

Credit: **2**

Subject: **THERMO DYNAMICS AND FLUID MECHANICS LAB**

**THERMODYNAMIC LAB**

1. Valve timing and port timing diagrams for IC Engines.
2. Performance test on a petrol Engine.
3. Performance test on a Diesel Engine.
4. Heat Balance test on a IC Engine.
5. Performance test on a Refrigerator ( Determination of COP )

**FLUID MECHANICS LAB**

1. Flow measurements using venture meter.
2. Test to estimate losses in pipe flow.
3. Test on positive displacement pump for obtaining its characteristics curves and parameters.
4. Test on jet pump for obtaining its characteristics curves and design flow parameters.

**Department of Electronics and Instrumentation**

Course: **BE**

Branch: **EIE**

Semester: **V**

Sub. Code: **EC5P7**

Credit: **2**

Subject: **POWER ELECTRONICS AND DRIVES LAB**

1. SCR, MOSFET & IGBT Characteristics – Study.
2. UJT, R, RC Firing circuits for SCR.
3. SCR based half controlled & fully controlled converters.
4. SCR based DC Voltage Commutated chopper.
5. SCR based DC Current Commutated chopper.
6. SCR based Series Inverter.
7. SCR based Parallel Inverter.
8. Simulation of above Experiments using PSIM.
9. Simulation of closed loop control of converter fed DC motor using PSIM.
10. Simulation of closed loop control of chopper fed DC motor using PSIM.
11. Simulation of VSI fed 3-phase induction motor using PSIM.
12. Simulation of 3-phase synchronous motor drive using PSIM.

**Department of Electronics and Instrumentation**

Course: **BE**

Branch: **EIE**

Semester: **V**

Sub. Code: **EE5P8**

Credit: **2**

Subject: **CONTROL SYSTEMS LAB**

1. Analysis of Step, Ramp, Impulse and Parabolic response of First Order System
2. Analysis of Step, Ramp response of Second Order System
3. Analysis of Time domain specifications of Second Order System
4. Stability analysis of Linear System using graphical methods (Time and Frequency Domain)
5. Design and Simulation of P, PI, PD, PID Controllers for the given system using Cohen-Coon Method.
6. Design and Simulation of P, PI, PD, PID Controllers for the given system using Ziegler Nichols Method.
7. Design and Simulation of Lag, Lead and Lag-Lead Compensators
8. Tuning of PID Controllers using Ziegler Nichols Method in SIMULINK.
9. Study the response of various control schemes in SIMULINK (Feedback, Feed Forward, and Cascade Control).
10. Study the relationship between controllability, Observability and transfer function.



# **VI - SEMESTER**



**Department of Electronics and Instrumentation**

Course: **BE**

Branch: **EIE**

Semester: **VI**

Sub. Code: **MG6T1**

Credit: **3**

Subject: **OPERATIONAL RESEARCH**

**UNIT -I      LINEAR PROGRAMMING AND SIMPLEX METHOD**

Mathematical formulation of the problem - Graphical solution method - Exceptional cases - General linear programming problem - Canonical and standard forms of linear programming problem - The simplex method - Computational procedure : The simplex algorithm - Artificial variable techniques : Big M method, Two phase method - problem of degeneracy.

**UNIT -II      TRANSPORTATION, ASSIGNMENT AND ROUTING PROBLEMS**

Mathematical formulation of the transportation problem - Triangular basis - Loops in a transportation table - Finding initial basic feasible solution (NWC, IBM and VAM methods) - Moving towards optimality - Degeneracy in transportation problems- Transportation algorithm (MODI method) - Unbalanced transportation problems - Mathematical formulation of the assignment problem - Assignment algorithm : Hungarian assignment method - Routing problems : Travelling salesman problem.

**UNIT -III      GAME THEORY AND SEQUENCING PROBLEMS**

Two person zero sum games - Maxmin Minmax principle - Games without saddle points (Mixed strategies) - Solution of 2 X 2 rectangular games - Graphical method - Dominance property - Algebraic method for m x n games - Matrix oddments method for m x n games - Problem of sequencing - Problems with n jobs and 2 machines - Problems with n jobs and k machines - Problems with 2 jobs and k machines.

**UNIT -IV INTEGER PROGRAMMING AND INVENTORY CONTROL**

Gomory's All I.P.P method - Gomory's mixed integer method - Branch and bound method - Reasons for carrying inventory - Types of inventory - Inventory decisions - Economic order quantity - Deterministic inventory problem - EOQ problem with price breaks - Multi item deterministic problem.

**UNIT- V      REPLACEMENT PROBLEMS AND PERT/CPM**

Replacement of equipment or asset that deteriorates gradually - Replacement of equipment that fails suddenly - Recruitment and promotion problem - Network and basic components - Rules of network construction - Time calculations in networks - Critical path method (CPM) - PERT - PERT calculations - Negative float and negative Slack - Advantages of network (PERT/CPM).

**TEXT BOOK**

1. Kanti Swarup, P.K.Gupta and Man Mohan, Operations Research, Eighth Edition, Sultan Chand & Sons, New Delhi, 1999.

**REFERENCES**

1. H.A.Taha, Operations Research, Sixth Edition, MacMillen.
2. Richard Bronson, Operations Research, (Schaum's Outline Series, McGraw Hill Company, 1982.
3. J.K.Sharma, Operation Research (Theory and Applications), Mac Millen Ltd., 1997.

## Department of Electronics and Instrumentation

Course: **BE**  
Sub. Code: **EC6T3**

Branch: **EIE**

Semester: **VI**  
Credit: **3**

### Subject: **MICROPROCESSOR AND MICROCONTROLLER** (Common to the branches **EEE/ EIE / MECHATRONICS**)

**Pre-requisite:** Basic knowledge of computer, digital electronics

**Aim**

To excel in the Architecture of 8086 & 8051 and to develop skill in simple program writing, to study simple applications.

**Objectives**

The objective of the course is to impart knowledge on:

1. The Architecture of 8086 & 8051.
2. The addressing modes & instruction set of 8086 & 8051.
3. The need & use of Interrupt structure.
4. Simple program Skills.
5. Commonly used peripheral / interfacing ICs.

**Outcome**

After completion of the course the students are expected to be able to:

1. Understand the functional block diagram, Timing Diagram, Interrupt structure and Multiprocessor configurations of 8086 Microprocessor.
2. Develop the Programming skills using Loop structure with counting & Indexing, Look up table, Subroutine instructions stack.
3. Interface ICs 8255 PPI, 8259 PIC, 8257 DMA, 8251 USART, 8279 Key board display controller and 8253 Timer/ Counter, A/D and D/A converter.
4. Comprehend the Functional block diagram, Instruction format and addressing modes, Interrupt structure, I/O Ports and Serial communication of 8051 Microcontroller.
5. Develop the programming skills in PID control algorithm, square, triangular and sine wave form generation, closed loop control of servo motor and stepper motor control.

#### **UNIT I INTRODUCTION TO MICROPROCESSOR- 8085**

Comparison of microcomputer with "mini" and "large" Computers-Advantages and limitations of Microprocessor based system design -8085 Microprocessor architecture-Addressing modes- Instruction set- Programming the 8085- interrupts – Memory and I/O

#### **UNIT II 16 – BIT MICROPROCESSOR – 8086**

Intel 8086 microprocessor - Architecture - Instruction Set-Addressing Modes-- Assembly Language Programming-Procedures- Interrupts

#### **UNIT-III MULTIPROCESSOR CONFIGURATIONS**

Coprocessor Configuration – Closely Coupled Configuration – Loosely Coupled Configuration –8087 Numeric Data Processor – Data Types – Architecture –8089 I/O Processor –Architecture –Communication between CPU and IOP

#### **UNIT- IV INTERFACING AND SYSTEM DESIGN USING MICRO PROCESSOR**

1. 8255-Programmable peripheral Interface along with 8085-Both Mode 0 and Mode 1, detailed study.
2. 8254 - Programmable Interval Timer along with Intel 8086 - Both Mode 0 and Mode 3 to be studied.
3. Need for the following ICs: (a) 8251 - USART; (b) 8257 - Direct Memory Access Controller; (c) 8259-Programmable Interrupt Controller; (d) 8279 - Keyboard / Display Interface
4. Case studies – Traffic light control, washing machine control- Motor Control- Relay, PWM, DC & Stepper Motor

#### **UNIT- V MICROCONTROLLERS**

Architecture of 8051 Microcontroller – signals – I/O ports – memory – counters and timers – serial data I/O – interrupts-

Interfacing -keyboard, LCD,ADC & DAC

**TEXT BOOKS:**

1. Ramesh S. Gaonkar ,”Microprocessor – Architecture, Programming and Applications with the 8085” Penram International Publisher , 5th Ed.,2006
2. Yn-cheng Liu,Glenn A.Gibson, “Microcomputer systems: The 8086 / 8088 Family architecture, Programming and Design”, second edition, Prentice Hall of India , 2006 .
3. LA Levant Hal, Introduction to Microprocessor, Software, Hardware, Programming, PHI, Inc.1978.
- 4.. Kenneth J.Ayala, 'The 8051 microcontroller Architecture, Programming and applications' second edition ,Penram international.

**REFERENCES:**

2. Douglas V.Hall, “ Microprocessors and Interfacing : Programming and Hardware”, second edition , Tata Mc Graw Hill ,2006.
3. A.K.Ray & K.M Bhurchandi, “Advanced Microprocessor and Peripherals – Architecture, Programming and Interfacing”, Tata Mc Graw Hill , 2006.
4. Mohamed Ali Mazidi,Janice Gillispie Mazidi,” The 8051 microcontroller and embedded systems using Assembly and C”,second edition, Pearson education /Prentice hall of India , 2007.

## Department of Electronics and Instrumentation

Course: **BE**

Branch: **EIE**

Semester: **VI**

Sub. Code: **EI6T3**

Credit: **4**

**Subject: PROCESS CONTROL INSTRUMENTATION**

**Pre-requisite:** Basic knowledge of transducers.

### **Aim**

To provide basic knowledge about of controllers, find control element and the processes.

