Syllabus for B.Tech(Instrumentation & Control Engineering) upto Fourth Year

Revised Syllabus of B.Tech ICE (for the students who were admitted in Academic Session 2010-2011)

Third Semester

A. Theory							
Sl. No.	CODE	Paper	Contact Hours/Week				Credit
			L	T	P	Total	
1	M(CS)301	Numerical Methods	2	1	0	3	2
2	M-302	Mathematics – III	3	1	0	4	4
3	EC(EE)301	Analog Electronic Circuits	3	0	0	3	3
4	EC(EE)302	Digital Electronic Circuits	3	0	0	3	3
5	EE- 301	Electric Circuit Theory	3	1	0	4	4
6	EE- 302	Electric field	3	1	0	4	4
Total Theory						21	20
B. Practical							
7	M(CS)391	Numerical Methods Lab	0	0	2	2	1
8	EC(EE)391	Analog & Digital Electronic Circuits Lab	0	0	3	3	2
9	EE- 391	Electric Circuit Lab	0	0	3	3	2
11	HU 381	Technical report Writing & language laboratory practice	0	0	3	3	2
Total Practical						11	7
Total of Semester						32	27

Fourth Semester

4th Semester

Theory:

Sl. No.	CODE	Paper	Contacts periods Per weeks			Total Contact Hrs	Credits
			L	T	P		
1	HU-401	Values and Ethics in Profession	3	0	0	3	3
2	PH (EE)-401	Physics-II	3	1	0	4	4
3	EI (IC)-401	Sensors & Transducers	3	1	0	4	3
4	CH-401	Basic Environmental Engineering & Biology	3	0	0	3	3
5	IC-401	Basic Control theory	3	1	0	4	4
6	EE-402	Electrical & Electronic measurement	3	1	0	4	3
						22	20

Practical / Sessional:

Sl. No.	CODE	Paper	Contacts periods Per weeks			Total Contact Hrs	Credits
			L	T	P		
1	PH (EE)-491	Physics-II Lab	0	0	3	3	2
2	IC -491	Basic Control theory Lab	0	0	3	3	2
3	EI (IC)-491	Sensors & Transducers Lab	0	0	3	3	2
3	EE-492	Electrical & Electronic measurement Lab	0	0	3	3	2
		Total of Practical / Sessional				12	8
TOTAL OF SEMESTER:						34	28

Syllabus for B.Tech(Instrumentation & Control Engineering) upto Fourth Year

Revised Syllabus of B.Tech ICE (for the students who were admitted in Academic Session 2010-2011)

5th Semester

Theory:

Sl. No.	CODE	Paper	Contacts periods Per weeks			Total Contact Hrs	Credits
			L	T	P		
1	HU-501	Economics for Engineers	3	0	0	3	3
2	IC-501	Industrial Instrumentation-I	3	1	0	4	4
3	IC-502	CONTROL SYSTEM	3	1	0	4	4
4	IC 503	Electric Machine	3	1	0	4	4
5	IC-504	A. Data structure & algorithm B. Computer Organization C. Micro Processor & Micro controller	3	0	0	3	3
						18	18

Practical / Sessional:

Sl. No.	CODE	Paper	Contacts periods Per weeks			Total Contact Hrs	Credits
			L	T	P		
1	IC-591	Industrial Instrumentation –I	0	0	3	3	2
2	IC-592	CONTROL SYSTEM	0	0	3	3	2
3	IC-593	Electric Machine	0	0	3	3	2
4	IC-594	A. Data structure & algorithm B. Computer Organization C. Micro Processor & Microcontroller	0	0	3	3	2
5	IC581	Seminar	0	0	3	3	2
Total of Practical / Sessional						15	10
TOTAL OF SEMESTER:						33	28

IC 6th Semester

Theory:

Sl. No.	CODE	Paper	Contact periods Per week			Total Contact Hrs	Credits
			L	T	P		
1	HU-601	Principle of Management	2	0	0	2	2
2	IC-601	Process Control	3	1	0	4	4
3	IC-602	Advanced Control system	3	1	0	4	4
4	IC-603	Industrial Instrumentation-II	3	1	0	4	4
5	IC-604	a. Software Engineering b. Data Base Management System c. Object Oriented Programming d. Operating System	3	0	0	3	3
6	IC-605	a. Digital Signal Processing b. Communication Engineering. c. Power Plant Instrumentation	3	0		3	3
						20	20

Practical / Sessional:

Sl. No.	CODE	Paper	Contact periods Per week			Total Contact Hrs	Credits
			L	T	P		
1	IC-691	Process Control	0	0	3	3	2
2	IC-692	Advanced Control system	0	0	3	3	2
3	IC-693	Industrial Instrumentation-II	0	0	3	3	2
4	IC-694	a. Software Engineering b. Data Base Management System c. Object Oriented Programming d. Operating System	0	0	3	3	2
		Total of Practical / Sessional				12	8
TOTAL OF SEMESTER:						32	28

Syllabus for B.Tech(Instrumentation & Control Engineering) upto Fourth Year

Revised Syllabus of B.Tech ICE (for the students who were admitted in Academic Session 2010-2011)

Industrial training conducted after 6th Semester.

7th Semester

Theory:

Sl. No.	CODE	Paper	Contacts periods Per weeks			Total Contact Hrs	Credits
			L	T	P		
1	IC-701	Logic & Distributed Control System	4	0	0	4	4
2	IC-702	Data Communication & Telemetry	3	1	0	4	4
3	IC-703	(a)Advanced process Control (b)Power Plant Instrumentation © Biomedical Instrumentation	3	0	0	3	3
4	IC-704	(a) Power Electronics (b) Micro Electronics & VLSI Technology © Advanced Sensors	3	0	0	3	3
5	FE IC-705	(a)System programming and operating system (b) Embedded system © AI & soft computing	3	0	0	3	3
						17	17

Practical / Sessional:

Sl. No.	CODE	Paper	Contacts periods Per weeks			Total Contact Hrs	Credits
			L	T	P		
1	IC-781	Seminar on industrial training	0	0	3	3	2
2	IC-791	Logic & Distributed Control System	0	0	3	3	2
3	IC 791	(a)System programming and operating system (b) Embedded system © AI & soft computing (d) Operation research	0	0	3	3	2
4	IC-792	Instrumentation & Control system design	0	0	3	3	2
5	IC-782	Project-I	0	0	3	3	2
		Total of Practical / Sessional				15	10
TOTAL OF SEMESTER:			18	02	09	32	27

PC= Professional core

PE=Professional Elective

FE=Free Elective

Syllabus for B.Tech(Instrumentation & Control Engineering) upto Fourth Year

Revised Syllabus of B.Tech ICE (for the students who were admitted in Academic Session 2010-2011)

8th Semester

Theory:

Sl. No.	CODE	Paper	Contacts periods Per weeks			Total Contact Hrs	Credits
			L	T	P		
1	HU-801A	Organizational Behaviour	2	0	0	2	2
2	IC-801	(a) Analytical Instrumentation (b) Non destructive testing & ultrasonic Instrumentation (c) Optoelectronics & Laser Based instrumentation.	3	0	0	3	3
3	IC-802	(a)Digital Image Processing (b) Computer Networks © Mobile Computing	3	0	0	3	3
		TOTAL				08	08

Practical / Sessional:

Sl. No.	CODE	Paper	Contacts periods Per weeks			Total Contact Hrs	Credits
			L	T	P		
1	IC-881	Project-II	0	0	12	12	6
2	IC-882	Instrumentaion & Control system design-II	0	0	6	6	4
3	IC-883	Grand Viva					3
		Total of Practical / Sessional				18	13
		TOTAL SEMESTER				26	21

Third Semester
Theory

NUMERICAL METHODS
Code: M (CS) 301

Contacts: 2L **Credits: 2**

Approximation in numerical computation: Truncation and rounding errors, Fixed and floating-point arithmetic, Propagation of errors. (4)

Interpolation: Newton forward & backward interpolation, Lagrange's and Newton's divided difference Interpolation. (5)

Numerical integration: Trapezoidal rule, Simpson's 1/3 rule, Weddle's rule. (3)

Numerical solution of a system of linear equations:
Gauss elimination method, Matrix inversion, LU Factorization method, Gauss-Jacobi and Gauss-Seidel iterative methods. (6)

Numerical solution of Algebraic equation:
Bisection method, Secant method, Regula-Falsi method, Newton-Raphson method. (4)

Numerical solution of ordinary differential equation: Taylor's series method, Euler's method, Runge-Kutta methods, Predictor-Corrector methods and Finite Difference method. (6)

Text Books:

1. C.Xavier: C Language and Numerical Methods.
2. Dutta & Jana: Introductory Numerical Analysis.
3. J.B.Scarborough: Numerical Mathematical Analysis.
4. Jain, Iyengar ,& Jain: Numerical Methods (Problems and Solution).

References:

1. Balagurusamy: Numerical Methods, Scitech.
2. Baburam: Numerical Methods, Pearson Education.
3. N. Dutta: Computer Programming & Numerical Analysis, Universities Press.
4. SoumenGuha& Rajesh Srivastava: Numerical Methods, OUP.
5. Srimanta Pal: Numerical Methods, OUP.

MATHEMATICS

Code: M 302

Contacts: 3L +1T **Credits: 4**

Note 1: The whole syllabus has been divided into five modules.

Note 2: Structure of the question paper

There will be three groups in the question paper. In Group A, there will be one set of multiple choice type questions spreading the entire syllabus from which 10 questions (each carrying one mark) are to be answered. From Group B, three questions (each carrying 5 marks) are to be answered out of a set of questions covering all the three modules. Three questions (each carrying 15 marks) are to be answered from Group C. Each question of Group C will have

two or three parts covering not more than two modules. Sufficient questions should to be set covering the whole syllabus for alternatives.

Module I

Fourier series:

Introduction, Periodic functions, Even and odd functions, Special waveforms, Eulers formulae for Fouriers coefficients, Dirichlet's conditions and sum of the Fourier series, Half range Fourier series, Parseval's identity (Statement only).

Fourier Transform: Fourier Transform and its properties, Inverse Fourier Transform (Statement only), Fourier Transform of derivatives (Statement only), Convolution theorem (Statement only). Related problems.

(8L)

Module II

Calculus of Complex variable:

Functions, Limit and Continuity, Analytic functions, Cauchy-Riemann equations

(Statement only) and related problems, Analytic continuation, Complex integration and Cauchy's theorem (Statement only), Cauchy's integral formula (Statement only), Taylors and Laurent series, Zeros of an analytic function, Poles, Essential singularities, Residue theorem (Statement only) and its application to evaluation of definite integrals (Elementary cases only), Introduction to Conformal Mapping. (12L)

Module III

Probability:

Axiomatic definition of probability, Conditional probability, Independent events, Related problems, Bayes theorem (Statement only) & its application. One dimensional random variable, Probability distributions-discrete and continuous, Expectation, Binomial, Poisson, Uniform, Exponential and Normal distribution, Problems on Binomial, Poisson and Normal distribution only. (12L)

Module IV

Partial Differential Equations:

Solution of one dimensional wave equation, One dimensional heat-conduction equation, Laplace equation in two dimension by the methods of

1: Separation of variables 2: Integral Transforms (Laplace and Fourier Transforms)

(6L)

Module V

Series solution of Ordinary Differential equation:

Introduction, validity of series solution of an ordinary differential equation, general method to solve equation of the type: $P_o y'' + P_1 y' + P_2 y = 0$, related problems, Bessel's equation, properties of Bessel's function, Recurrence formula for Bessel's function of first kind, Legendre's equation, Legendre function; Recurrence formula for Legendre function ($P_n(x)$); Orthogonality relation. (10L)

Text Books:

1. Brown J.W and Churchill R.V: Complex Variables and Applications, McGraw-Hill.

2. Das N.G.: Statistical Methods, TMH.
3. Grewal B S: Higher Engineering Mathematics, Khanna Publishers.
4. James G.: Advanced Modern Engineering Mathematics, Pearson Education.
5. Lipschutz S., and Lipson M.L.: Probability (Schaum's Outline Series), TMH.