### **Objectives**

The objective of the course is to impart knowledge on:

1. To study the basic characteristics of first order and higher order processes.
2. To get adequate knowledge about the characteristics of various controller modes and methods of tuning of controller.
3. To study about various complex control schemes.
4. To study about the construction, characteristics and application of control valves.
5. To study the five selected unit operations and a case study of distillation column control

### **Outcome**

After completion of the course the students are expected to be able to:

1. Understand the characteristics of higher order processes, controller modes and methods of tuning of controller.
2. Gain knowledge about complex control schemes and control valves.
3. Get some basic knowledge about the fuzzy logic.

### **UNIT -I MATHEMATICAL MODELLING OF PROCESSES**

Need for process control – Mathematical model of first order liquid level and thermal processes – First and second order process – Process with dead time, process with inverse response – Interacting and non-interacting systems – Continuous and batch process – Servo and regulator operation.

### **UNIT- II CONTROLLER CHARACTERISTICS & TUNING**

Basic control action – Characteristics of ON-OFF, proportional, integral and derivative control modes – Composite control modes – P+I, P+D and P+I+D control modes – Electronic controllers to realize various control actions – Evaluation criteria – IAE, ISE, ITAE and ¼ decay ratio – Tuning of controllers – Ziegler-Nichol's method and - Cohencoon method – Damped oscillation method.

### **UNIT –III CONTROL SYSTEMS WITH MULTIPLE LOOPS**

Cascade control – Feed forward control – Ratio control – Selective control systems – Split range control – Adaptive and inferential control. MIMO controller.

### **UNIT- IV FUZZY LOGIC CONTROL SYSTEM**

Fuzzy logic controller - fuzzification interface - knowledge base- - decision making logic - defuzzification interface - design of fuzzy logic controller case study

### **UNIT –V FINAL CONTROL ELEMENT**

I/P and P/I converter – Pneumatic,hydraulic and electric actuators – Valve positioned including smart positioning – Control valves characteristics – Classification of control valves – Control valve sizing – Cavitations and flashing – Selection of control valves – pressure relief valve,self regulating valve,solenoid.

### **TEXT BOOKS**

1. Donald P. Eckman, 'Automatic Process Control', Wiley Eastern Ltd., New Delhi, 1993.
2. G.Stephanopoulos, 'Chemical Process Control', Prentice Hall of India, New Delhi, 1990.
3. Klir G.J., and Yuan B.B., Fuzzy sets and fuzzy logic, Prentice Hall of India, New Delhi, 1997.
4. Donald R. Coughanowr,'Process System Analysis and Control',Mcgraw Hill,1991.

### **REFERENCE BOOKS**

1. B.G.Liptak, 'Process Control', Chilton Book Company, 1994.
2. Curtis D. Johnson, 'Process Control Instrumentation Technology', 7<sup>th</sup> Edition,Pearson Education, New Delhi, 2002 / PHI.
3. J.G.Balchen and K.J.Mumme, 'Process Control structures and Application', Vannostrand Reinhold Co., New York, 1988

## Department of Electronics and Instrumentation

Course: **BE**  
Sub. Code: **EI6T4**

Branch: **EIE**

Semester: **VI**  
Credit: **3**

Subject: **INDUSTRIAL CHEMICAL PROCESS**

**Pre-requisite:** Nil.

### **Aim**

To provide basic knowledge about Industrial chemical processes.

### **Objectives**

The objective of the course is to impart knowledge on:

1. To study the basic manufacturing various chemicals.
2. To get adequate knowledge about the Mass transfer/ Distillation/ extraction/ leaching process.
3. To study the characteristics of chemical reactors.
4. To study about various Automation techniques.

### **Outcome**

After completion of the course the students are expected to be able to:

1. Understand the basic manufacturing various chemicals.
2. Get adequate knowledge about the Mass transfer/ Distillation/ extraction/ leaching process.
3. Understand characteristics of chemical reactors.
4. Understand about various Automation techniques.

### **UNIT- I**

Overview of a chemical process Industries-Manufacture of  $H_2$ ,  $SO_4$ ,  $NaOH$ ,  $NH_3$ , Edible oil, pulp and paper, petrolecem, refining plastics (P.E; PVC), polyester fibre - These process industries cover: Inorganic ( $H_2$ ,  $SO_4$ ,  $NaOH$ ,  $NH_3$ ) organic (Edible, pulp & paper), petroleum, polymer (PE, PVC) & fibre

### **UNIT -II**

Mass transfer - mechanism - Distillation Absorption, extraction, leaching, adsorption, drying, and crystallization.

### **UNIT- III**

Chemical reactors, mixing, size reduction, filtration, other separations membrane separation, solvent extraction, centrifugation-P&I diagram, Chemical engineering symbols,SAMA.

### **UNIT -IV**

Concept of material, energy momentum balance, case study of process variables and control in typical unit operation as distillation, absorption, reactors, heat exchangers

### **UNIT -V**

Automation of Assembly lines- Concept of automation in industry,mechanization and automation.

Automation using Hydraulic systems – Design aspects of various elements of hydraulic systems such as pumps, valves, filters, reservoirs, accumulators, actuators and intensifiers.

Automation using pneumatic systems – Pneumatic fundamentals – Introduction to Automation using pneumatic systems.

### **TEXT BOOKS**

1. Dryden's outlines of chemical technology by Gopal Rao, East West Publishers 1997, New Delhi.
2. Shreve's chemical process industries Mc Graw Hill, Auckland, 1984
3. Unit operations of chemical engg - McCabe, J. Smith & P. Harriott, Mc Graw Hill, 7<sup>th</sup> Edition, 2004.

### **REFERENCES**

1. Perry's chemical engg's hand book - Mc Graw Hill, 8<sup>th</sup> Edition, 2008.

## Department of Electronics and Instrumentation

Course: **BE**  
Sub. Code: **EI6T5**

Branch: **EIE**

Semester: **VI**  
Credit: **3**

Subject: **ANALYTICAL INSTRUMENTATION**

**Prerequisite:** Electronic Devices and Circuits

### **Aim**

To equip the students with an adequate knowledge about number of analytical tools which are useful for various applications.

### **Objectives**

The course will enable the students to:

1. To understand various techniques and methods of analysis which occur in the various regions of the spectrum.
2. To study important methods of analysis of industrial gases.
3. To understand the important radio chemical methods of analysis.

### **Outcome**

At the end of the course students should able to do the following:

4. Understand various techniques and methods of analysis.
5. Understand various methods of chromatography and gas analyzers.
6. Get adequate knowledge about radio chemical methods of analysis.

### **UNIT- I COLORIMETRY AND SPECTROPHOTOMETRY**

Spectral methods of analysis– Beer-Lambert law – Colorimeters – UV-Visible spectrophotometers – Single and double beam instruments , Sources and detectors – IR Spectrophotometers – Types – Attenuated total reflectance flame photometers – Atomic absorption spectrophotometers – Sources and detectors – FTIR spectrophotometers – Flame emission photometers – Fluorescence spectrophotometer

### **UNIT- II CHROMATOGRAPHY**

Different techniques – Techniques by chromatographic bed shape- Column chromatography-Planer Chromatography-Paper Chromatography-Thin layer Chromatography-Applications - Techniques by physical state of mobile phase- Gas chromatography – Sources- Detectors – Liquid chromatographs – sources- detectors- Applications – High-pressure liquid chromatographs – sources-detectors- Applications- Techniques by separation mechanism-Ion exchange chromatography-size-exclusion chromatography-Applications

### **UNIT -III INDUSTRIAL GAS ANALYZERS AND POLLUTION MONITORING INSTRUMENTS**

Types of gas analyzers – Oxygen, NO<sub>2</sub> and H<sub>2</sub>S types, IR analyzers, thermal conductivity analyzers, analysis based on ionization of gases. Air pollution due to carbon monoxide, hydrocarbons, nitrogen oxides, sulphur dioxide estimation - Dust and smoke measurements.

### **UNIT -IV PH METERS AND DISSOLVED COMPONENT ANALYZERS**

Principle of pH measurement, glass electrodes, hydrogen electrodes, reference electrodes, selective ion electrodes, ammonia electrodes, biosensors, dissolved oxygen analyzer – Sodium analyzer – Silicon analyzer.

### **UNIT-V NUCLEAR MAGNETIC RESONANCE AND MICROSCOPIC TECHNIQUES**

NMR :- Basic principles , NMR spectrometer and Applications - Electron spin Resonance spectroscopy: – Basic principles, Instrumentation and applications. Scanning Electron Microscope (SEM) :- Basic principles, Instrumentation and applications. Transmission Electron Microscope (TEM):- Basic principles – Instrumentation and applications. Mass spectrometers :- Different types and Applications.

### **TEXT BOOKS:**

1. R.S. Khandpur, Handbook of Analytical Instruments, Tata McGraw Hill publishing Co. Ltd., 2<sup>nd</sup> edition, 2006.
2. G.W. Ewing, Instrumental Methods of Analysis, Mc Graw Hill, 2004.
3. Liptak, B.G., Process Measurement and Analysis, CRC Press, 2005.

### **REFERENCES:**

1. Braun, R.D., Introduction to Instrumental Analysis, Mc Graw – Hill, Singapore, 2006.
2. H.H.Willard, L.L.Merritt, J.A.Dean, F.A.Settle, Instrumental methods of analysis, CBSpublishing & distribution, 1995.
3. James keeler ; Understanding NMR Spectroscopy, Second Edition John Wiley & Sons, 2010.
4. John H.Nelson , Nuclear Magnetic Resonance Spectroscopy, Prentice Hall/Pearson Education,2003.
5. Frank G. Kerry Industrial Gas Handbook: Gas Separation and Purification, Taylor and francis group, 2007.



## Department of Electronics and Instrumentation

Course: **BE**  
Sub. Code: **EI6T6**

Branch: **EIE**

Semester: **VI**  
Credit: **3**

Subject: **FIBER OPTICS & LASER INSTRUMENTS**

### **Aim**

To provide knowledge about the Industrial applications of optical fibers and laser instruments.

### **Objectives**

The course will enable the students to:

1. Get exposed to the basic concepts of optical fibers and their properties.
2. Acquire adequate knowledge about the Industrial applications of optical fibers.
3. Acquire knowledge about Laser fundamentals and Industrial application of lasers.
4. Get adequate knowledge about holography & Medical applications of Lasers.

### **Outcome**

After completion of the course the students are expected to be able to:

1. Specify and operate optical test instrumentation, for example, optical spectrum analyzers and laser beam profilers.
2. Align, maintain and operate optical components and support and positioning equipment.
3. Survey a laser work area, citing unsafe conditions present.
4. Gain knowledge about Holographic techniques and medical applications of laser

### **UNIT -I OPTICAL FIBERS AND THEIR PROPERTIES**

Principles of light propagation through a fiber-Different types of fibers and their properties - Transmission characteristics of optical fiber-absorption losses-Scattering losses-Dispersion - Optical sources - Optical detectors - LED -LD - PIN and APD

### **UNIT -II INDUSTRIAL APPLICATION OF OPTICAL FIBERS**

Fiber optic sensors - Fiber optic Instrumentation system - Different types of modulators- Detectors- Application in Instrumentation - Interferometric method of measurement of length- Moire fringes - measurement of pressure, temperature, current, voltage, liquid level and strain - fiber optic gyroscope

### **UNIT – III LASER FUNDAMENTALS**

Fundamental characteristics of Lasers - three level and four level lasers - properties of laser- laser modes - resonator configuration - Q- switching and mode locking - cavity dumping - Types of lasers Gas lasers, solid lasers, liquid lasers - semiconductor lasers

### **UNIT – IV INDUSTRIAL 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 materials - removal and vaporization

### **UNIT - V HOLOGRAM AND MEDICAL APPLICATION**

Holography - Basic principle - Methods - Holographic interferometry and application, Holography for non – destructive testing- Holographic components - Medical applications of lasers,- Laser instruments for surgery, removal of tumors, brain surgery, plastic surgery, Eye surgery.

### **Text Books**

1. Jasprit Singh, Semi Conductor Optoelectronics, McGraw Hill,1995
2. Ghatak A.K. and Thiagarajar K, Optical Electronics Foundation book , TMH, Cambridge University Press, 1989
3. J.M. Senior, Optical Fiber Communication - Principles and Practice, Prentice Hall of India, 2005.
4. J. Wilson and J.F.B. Hawkes, Introduction to Opto Electronics, Prentice Hall of India, 2001.

### **Reference Books**

1. John and Harry, Industrial Lasers and their Applications, McGraw Hill 1974
2. John F Ready,. Industrial Applications of Lasers, Academic Press, 1997
3. Monte Ross, Laser Applications, McGraw Hill, 1968
4. Donald J.Sterling Jr, Technicians Guide to Fiber Optics, 3rd Edition, Vikas Publishing House, 2000.
5. M. Arumugam, Optical Fiber Communication and Sensors, Anuradha Agencies, 2002.
6. Monte Ross, Laser Applications, McGraw Hill, 2004.
7. G. Keiser, Optical Fiber Communication, McGraw Hill, 2006.
8. Mr. Gupta, Fiber Optics Communication, Prentice Hall of India, 2004.

**Department of Electronics and Instrumentation**

Course: **BE**

Branch: **EIE**

Semester: **VI**

Sub. Code: **SA6T6**

Credit: **1**

Subject: **SANSKRIT & INDIAN CULTURE - VI**

**Unit I** – (2) Social significance of religion - evolution of religious thoughts and ritual practices; (1) different philosophical Schools.

**Unit II** – (1) structural evolution for ritual practices; significance of temples & other constructions. (2) Civil engineering skill & construction technologies; scientific aspects in *Vastusastra* .

**Unit III** – (1) Important personalities and their Contribution – Devarishies, Maharishies, Rishies, Seers and contribution of their institutions to protect the cultural heritage.

**Unit IV** – (3) Vedic Mathematics, Astrology & Astronomy, etc. early Indian works and its importance in day to day life.

**Unit V** – (5) project work - ancient Indian technological thoughts with modern applications in different fields.

**Reference Books**

1. Datta, B. & A.N. Singh. 1962(rp). History of Hindu Mathematics. 2 Vols. Asian Publishing House. Bombay.
2. Jagadguru Swami Sri Bharati Krishna Tirthaji Maharaj. 1994 Vedic Mathematics. Motilal Banarasidas. New Delhi.
3. Kulkarni, R.P. 1983. Geometry according to Sulba Sutra. Samsodhana Mandal. Pune.
4. Radhakrishna, S. 1993(rp). Indian Philosophy. Vol I & II. Oxford University Press. Delhi.
5. Rao, J. 1960. Principles and Practices of Medical Astrology. Raman Publications. Bangalore.

**Department of Electronics and Instrumentation**

Course: **BE**  
Sub. Code: **EC6P7**

Branch: **EIE**

Semester: **VI**  
Credit: **2**

Subject: **MICROPROCESSOR AND MICROCONTROLLER LABORATORY**

**Pre-requisites:**

Digital Electronics and Number System Conversion

**List of Experiments:**

**EXPERIMENTS IN MICROPROCESSOR 8085:**

- 1) Write a ALP to perform basic arithmetic operation on two 8 bit numbers
- 2) Write a ALP to find the square of a given number using Look up Table Technique
- 3) Write a ALP to sort the given array of numbers in Ascending/Descending Order
- 4) Write a ALP to search for a given number and display the number of occurrences of the given number
- 5) INTERFACING USING 8085
  - a) Study the various modes of 8255 interfaced with 8085 microprocessor
  - b) Generation of Square, Triangular and Saw tooth waveform using DAC interfaced with 8085 microprocessor
  - c) Write a ALP to control the speed and direction of Stepper motor

**EXPERIMENTS IN MICROPROCESSOR 8086:**

- 1) Write a ALP to perform basic arithmetic operation on two 16 bit Numbers
- 2) Write a ALP to study the addressing modes in 8086

**EXPERIMENTS IN MICROCONTROLLER 8051:**

- 1) Write a microcontroller program to perform basic arithmetic operation on two 8 bit numbers
- 2) Study and analyze the interfacing of Seven Segment Display with Microcontroller 8051
- 3) Study and analyze the interfacing of Keyboard with Microcontroller 8051.
- 4) Study and analyze the interfacing of Traffic Light Control with Microcontroller 8051.
- 5) Study and analyze the interfacing of 16 x 2 LCD Display with Microcontroller 8051 using Keil  $\mu$ Vision.

**Department of Electronics and Instrumentation**

Course: **BE**

Branch: **EIE**

Semester: **VI**

Sub. Code: **EI6P8**

Credit: **2**

Subject: **SIMULATION LAB**  
(Using **PSPICE, MATLAB and ORCAD**)

**Experiments using PSPICE**

- 1) Verification of Rectifier Circuits (Half wave and Full wave rectifier)
- 2) Verification of Clippers and Clampers
- 3) Design and Verification of Class A and Push Pull Power Amplifier
- 4) Design and Verification of Voltage Regulators

**Experiments using ORCAD**

- 1) Design of Oscillators (RC, WeinBridge, Hartley, Colpitts)
- 2) Applications of Operational Amplifiers (Circuits for ADC, DAC and Instrumentation Amplifier)
- 3) Design of Multivibrator Circuits using 555 Timer (Astable, Monostable and Bistable)

**Experiments using MATLAB**

- 1) Design of FIR and IIR Filters
- 2) Design of AM and FM Modulation and Demodulation Techniques
- 3) Design of ASK and FSK Modulation and Demodulation Method

**Department of Electronics and Instrumentation**

Course: **BE**

Branch: **EIE**

Semester: **VI**

Sub. Code: **EI6P9**

Credit: **2**

**Subject: INDUSTRIAL AND PROCESS CONTROL LAB**

1. Operation of interacting and non-interacting systems
2. Responses of different order processes with and without transportation lag
3. Response of on-off controller
4. Response of P+I+D controller
5. Characteristics of control valve with and without positioner
6. Operation of on-off controlled thermal process
7. Closed loop response of flow control loop
8. Closed loop response of level control loop
9. Closed loop response of temperature control loop
10. Closed loop response of pressure control loop
11. Tuning of controllers
12. Study of complex control system (ratio / cascade / feed forward)



# **VII - SEMESTER**





**Department of Electronics and Instrumentation**

Course: **BE**  
Sub. Code: **EC7T1**

Branch: **EIE**

Semester: **VII**  
Credit : **3**

Subject: **VLSI DESIGN**  
(Common to EIE/ECE)

**Pre - requisite:** Electronic devices and circuits, Digital Electronics.

**Aim:** To introduce the technology and concepts of VLSI.

**Objectives :**

1. To introduce MOS theory / Manufacturing Technology.
2. To study inverter / counter logic / stick / machine diagram / sequential circuits.
3. To study address / memory / arithmetic circuits.
4. To introduce FPGA architecture / principles / system design.

**Outcome:**

1. Understand the principles of CMOS-VLSI technology.
2. Adequate knowledge about design issues involved at circuit, logic, layout, system level and to learn programmable logics.

**UNIT – I**

**INTRODUCTION TO VLSI AND MOS TRANSISTOR THEORY:** Evolution of IC Technologies: SSI, MSI, LSI, VLSI, ULSI, and GLSI. The Moore's Law.

**MOS THEORY:** The MOS as switch – nMOS and pMOS. CMOS logic and its features. The nMOS enhancement Transistor – Working and Characteristics. Threshold voltage and Body effect of MOS. MOS device design equations (First order effects).

**MOS INVERTERS:** The CMOS inverter Transfer characteristics, Noise margin. The nMOS and pseudo-nMOS inverter. The BiCMOS Inverter. The CMOS Transmission gate.

**UNIT – II**

**CMOS PROCESSING TECHNOLOGY AND LAYOUTS:** Silicon Semiconductor fabrication technology, Fabrication of nMOS and CMOS (Basic n-WELL process).

**LAYOUTS AND DESIGN RULES:** Layout based rules, Simple CMOS Stick Layout diagrams - Inverter, NAND/NOR gates and Multiplexer. Scaling: Constant Field, and Constant voltage.