References:

1. Bhamra K. S.: Partial Differential Equations: An introductory treatment with applications, PHI
2. Dutta Debashis: Textbook of Engineering Mathematics, New Age International Publishers.
3. Kreyzig E.: Advanced Engineering Mathematics, John Wiley and Sons.
4. Potter M.C, Goldberg J.L and Aboufadel E.F.: Advanced Engineering Mathematics, OUP.
5. Ramana B.V.: Higher Engineering Mathematics, TMH.

ANALOG ELECTRONIC CIRCUITS
EC (EE)-301

Credit: 3 **Contact: 3L**

Module	Content	Hour
1	**Filters & Regulators:** Capacitor filters, π-section filter, ripple factor, series and shunt voltage regulator, percentage regulation, Concept of SMPS.	4
2	**Transistor biasing & stability:** Q point, Self Bias-CE, Compensation techniques, h-model of Transistor, Expression of voltage gain, current gain, input & output impedance, Trans-resistance & Trans-conductance, Emitter follower circuits, High frequency model of Transistor.	5
3	**Transistor amplifier:** RC coupled amplifier, Function of all components, Equivalent circuit, derivation of voltage gain, Current gain, Input impedance & output impedance, Frequency response characteristics, Lower & upper half frequencies, Bandwidth, Concept of Wide band amplifier.	5
4	**Feed back amplifier & Oscillators:** Concept of Feed back, Negative & Positive feedback, Voltage/Current, Series/Shunt feedback, Berkhausen criterion, Colpit , Hartley's, Phase shift, Wien bridge, & Crystal oscillators.	4
5	**Operational amplifier:** Ideal OPAMP, Differential amplifier, Constant current source (Current mirror etc), Level shifter, CMRR, Open & closed loop circuits, importance of feedback loop (positive & negative), inverting & non-inverting amplifiers, Voltage follower/Buffer circuits.	5
6	**Application of Operational amplifiers:** Adder, Integrator & Differentiator, Comparator, Schmitt Trigger, Instrumentation Amplifier, Log & Antilog amplifier, Trans-conductance multiplier, Precision rectifier, Voltage to current & Current to voltage converter.	5
7	**Power amplifier:** Class A, B, AB, C, Conversion efficiency, Tuned amplifier.	4
8	**Multivibrator:** Monostable, Bistablemultivibrator, Monostable&Astable operation using 555 timer.	2
9	**Special function circuits:** VCO & PLL	2

Text Books:

1. Microelectronic Circuits, Sedra& Smith, Oxford University Press.
2. Integrated Electronics, Milman&Halkias, McGraw Hill Company.
3. Electronic devices & Circuits, Balbir Kumar &Shail B. Jain, PHI.
4. Op-amps and Linear IC's, R.A. Gayakwad, PHI.

Reference Books:

1. Microelectronic Circuit- Analysis & Design, Rashid, Cenage Learning.

2. Electronic Circuits: Discrete & Integrated, 3rd Edition, Schilling &Belove, McGraw Hill Company.
3. Electronic principles, 6th Edition, Malvino, McGraw Hill Company.
4. Operational Amplifier & Linear IC's, Bell, Oxford University Press.
5. 2000 Solved Problems in Electronics, Jimmie J. Cathey, McGraw Hill Inc.
6. Electronic Devices -System & Application, RobertDiffenderfer, Cengage Learning.
7. Op- Amps & Linear Integrated Circuits, Ravi Raj Dudeja& Mohan Dudeja, Umesh Publication.

DIGITAL ELECTRONICS CIRCUITS
EC (EE)-302

Credit: 3 **Contact: 3L**

Module	Content	Hour
1	**Data and number system:** Binary, Octal and Hexadecimal representation and their conversion, BCD, ASCII, EBDIC, Gray codes and their conversion, Signed binary numbers representation with 1's and 2's complement methods, Binary arithmetic.	5
2	**Boolean algebra:** Various logic gates and their truth tables and circuits, Representation in SOP and POS forms, Minimization of logic expressions by algebraic method, K-map method.	5
3	**Combinational circuits:** Adder and sub tractor circuit, Circuit of Encoder, Decoder, Comparator, Multiplexer, De-Multiplexer and parity Generator.	5
4	**Memory systems:** RAM, ROM, EPROM, EEROM	4
5	**Sequential circuits:** Basic memory elements, S-R, J-K, D, and T Flipflop, various types of Registers, Counters & their design, Irregular counter, State table & State transition diagram, Sequential circuit design methodology.	6
6	**Different types of A/D and D/A conversion techniques.**	4
7	**Logic families:** TTL, ECL, MOS & CMOS, their operation and specification.	5

Text Books:

1. Digital Principles & Application, 5th Edition, Leach &Malvino, McGraw Hill Company.
2. Digital Fundamental, 8th Edition, Floyd & Jain. Pearson Education.
3. Fundamental of Digital Circuits, A. Anand Kumar, PHI.

Reference Books:

1. Digital Logic Design, Morries Mano, PHI.
2. Digital Integrated Electronics, H. Taub& D. Shilling, McGraw Hill Company.
3. Digital Electronics, James W. Bignell& Robert Donovan, Thomson Delman Learning.
4. Fundamental of logic Design, Charles H. Roth, Thomson Delman Learning.

ELECTRIC CIRCUIT THEORY
EE-301

Credit: 4 **Contact: 3L+1T**

Module	Content	Hour
1	**Introduction:** Continuous & Discrete, Fixed & Time varying, Linear and Nonlinear, Lumped and Distributed, Passive and Active networks and systems. Independent & Dependent sources, Step, Ramp, Impulse, Sinusoidal, Square, Saw tooth signals.	3
2	**Coupled circuits:** Magnetic coupling, Polarity of coils, Polarity of induced voltage, Concept of Self and Mutual inductance, Coefficient of coupling, Modeling of coupled circuits, Solution of problems.	3

3	**Laplace transforms:** Impulse, Step & Sinusoidal response of RL, RC, and RLC circuits. Transient analysis of different electrical circuits with and without initial conditions. Concept of Convolution theorem and its application. Solution of Problems with DC & AC sources.	8
4	**Fourier method of waveform analysis:** Fourier series and Fourier Transform (in continuous domain only). Application in circuit analysis, Solution of Problems	8
5	**Network equations**: Formulation of network equations, Source transformation, Loop variable analysis, Node variable analysis. Network theorem: Superposition, Thevenin's, Norton's & Maximum power transfer theorem. Millman's theorem and its application in three phase unbalanced circuit analysis. Solution of Problems with DC & AC sources.	6
6	**Graph theory and Networks equations:** Concept of Tree, Branch, Tree link, Incidence matrix, Tie-set matrix and loop currents, Cut set matrix and node pair potentials. Duality, Solution of Problems	4
7	**Two port networks analysis:** Open circuit Impedance & Short circuit Admittance parameter, Transmission parameters, Hybrid parameters and their inter relations. Driving point impedance & Admittance. Solution of Problems	4
8	**Filter Circuits:** Analysis and synthesis of Low pass, High pass, Band pass, Band reject, All pass filters (first and second order only) using operational amplifier. Solution of Problems	4

Text Books:

1. Networks and Systems, D. Roy Chowdhury, New Age International Publishers
2. Network Analysis and Synthesis, C.L. Wadhwa, New Age International Publishers
3. Circuit and Networks: Analysis and synthesis, A. Sudhakar& S.S. Palli
   4th edition. Tata McGraw Hill Education Pvt. Ltd.
4. Circuit theory, Dr. AbhijitChakrabarty, DhanpatRai& Co Pvt. Ltd.

Reference Books:

1. Network Analysis, M.E. Valkenburg, Pearson Education .
2. Fundamental of Electric circuit theory, D. Chattopadhay& P.C. Rakshit, S. Chand.
3. Engineering Circuit Analysis, W.H. Hyat, J.E. Kemmerly& S.M. Durbin, TheMcGraw Hill Company.
4. Electric Circuit, M. Nahvi& J.A. Edminister, Schum's outline series, The McGraw Hill Company.
5. Electric Circuit Analysis, S. Sivanagaraju, G. Kishor, C.Srinivasa Rao, Cengage Learning
6. Fundamental of Electric Circuits, Charles K. Alexander, Mathew. N.O. Sadiu, Tata McGraw Hill Educaton.
7. Engineering Circuit Analysis, W.H. Hayt, J.E. Kemmerly, S.M. Durbin, The McGraw Hill Companies
8. Introduction to Electric Circuits, Richard C. Dorf, James A. Svoboda, Wiley India Edition.
9. Electric Circuits, Syed A. Nasar, Schaum's solved problem series, Tata McGraw Hill Publishing Company Limited.

FIELD THEORY
EE-302

Credit: 4 **Contact: 3L+1T**

Module	Content	Hour
1	**Introduction:** Co-ordinate systems and transformation, Cartesian coordinates, Circular cylindrical coordinates, Spherical coordinates & their transformation. Differential length, area and volume in different coordinate systems. Solution of problems	3
2	**Introduction to Vector calculus:** DEL operator, Gradient of a scalar, Divergence of a vector & Divergence theorem, Curl of a vector & Strokes theorem, Laplacian of a scalar, Classification of vector fields, Helmholtz's theorem. Solution of problems	3

3	**Electrostatic field:** Coulomb's law, field intensity, Gauss's law, Electric potential and Potential gradient, Relation between E and V, an Electric dipole and flux lines. Energy density in electrostatic field. Boundary conditions: Dielectric-dielectric, Conductor –dielectric, Conductor-free space. Poisson's and Laplace's equation, General procedure for solving Poisson's and Laplace's equation. Solution of problems	8
4	**Magneto static fields:** Biot- savart law, Ampere's circuit law, Magnetic flux density, Magnetic static and Vector potential, Forces due to magnetic field, Magnetic torque and moments, Magnetisation in material, Magnetic boundary condition, Inductor and Inductances, Magnetic energy, Force on magnetic material. Solution of problems	8
5	**Electromagnetic fields:** Faraday's law, Transformer and motional emf,Displacement current,Maxwell's equations,Time varying Potential,Time harmonic fields. Solution of problems	5
6	**Electromagnetic wave propagation:** Wave equation, Wave propagation in lossy dielectric, Plane waves in loss less dielectric, Plane wave in free space, Plane wave in good conductor, Skin effect, Skin depth, Power &Poynting vector, Reflection of a plane wave at normal incidence, reflection of a plane wave at oblique incidence, Polarisation. Solution of problems	6
7	**Transmission line:** Concept of lump & distributed parameters, Line parameters, Transmission line equation & solutions, Physical significance of solutions, Propagation constants, Characteristic impedance, Wavelength, Velocity of propagation. Solution of problems	4

Text Books:

1. Elements of Electromagnetic, Mathew N.O. Sadiku, 4th edition, Oxford university press.
2. Engineering Electromagnetic, W.H. Hyat& J.A. Buck, 7th Edition, TMH
3. Theory and problems of Electromagnetic, Edminister, 2nd Edition, TMH
4. Electromagnetic field theory fundamentals, Guru &Hizroglu, 2nd edition, Cambridge University Press.

Reference Books:

1. Electromagnetic with application, Krause, 5th Edition, TMH.
2. Elements of Engineering Electromagnetic, N.N. Rao, 6th Edition, Pearson Education.

Practical
NUMERICAL METHODS LABORATORY
Code: M (CS) 391

Credits: 1 **Contact:2**

1. Assignments on Newton forward & backward, Lagrange's interpolation.
2. Assignments on numerical integration using Trapezoidal rule, Simpson's 1/3 rule, Weddle's rule.
3. Assignments on numerical solution of a system of linear equations using Gauss elimination, Matrix inversion, Gauss-Jacobi, and Gauss-Seidel iterations.
4. Assignments on numerical solution of Algebraic Equation by Bisection, Secant, Regular-falsi and Newton Raphson methods.
5. Assignments on ordinary differential equation: Taylor series, Euler's, Runga-Kutta and Finite difference methods.
6. Introduction to Software Packages: Matlab /Scilab / Labview / Mathematica.