**UNIT – III**

**MOS Circuit performance and CMOS Logic circuits:** Sheet Resistance definition, MOS device capacitances – model. Distributed RC effects. Switching characteristics - Rise time, Fall time, and Delay time. Stage ratio. Simple examples of Combinational and Sequential circuits using CMOS: NAND/ NOR gates, and Compound gates, Latches, and Registers.

**UNIT- IV**

**Sub System Design, and Testing:** General System Design–Design of ALU subsystems, Adder and Multipliers Memories – Static RAM, Control Logic Implementation using PLA's. Testing of VLSI circuits –Need for Testing, Fault models, and ATPG. Design for Testability (DFT)– Scan Based and Self-test approaches.

**UNIT – V**

**Programmable Logic's:** Basic ROM structures, PLAs, PALs, PLDs, Implementation of Traffic Light controller using PLD. FPGAs and CPLDs: XILINX and ALTERA series.

**TEXT BOOK:**

1. Neil Weste and Kamran Eshraghian "Principles of CMOS VLSI Design "- Addison Wesley, 1998.
2. Charles H Roth, Jr. "Digital Systems Design using VHDL"- Thomson Learning, 2001

**REFERENCE BOOKS:**

1. VLSI Design Principles- John P. Uyemura, John Wiley, 2002
2. E. Fabricious , Introduction to VLSI design, McGraw-Hill 1990
3. Wayne Wolf, Modern VLSI Design, Pearson Education 2003

**Department of Electronics and Instrumentation**

Course: **BE**  
Sub. Code: **EI7T2**

Branch: **EIE**

Semester: **VII**  
Credit : **3**

Subject: **EMBEDDED SYSTEMS**  
(Common to **EIE/ MECHATRONICS**)

**Prerequisite:** Microprocessor and Microcontroller, Basics of C programming.

**Aim**

To give an insight of Embedded Systems

**Objectives**

The course will enable the students to:

1. Get introduced to features that build an embedded system.
2. Learn about the various components within an embedded system.
3. Learn the techniques of interfacing between processors & peripheral device related to embedded processing
4. Do the efficient programs on any dedicated processor.

**Outcome**

The students should be able to:

1. Understand Basic building blocks of embedded systems
2. Interface various peripherals to processors
3. Program embedded systems
4. Use the basic concepts of systems programming like operating system, assembler compilers etc. and to understand the management task needed for developing embedded system.

**UNIT –I                    EMBEDDED COMPUTING**

Challenges of Embedded Systems – Embedded system design process. Embedded processors – 8051 Microcontroller, ARM processor – Architecture, Instruction sets and programming.

**UNIT -II                MEMORY AND INPUT / OUTPUT MANAGEMENT**

Programming Input and Output – Memory system mechanisms – Memory and I/O devices and interfacing – Interrupts handling.

**UNIT -III                PROCESSES AND OPERATING SYSTEMS**

Multiple tasks and processes – Context switching – Scheduling policies – Interprocess communication mechanisms – Performance issues.

**UNIT- IV                EMBEDDED SOFTWARE**

Programming embedded systems in assembly and C – Meeting real time constraints – Creating an Embedded Operating Systems - Multi-state systems and function sequences

**UNIT -V                EMBEDDED SYSTEM DEVELOPMENT**

Design issues and techniques –Using the Serial Interface - Case studies – Intruder Alarm Systems – Controlling a Mobile Robot.

**TEXT BOOKS**

1. Wayne Wolf, “Computers as Components: Principles of Embedded Computer System Design”, Elsevier, 2006.
2. Michael J. Pont, “Embedded C”, Pearson Education, 2007.

**REFERENCES**

1. Steve Heath, “Embedded System Design”, Elsevier, 2005.
2. Raj Kamal, “Embedded Systems Architecture, Programming and Design”, Second Edition.

## Department of Electronics and Instrumentation

Course: **BE**

Branch: **EIE**

Semester: **VII**

Sub. Code: **EI7T3**

Credit: **3**

Subject: **PRINCIPLES OF MANAGEMENT AND PROFESSIONAL ETHICS**  
(Common to EIE/ECE/EEE/ MECHATRONICS)

**Prerequisite:** Nil

### **Aim**

The students are expected to learn the basics of management functions and realize the ideal characteristics of a manager. The impetus of this subject is to make the students familiarize with the professional skills required to be an effective manager.

### **Objectives**

The course should enable the students to:

4. Knowledge on the principles of management is essential for all kinds of people in all kinds of organizations.
5. Have a clear understanding of the managerial functions like planning, organizing, staffing, leading and controlling.
6. To understand global business and diversity.
7. Students will also gain some basic knowledge on international aspect of management.
8. To understand the concepts of computer ethics in work environment.

### **Outcomes**

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

1. Helps to examine situations and to internalize the need for applying ethics principles, values to tackle with various situations.
2. Develop a responsible attitude towards the use of computer as well as the technology.
3. Able to envision the societal impact on the products / projects they develop in their career.
4. Understanding the code of ethics and standards of computer professionals.
5. Analyze the professional responsibility and empowering access to information in the work place.

### **UNIT- I INTRODUCTION TO MANAGEMENT**

Definition of Management, process of Management- Planning, Organizing, leading, Controlling Classical Approach-Contribution. and Limitation, Management Science Approach, Skills, Roles and Performance: Types of managers Managerial Skills,- Technical Skill, Analytical Skill Decision Making skill, Human Relation skill, Communication skill. Managerial Roles –Interpersonal Role, Informational Role, Decisional Role.

### **UNIT – II PLANNING FUNCTION**

Elements of Planning-Objectives, Action, Resource, Implementation. Managerial Decision Making: Types of Decision, Process of Decision Making, Decision Making-Certainty Condition, Uncertainty Condition, Selecting Alternative. Managing Information System; Need for Decision Support System, MIS and DSS Strategic Planning –Organizational Strategy, Business Portfolio Matrix.

### **UNIT –III ORGANIZING FUNCTION**

Organizational Structure- Job Design, Departmentation, Span of Control, Delegation of Authority, Decentralized authority, Chain of Command and Authority, Line and Staff concept Matrix organizational Design

### **UNIT –IV ENGINEERING ETHICS**

Senses of 'engineering ethics' – variety of moral issues – types of inquiry – moral dilemmas – moral autonomy – Kohlberg's theory – Gilligan's theory – consensus and controversy – professions and professionalism – professional ideas and virtues – theories about right action – self-interest – customs and religion – uses of ethical theories

### **UNIT – V ENGINEER'S RESPONSIBILITY FOR SAFETY**

Safety and risk – Assessment of safety and risk – Risk benefit analysis – Reducing risk – The three mile Island and Chernobyl case studies

### **TEXT BOOKS**

1. Mike Martin & Roland Schinzinger "Ethics in engineering" Mc Graw Hill 2009.
2. Govindarajan M, Natarajan. S. Senthil kumar V.S, "Engineering Ethics", Prentice Hall of India, 2004

### **REFERENCE BOOKS**

1. Charles D. Fleddermamm, "Engineering Ethics", Pearson Hall (2004)
2. Charles E. Haris, Michael S. Protchard & Michael J. Rabins, "Engineering Ethics- concepts and cases", Wadsworth Thompson Learning
3. Jhon R. Boartright, "Ethics and conduct of Business", Pearson Education (2003)
4. Edmund G. See Bauer & Robert L. Bany, "Fundamental of Ethics for Scientists and Engineering", Oxford University

## Department of Electronics and Instrumentation

Course: **BE**  
Sub. Code: **EI7T4**

Branch: **EIE**

Semester: **VII**  
Credit : **4**

Subject: **COMPUTER CONTROL OF PROCESSES**

**Prerequisite:** Control systems.

### **Aim**

To give an insight about computerized control in industries.

### **Objectives**

The course will enable the students to:

1. To study the analysis of discrete data system
2. To learn about the various digital control algorithm.
3. To study the techniques of DAS, DDC, AI and SCADA.
4. To learn about PLC and programming some basic applications.

### **Outcome**

The students should be able to:

1. Understand the analysis of discrete data system
2. Understand about the various digital control algorithm.
3. Learn the techniques of DAS, DDC, AI and SCADA.
4. Understand about programming of PLC.

### **UNIT-I ANALYSIS OF DISCRETE DATA SYSTEM**

State-space representation of discrete data systems – Selection of sampling process – Selection of sampling period – Review of z-transform – Pulse transfer function – Modified z-transform - Stability of discrete data system – Jury's stability test.

### **UNIT-II DESIGN OF DIGITAL CONTROLLER**

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

### **UNIT-III COMPUTER AS A CONTROLLER**

Basic building blocks of computer control system – Data acquisition systems – SCADA – Direct digital control – Introduction to AI and expert control system – Case study - Design of computerized multi loop controller.

### **UNIT-IV PROGRAMMABLE LOGIC CONTROLLER**

Evolution of PLC's – Components of PLC – Advantages over relay logic - PLC programming languages – Ladder diagram – Programming timers and counters – Design of PLC.

### **UNIT-V APPLICATIONS OF PLC**

Instructions in PLC – Program control instructions, math instructions, sequencer instructions – Use of PC as PLC – Application of PLC – Case study of bottle filling system.

### **TEXT BOOKS**

1. P.B. Deshpande, and R.H.Ash, 'Computer Process Control', ISA Publication, USA, 1995.
2. Petruzella, 'Programmable Controllers', McGraw Hill, 1989.

### **REFERENCE BOOKS**

1. C.M.Houpis, G.B.Lamont, 'Digital Control Systems Theory, Hardware and Software', International Student Edition, McGraw Hill Book Co., 1985.
2. G. Stephanopoulos, 'Chemical Process Control', Prentice Hall of India, New Delhi, 1990.
3. T.Hughes, 'Programmable Logic Controllers, 3<sup>rd</sup> Edition, ISA press.
4. Singh, 'Computer Aided Process Control', Prentice Hall of India, 2004.

**Department of Electronics and Instrumentation**

Course: **BE**  
Sub. Code: **EI7P7**

Branch: **EIE**

Semester: **VII**  
Credit :**2**

**Subject: COMPUTER CONTROL LAB  
PLC**

1. Logic gate operations, Timing operations, counter operations and math operation using PLC.
2. Control of battle filling system and sequential operation of motors using PLC.
3. Programming a PLC to demonstrate an operation of batch process.

**DESIGN PROJECT**

4. Design of instrumentation Amplifier.
5. Design of control valve.
6. Design of signal conditioning circuits for strain gauge and RTD.
7. Design of PID controller using operational amplifier.

**Department of Electronics and Instrumentation**

Course: **BE**  
Sub. Code: **EI7P8**

Branch: **EIE**

Semester: **VII**  
Credit : **2**

Subject: **VIRTUAL INSTRUMENTATION LAB**

**MATLAB**

1. Time responses of various system compensation, stability and analysis using MATLAB.
2. Simulation of complex control system using MATLAB.
3. Design of filters and resonant circuits.

**LAB VIEW**

4. Creating virtual instrumentation for simple applications.
5. Programming exercises for loop and charts.
6. Programming exercises for clusters and graphs.
7. Programming exercises on case and sequence structure, file input/output.
8. Data acquisition through virtual instrumentation.
9. Simulating reactor control using virtual instrumentation.
10. Real time temperature control using virtual instrumentation.
11. Real time sequential control of any batch process.

# **VIII - SEMESTER**





**Department of Electronics and Instrumentation**

Course: **BE**  
Sub. Code: **EI8T1**

Branch: **EIE**

Semester: **VIII**  
Credit : **3**

Subject: **ROBOTICS AND AUTOMATION**  
(Common to **EIE/ MECHATRONICS**)

**Prerequisite:** Basic Physics, Sensors and Transducers

**Aim**

To expose students to Robotics and its application in the field of Automation.

**Objectives**

The course will enable the students to:

1. Understand the various kinematics and inverse kinematics of robots.
2. Study the Euler, Lagrangian formulation of Robot dynamics.
3. Study the trajectory planning for robot.
4. Study the control of robots for some specific applications.

**Outcome**

At the end of the course the students will be able to

1. Explain forward and inverse kinematics of Robotics is learned by which of robotic arm shall be calculated.
2. Explain Dynamic behavior of Robots is learned by which Velocity kinematics is studied in detail.
3. Understand trajectory planning the path travelled by robotic arm from initial position to final position is planned.
4. Explain the Applications of Robotics in various industries are studied.

**UNIT-I**

Robots introduction - Asimov's laws of robotics -Basic components-Classification—Characteristics-Work volume, spatial resolution and repeatability, Coordinate system- Drives & Control systems –Actuators-Control loop, Feedback system.

**UNIT-II**

Transducers & Sensors-Tactile sensors-Proximity & Range sensors-Image Processing & Analysis-Image Data reduction-Feature extraction-Object Recognition

**UNIT-III**

End effectors – Wrist configuration, Pitch, Yaw, Roll – Types-Mechanical Grippers-Vacuum Cups-Magnetic Grippers -Robot/End effectors Interface-Software for industrial robots.

**UNIT-IV**

Robot motion analysis–Kinematics-Homogenous Transformations-Robot Dynamics Configuration of Robot controller

**UNIT-V**

Industrial Robots – Programming –welding painting-Assembly-Remote Controlled Robots for Nuclear, Thermal, 3and Chemical plants-Industrial Automation-Typical EGS of automated industries.

**Text Books**

1. Oran Koren, “Robotics for Engineers”, McGraw Hill, 1985. ISBN -0-07-100534-X
2. Mikell P. Groover, “Industrial Robots – Technology Programming & Applications” McGraw Hill Ltd., 2012. ISBN-0-07-100442-4
3. Deb.S.R.”Robotics Technology and Flexible Automation”, Tata McGraw Hill, 2010.

## Department of Electronics and Instrumentation

Course: **BE**

Branch: **EIE**

Semester: **VIII**

Sub. Code: **EI8T2**

Credit: **3**

### Subject: **BIOMEDICAL INSTRUMENTATION**

#### **Aim**

To make the student understand about the construction, working and operation of various biomedical instruments.

#### **Objectives**

The course will enable the students to:

1. Understand the Physiology of the heart, lung, blood circulation and respiration including different transducers used.
2. Learn about various sensing and measurement devices of electrical and non-electrical origin.
3. Understand modern methods of imaging techniques.
4. Study about medical assistance techniques and therapeutic equipments

#### **Outcome**

At the end of this course the students should be able to:

1. Know the basic concepts of Anatomy & Physiology
2. Have adequate knowledge about different types of Electrodes, Transducers and Amplifiers
3. Understand the important and modern methods of imaging techniques
4. Comprehend about the Human Assist Devices and Therapeutic Equipments

### **UNIT -I FUNDAMENTALS OF BIOMEDICAL ENGINEERING**

Cell and its structure – Resting and Action Potential – Nervous system and its fundamentals - Basic components of a biomedical system- Cardiovascular systems- Respiratory systems -Kidney and blood flow - Biomechanics of bone - Biomechanics of soft tissues - Basic mechanics of spinal column and limbs -Physiological signals and transducers - Transducers – selection criteria – Piezo electric, ultrasonic transducers - Temperature measurements - Fibre optic temperature sensors.

### **UNIT- II NON ELECTRICAL PARAMETERS MEASUREMENT AND DIAGNOSTIC PROCEDURES**

Measurement of blood pressure - Cardiac output - Heart rate - Heart sound - Pulmonary function measurements – spirometer – Photo Plethysmography, Body Plethysmography – Blood Gas analysers, pH of blood –measurement of blood pCO<sub>2</sub>, pO<sub>2</sub>, finger-tip oxymeter - ESR, GSR measurements.

### **UNIT -III ELECTRICAL PARAMETERS ACQUISITION AND ANALYSIS**

Electrodes – Limb electrodes –floating electrodes – pregelled disposable electrodes - Micro, needle and surface electrodes – Amplifiers, Preamplifiers, differential amplifiers, chopper amplifiers – Isolation amplifier - ECG – EEG – EMG – ERG – Lead systems and recording methods – Typical waveforms - Electrical safety in medical environment, shock hazards – leakage current-Instruments for checking safety parameters of biomedical equipments.

### **UNIT -IV IMAGING MODALITIES AND ANALYSIS**

Radio graphic and fluoroscopic techniques – Computer tomography – MRI – PET-SPECT-Ultrasonography – Endoscopy – Thermography –Different types of biotelemetry systems - Retinal Imaging - Imaging application in Biometric systems - Analysis of digital images

### **UNIT- V LIFE ASSISTING, THERAPEUTIC AND ROBOTIC DEVICES**

Pacemakers – Defibrillators – Ventilators – Nerve and muscle stimulators – Diathermy – Heart – Lung machine – Audio meters – Dialysers – Lithotripsy - ICCU patient monitoring system - Nano Robots - Robotic surgery – Advanced 3D surgical techniques- Orthopedic prostheses fixation.

#### **TEXT BOOKS:**

1. Leslie Cromwell, Biomedical Instrumentation and Measurement, Prentice hall of India, New Delhi, 2007.
2. M.Arumugam, 'Bio-Medical Instrumentation', Anuradha Agencies, 2003.
3. Khandpur R.S, Handbook of Biomedical Instrumentation, , Tata McGraw-Hill, New Delhi, 2 Edition, 2003.

#### **REFERENCES:**

1. John G. Webster, Medical Instrumentation Application and Design, John Wiley and sons, NewYork, 1998.
2. Duane Knudson, Fundamentals of Biomechanics, Springer, 2nd Edition, 2007.
3. Suh, Sang, Gurupur, Varadraj P., Tanik, Murat M., Health Care Systems, Technology and Techniques, Springer, 1st Edition, 2011.
4. Ed. Joseph D. Bronzino, The Biomedical Engineering Hand Book, Third Edition, Boca Raton, CRC Press LLC, 2006.
5. Joseph J.carr and John M. Brown, Introduction to Biomedical Equipment Technology, John Wiley and sons, New York, 4<sup>th</sup> Edition, 2012.

## ELECTIVE - I

### Department of Electronics and Instrumentation

Course: **BE**

Branch: **EIE**

Semester: **VII**

Sub. Code: **EI7E2**

Credit : **3**

Subject: **INSTRUMENTATION AND CONTROL IN PAPER INDUSTRIES**

**Prerequisite:** Process Control Instrumentation

#### **Aim**

To provide a window of applications of instrumentation and automation in processing industries to students with specialization in Instrumentation Engineering.

#### **Objectives**

To enable the students to

1. Have an in-depth understanding of the various unit operations in the industry
2. Find the alternative sensors and transducers for various measurements
3. Evolve the appropriate controls and schematics for specific applications

#### **Outcome**

At the end of this course the students should be able to:

1. Know the role of Instrumentation Engineer in such industries
2. Understand the importance of safety to plant and personnel
3. Economic and social implications of the industry

#### **UNIT -I**

Raw materials-pulping process – chemical recovery process – paper making process – converting.

#### **UNIT- II**

Measurements of basic weight – density – specific gravity – flow – level of liquids and solids – pressure – temperature – consistency – moisture – pH – oxidation – reduction potential – graphic displays and alarms

#### **UNIT -III**

Blow tank controls – digester liquor feedpump controls – brown stock wacher level control – stock chest level control – basic weight control – dry temperature control

#### **UNIT -IV**

Dissolving tank density control – white liquor classifier density control – white liquor flow control – condensate conductivity control

#### **UNIT- V**

Computer applications in pulping process control, liquid level control and input stock control

#### **References**

1. B.G. Liptak – Instrumentation in the Processing industries – Ghilton Book Co., 1973.
2. D.M. Considine – Handbook of applied Instrumentation.



**Department of Electronics and Instrumentation**

Course: **BE**  
Sub. Code: **EI7E4**

Branch: **EIE**

Semester: **VII**  
Credit : **3**

Subject: **VIRTUAL INSTRUMENTATION**

**Prerequisite:** Digital Electronics and C Programming..

**Aim**

To provide the students with LabVIEW software to suit the industrial applications.