ANALOG & DIGITAL ELECTRONIC CIRCUIT LABORATORY
EC (EE)-391

Credit: 2 **Contact: 3**

1. Study of Ripple and Regulation characteristics of full wave rectifier with and without capacitor filter.
2. Study of Zener diode as voltage regulator.
3. Construction of two stage R-C coupled amplifier & study of its gain and Bandwith.
4. Study of class A, C & Push pull amplifier.
5. Realisation V-I & I-V converter using Operational Amplifier.
6. Study of timer circuit using NE 555 and configuration of Monostable and AstableMultivibrator.
7. Study of DAC & ADC
8. Realisation of basic gates using Universal logic gates.
9. Realisation of RS-JK & D filpflop using logic gates.
10. Design of Combinational circuit for BCD to decimal conversion to drive 7-segment display using Multiplexer.
11. Realisation of Synchronous Up/Down counter.
12. Construction of simple Decoder & Multiplexer circuits using logic gates.
13. Construction of adder circuit using Shift register & Full adder.

ELECTRIC CIRCUIT THEORY LABORATORY
EE-391

Credit: 2 **Contact: 3**

1. Transient response of R-L and R-C network: simulation with PSPICE /Hardware
2. Transient response of R-L-C series and parallel circuit: Simulation with PSPICE/ Hardware
3. Determination of Impedance (Z) and Admittance (Y) parameter of two port network: Simulation / Hardware.
4. Frequency response of LP and HP filters: Simulation / Hardware.
5. Frequency response of BP and BR filters: Simulation /Hardware.
6. Generation of Periodic, Exponential, Sinusoidal, Damped Sinusoidal, Step, Impulse, Ramp signal using MATLAB in both discrete and analog form.
7. Determination of Laplace transform and Inverse Laplace transform using MATLAB.
8. Amplitude and Phase spectrum analysis of different signals using MATLAB.
9. Verification of Network theorem using SPICE

TECHNICAL REPORT WRITING & LANGUAGE LABORATORY PRACTICE
CODE: HU 381

CREDIT: 2 **CONTACT: 1L+2P**

Guidelines for Course Execution:

Objectives of this Course: This course has been designed:

1. **To inculcate a sense of confidence in the students.**
2. **To help them become good communicators both socially and professionally.**
3. **To assist them to enhance their power of Technical Communication.**

Detailed Course Outlines:

A. ***Technical Report Writing*** : 2L+6P

1. Report Types (Organizational / Commercial / Business / Project)
2. Report Format & Organization of Writing Materials
3. Report Writing (Practice Sessions & Workshops)

B. ***Language Laboratory Practice***

I. Introductory Lecture to help the students get a clear idea of Technical Communication & the need of Language Laboratory
Practice Sessions 2L
2. Conversation Practice Sessions: (To be done as real life interactions) 2L+4P
a) Training the students by using Language Lab Device/Recommended Texts/cassettes /cd's to get their Listening Skill & Speaking Skill honed
b) Introducing Role Play & honing over all Communicative Competence
3. Group Discussion Sessions: 2L+6P
a) Teaching Strategies of Group Discussion
b) Introducing Different Models & Topics of Group Discussion
c) Exploring Live /Recorded GD Sessions for mending students' attitude/approach & for taking remedial measure
Interview Sessions; 2L+6P

- ***a) Training students to face Job Interviews confidently and successfully***
- ***b) Arranging Mock Interviews and Practice Sessions for integrating Listening Skill with Speaking Skill in a formal situation for effective communication***

4. Presentation: 2L+6P

- ***a) Teaching Presentation as a skill***
- ***b) Strategies and Standard Practices of Individual /Group Presentation***
- ***c) Media & Means of Presentation: OHP/POWER POINT/ Other Audio-Visual Aids***

5. Competitive Examination: 2L+2P

- ***a) Making the students aware of Provincial /National/International Competitive Examinations***
- ***b) Strategies/Tactics for success in Competitive Examinations***
- ***c) SWOT Analysis and its Application in fixing Target***

Books – Recommended:

NiraKonar: English Language Laboratory: A Comprehensive Manual
PHI Learning, 2011
D. Sudharani: Advanced Manual for Communication Laboratories & Technical Report Writing
Pearson Education (W.B. edition), 2011

References:

Adrian Duff et. al. (ed.): Cambridge Skills for Fluency
A) Speaking (Levels 1-4 Audio Cassettes/Handbooks)
B) Listening (Levels 1-4 Audio Cassettes/Handbooks)
Cambridge University Press 1998
Mark Hancock: English Pronunciation in Use
4 Audio Cassettes/CD'S OUP 2004

Fourth Semester
Theory

VALUES & ETHICS IN PROFESSION

HU-401
Contracts:3L
Credits- 3
Science, Technology and Engineering as knowledge and as Social and Professional Activities

Effects of Technological Growth:

Rapid Technological growth and depletion of resources, Reports of the Club of Rome. Limits of growth: sustainable development
Energy Crisis: Renewable Energy Resources
Environmental degradation and pollution. Eco-friendly Technologies. Environmental Regulations, Environmental Ethics
Appropriate Technology Movement of Schumacher; later developments
Technology and developing notions. Problems of Technology transfer, Technology assessment impact analysis.
Human Operator in Engineering projects and industries. Problems of man, machine, interaction, Impact of assembly line and automation. Human centered Technology.

Ethics of Profession:

Engineering profession: Ethical issues in Engineering practice, Conflicts between business demands and professional ideals. Social and ethical responsibilities of Technologists. Codes of professional ethics. Whistle blowing and beyond, Case studies.

Profession and Human Values:

Values Crisis in contemporary society
Nature of values: Value Spectrum of a good life
Psychological values: Integrated personality; mental health
Societal values: The modern search for a good society, justice, democracy, secularism, rule of law, values in Indian Constitution.
Aesthetic values: Perception and enjoyment of beauty, simplicity, clarity
Moral and ethical values: Nature of moral judgements; canons of ethics; ethics of virtue; ethics of duty; ethics of responsibility.

Books:

1. Stephen H Unger, Controlling Technology: Ethics and the Responsible Engineers, John Wiley & Sons, New York 1994 (2nd Ed)
2. Deborah Johnson, Ethical Issues in Engineering, Prentice Hall, Englewood Cliffs, New Jersey 1991.
3. A N Tripathi, Human values in the Engineering Profession, Monograph published by IIM, Calcutta 1996.

Physics-II
PH (EE)-401
Contacts : 3L + 1T
Credits : 4

Topic	No of periods
Module-I	
Quantum mechanics: • Generalized co-ordinates, Lagrange's equation of motion and Lagrangian, generalized force potential, moment and energy. Hamilton's Equation of motion and Hamiltonian. Properties of Hamilton and Hamilton's equation of motion.	6

• Concept of probability and probability density, operator, Commutator, Formulation of quantum mechanics and Basic postulates, Operator correspondence, Time dependent Schrödinger's equation, formulation of time independent Schrödinger's equation by method of separation of variables, Physical interpretation of wave function Ψ(normalization and probability interpretation), Expectation values, Application of Schrödinger equation-Particle in an infinite square well potential (1-D and 3-D potential well), Discussion on degenerate levels.	10

Module-II

Statistical mechanics: • Concept of energy levels and energy states. Microstates, Macrostates and thermodynamic probability, equilibrium macrostate. MB, FD, BE statistics (no deduction necessary), fermions, bosons (definitions in terms of spin, examples), physical significance and application, classical limits of quantum statistics. Fermi distribution at zero and non –zero temperature.	4

Module-III

Dielectric Properties: • Dielectric Material: Concept of Polarization, the relation between D, E and P, Polarizability, Electronic, Ionic, Orientation & Space charge polarization, behavior of Dielectric under alternating field, Dielectric losses.	3
The Magnetic properties: • Magnetization M, relation between B, H & M. Bohr megneton, Diamagnetism-Larmor frequency & susceptibility, Curie law, Weiss molecular field theory & Curie-Weiss law, Hysteresis loss, Antiferromagnetism, Ferromagnetism & Ferrites (analitative).	4

Module-IV

Crystal structure • Crystal structure- Bravais lattice, Miller indices • Crystal diffraction (qualitative), Bragg's law and reciprocal lattice,Brillouin zone. (Qualitative description) • Free electron theory of metal – calculation of Fermi energy, density of states. • Band theory of solids- Bloch theorem, Kronig Penny model. • Electronic conduction in solids-Drude's theory, Boltzmann equation, Wiedemann Frantz law. • Semiconductor-Band structure, concept of electron and holes, Fermi level, density of states.	1 2 2 3 3 3

Text Books:

1. Perspectives of Modern Physics: A. Baiser
2. Modern Physics and Quantum Mechanics E.E. Anderson
2.Refresher course in B.Sc. Physics (Vol. III): C.L. Arora
3.Fundamentlas of Physics (Vol. III): Haliday, Resnick&Krane
4.Engineering Physics: R.K. Kar
5.Classical Mechanics: a) A.K. Roychaudhuri
b) R.G. Takwal& P.S. Puranic
6. Quantum Mechanics: a) Eisberg&Resnic
b) A.K. Ghatak& S. Lokanathan
c) S.N. Ghoshal
7.Statistical Mechanics and Thermal Physics: a) Sears and Salinger
b) AvijitLahiri
c) Evelyn Guha
8.SolidSate Physics: a) A.J. Dekker

b) C. Kittel
c) Aschroft&Mermin
d) S.O. Pillai

SENSORS & TRANSDUCERS

EI (IC)-401 Credit-3 3L+1T

Module-I

Definition, principle of sensing & transduction , classification	1
Mechanical and Electromechanical sensor	1
• Resistive (potentiometric type): Forms, material, resolution, accuracy, sensitivity.	2
• Strain gauge: Theory, type, materials, design consideration, sensitivity, gauge factor, variation with temperature, adhesive, rosettes.	2
• Inductive sensor: common types- Reluctance change type, Mutual inductance change type, transformer action type, Magnetostrictive type, brief discussion with respect to material, construction and input output variable, Ferromagnetic plunger type, short analysis.	3
• LVDT: Construction, material, output input relationship, I/O curve, discussion.	2
• Proximity sensor.	1

Module-II

• Capacitive sensors: variable distance-parallel plate type, variable area- parallel plate, serrated plate/teeth type and cylindrical type, variable dielectric constant type, calculation of sensitivity.	3
• Stretched diaphragm type: microphone, response characteristics.	2
• Piezoelectric element: piezoelectric effect, charge and voltage co-efficient, crystal model, materials, natural & synthetic type, their comparison, force & stress sensing, ultrasonic sensors.	3

Module-III

Thermal sensors:	
• Material expansion type: solid, liquid, gas & vapor	2
• Resistance change type: RTD materials, tip sensitive & stem sensitive type, Thermister material, shape, ranges and accuracy specification.	3
• Thermoemf sensor: types, thermoelectric power, general consideration,	1
• Junction semiconductor type IC and PTAT type.	2
• Radiation sensors: types, characteristics and comparison.	2
• Pyroelectric type	1

Module-IV

Magnetic sensors:	
• Sensor based on Villari effect for assessment of force, torque, proximity, Wiedemann effect for yoke coil sensors, Thomson effect, Hall effect, and Hall drive, performance characteristics.	4
• Radiation sensors: LDR, Photovoltaic cells, photodiodes, photo emissive cell-types, materials, construction, response.	2
• Geiger counters, Scintillation detectors.	2

Introduction to smart sensors	1

Text books:

1. Sensor & transducers, D. Patranabis, 2nd edition, PHI
2. Instrument transducers, H.K.P. Neubert, Oxford University press.
3. Measurement systems: application & design, E.A.Doebelin, McGraw Hill.

CH401: Basic Environmental Engineering & Elementary Biology
Contacts : 3L
Credits : 3

General

Basic ideas of environment, basic concepts, man, society & environment, their interrelationship.

1L

Mathematics of population growth and associated problems, Importance of population study in environmental engineering, definition of resource, types of resource, renewable, non-renewable, potentially renewable, effect of excessive use vis-à-vis population growth, Sustainable Development.

2L

Materials balance: Steady state conservation system, steady state system with non conservative pollutants, step function. 1L

Environmental degradation: Natural environmental Hazards like Flood, earthquake, Landslide-causes, effects and control/management; Anthropogenic degradation like Acid rain-cause, effects and control. Nature and scope of Environmental Science and Engineering.

2L

Ecology

Elements of ecology: System, open system, closed system, definition of ecology, species, population, community, definition of ecosystem- components types and function. 1L

Structure and function of the following ecosystem: Forest ecosystem, Grassland ecosystem, Desert ecosystem, Aquatic ecosystems, Mangrove ecosystem (special reference to Sundar ban); Food chain [definition and one example of each food chain], Food web. 2L

Biogeochemical Cycle- definition, significance, flow chart of different cycles with only elementary reaction [Oxygen, carbon, Nitrogen, Phosphate, Sulphur]. 1L

Biodiversity- types, importance, Endemic species, Biodiversity Hot-spot, Threats to biodiversity, Conservation of biodiversity. 2L

Air pollution and control

Atmospheric Composition: Troposphere, Stratosphere, Mesosphere, Thermosphere, Tropopause and Mesopause. 1L

Energy balance: Conductive and Convective heat transfer, radiation heat transfer, simple global temperature model [Earth as a black body, earth as albedo], Problems. 1L

Green house effects: Definition, impact of greenhouse gases on the global climate and consequently on sea water level, agriculture and marine food.Global warming and its consequence, Control of Global warming. Earth's heat budget. 1L

Lapse rate: Ambient lapse rate Adiabatic lapse rate, atmospheric stability, temperature inversion (radiation inversion). 2L

Atmospheric dispersion: Maximum mixing depth, ventilation coefficient, effective stack height, smokestack plumes and Gaussian plume model. 2L

Definition of pollutants and contaminants, Primary and secondary pollutants: emission standard, criteria pollutant.

Sources and effect of different air pollutants- Suspended particulate matter, oxides of carbon, oxides of nitrogen, oxides of sulphur, particulate, PAN. 2L

Smog, Photochemical smog and London smog.

Depletion Ozone layer: CFC, destruction of ozone layer by CFC, impact of other green house gases, effect of ozone modification. 1L

Standards and control measures: Industrial, commercial and residential air quality standard, control measure (ESP. cyclone separator, bag house, catalytic converter, scrubber (ventury), Statement with brief reference). 1L

Water Pollution and Control

Hydrosphere, Hydrological cycle and Natural water.

Pollutants of water, their origin and effects: Oxygen demanding wastes, pathogens, nutrients, Salts, thermal application, heavy metals, pesticides, volatile organic compounds. 2L

River/Lake/ground water pollution: River: DO, 5 day BOD test, Seeded BOD test, BOD reaction rate constants, Effect of oxygen demanding wastes on river[deoxygenation, reaeration], COD, Oil, Greases, pH. 2L

Lake: Eutrophication [Definition, source and effect]. 1L

Ground water: Aquifers, hydraulic gradient, ground water flow (Definition only) 1L

Standard and control: Waste water standard [BOD, COD, Oil, Grease],

Water Treatment system [coagulation and flocculation, sedimentation and filtration, disinfection, hardness and alkalinity, softening]

Waste water treatment system, primary and secondary treatments [Trickling filters, rotating biological contractor, Activated sludge, sludge treatment, oxidation ponds] tertiary treatment definition.

2L

Water pollution due to the toxic elements and their biochemical effects: Lead, Mercury, Cadmium, and Arsenic

1L

Land Pollution

Lithosphere; Internal structure of earth, rock and soil 1L

Solid Waste: Municipal, industrial, commercial, agricultural, domestic, pathological and hazardous solid wastes; Recovery and disposal method- Open dumping, Land filling, incineration, composting, recycling.

Solid waste management and control (hazardous and biomedical waste). 2L

Noise Pollution

Definition of noise, effect of noise pollution, noise classification [Transport noise, occupational noise, neighbourhood noise] 1L

Definition of noise frequency, noise pressure, noise intensity, noise threshold limit value, equivalent noise level, $L_{10}(18\text{hr Index})$, Ld_n.

Noise pollution control. 1L

Environmental Management:

Environmental impact assessment, Environmental Audit, Environmental laws and protection act of India, Different international environmental treaty/ agreement/ protocol. 2L

References/Books

1. Masters, G. M., "Introduction to Environmental Engineering and Science", Prentice-Hall of India Pvt. Ltd., 1991.
2. De, A. K., "Environmental Chemistry", New Age International.

BASIC CONTROL THEORY

IC-401 Credit 4 3L+1T

Topic	No of periods
Module-I	
Introduction to control system:	
• Concept of feedback and automatic control, effect of feedback, objective of control system, definition of linear and nonlinear system. Elementary concept of sensitiveness & robustness.	2
• Types of control system: Servomechanism and regulator, examples of feedback control system	1
Mathematical modeling of dynamical system:	1

• Electrical analogy of spring-mass-dashpot and other systems.	1
• Transfer function concept, pole and zero of transfer function,	2
• Block diagram algebra,	2
• Signal flow graph, Mason's gain formula	
Control system component:	1
• Potentiometer, Synchros, Resolver, Position encoder,	1
• DC & AC Techo-generator, actuators.	
• Block diagram level description of feedback control systems for position control. Speed control of DC motor, temperature control, liquid level control, voltage control of alternator.	3

Module-II

Time domain analysis:	
• Step and impulse response of first-order and second -order system	2
• Time domain analysis of a standard closed loop second-order system, concept of undamped natural frequency, damping, overshoot, rise time, settling time.	1
• Dependence of time domain performance parameters on natural frequency and damping ratio.	2
• Effects of pole & zeros on transient response, stability of linear system by pole location.	1
• Routh -Hurwitz criteria	3
Error analysis:	
• Steady state error in control system due to step, ramp and parabolic input, concept of error and time constants.	2

Module-III

Stability analysis:	
• Root locus technique, construction of root loci of for simple systems, effect of gain on the movement of poles and zeros.	4
Frequency domain analysis of linear systems:	
• Bode plots, gain margins and phase margins, determination of margins in Bode plots. Concept of resonance frequency of peak magnification.	4
• Polar plots	1
• Nyquist criteria, measure of relative stability,	2
• Nichol's chart, M-circle and M-Contours in Nichol	1

Module-IV

Control system performance measure:	
• Improvement of system performance through compensation, Lead, Lag & Lead Lag compensation.	2
• P, PI, PD, PID control.	2

Numerical problems to be solved

Text Books:

1. Modern Control Engineering, K. Ogata, 4th Edition, Pearson Education.
2. Control System Engineering, I.J. Nagrath& M. Gopal, New Age International Publication.
3. Control system Engineering, D. Roy Choudhury, PHI
4. Automatic Control system, B.C. Kuo, PHI

Reference Books:

1. Control Engineering, Theory & Practice, M.N. Bandyopadhyaya, , PHI

2. Control system Engineering, S. Norman Nishe, 3rd Edition, John Wiely and Sons.
3. Modern control system, R.C. Dorf& R.H. Bishop, 11th Edition, Pearson Education.
4. Control system design, Graham C Goodwin, Stefan F.Graebe, Mario E. Salgado, PHI
5. Modern control technology components & systems, Christopher T. Kilian, 3rd Edition, Cengage learning.

ELECTRICAL & ELECTRONIC MEASUREMENT

EE-402 Credit: 3 3L+1T

Topic	No of periods
Module-I	
Measurements: • Method of measurement, Measurement system, Classification of instruments, Definition of accuracy, Precision, Resolution, Speed of response, Error in measurement, Classification of errors, loading effect due to shunt and series connected instruments.	3
Analog meters: • General features, Construction, Principle of operation and torque equation of Moving coil, Moving iron, Electrodynamometer, Induction instruments	3
• Principle of operation of the Electrostatic, Thermoelectric, Rectifier type instruments, Extension of instrument ranges and multipliers.	3
Module-II	
Instrument transformer: • Disadvantage of shunt and multipliers, Advantage of Instrument transformers, Principle of operation of Current& Potential transformer, errors.	4
Measurement of Power: • Principle of operation of Electrodynamic& Induction type wattmeter. Wattmeter errors.	3
Measurement of resistance: • Measurement of medium, low and high resistances, Megger.	4
Module-III	
Measurement of Energy: • Construction, theory and application of AC energy meter, testing of energy meters.	3
Potentiometer: • Principle of operation and application of Crompton's DC potentiometer, Polar and Co-ordinate type AC potentiometer. Application.	4
AC Bridges: • Measurement of Inductance, Capacitance and frequency by AC bridges.	4
Module-IV	
Cathode ray oscilloscope (CRO):	

• Measurement of voltage, current, frequency & phase by oscilloscope. Frequency limitation of CRO. Sampling and storage oscilloscope, Double beam CRO.	3
Electronic Instruments:	
• Advantages of digital meter over analog meters, Digital voltmeter, Resolution and sensitivity of digital meters, Digital multimeter, Digital frequency meter, Signal generator.	4
Sensors & Transducers:	
• Introduction to sensors & Transducers, Strain gauge, LVDT, Temperature transducers, Flow measurement using magnetic flow measurement.	3

Numerical Problems to be solved in the tutorial classes.

Text Books:

1. A course in Electrical & Electronic Measurements & Instrumentation, A.K. Sawhney, DhanpatRai& sons.
2. Electrical Measurement & Measuring Instruments, E.W. Golding & F.C. Wides, Wheeler Publishing.
3. Electronic Instruments, H.S. Kalsi, Tata Mc-Graw hill, 2nd Edition.

Reference Books:

1. Sensors & Transducers, D. Patranabis, PHI, 2nd edition.
2. Digital Instrumentation, A.J. Bouwens, Tata Mc-Graw hill.
3. Modern Electronic instrumentation & Measuring instruments, A.D. Heltric& W.C. Copper, Wheeler Publication.
4. Instrument transducers, H.K.P. Neubert, Oxford University press.

Practical

Physics Lab-2
Code: PH(EE)-491PH-491
Contacts: (3P)
Credit: (2)

1. Determination of dielectric constant of a given dielectric material.
2. Determination of thermo electric power at a certain temperature of a given thermocouple.
3. Determination of specific charge (e/m) of electron by J.J. Thompson's method.
4. Determination of Planck constant using photocell.
5. Determination of Lande'g factor using Electron spin resonance spectrometer.
6. Determination of Stefen's radiation constant.
7. Verification of Bohr's atomic orbital theory through Frank-Hertz experiment.
8. Determination of Rydberg constant by studying Hydrogen –Helium spectrum.
9. Determination of Hall coefficient of semiconductor.
10. Determination of Band gap of semiconductor.
11. To study current voltage characteristics, load response, areal characteristic and spectral response of a photovoltaic solar cell.

Basic Control Theory Laboratory

IC-491 Credit: 2 3P

1. Familiarization with MATLAB control system tool box, Simulink tool box & PSPICE
2. Determination of Step response for first order and second order system with unity feedback on CRO and calculation of control system specification: Time constant, percentage peak overshoot, settling time from the response.

3. Determination of Step response and Impulse response for type-0, type-1 and type-2 system with unity feedback using MATLAB/PSPICE.
4. Determination of Root locus, BODE plot, Nyquist plot for 2nd order system & determination of different control system specification from the plot using MATLAB.
5. Determination of PI, PD and PID controller action for first order simulated processes.
6. Evaluation of steady state error, settling time, percentage peak overshoot, gain margin, phase margin, with addition of lead compensator and lag compensator in the forward path transfer function for unity feedback control system.
7. Study of practical position control system and determination of control system specification for different system parameters.

TRANSDUCERS & SENSORS LABORATORY

EI (IC)-491 Credit-2 3P

1. Study of two channel Voltage to Current transmitter (V-I Transmitter)
2. Study of two channel I-V receiver (Converter)
3. Temperature measurement using AD590 Semiconductor temperature sensor.
4. Displacement measurement by Capacitive Transducers.
5. Pressure & Displacement measurement by Linear Variable Displacement Transducers (LVDT).
6. Study of load cell. (To study the load cell behavior for tensile & compressive load)
7. Torque measurement by Strain Gauge Transducers.
8. Measurement of linear displacement using Inductive Displacement Transducers.
9. Measurement of speed using Magnetic Pick-Up Proximity Sensor.
10. Relative Humidity measurement using Capacitive Transducer.
11. Displacement measurement by Magnetic Bi-Polar Digital Position Sensor (using Hall Effect)
12. Measurement of angular speed by Stroboscope.
13. Study of LDR
14. Study of Photo Diodes & Photo Voltaic cells.