**Objectives:**

1. To understand various methods of l o o p s a n d c h a r t s .
2. To study important methods of Data acquisition and control.
3. To understand the LabVIEW based advanced control system.

**Outcome:**

At the end of this course the students should be able to:

1. Know the basic concepts of LabVIEW.
2. Have adequate knowledge about different types of controls in LabVIEW.
3. Understand the methods of Data acquisition and control..
4. Design the LabVIEW based advanced control system

**UNIT- I INTRODUCTION**

Programming paradigms- Virtual Instrumentation- Definition to Virtual Instrumentation (VI)- LabVIEW software- LabVIEW basics- LabVIEW environment- Simple problems

**UNIT-II VI USING LABVIEW**

Creating, Editing and debugging a VI in LabVIEW- Creating a sub VI- Loops and charts-Case and sequence structures- File I/O- VI customization- Simple problems

**UNIT-III DATA ACQUISITION AND CONTROL IN VI**

Plug-in DAQ boards- Organization of the DAQ VI System- Performing analog input and analog output- Scanning multiple analog channels - Driving the digital I/Os - Buffered data acquisition-Simple problems

**UNIT- IV LABVIEW FOR ADVANCED SYSTEMS**

Bio-bench control and simulation using LabVIEW- Integrated design Environment for dynamic systems- LabVIEW based fuzzy logic and genetic algorithms

**UNIT- V LABVIEW AND AUTOMATION TECHNOLOGY**

Mathematics and simulation in LabVIEW- Commercial communication applications- Fourier transform analysis- Time frequency analysis of signals- Designing digital filters- Quality, Reliability and maintenance of LabVIEW programs

**Text Books**

1. Rahman, and Herbert Pichlik,, 'LabVIEW – Applications and Solutions', National Instruments Release, ISBN 0130964239
2. National Instruments LabVIEW Manual

**Reference Books**

1. Lisa K. Wells Jeffrey Travis, 'LabVIEW for Everyone', National Instruments Release, ISBN 013065096
2. 'Sensors and Transducer and LabVIEW', National Instruments Release, ISBN 0130811556

## ELECTIVE - II

### Department of Electronics and Instrumentation

Course: **BE**  
Sub. Code: **EI7EA**

Branch: **EIE**

Semester: **VII**  
Credit : **3**

Subject: **INSTRUMENTATION AND CONTROL IN PETROCHEMICAL INDUSTRIES**

**Aim:** To make the students to have a clear idea about petrochemical industries.

#### **Objective**

To enable the students to

1. Learn the complete operation of Petrochemical Industries.
2. Acquire basic understanding of reaction & control of this Industry.

#### **Outcome**

At the end of this course the students should be able to:

1. Deals with various equipments involved in the Petrochemical Industries.
2. Deals Distillation Column, Reactor, Heat exchangers, Evaporators.
3. Deals with performance of the pumps also.

#### **UNIT – I**

Instrumentation and control in distillation columns: Distillation equipment, variables and degrees of freedom, measurement and control of column pressure, liquid distillate, vapour distillate and inserts, control of feed in reboiler and reflux, cascade and feed forward controls.

#### **UNIT – II**

Instrumentation and control in chemical reactors: Temperature and pressure control in batch reactors. Instrumentation and control in dryers: Batch dryers and continuous dryers.

#### **UNIT – III**

Instrumentation and control in heat exchangers: Variables and degrees of freedom, liquid to liquid heat exchangers, steam heaters, condensers, reboilers and vaporisers, use of cascade and feed forward control

#### **UNIT – IV**

Instrumentation and control in evaporators: Types of evaporators, measurement and control of absolute pressure, density, conductivity, differential pressure and flow.

#### **UNIT – V**

Instrumentation and control in effluent and water treatment: Chemical oxidation, chemical reduction, neutralization, precipitation and biological control.

#### **Text Books**

1. Liptak B. G, Process Control, Third edition, Chilton Book Company, Pennsylvania, 1995. ISBN-0-7506-2254-7
2. Liptak B. G, Process Measurement and Analysis, Third edition, Chilton Book Company, Pennsylvania, 1995. ISBN-07506-2255-5
3. Shreve's chemical process industries Mc Graw Hill, Auckland, 1984

#### **References**

1. Considine D.M., 'Process / Industrial Instruments and Control Handbook', Fourth edition, McGraw Hill, Singapore, 1993. ISBN-0-07-012445-0

**Department of Electronics and Instrumentation**

Course: **BE**

Branch: **EIE**

Semester: **VII**

Sub. Code: **EI7EB**

Credit : **3**

**Subject: INSTRUMENTATION IN IRON AND STEEL INDUSTRIES**

**Aim**

To provide a window of applications of instrumentation and automation in processing industries to senior students with specialization in Instrumentation Engineering.

**Objectives**

To enable the students to

1. Have an in-depth understanding of the various unit operations in the industry
2. Find the appropriate sensors and transducers for various measurements
3. Evolve the appropriate controls and schematics for specific applications

**Outcome**

At the end of this course the students should be able to:

1. Know the role of Instrumentation Engineer in such industries
2. Understand the importance of safety to plant and personnel
3. Economic and social implications of the industry

**UNIT – I**

Flow diagram and description of the processes: Raw materials preparation, iron making, blast furnaces, stoves, raw steel making, basic oxygen furnace, electric furnace.

**UNIT – II**

Casting of steel: Primary rolling, cold rolling and finishing.

**UNIT – III**

Instrumentation: Measurement of level, pressure, density, temperature, flow weight, thickness and shape, graphic displays and alarms.

**UNIT – IV**

Control and systems: Blast furnace stove combustion control system, gas and water controls in BOF furnace. Sand casting old control.

**UNIT – V**

Computer applications: Model calculation and logging, rolling mill control, annealing process control Computer (center utilities dispatch computer).

**Text Books**

1. Tupkary R.H, Introduction to Modern Iron Making , Khanna Publishers, New Delhi, 1986 - II Edition
2. Tupkary R.H., Introduction to Modern Steel Making, Khanna Publishers, New Delhi,1989 – IV Edition.

**Reference Books**

1. Liptak B. G, Instrument Engineers Handbook, volume 2, Process Control, Third edition, CRC press, London, 1995
2. Considine D.M, Process / Industrial Instruments and Control Handbook, Fourth edition, McGraw Hill, Singapore, 1993 – ISBN-0-07-012445-0

## Department of Electronics and Instrumentation

Course: **BE**  
Sub. Code: **EI7EC**

Branch: **EIE**

Semester: **VII**  
Credit : **3**

Subject: **NEURAL NETWORKS AND FUZZY LOGIC CONTROL**

**Prerequisite:** It is highly recommended to have some knowledge on crisp set theory and be familiar with Matlab/Simulink.

### **Aim**

This course provides a way to understand the concepts of Artificial Intelligence, ANN , Genetic Algorithms and Fuzzy systems and its applications .

### **Objectives**

1. To expose the students to the concepts of feed forward neural networks.
2. To provide adequate knowledge about feedback neural networks.
3. To teach about the concept of fuzziness involved in various systems.
4. To provide adequate knowledge about fuzzy set theory.
5. To provide comprehensive knowledge of fuzzy logic control and adaptive fuzzy logic and to design the fuzzy control using genetic algorithm.
6. To provide adequate knowledge of application of fuzzy logic control to real time systems.

### **Outcome**

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

1. Develop through basic knowledge about analysis of learning systems in conjunction with feedback control systems
2. Acquire knowledge on the applications of Computer simulation of intelligent control systems.
3. Learn the usage of different types of algorithms.

### **UNIT – I**

Introduction to neural networks, different architectures of neural networks, Rosenblott's perceptrons, multi layer perceptrons, back propagation algorithm, Hopfield's networks, Kohonen's self organizing maps, adaptive resonance theory.

### **UNIT – II**

Neural networks for control systems: Schemes of neuro-control, identification and control of dynamical systems , case studies(Inverted Pendulum, Articulation Control)

### **UNIT – III**

Introduction to fuzzy logic: Fuzzy sets, fuzzy relations, fuzzy conditional statements, fuzzy rules, fuzzy learning algorithms.

### **UNIT – IV**

Fuzzy logic for control systems : Fuzzy logic controllers, fuzzification interface, knowledge/rule base, decision making logic, defuzzification interface, design of fuzzy logic controllers, case studies(Inverted Pendulum, Articulation Control)

### **UNIT – V**

Neuro-fuzzy and fuzzy-neural control systems: Adaptive fuzzy systems , optimizing the membership functions and the rule base of fuzzy logic controllers using neural networks, fuzzy transfer functions in neural networks.

### **Text Books**

1. Kosko, B, Neural Networks and Fuzzy Systems : A Dynamical Approach to Machine Intelligence, Prentice Hall, New Delhi , 1991.
2. Wasserman P.D, Neural Computing Theory & Practice ,Van Nortland Reinhold,1997.
3. J.Ross,Fuzzy Logic with Engineering Applications, 1997 – ISBN-0-07-144711-X

### **References`**

1. Jacek M. Zurada, 'Introduction to Artificial Neural Systems', Jaico Publication House,1995.



**Department of Electronics and Instrumentation**

Course: **BE**  
Sub. Code: **EI7ED**

Branch: **EIE**

Semester: **VII**  
Credit : **3**

**Subject: COMPUTER AIDED INSTRUMENTATION**

**Aim**

This course aims to familiarize students with the use of PC for simple control and interfacing applications.

**Objectives**

1. Know the Concepts of Computerized instruments.
2. Know the design techniques and programming
3. Know the interfacing concepts
4. To design microcontroller for different applications.

**Outcome**

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

1. Design microcontroller for different application
2. The interfacing concepts for computer and instruments

**UNIT -I**

Data Acquisition and conversion – introduction – signal conditioning of the inputs- single & multi channel DAS – data conversion – A/D & D/A converters – multiplexers – sample and hold circuits.

**UNIT- II**

Micro Controllers and PC based DAS – Introduction –8051 microcontroller – Programming in 8051 – application of 8051 – PC based instrumentation – I/P & O/P displays – analog displays and recorders-digital I/O displays – display multiplexing and zero suppression.

**UNIT -III**

Graph theoretical concepts for computer vision – Introduction – Basic definition – graph representation of two dimensional digital images – matching – graph grammars – control basic – optimizing controls – analog versus digital instrumentation –converters – telemetry systems – transmitters – (electronic and intelligent) – fibre optic transmission – digital recorders – recorders – tape recorders – speech synthesis – voice recognition.

**UNIT -IV**

Computerized ECG-EEG-EMG-CAT – processing of ultra sound images in medical diagnosis – introduction – ultra sound imaging systems – processing the B-mode image- examples of image processing B-mode images – perspectives.

**UNIT- V**

Three dimensional fast full body scanning – evaluation of hardware & software – mechanical design – measuring process – ranges of applications – data acquisition by confocal microscopy – image restoration – detection –segmentation – graph construction – interpretation – results –magnetic resonance imaging in medicine – basic magnetic resonance physics – images acquisition – Reconstruction – fast imaging methods.

**Reference Books:**

1. Bernal Jahne, Horst Han Backer peter Geibler, “Handbook of Computer Vision and Application” Academic press san Diego , London, Boston, network, Tokyo, Toronto, 1999.
2. R.B.Khandpur, “Handbook of Biomedical Instrumentation”, Prentice Hall of India, 2001.
3. Zang-Hee Cho etall, “Foundations of Medical Imaging”, IEEE Press, 2000.

## ELECTIVE- III

### Department of Electronics and Instrumentation

Course: **BE**  
Sub. Code: **EI8E1**

Branch: **EIE**

Semester: **VIII**  
Credit : **3**

Subject: **DIGITAL CONTROL SYSTEMS**

**Prerequisite:** Digital Electronics and Control Systems.

#### **Aim**

To make the students to have relevant knowledge for the industrial requirements.

#### **Objectives:**

1. To understand various techniques and methods of analysis which occur in the various regions of the spectrum.
2. To understand system response and stability.
3. To study various applications of digital control systems.

#### **Outcome:**

At the end of this course the students should be able to:

1. Know the basic concepts of converters.
2. Have adequate knowledge about different digital control algorithms.
3. Understand the important of digital control design in real time applications.

#### **UNIT -I SAMPLE THEORY AND CONVERTERS**

Review of Sample theory - Shannon's sampling theorems - Sampled Data Control system, Digital to Analog conversion – Analog to Digital conversion, Ramp type A/D, Dual slope A/D, Successive approximation A/D. - A/D & D/A converters - Review of Z and Inverse Z transform - Reconstruction - Zero Order Hold.

#### **UNIT -II SYSTEM RESPONSE**

Response of sampled data systems to step and ramp inputs - Steady state errors - Z domain equivalent - Stability studies - Bilinear transformation - Jury's stability test.

#### **UNIT -III FUNCTION REALISATION**

State sequences for sampled data systems - solutions - Pulse transformation function by direct, cascade and parallel realization - Sampled data model for continuous system - Controllability and observability.

#### **UNIT- IV DIGITAL PROCESS CONTROL DESIGN**

Digital PID algorithm - Positional and incremental forms - Dead-beat algorithm-Ringing - Dahlin's and Kalman's algorithms - Implementation of control algorithms using microprocessors - General description of microcontrollers - Digital quantization.

#### **UNIT- V APPLICATIONS**

System models, control algorithms and their implementation for micro processor based position and temperature control systems - Operational features of stepper motors - Drive circuits - Interfacing of stepper motor to microprocessors.

#### **Text Book**

1. Gopal.M: "Digital Control Engineering", Wiley Eastern Publications, 1988

#### **Reference Books**

1. Ahson, S.I., "Microprocessors with Applications in Process Control", TMH, 1984.
2. Nagrath, J.J, and Gopal, M, "Control System Engineering", Wiley & Sons. 1985
3. Constantine Houppis, and Garry Lamont., "Discrete Control systems" - Theory, Hardware and Software, McGraw Hill, 1985.



**Department of Electronics and Instrumentation**

Course: **BE**  
Sub. Code: **EI8E3**

Branch: **EIE**

Semester: **VIII**  
Credit : **3**

Subject: **AIRCRAFT INSTRUMENTATION**

**Prerequisite:** Measurements and Instruments.

**Aim**

The aim of this course is to understand the concepts and to familiarize the student with the principle of operation, capabilities and limitations of various Aircraft instruments so that he will be able to operate these instruments effectively.

**Objectives**

The course should enable the students to:

1. Understand the Instrument display and Cockpit layout.
2. Understand the Operation of Flight instruments.
3. Study the characteristics of Gyroscopic Instruments.

**Outcome**

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

1. Develop basic knowledge on the behavior and the characteristics of various indicators in aircraft.
2. Acquire knowledge on the aircraft computer systems
3. Learn the usage of power plant instruments in an aircraft..

**UNIT- I INTRODUCTION**

Classification of aircraft- instrumentation -instrument displays, panels, cock- pit layout.

**UNIT-II FLIGHT INSTRUMENTATION**

Static & pitot pressure source -altimeter -airspeed indicator -machmeter -maximum safe speed indicator- accelerometer.

**UNIT-III GYROSCOPIC INSTRUMENTS**

Gyroscopic theory -directional gyro indicator arti ficial horizon -turn and slip indicator.

**UNIT-IV AIRCRAFT COMPUTER SYSTEMS**

Terrestrial magnetism, aircraft magnetism, Direct reading magnetic components- Compass errors gyro magnetic compass.

**UNIT- V POWER PLANT INSTRUMENTS**

Fuel flow -Fuel quantity measurement, exhaust gas temperature measurement and pressure measurement.

**Text Books**

1. Pallett, E.B.J : " Aircraft Instruments -Principles and applications", Pitman and sons, 1981.
2. Aircraft Instrumentation and systems, S.Nagabhushana, L.K.Sudha. I.K. International Publishing House Pvt., Ltd., S-25, Green Park Extensions, Uphaar Cinema Market, New Delhi – 110016( India), Info@ik international .com, ISBN : 978-93-80578-35-4

**Department of Electronics and Instrumentation**

Course: **BE**  
Sub. Code: **EI8E4**

Branch: **EIE**

Semester: **VIII**  
Credit : **3**

Subject: **DIGITAL INSTRUMENTATION**

**Aim:** To make the students to have depth knowledge in Digital instruments.

**Objective:**

1. To understand about digital methods of measurements.
2. To understand about recording and signal processing instruments.

**Outcome:**

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

1. Good knowledge in digital method of measurements.
2. Good knowledge in recording and signal processing instruments

**UNIT -I**

**INTRODUCTION**

Digital codes - memory devices - basic building blocks - gates, FF and counters – discrete data handling - sampling - sampling theorem - aliasing errors -reconstruction - extrapolation - synchronous and asynchronous sampling.

**UNIT -II**

**DIGITAL METHODS OF MEASUREMENTS**

Review of A/D, D/A techniques –F/V and V/F conversion techniques -digital voltmeters and multimeters-automation and accuracy of digital voltmeters and multimeters - digital phase meters -digital tachometers -digital frequency, period and time measurements-Low frequency measurements -automatic time and frequency scaling - sources of error -noise -inherent errors in digital meters, Hidden errors in conventional ac measurements- RMS detector in digital multimeters- mathematical aspects of RMS.

**UNIT-III**

**DIGITAL DISPLAY & RECORDING DEVICES**

Digital storage oscilloscopes -digital printers and plotters -CDROMS -digital magnetic tapes, dot matrix and LCD display CROs, Colour Monitor, Digital Signal Analyser, and Digital Data Acquisition.

**UNIT- IV**

**SIGNAL ANALYSIS**

Amplifiers, filters, transmitter, receiver, wireless base and mobile station test sets, noise figure meters, RF network analyser, and high frequency signal sources.

**UNIT- V**

**CURRENT TRENDS IN DIGITAL INSTRUMENTATION**

Introduction to special function add on cards -resistance card -input and output cards -counter, test, and time of card and Digital Equipment construction with modular designing; interfacing to microprocessor, micro-controllers and computers. Computer aided software engineering tools (CASE) -use of CASE tools in design and development of automated measuring systems - interfacing IEEE cards -intelligent and programmable instruments using computers.

**TEXT BOOKS**

1. D.Patranabis, Principles of Electronic Instrumentation ,PH,2008
2. Bouwens, A.J. "Digital instrumentation" McGraw Hill 1984
3. John Lenk, D. "Handbook of Microcomputer Based Instrumentation and Control"; PH, 1984.

**REFERENCES**

1. Doebelin, Measurement System, Application & Design, IV Ed, McGraw Hill, 1990.
2. Albert.D.Helfrick, William D.Cooper, Modern Electronic Instrumentation and Measurement Techniques 3.Oliver&Cage , Electronic measurements & Instrumentation, McGraw Hill,1987
- 4.T.S.Rathore, Digital Measurement Techniques, Narosa Publishing House

## **ELECTIVE – IV**

### **Department of Electronics and Instrumentation**

Course: **BE**  
Sub. Code: **EI8EU**

Branch: **EIE**

Semester: **VIII**  
Credit : **3**

Subject: **AUTOMOTIVE INSTRUMENTATION**

**Prerequisite:** Basic measurement and Instruments

#### **Aim**

To provide an overview of the concepts involved Automotive Instrumentation.

#### **Objectives**

At the end of the course, the student will be able

1. To know about the Automotive.
2. To know about the warning Instruments and Control Switches.

#### **Outcome**

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

1. Develop through basic knowledge about Automotive.
2. Acquire knowledge on the applications of Automotive Instrumentation.
3. Learn the usage of modern Automotive Techniques.

#### **UNIT-I AUTOMOBILE PANEL METERS AND SENSOR DESIGN**

Ergonomics- Panel Meters- Controllers- Sensor for Fuel Level in Tank, Engine Cooling-Water Temperature Sensors Design, Engine Oil Pressure Sensor Design, Speed Sensor, Vehicle Speed Sensor Design, Air Pressure Sensors, Engine Oil Temperature Sensor.