ELECTRIC AND ELECTRONIC MEASUREMENT LABORATORY

EE-492 Credit: 2 3P

List of Experiments:

1. Instrument workshop- Observe the construction of PMMC, Dynamometer, Electrothermal and Rectifier type of instruments, Oscilloscope and Digital multimeter.
2. Calibrate moving iron and electrodynamometer type ammeter/voltmeter by potentiometer.
3. Calibrate dynamometer type wattmeter by potentiometer.
4. Calibrate AC energy meter.
5. Measurement of resistance using Kelvin double bridge.
6. Measurement of power using Instrument transformer.
7. Measurement of power in Polyphase circuits.
8. Measurement of frequency by Wien Bridge.
9. Measurement of Inductance by Anderson bridge
10. Measurement of capacitance by De Sauty Bridge.
11. Measurement of capacitance by Schering Bridge.

SEMESTER – V
Theory

Economics for Engineers
HU-501
Contracts: 3L
Credits- 3

1. Economic Decisions Making – Overview, Problems, Role, Decision making process.
2. Engineering Costs & Estimation – Fixed, Variable, Marginal & Average Costs, Sunk Costs, Opportunity Costs, Recurring And Nonrecurring Costs, Incremental Costs, Cash Costs vs Book Costs, Life-Cycle Costs; Types Of Estimate, Estimating Models - Per-Unit Model, Segmenting Model, Cost Indexes, Power-Sizing Model, Improvement & Learning Curve, Benefits.
3. Cash Flow, Interest and Equivalence: Cash Flow – Diagrams, Categories & Computation, Time Value Of Money, Debt repayment, Nominal & Effective Interest.
4. Present Worth Analysis : End-Of-Year Convention, Viewpoint Of Economic Analysis Studies, Borrowed Money Viewpoint, Effect Of Inflation & Deflation, Taxes, Economic Criteria, Applying Present Worth Techniques, Multiple Alternatives.
5. Cash Flow & Rate Of Return Analysis – Calculations, Treatment of Salvage Value, Annual Cash Flow Analysis, Analysis Periods; Internal Rate Of Return, Calculating Rate Of Return, Incremental Analysis; Best Alternative Choosing An Analysis Method, Future Worth Analysis, Benefit-Cost Ratio Analysis, Sensitivity And Breakeven Analysis. Economic Analysis In The Public Sector - Quantifying And Valuing Benefits & drawbacks.
6: Uncertainty In Future Events - Estimates And Their Use In Economic Analysis, Range Of Estimates, Probability, Joint Probability Distributions, Expected Value, Economic Decision Trees, Risk, Risk vs Return, Simulation, Real Options.
7. Depreciation - Basic Aspects, Deterioration & Obsolescence, Depreciation And Expenses, Types Of Property, Depreciation Calculation Fundamentals, Depreciation And Capital Allowance Methods, Straight-Line Depreciation Declining Balance Depreciation, Common Elements Of Tax Regulations For Depreciation And Capital Allowances.
8. Replacement Analysis - Replacement Analysis Decision Map, Minimum Cost Life Of A New Asset, Marginal Cost, Minimum Cost Life Problems.
9. Inflation And Price Change – Definition, Effects, Causes, Price Change With Indexes, Types of Index, Composite vs Commodity Indexes, Use of Price Indexes In Engineering Economic Analysis, Cash Flows that inflate at different Rates.
10. Accounting – Function, Balance Sheet, Income Statement, Financial Ratios Capital Transactions, Cost Accounting, Direct and Indirect Costs, Indirect Cost Allocation.

Readings

1. James L.Riggs,David D. Bedworth, Sabah U. Randhawa : Economics for Engineers 4e , Tata McGraw-Hill
2. Donald Newnan, Ted Eschembach, Jerome Lavelle : Engineering Economics Analysis, OUP
3. John A. White, Kenneth E.Case,DavidB.Pratt : Principle of Engineering Economic Analysis, John Wiley
4. Sullivan and Wicks: Engineering Economy, Pearson
5. R.PaneerSeelvan: Engineering Economics, PHI
6. Michael R Lindeburg : Engineering Economics Analysis, Professional Pub

INDUSTRIAL INSTRUMENTATION -I
IC-501

Credit: 4 **Contact: 3L+1T**

Module	Content	Hour
1	**Introduction to Industrial Instrumentation:** Temperature and heating, definitions, temperature scales. Bimetallic thermometers, filled-bull and glass stem thermometers. **Thermocouples:** Thermoelectric effects, law of thermocouple, cold junction compensation techniques, thermocouple types, construction, installation and protection,	10

	measuring circuits. Thermocouple burnout detection and high temperature measurement methods.	
2	**Temperature Measurement:** Resistance Temperature Detector (RTD), principle, type, construction and measuring circuits. **Thermistors:** Principle and sensor types, manufacturing techniques, measuring circuits, linearization methods and application. Pneumatic and suction pyrometers, Integrated circuit sensor, Diode type sensors, Ultrasonic thermometers, Johnson noise thermometer, Fluid sensors, Spectroscopic temperature measurement, Thermograph, Temperature switches , Thermostats.	10
3	**Radiation measurement:** Radiation thermometers, introduction, definition of terms, general form of radiation measurement system, radiation thermometer types, photo electric radiation thermometers, signal conditioning for radiation thermometers, remote reading thermometers. Temperature sensor selection and application, sensor calibrators and simulators.	7
4	**Pressure measurement:** Pressure measurement basics, mechanical type instruments, Electro mechanical type, Low-pressure measurement, related accessories, pressure measuring standards, selection and application. Definition of transmitter, classification, pneumatic transmitter, force balance type, torque balance type, two wire and four wire transmitter, I/P and P/I converter.	8
5	**Measurement of viscosity:** Definition, units, Newtonian and Non-newtonian behavior, measurement of viscosity using laboratory viscometer, industrial viscometers, viscometer selection and application. Measurement of density, definition, units, liquid density, measurement, gas densitometers, application and selection.	5

Numerical problems to be solved in the tutorial classes.

Text Books:

1. Measurement Systems: Application and design, E.O. Doebin, 4th Edition, McGraw Hill.
2. Principle of Industrial Measurement, D. Patranabis, 2nd Edition, Tata McGraw Hill.

Reference Books:

1. Instrumentation Reference book, B.E. Noltingk, 2nd Edition, Butterworth Heinmann, Oxford
2. Process/Industrial Instruments and control handbook, C.M. Douglas, 4th Edition, McGraw Hill.

INDUSTRIAL INSTRUMENTATION –I LABORATORY
IC591

Credit: 2 **3P**

1. Calibration of pressure gauge by dead weight tester.
2. Study of Thermocouple characteristics and Measurement of temperature with it.
3. Study of RTD characteristics and measurement of temperature with it
4. Measurement of temperature by using Thermistors.
5. Measurement of Viscosity.

ELECTRIC MACHINE
IC-503

Credit: 4 **Contact: 3L+1T**

Module	Content	Hour
1	**Basics of Electrical Machines:** Electromechanical Energy Conversion Principle, Singly Excited Magnetic System and Doubly Excited Magnetic system. Physical concept of torque production; Electromagnetic torque and Reluctance torque. Concept of General terms pertaining to Rotating Machines: Electrical & Mechanical degree, Pole pitch, Coil, Generated EMF in full pitched coil, Generated EMF in a short pitched coil, EMF polygon, Distribution factor, Pitch factor. MMF produced by Distributed Windings, MMF of a coil, MMF of single phase distributed Winding, MMF waveform of Commutator machines.	08
2	**3-Phase Transformer:** Determination of polarity and connections (star/star, star/delta, delta/star, star/zigzag, delta/zigzag, open delta), Phasor groups. Effect of unbalanced loading, Production of Harmonics in Transformer and its suppression, Parallel operation of Transformers.	06
3	**3-Phase Induction machine:** Induction motor as a Transformer, Flux and MMF phasors in Induction motors, Equivalent circuit, Performance equations, Induction motor phasor diagram Toque-slip characteristic, Power slip characteristic, Determination of equivalent circuit parameters. Methods of starting of squirrel Cage and Wound rotor Motors. Speed control of Induction motor Application of Polyphase Induction motor.	08
4	**Synchronous machines:** Construction, Types, Excitation systems, Generator & Motor modes, Armature reaction, Theory for salient pole machine, Two reaction theory, Voltage regulation (EMF, MMF, ZPF). Operating characteristics of Alternators and their rating. Power angle characteristics of Synchronous machines. Parallel operation of Alternators, starting of Synchronous motor, V-curve. Applications	10
5	**Special Electromechanical devices:** Principle and construction of switched Reluctancemotor, Permanent magnet machines, Brushless DC machines, Hysteresis motor, Stepper motor, Tacho generators	08

Numerical problems to be solved in the tutorial classes.

Text Books:

1. Electrical Machinery, P.S. Bhimra, Khanna Publishers.
2. Electrical Machines, Nagrath&Kothary, TMH
3. Electrical Machines, Theory & Applications, M.N. Bandyopadhyay, PHI

Reference Books:

1. Electric Machinery & Transformer, Bhag S. Guru and H.R. Hiziroglu, 3rd Edition, Oxford University press.
2. Electric Machinery &Transformes, Irving L. Kosow, PHI
3. Electric Machinery, A.E.Fitzgerald, Charles Kingsley,Jr. & Stephen D. Umans, 6th Edition, Tata McGraw Hill Edition.

4. Electrical Machines, R.K. Srivastava, Cengage Learning
5. Theory of Alternating Current Machinery, Alexander S Langsdorf, Tata McGraw Hill Edition
6. The performance and Design of Alternating Current Machines, M.G.Say, CBS publishers& distributors.
7. Problems in Electrical Engineering, Parker smith, 9th Edition, CBS publishers & distributors.
8. Electric Machines, Charles A. Gross, CRC press.

ELECTRIAL MACHINES LABORATORY
IC-593

Credit: 2 **3P**

1. Different methods of starting of a 3 phase Cage Induction Motor & their comparison[DOL, Auto transformer & Star-Delta]
2. Speed control of 3 phase squirrel cage induction motor by different methods & their comparison [voltage control & frequency control].
3. Speed control of 3 phase slip ring Induction motor by rotor resistance control.
4. Determination of regulation of Synchronous machine by
   (a) Potier reactance method.
   (b) Synchronous Impedance method.
5. Determination of equivalent circuit parameters of a three phase Induction motor by no load & blocked rotor test.
6. Load test on three phase Induction motor to obtain the performance characteristics.
7. Determination of polarity and study of different connection of a 3 phase transformer. .
8. Load test on wound rotor Induction motor to obtain the performance characteristics.

CONTROL SYSTEM
IC-502

Credit: 4 **Contact: 3L+1T**

Module	Content	Hour
1	**State variable model of continuous dynamic systems:** Converting higher order linear differential equation into state variable (SV) form. Obtaining SV model from transfer function. Obtaining characteristic equation and transfer functions from SV model. Obtaining SV equations directly from R-L-C and Spring-Mass-Dashpot systems. Concept and properties associated with state equations. Linear Transformations on state variables. Canonical forms of SV equations. Companion forms. Solutions of state equations. State transition matrix. Properties of state transition matrix. Controllability and observability. Linear state variable feedback controller. The pole allocation problems. Linear system design by state variable feedback.	15
2	**Analysis of discrete time (sampled data) systems using Z transforms:** Difference equations. Inverse Z transform. Stability and damping in Z domain. Practical sampled data systems and computer control. Practical and theoretical samplers. Sampling as impulse modulation. Sampled spectra and aliasing. Anti-aliasing filters. Zero order hold. Approximation of discrete (Z domain) controllers with ZOH by Tustin transform and other methods. State variable analysis of sampled data system. Digital compensator design using frequency response.	10
	Introduction to nonlinear system: Block diagram and state variable representations. Characteristics of common nonlinearities.	

3	Phase plane analysis of linear and non-linear second order systems. Methods of obtaining phase plane trajectories by graphical method-isoclines method. Qualitative analysis of simple control systems by phase plane methods. Describing function method. Limit cycles in non-linear systems. Prediction of limit cycles using describing function. Stability concepts for nonlinear systems. BIBO vs. State stability. Lyapunov's definition. Asymptotic stability. Global asymptotic stability. The first and second methods of Lyapunov to analyze non-linear systems.	15

Numerical problems to be solved in the tutorial classes.

Text books:

1. Digital control and state variables, M.Gopal , 4th Edition, McGraw Hill
2. Control System Engineering, D.RoyChoudhuri, PHI
3. Control System Engineering, I.J. Nagrath& M. Gopal, New Age International.
4. Introduction to control Systems, D.K. Anand& R.B. Zmood, 3rd Edition, (Butterworth-Heiemann), Asian Books.

Reference Books:

1. Control Engineering Theory & Practice, Bandyopadhyaya, PHI
2. Automatic Control Systems, B.C Kuo& F. Golnaraghi, 8th Edition, Wiley India.
3. Control System Engineering, Norman Nise, 5th Edition, John Wiley & Sons
4. Control System Design, C. Goodwin Graham, F. Graebe F. Stefan, Salgado. E. Mario, PHI
5. Modeling & Control of dynamic system, Macia&Thaler, Thompson
6. Modern Control Technology Components & Systems, 3rd edition, C.T Kilian, Cengage Learning.
7. Control System Engineering, R. Anandanatarajan& R. Ramesh Babu, , SCITECH

CONTROL SYSTEM-I LABORATORY
IC-592

Credit: 2 **3P**

1. Study of a practical position control system. To obtain closed step response for over damped and under damped condition with gain setting. To determine the rise time and peak time using individualized components in SIMULINK. Determination of undamped natural frequency and damping ration from experimental data.
2. Tuning of P, PI and PID controller for first order plant with dead time using Z-N method. To compute controller gain by Z-N method for the process parameter (time constant and delay/lag) provided. The steady state and transient performance of the closed loop plant with and without steady disturbances to be noted. Theoretical phase and gain margins to be manually computed for each gain setting.
3. Design of Lead and Lag compensation. Step response to be obtained with the plant transfer function provided.
4. State variable analysis. To obtain
   (a) Transfer function from SV model and vice versa.
   (b) Step response for a SISO system in SV form.
5. State variable analysis. To obtain step response and initial condition response for a single input, two output system given in SV form.
6. Performance analysis of a discrete time system. Study of closed response of a continuous system with a digital controller with sample and hold circuit.
7. Study of the effects of nonlinearity in a feedback controlled system using time response. To determine of step response with limiter nonlinearity introduced into the forward path of 2nd order

unity feedback control systems. The open loop plant will have one pole at the origin and other pole will be in LHP or RHP. To verify

(i) With open loop stable pole, the response is slowed down for larger amplitude input

(ii) For unstable plant, the closed loop system may become oscillatory with large input amplitude

8. Study of the effect of nonlinearity in a feedback controlled system using phase plane plots. To determine the phase plane trajectory and possibility of limit cycle for common nonlinearity.

(PSPICE, MATLAB, Scilab and CACSAD Tools may be used)

Reference Books:

1. Matlab& Simulink for Engineers, Agam Kumar Tyagt, Oxford
2. Modeling &Simulatrion using Matlab-Similink, Dr. S. Jain, Wiley India
3. Matlab& its application in Engineering, Raj K Bansal, A.K. Goel& M.K. Sharma, Pearson
4. MATLAB programming for Engineers, S.J. Chapman, 3rd Edition, Cengage

MICROPROCESSOR & MICROCONTROLLER
IC-504C

Credit: 3 **Contact: 3L**

Module	Content	Hour
1	**Introduction to Computer architecture:** Architecture of a typical Microprocessor**,** Bus configuration, The CPU module, ROM & RAM families, Introduction to assembly language & machine language programming, Instruction set of typical microprocessor (e.g. 8085), Subroutine & stack, Timing diagram, Memory Interfacing, Interfacing input output- port, Interrupt & interrupt handling, Serial & parallel data transfer scheme, Programmed & interrupt driven data transfer, Direct memory access, Programmable peripheral devices, Programmable interval timer, Analog input-output using AD & DA converter.	23
2	**Assembly language programme of a typical Microprocessor:** Use of compilers, assembler, linker & debugger.	5
3	**Basic 16 bit Microprocessor (e.g. 8086):** Architecture, Min-max mode.	4
4	Introduction to microcontroller: Architecture & instruction set of a typical microcontroller (e.g. PIC16F84 device), Feature of popular controller (processor 8031/8051), its programming & interfacing.	8

Text Books:

1. Microprocessor architecture, programming & application with 8085, R. Gaonker, Penram International.
2. Advanced Microprocessors and Peripheral, Ajay Kumar Ray, Koshor M Bhurchandi, Tata MC Graw hill Publishing Company.
3. Microprocessor & Interfacing, D.V. Hall, McGraw Hill.
4. The 8051 microcontroller, Ayala, Thomson.

Reference Books:

1. Advanced Microprocessors, Y. Rajasree, New Age international Publishers.
2. An introduction to the Intel family of Microprocessors, James L. Antonakos, Pearson Education,

3. The 8051 Microcontroller and Embedded systems, Muhammad Ali Mazidi& J. G. Mazidi, Pearson Education.
4. The 8086 Microprocessors: Programming & Interfacing the PC, K.J.Ayala, Thomson.
5. Microprocessor & Peripherals, S.P. Chowdhury & S. Chowdhury, Scitech.
6. Microchip technology data sheet, www.microchip.com

MICROPROCESSOR & MICROCONTROLER LABORATORY
IC-594C

Credit: 2 **3P**

1. Familiarization with 8085 register level architecture and trainer kit components including the memory map. Familiarization with process of storing and viewing the contents of memory as well as registers.
2. (a) Study of prewritten program on trainer kit using the basic instruction set (data transfer, load/store, arithmetic, logical)
   (b) Assignment based on that.
3. (a) Familiarization with 8085 simulator on PC
   (b) Study of prewritten program using basic instruction set (data transfer, load/store, arithmetic, logical).
   (c) Assignment based on that.
4. Programming using kit/simulator.
   (a) Lookup table
   (b) Copying a block of memory
   (c) Shifting a block of memory.
   (d) Packing and unpacking of BCD numbers.
   (e) Addition of BCD number
   (f) Binary to ASCII conversion
   (g) String matching
5. Program using subroutine calls and using IN/OUT instruction using 8255 PPI on the trainer kit e.g. subroutine for delay, reading switch state and glowing LEDs accordingly, finding out frequency of pulse train etc.
6. Interfacing any 8 bit latch (74LS373) with trainer kit as a peripheral mapped output port with absolute address decoding.
7. Interfacing with I/O module :
   (a) ADC
   (b) Speed control of DC motor with DAC
   (c) Keyboard
   (d) Multi digit display with multiplexing.
   (e) Stepper motor
8. Study of 8031/8051 Micro controller kit and writing program for the following task using the kit
   (a) table look up
   (b) basic arithmetic and logical operation
   (c) interfacing of keyboard and stepper motor.

DATA STRUCTURE & ALGORITHM
IC-504A

Credit: 3 **Contact: 3L**

Module	Content	Hour
1	**Introduction:** Importance of study of Data structure**,** Concept of data structure: Data and data structure, Abstract data type and data type. Algorithm and programs, Basic idea of pseudo-code, Algorithm efficiency and analysis, time and space analysis of algorithms-order notations. Different representation: row major, column major. Sparse matrix, its implementation and usage. Array representation of polynomials. Singly linked list, circular linked list, doubly linked list, linked list representation of polynomial and applications.	08
2	**Stack & queue:** Stack and its implementation, (using array, using linked list) application. Queue, circular queue, dequeue, Implementation of queue- both linear and circular (using array, using linked list) applications. **Recursion:** Principle of recursion- use of stack, difference between recursion and iteration, tail recursion., Application-The Tower of Hanoi, Eight Queen Puzzle.	07
3	**Nonlinear data structure:** **Trees:** Basic terminologies, forest, tree representation (using array, using linked list). Basic trees, binary tree traversal (Pre-,in-,post-order), threaded binary tree(left, right, full), non recursive traversal algorithm using threaded binary tree, expression tree. Binary search tree-operations (creation, insertion, deletion, searching), Height balanced binary tree-AVL tree (insertion, deletion with examples only). B tree orations ((insertion, deletion with examples only) **Graph:** Graph definition and concept, (directed/undirected graph, weighted/un-weighted edges, sub-graph, degree, cut vertex /articulation point, pendant node, clique, complete graph, connected –strongly connected component, weakly connected component-path, shortest path, isomorphism. Graph representation/storage implementation- adjacency matrix, adjacency list, adjacency multi-list. Graph traversal and connectivity- Depth First Search (DFS), Breadth-First Search (BFS), concept of edges used in DFS and BFS (tree-edge, back-edge, cross-edge, and forward-edge, application. Minimal spanning tree-Prim's algorithm (Basic idea of greedy methods)	15
4	**Searching, Sorting:** Sorting algorithm, Bubble sort and optimization, insertion sort, shell sort, selection sort, merge sort, quick sort, heap sort (Concept, of max heap, application-priority queue, radix sort. Searching, sequential search, binary search, interpolation search. Hashing, Hashing functions, collision resolution techniques.	10

Text Books:

1. Data structure using C, ReemaThareja, Oxford.
2. Data structure, S.Lipschutz.
3. Data structure and program design in C, Robert L Krusse, B.P.Leung

Reference Books:

1. Data structure using C++, Varsha H. Patil, Oxford

DATA STRUCRURE & ALGORITHM LABORATORY
IC- 594A

Credit- 2 3P

1. Implementation of array operation
2. Stack and queue: adding, deleting elements. Circular Queue: adding & deleting elements, Merging problems .
3. Evaluation of expression operation on multiple stack & queues.
4. Implementation of linked lists, inserting, deleting, inverting a linked list, implementation of stacks & queue using linked list.
5. Polynomial addition, Polynomial multiplication
6. Sparse Matrices, Multiplication, addition
7. Recursive and Nonrecursive traversal of Trees
8. Threaded binery tree traversal. AVL tree implementation.
9. Application of Trees. Application of sorting and searching algorithm.
10. Hash tables implementation, searching, inserting and deleting, searching & sorting techniques.

Experiments mentioned above are not exhaustive. More experiments may be conducted.

COMPUTER ORGANIZATION
IC-504B

Credit: 3 **Contact: 3L**

Module	Content	Hour
1	Basic organization of the stored program in computer and operation sequence for execution of a program. Role of operating systems and compiler/ assembler. Fetch, decode and execute cycle. Concept of operator, operand, registers and storage. Instruction format. Instruction sets and addressing modes. Commonly used number systems. Fixed and floating point representation of numbers.	10
2	Overflow and underflow. Design of address- ripple carry and carry look ahead principles. Design of ALU Fixed point multiplication-Booth's algorithm Fixed point division-Restoring and non restoring algorithms. Floating point-IEEE 754 standard.	10
3	Memory unit design with special emphasis on implementation of CPU-memory interfacing. Memory organization. Static and dynamic memory, memory hierarchy, associative memory. Cache memory. Virtual memory. Data path design for read/write access.	10
4	Design of control unit-hardwired and micro programmed control.	

	Introduction to instruction pipelining. Introduction to RISC architecture, RISC vs. CISC architecture. I/O operations-Concepts of handshaking. Polled I/O, Interrupt and DMA.	10

Text Books:

1. Computer System architecture, M.M. Mano, PHI
2. Computer Architecture, P. Behrooz, Oxford University Press.

Reference Books:

1. Computer Architecture & Organization, J.P. Hayes, McGraw Hill.
2. Computer Organization, Hamacher, McGraw Hill.
3. Computer Organization & design, P. Pal Chaudhuri, PHI
4. Computer Organization & Architecture, P. N. Basu, Vikas Pub.