#### **UNIT- II INDICATING INSTRUMENTATION DESIGN**

Moving Coil Instrument Design, Moving Iron Instruments, Balancing Coil Indicator Design, Ammeter and voltmeter- Odometer and Taximeter Design. Design of Alphanumeric Display for Board Instruments

#### **UNIT- III WARNING AND ALARM INSTRUMENTS**

Brake Actuation Warning System. Traficators, Flash System, Oil Pressure Warning System, Engine Overheat Warning System, Air Pressure Warning System, Speed Warning System. Door Lock Indicators, Gear Neutral Indicator, Horn Design, Permanent Magnet Horn, Air Horn, Music Horns

#### **UNIT-IV DASH BOARD AMENITIES**

Car Radio Stereo, Courtesy Lamp, Timepiece, Cigar Lamp, Car Fan, Windshield Wiper, Window Washer, Instrument Wiring System and Electromagnetic Interference Suppression, Wiring Circuits for Instruments, Electronic Instruments. Dash Board Illumination

#### **UNIT- V SWITCHES AND CONTROLS**

Horn Switches, Dipper Switches, Pull and Push Switches, Flush Switches, Toggle Switches, Limit Switches, Ignition Key, Ignition Lock, Relay and Solenoid. Non-contact Switches

#### **Text Books**

1. Walter E, Billiet and Leslie .F, Goings, 'Automotive Electric Systems', American Technical Society, Chicago, 1971.
2. Judge.A.W, 'Modern Electric Equipments for Automobiles', Chapman and Hall, London, 1975.

#### **Reference Books**

1. Sonde.B.S., 'Transducers and Display System', Tata McGraw Hill Publishing Co. Ltd., New Delhi, 1977.
2. W.F. Walter, 'Electronic Measurements', Macmillan Press Ltd., London.
3. E.Dushin, 'Basic Metrology and Electrical Measurements', MIR Publishers, Moscow, 1989

## Department of Electronics and Instrumentation

Course: **BE**  
Sub. Code: **EI8EV**

Branch: **EIE**

Semester: **VIII**  
Credit : **3**

Subject: **MEMS AND NANO TECHNOLOGY**

**Prerequisite:** VLSI

### **Aim**

This course is offered to students to gain basic knowledge on MEMS (Micro electro Mechanical System) and various fabrication techniques. This enables them to design, analyze, fabricate and test the MEMS based components.

### **Objectives**

1. Introduction to MEMS and micro fabrication
2. To study the essential material properties
3. To study various sensing and transduction technique
4. To know various fabrication and machining process of MEMS
5. To know about the polymer and optical MEMS

### **Outcomes**

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

1. Develop through basic knowledge about MEMS and fabrication techniques.
2. Acquire knowledge on the applications and testing of MEMS.
3. Learn the usage of MEMS Techniques.

### **UNIT – I INTRODUCTION**

Historical background - development of microelectronics - evolution of micro sensors – mems - emergence of micro machines - electronic materials – processing – introduction - electronic materials - their deposition - pattern transfer - etching electronic materials – doping semiconductors

### **UNIT – II MEMS MATERIALS AND PROCESSING**

Overview, metals – semiconductors – ceramic - polymeric - composite materials - Silicon micro machining – bulk- etch-stop techniques - dry etching - buried oxide process - silicon fusion bonding - anodic bonding

### **UNIT – III SILICON MICRO MACHINING**

Surface - sacrificial layer technology - material systems in sacrificial layer technology - plasma etching - combined IC technology - anisotropic wet etching

### **UNIT – IV MICRO SENSORS**

Thermal sensors - radiation sensors - mechanical sensors – magnetic sensors - biochemical sensors - flow sensors - SAW devices – saw devices development - history, transducers in SAW devices - acoustic waves

### **UNIT – V NANOTECHNOLOGY**

Scientific revolutions - types of nanotechnology – nanomachines - nano materials – atomic structure surfaces - dimensional space - molecular nanotechnology - nanopowders – nanomaterials - preparation and applications

### **TEXT BOOKS**

1. Simon Sze, Semiconductor Sensors, John Wiley & Sons, Inc. New Delhi., 1994
2. Elwenspoek, M. and Wiegerink, R., Mechanical Microsensors, Springer-Verlag Berlin Heidelberg, 2001

### **REFERENCES**

1. Poole, P. and Frank J. Owens., Introduction to Nano Technology., John Wiley & Sons., INC., 2003
2. Bharat Bhushan, Hand Book of Nano technology, Springer Publication., 1st edition, 2004
3. Julian W. Gardner and Vijay K. Varadan, Microsensors, MemS, And Smart Devices, John Wiley & sons Ltd., New Delhi, 2001
4. Massood Tabib-azar, microactuators - electrical, magnetic, thermal, optical, mechanical, chemical and smart structures, kluwer academic publishers, New York, 1997





**Department of Electronics and Instrumentation**

Course: **BE**  
Sub. Code: **EI8EX**

Branch: **EIE**

Semester: **VIII**  
Credit : **3**

**Subject: ADVANCED DIGITAL PROCESS CONTROL**

**Aim:**

To establish theoretical foundation of Advanced Digital Process Control for the process industry.

**Objectives**

To know about

1. Process modeling and Simulation of Process Dynamics.
2. Methods to identify system parameters.
3. Kalman filter and Adaptive Predictive Control.

**Outcome**

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

1. Knowledge about digital controllers.
2. Functions of PLC in industries.

**UNIT- I INTRODUCTION TO COMPUTER PROCESS CONTROL**

Review of sample theory-Response of sample data system to step and ramp input- steady state error-Z domain equipment- Linear transformation- Pulse transfer function-Modified Ztransform-Sample data model for continuous system bilinear transformation- Jury's Stability Test

**UNIT-II DESIGN OF DIGITAL CONTROLLER**

Digital PID –Deadbeat- Dahlin's algorithms-Kalman's algorithms-Implementation of control algorithm using microprocessor- Position and Velocity forms-Dead time compensation and smith predictor algorithm

**UNIT- III PROGRAMMABLE LOGIC CONTROLLER**

Introduction- Overview of PLC systems- I/O Modules- Power supplies General PLC programming procedures- Programming ON-OFF outputs- Auxiliary commands and functions- Creating ladder diagrams from process control descriptions- PLC basic functions- Register basics-Timer and counter functions

**UNIT- IV PLC INTERMEDIATE FUNCTIONS**

Arithmetic functions- Comparison function-SKIP and MCR function-Data move system-PLC - advanced intermediate function- Utilizing digital bits- Sequencer functions- Matrix functions- PLC advanced function- Alternate programming language- Analog PLC operation- Networking of PLC- PLC installation- Design of interlocks and alarms using PLC- Three way traffic light problem- Annunciator problem-Trouble shooting and Maintenance

**UNIT-V APPLICATIONS**

Implementation of microprocessor based position and temperature control systems- Operational features of stepping motor- Drive circuits- Interfacing of stepper motor to computer- Interfacing of computer with temperature flow, level process

**TEXT BOOKS:**

1. Gopal M., 'Digital Control and State Variable Methods', Tata McGraw Hill Pub., 2003. ISBN 0070483027
2. HughesT.A., Programmable Logic Controllers, ISA Press, 2000 ISBN 1556177291

**REFERENCE BOOKS**

- 1 Despande P.B. and Ash R.H., Computer Process Control, ISA Publication, USA,1988 ISBN 155617005X
- 2 Houpis C.H, Lamont G.B., Digital Control Systems - Theory, Hardware, Software, McGraw Hill Book Co., 1991, ISBN 0070305005
3. Kuo.B, Digital Control Systems, Oxford University Press, 1991 ISBN 0030128846
4. John Webb, W, Ronald Reis, A.,: "Programmable logic controllers principles and applications", 3/e, Prentice hall Inc., New Jersey, 1995.

**Subject: ADAPTIVE CONTROL**

**Prerequisite:** Control System.

**Aim**

To provide the knowledge about various advanced control techniques and their importance in industry.

**Objectives:**

1. To understand various techniques and methods of adaptive schemes and problems.
2. To study important methods of analysis of PID tuning.
3. To understand the important Practical Issues and Implementation.

**Outcome:**

At the end of this course the students should be able to:

1. Know the basic concepts of adaptive control schemes.
2. Have adequate knowledge about different types of tuning methods.
3. Understand the Practical Issues and Implementation of these controllers in industries.

**UNIT -I INTRODUCTION**

Linear Feedback- Effect of Process variations: Non-linear Actuators-Flow and speed variation – Variations in Disturbance Characteristics - Adaptive schemes- The Adaptive control Problem- applications

**UNIT- II MODEL REFERENCE ADAPTIVE SYSTEMS**

Introduction-MIT Rule- Determination of the Adaptation Gain-Lyapunov Theory-design of MRAC using Lyapunov Theory-Bounded input, bounded output Stability- Applications to Adaptive control- Output feedback-Relations between MRAC and STR- Nonlinear Systems

**UNIT -III AUTO TUNING**

Introduction- PID Control Auto tuning techniques-Transient Response methods: Ziegler-Nichols Step response method-Characterization of step response- Method based on relay feedback: Ziegler- Nichols closed loop method-Method of Describing function- relay oscillations

**UNIT- IV GAIN SCHEDULING**

Introduction-The principle- Design of gain scheduling Controllers- nonlinear Transformations- Applications of Gain scheduling: Ship steering-pH Control-Combustion control-Fuel Air control in car Engine-Flight control systems

**UNIT -V PRACTICAL ISSUES AND IMPLEMENTATION**

Introduction-Controller Implementation-Controller Design-Solving the Diophantine equation- Estimator Implementation-Square Root Algorithms-Interaction of Estimation and control- prototype algorithms- Operational issues

**Text Books**

1. Karl J. Astrom, Biorn Wittenmark, "Adaptive Control" Pearson Education Asia, Second Edition, 2001.
2. Gang Tao, "Adaptive Control design and Analysis", John Wiley & Sons, New Jersey, 2003

**Reference Book**

1. Gang Tao, Adaptive Control Design And Analysis, John Wiley & Sons, 2003.