COMPUTER ORGANIZATION

IC-594B

Credit: 2 **3P**

1. Familiarity with IC chips e.g.
   (a) Multiplexer
   (b) Decoder
   (c) Encoder
   (d) Comparator

   Truth table verification and clarification from Data-book.

2. Design an Adder/Sub tractor composite unit.
3. Design a BCD adder
4. Design of a Carry-Look-Ahead Adder circuit.
5. Use of a multiplexer unit to design a composite ALU.
6. Use of an ALU chip for multibit arithmetic operation.
7. Implementations of read write operation using RAM IC.
8. Cascade two RAM ICs for vertical and horizontal expansion.

SEMESTER – VI

Theory

PRINCIPLE OF MANAGEMENT
HU-601

Credit: 2 **Contact: 2L**

Module	Content	Hour
1	**Basic concepts of management**: Definition – Essence, Functions, Roles, Level. **Functions of Management**: Planning – Concept, Nature, Types, Analysis, Management by objectives; Organization Structure – Concept, Structure, Principles, Centralization, Decentralization, Span of Management; Organizational Effectiveness.	05
2	**Management and Society** – Concept, External Environment, CSR, Corporate Governance, Ethical Standards. **People Management** – Overview, Job design, Recruitment & Selection, Training & Development, Stress Management. **Managerial Competencies** – Communication, Motivation, Team Effectiveness, Conflict Management, Creativity,Entrepreneurship	05
3	**Leadership:** Concept, Nature, Styles. **Decision making**: Concept, Nature, Process, Tools & techniques. **Economic, Financial & Quantitative Analysis** – Production, Markets, National Income Accounting, Financial Function & Goals, Financial Statement & Ratio Analysis, Quantitative Methods – Statistical Interference, Forecasting, Regression Analysis, Statistical Quality Control.	05
4	**Customer Management** – Market Planning & Research, Marketing Mix, Advertising & Brand Management. **Operations & Technology Management** – Production & Operations Management, Logistics & Supply Chain Management, TQM, Kaizen & Six Sigma, MIS.	05

Text Books:

1. Management: Principles, Processes & Practices – Bhat, A & Kumar, A (OUP).
2. Essentials for Management – Koontz, Revised edition, Tata McGraw Hill (TMH)
3. Management – Stoner, James A. F. (Pearson)
4. Management - Ghuman, Tata McGraw Hill(TMH)

PROCESS CONTROL
IC-601

Credit: 4 **Contact: 3L+1T**

Module	Content	Hour
1	General review of process, Process control & automation, Servo and regulatory control, Basic process control loop block diagram. Characteristic parameter of a process, Process quality, Process potential, Process resistance, Process capacitance, Process lag, Self regulation. Process modeling, Process equations-their limitations-general approach,. Typical processes and derivation of their functions. Characteristics and functions of different modes of control actions, Schemes and	10

	analysis of On-Off, Multistep, Floating, Time proportional, PID control. Effect of disturbances and variation in set point in process control. Offset-why it appears and how it is eliminated-analysis and mathematical treatment.	
2	Process reaction curves, Controllability-using (i) deviation reduction factors (ii) gain bandwidth product, State controllability. Tuning controllers: both closed and open loop methods (Ziegler-Nichols, Cohen, PRC method and 3-C method of parameter adjustment) Electronic PID controller design Pneumatic controllers-brief analysis.	08
3	Different control strategies-schemes, brief analysis and uses (i) Ratio control (ii) Cascade control (iii) Feed forward control (iv) Multivariable control	06
4	Final control element: actuators (Pneumatic actuators, Electrical actuators) and control valves (Globe, Ball. Butterfly, Gate, Pinch), different parts, Fail Position, Valve Characteristics, Cv, single & Double seated valves, Valve sizing, Valve selection, Cavitation, Flashing, Noise. Control valve accessories- Air filter regulator, I/P converter, Pneumatic positioner, Electro Pneumatic positioner, limit switches, Motion transmitter. Brief study of safety valves and Solenoid valves.	08
5	Introduction to Programmable Logic controllers- Basic Architecture and function, Input-output modules and interfacing, CPU and memory, Relays, Timers, Counters and their uses, PLC programming and applications, Introduction to DCS	08

Numerical problems to be solved in the tutorial classes.

Text Books:

1. Principle of Process control, D. Patranabis, TMH
2. Automatic Process Control, D.P. Eckman, John Wiley.
3. Process control, P. Harriott, McGraw Hill

Reference Books:

1. Chemical process control, G. Stephanpoulos, PHI
2. Process control instrumentation technology, C.D. Johnson, PHI
3. Process Control-Principles and application, S. Bhanot, Oxford University press.
4. Process Control, S.K. Singh, PHI
5. Process dynamic & Control, S. Sundaram, Cengage Learning.
6. Instrument Engineers Handbook, B.G. Liptak, Chilton Book Co. Philadelphia.

ADVANCED CONTROL SYSTEM
IC-602

Credit: 4 **Contact: 3L+1T**

Module	Content	Hour
1	**Feedback Linearization**: Motivation, Input–Output Linearization, Full-State Linearization, State Feedback Control and Stabilization.	05
2	**Sliding Mode Control:** Overview of SMC, Motivating Examples, Stabilization of second order system; Advantages and disadvantages.	05
3	**Optimal control system:** Formulation of optimal control problem: Minimum time, minimum energy, minimum fuel problem, state regulator, output regulator & tracking problems. Calculus of variations: Constrained fixed point and variable point problems, Euler Lagrange equations. Problems with equality and inequality constraints. Engineering application, Lagrange, Mayer &Bolza problems, Pontryagin's maximum (minimum) principle. Multiple decision process in discrete and continuous time - The dynamic programming. Numerical solution of two point boundary value problems - the steepest descent method and the Fletcher - Powell Method.	20
4	**Adaptive control of deterministic systems:** Introduction, Adaptive control methods-Gain scheduling, Model reference adaptive systems, Self tuning regulator, Direct and indirect adaptive controllers, Controller design methods-Model reference controllers, Pole placement controllers. Stability of Adaptive controllers. System parameter estimation, Least square estimation.	10

Numerical problems to be solved in the tutorial classes.

Text Books:

1. Applied Nonlinear control, J.J.E. Slotine& W. Li, Prentice Hall
2. Modern Control theory, M. Gopal, 2nd Edition, New age international publishers.
3. Introduction to control system, D.K. Anand& R.B. Zmood, Asian book Pvt. Ltd.

Reference Books:

1. Adaptive control system, K.J. Astrom and B. Wittenamark, Addision Wesley Publishing Co
2. Nonlinear Control system, J.E. Gibson, McGraw Hill Book Co.

INDUSTRIAL INSTRUMENTATION -II

IC-603

Credit: 4 **Contact: 3L+1T**

Module	Content	Hour
1	**Flow measurement**: Introduction, Head type, Area flow meter, Mass flow meter, Positive displacement type flow meter, Electrical type flow meter, Flow marker, Open channel flow measurement, Solid flow measurement.	08
2	**Level measurement:** Introduction, float level device, displacer level detectors, Differential pressure type level detector, Electrical type-resistance and capacitance type, Thermal, Microwave and ultrasonic radar and vibrating type level sensors. Level sensors selection and applications.	06
3	**Instruments for Analysis:** Introduction, Gas analyzers, Liquid analyzer, X-ray methods, Chromatography, Nuclear magnetic resonance spectroscopy, Electron spins resonance/electron paramagnetic resonance spectroscopy. Mass spectroscopy, Sampling techniques.	08
4	**Digital Transducers:** Introduction, Digital encoder, Linear displacement transducer, Digital tachometer, Frequency output type transducers, The signal & conversion, The instrument system.	06
5	**EMC:** Introduction, interference coupling mechanism, basics of circuit layout and grounding, concepts of interfaces, filtering and shielding, safety: introduction, electrical hazards, hazardous areas and classification, non-hazardous areas, enclosures, NEMA types, fuses and circuit breakers, Protection methods: Purging, explosion proofing and intrinsic safety.	07
6	Specification of instruments, preparation of project documentation, process flow sheet, instruments index sheet, instrument specification sheet, panel drawing and specifications	05

Numerical problems to be solved in the tutorial class.

Text Books:

1. Principle of Industrial Instrumentation , D. Patranabis, TMH publication
2. Measurement Systems : Application and Design, E.O. Doebelin , McGraw Hill,

Reference Books:

1. Applied Instrumentation in Process Industries - A survey, Vol.1 & Vol.2, Gulf Publishing Company, Houston.
2. Process Measurement and Analysis, B.G. Liptak, Third edition, Chilton Book, Company, Pennsylvania, 1995.
3. Process Instruments and Control Handbook, D. M. Considine, Fourth edition, McGraw Hill,
4. Mechanical and Industrial Measurements, R.K. Jain, Tata McGraw Hill.
5. Industrial flow measurement, D.W. Spitzer, ISA press, Newyork.
6. Flow measurement, D.W. Spitzer, ISA press, Newyork

SOFTWARE ENGINEERING

IC-604(a)

Credit: 3 **Contact: 3L**

Module	Content	Hour
1	**Overview of system analysis & design**: Business system concept, System development life cycle, waterfall model, Spiral Model, Feasibility Analysis, Technical feasibility, Cost-benefit Analysis, COCOMO model.	10
2	**System design:** Context diagram and DFD, Problem partitioning, Top down and bottom up design, decision tree, decision table and structured English, Functional Vs object oriented approach.	05
3	**Testing:** Levels of testing, Integration testing, Test case specification, Reliability assessment, Validation & Verification metrics, Monitoring & control	08
4	**System project management:** Project scheduling, Staffing, software configuration management, Quality assurance, Project monitoring.	07
5	**Fundamentals of Object oriented design in UML:** Static and dynamic models, necessity of modeling, UML diagrams, Class diagrams, Interaction diagrams, Collaboration diagram, Sequence diagram, State chart diagram, Activity diagram, Implementation diagram.	10

Text Books:

1. Software Engineering, R.G. Pressman, TMH
2. Software Engineering Fundamental, Behforooz, OUP
3. Software Engineering, Ghezzi, PHI

Reference Books:

1. An integrated approach to Software Engineering, PankajJalote, Narosa
2. Software quality, Benmenachen, Vikas
3. IEEE standard on Software Engineering.
4. Software defect Prevention, Kane, SPD.
5. Essentials of Software Engineering, Uma, Jaico

DATA BASE MANAGEMENT SYSTEM
IC-604(b)

Credit: 3 **Contact: 3L**

Module	Content	Hour
1	**Introduction:** Concept & Overview of DBMS, Data model, Database language, Database administrator, Database users, Three Schema architecture of DBMS.	04
2	**Entity-Relationship Model:** Basic concepts, Design Issues, Mapping Constraints, Keys, Entity-Relationship Diagram, Weak Entity sets, Extended E-R features.	06
3	**Relational Model:** Structure of relational Databases, Relational Algebra, Relational; calculus, Extended Relational Algebra operations, Views, Modification of the Database.	05

4	**SQL and Integrity Constraints:** Concept of DDL, DML, DCL. Basic structure, Set operations, Aggregate functions, Null values, Domain constraints, Referential integrity, Constraints, assertions, views, Nested sub queries, Data base security application development using SQL, Stored procedures and triggers.	08
5	**Relational Database design:** Functional dependency, Different anomalies in designing a Database, Normalization using functional dependencies, Decomposition, Boyce-Codd normal form, 3NF, Normalization using multi-valued dependencies, 4NF, 5 NF.	09
6	**Internal of RDBMS:** Physical data structures, Query optimization: join algorithm, statistics and cost base optimization, Transaction processing, Concurrency control and recovery management: transaction model properties, state serializability, look base protocols, two phase locking.	07
7	**File organization & index structures** File & records concepts, Placing file records on disk, Fixed and variable sized recotds, Types of single –Level index (primary. Secondary, clustering), Multilevel Indexes, Dynamic multilevel indexes using B tree and B+ tree.	

Text Books:

1. Database System Concepts, F. Henry & Abraham Silderscharz, McGraw Hill.
2. Database Management system, Ramakrishnan, McGraw Hill.
3. Principles of Database Systems, J.D. Ullman, Galgotia Publication.

Reference Books:

1. Principles of Database Management Systems. Martin James. PHI.
2. Database management Systems, A.K. Majumder&Pritimaybhattacharjya, Tata McGraw Hill.

OBJECT ORIENTED PROGAMMING
IC-604(c)

Credit: 3 **Contact: 3L**

Module	Content	Hour
1	**Object oriented Design:** Concept of Object oriented programming language, Major and minor elements, Object, Class, relationship among objects, aggregation, links, relationship among classes-association, aggregation using instantiation, meta-class, grouping constructs.	10
2	**Object oriented concept:** Difference between OOP and other conventional programming, advantages and disadvantages. Class, object, message passing, inheritance, encapsulation, polymorphism.	04
	Basic concepts of Object oriented programming using Java: Class & Object properties: Basic concepts of Java programming-advantages of Java, byte-code & JVM, data types, access specifiers, operators, control statements & loops, array, creation of class, object, constructor, finalize and garbage collection, use of method overloading, this keyword, use of objects as	

3	parameter & methods returning objects, call by value & call by reference, static variables & methods, garbage collection, nested and inner classes, basic string handling concepts, -String (discuss char(), compare(), equals(), equalsIgnorecase(), indexOf(), length(), substring(), toCharArray(),toLowercCase(), tostring(), methods), concept of mutable and immutable string, command line arguments, basics of I/O operations-keyboard input using BufferedReader& Scanner classes. Reusability properties: Super class & subclasses including multilevel hierarchy, process of constructor calling in inheritance, use of super and final keywords with super() method, dynamic method dispatch, use of abstract classes, & methods, interfaces. Creation of packages, importing packages, member access for packages. Exception handling &Multithreading : Exception handling basics, different types of exception classes, use of try & catch with throw, throws & finally, creation of user defined exception classes. Basics of multithreading, main thread, thread life cycle, creation of multiple threads, thread synchronization, inter thread communication, deadlocks for threads, suspending & resuming threads. Applet Programming (using swing): Basics of applet programming, applet life cycle, difference between application & applet programming, parameter passing in applet in applets, concept of delegation event model and listener, I/O in applets, use of repaint(), getDocumentBase(), getCodeBase() methods, layout manager (basic concept), creation of buttons (JButton class only) & text fields.	22

Text Books:

1. Object Oriented Modeling and design, James Rambaugh& MichaelBlaha, PHI.
2. Object Oriented Programming with C++ and Java, D. Samanta, PHI
3. Programming with Java: A Primer, E. Balagurusamy, TMH.

Reference Books:

1. Object oriented system Development, Ali Bahrami, McGraw Hill.
2. The complete reference Java2, PatrickNaughton& Herbert Schildt, TMH

OPERATING SYSTEM
IC-604 (d)

Credit: 3 **Contact: 3L**

Module	Content	Hour
1	**Introduction:** Introduction to OS, Operating system functions, evaluation of OS, different types of OS: batch, multi-programmed, time – sharing, real-time, distributed, parallel.	03
2	**System Structure:** Computer system operation, I/O structure, storage structure, storage hierarchy, different types of protections, operating system structure (Simple, layered, virtual machine), OS services, system calls.	03

3	**Process Management:** Process: Concept of process, process scheduling, operation on processes, co-operating processes, inter-process communication. Thread: Overview, benefits of threads, user and kernel threads. CPU scheduling: scheduling criteria, preemptive & non-preemptive scheduling, scheduling algorithm (FCFS, SJF, RR, and priority), algorithm evaluation, multi processor scheduling. Process Synchronization: background, critical section problem, critical region, synchronization hardware, classical problems of synchronization, semaphores. Deadlocks: system model, deadlock characterization, methods for handling deadlocks, deadlock prevention, deadlock avoidance, deadlock detection, recovery from deadlock.	13
4	**Storage Management:** Memory management: background, logical Vs physical addresses space, swapping, contiguous memory allocation, paging segmentation, segmentation with paging. Virtual memory: background, demand paging, performance, page replacement, page replacement algorithm (FCFS, LRU), allocation of frames, thrashing. File systems: file concept, access methods, directory structure, file system structure, allocation methods (contiguous, linked, indexed), free-space management (bit vector, linked list, grouping), directory implementation (linear list, hash table), efficiency & performance. I/O Management: I/O hardware, polling, interrupts, DMA, application I/O interface (block and character devices, network devices, clock and timers, blocking and non blocking I/O), kernel I/O subsystem (scheduling, buffering, caching, spooling and device reservation, error handling), performance. Disk Management: disk structure, disk scheduling (FCFS, SSTF, SCAN, C-SCAN), disk reliability, disk formatting, boot block, bad blocks. .	17
5	**Protection & Security**: Goals of protection, domain of protection, security problem, authentication, one time password, program threats, system threats, threats monitoring, encryption	04

Text Books:

4. Operating system: Concept & design, M. Milenkovie, McGraw Hill.
5. Operating System Design & Implementation, A.S. Tanenbaum, PHI
6. Operating system, Dhamdhere, TMH

Reference Books:

10. Operating system Concepts, A. Silbersehatz& J.L. Peterson, Wiley.
11. An introduction to operating system, H.N. Dietel, Addison Wesley.

DIGITAL SIGNAL PROCESSING
IC-605(a)

Credit: 3 **Contact: 3L**

Module	Content	Hour
1	**Discrete-time signals:** Concept of discrete-time signal, basic idea of sampling and reconstruction of signal, sampling theorem, sequences,-periodic, energy, power, unit-sample, unit step, unit ramp & complex exponentials, arithmetic operations on sequences. **LTI systems:** Definition, representation, impulse response, derivation for the output sequence, concept of convolution, graphical, analytical and overlap-add methods to compute convolution supported with examples and exercise, properties of convolution, interconnection of LTI systems with physical interpretations, stability and causality conditions, recursive and non recursive systems.	10
2	**Z- Transforms:** Definition, mapping between s-plane & z-plane, unit circle, convergence and ROC, properties of Z-transform, Z-transform on sequences with examples & exercises, characteristic families of signals along with ROC, convolution, correlation and multiplication using Z- transform, initial value theorem, Perseval's relation, inverse Z- transform by contour integration, power series & partial-fraction expansions with examples and exercises. **Discrete Fourier Transform:** Concept and relations for DFT/IDFT, Twiddle factors and their properties, computational burden on direct DFT, DFT/IDFT as linear transformation, DFT/IDFT matrices, computation of DFT/IDFT by matrix method, multiplication of DFTs, circulation convolution, computation of circular convolution by graphical, DFT/IDFT and matrix methods, linear filtering using DFT, aliasing error, filtering of long data sequences-Overlap-Save and Overlap-Add methods with examples and exercises. **Fast Fourier Transforms:** Radix-2 algorithm, decimation-in-time, decimation-in-frequency algorithm, signal flow graph, Butterflies, computations in one place, bit reversal, examples for DIT & DIF FFT Butterfly computations and exercises.	15
3	**Filter design:** Basic concepts of IIR and FIR filters, difference equations, design of Butterworth IIR analog filter using impulse invariant and bilinear transform, design of linear phase FIR filters, no. of taps, rectangular, Hamming and Blackman windows.	07
4	**Digital Signal Processor:** Elementary idea about the architecture and important instruction sets of TMS320C 5416/6713 processor, writing of small programs in assembly Language. **FPGA:** Architecture, different sub-systems, design flow for DSP system design, mapping of DSP alrorithms onto FPGA.	08

Numerical problems to be solved

Text Books:

1. Digital Signal Processing-A computer based approach, S. Mitra, TMH
2. Digital Signal Processing: Principles, Algorithms & Application, J.C. Proakis& M.G. Manslakis, PHI
3. Fundamental of Digital Signal Processing using MATLAB , Robert J. Schilling, S.L. Harris, Cengage Learning.
4. Digital Signal Processing-implementation using DSP microprocessors with examples from TMS320C54XX, Avtar Singh & S. Srinivasan, CengageLeasrning

Reference Books:

1. Digital Signal Processing, Chen, OUP
2. Digital Signal Processing, Johnson, PHI
3. Digital Signal Processing using MATLAB, Ingle, Vikas.
4. Digital Signal Processing, Ifeachor, Pearson Education.
5. Digital Signal Processing, A.V. Oppenhein& R.W. Shaffer, PHI
6. Theory and application of Digital Signal Processing, L.R. Rabiner& B. Gold, PHI
7. Digital Signal Processing, Ashok Ambarder, Cengage Learning.
8. Digital Signal Processing, S. Salivahanan, A. Vallavaris& C. Gnanpruja, TMH.
9. Xilinx FPGA user manual and application notes.

COMMUNICATION ENGINEERING
IC-605(b)

Credit: 3 **Contact: 3L**

Module	Content	Hour
1	**Elements of communication system:** The elements of a communication system, origin of noise and its effect, importance of SNR in system design. Basic principle of linear (AM) modulation, Generation of AM waves, Demodulation of AM wave. Basic principle of nonlinear (FM, PM) modulation. Generation of FM waves. Demodulation of FM waves. Sampling theorem, sampling rate, impulse sampling, reconstruction from samples, Aliasing. Analog pulse modulation-PAM (natural & flat topped sampling), PWM, PPM. Basic concept of Pulse code modulation, Block diagram of PCM, Multiplexing-TDM, FDM.	12
2	**Digital transmission:** Concept of Quantization & Quantization error, Uniform quantizer, Non-uniform quantizer, A-law and μ-law. Encoding, coding efficiency. Line coding & properties, NRZ & RZ, AMI, Manchester coding, PCM, DPCM. Base band pulse transmission, Matched filter, error rate due to noise, ISI, Raised cosine function, Nyquist criterion for distortion-less base band binary transmission, Eye pattern, Signal power in binary digital signal.	08
	Digital carrier modulation & demodulation technique: Bit rate, Baud rate, Information capacity, Shanon's limit, M-ary encoding, Introduction to the different digital modulation techniques-ASK.FSK, PSK, BPSK, QPSK, mention of 8 BPSK, 16 BPSK.	12

3	Introduction to QAM, basic of 8 QAM, 16 QAM. Basic concept of Delta modulating, Adaptive delta modulation. Introduction to the concept DPCM. Basic concept of spread spectrum modulation.	
4	**Introduction to coding theory:** Introduction, News value & Information content, Entropy, Mutual information, Information rate, Shanon-Fano algorithm for encoding, Shanon's theorem- source coding theorem, Channel coding theorem, Information capacity theorem. Basic principle of Error control & coding.	8

Numerical problems to be solved in the class.

Text Books:

1. An Introduction to Analog and Digital communication, Simon Haykin, Wiely India.
2. Analog communication system, P. Chakrabarti, DhanpatRai& Co.
12. Principle of digital communication, P. Chakrabarti, DhanpatRai& Co.
13. Modern Digital and Analog Communication systems, B.P. Lathi, Oxford university press

Reference Books:

1. Digital and Analog communication Systems, Leon W Couch II, Pearson Education Asia.
2. Communication Systems, A.B. Calson, McGraw Hill.

POWER PLANT INSTRUMENTATION
IC-605 (C)

Credit: 3 **Contact: 3L**

Module	Content	Hour
1	Concepts of Power plants of different types: Setups, energy conversions and measurement requirements, examples of Thermal, Hydal, and Nuclear plants. Thermal power plant and system instrumentation.	08
2	Boiler: control, monitoring and test instruments Instrumentation for : (i) Turbines (ii) Condensers (iii) Generators (iv) Coal handling (v) Water treatment (vi) Feed water, combustion air and flue gases	14
3	Instrumentation for safety interlocks - protective gears, emergency measures, Alarm systems and Analysis etc. Pollution measurement, monitoring and control.	10
4	Data handling-processing, logging, acquisition, accounting, display and storage. Instrumentation for Generator and Busbar coupling. Introduction to power plant modeling/simulation	08

Text Books:

1. Principles of Industrial Instrumentation, D. Patranabis, TMH New Delhi

Reference Books:

1. Electric Power Engineering Handbook – Edited by L. L. Grigsby.
2. Instrument Engineers Handbook, B. G. Liptak, Chilton Book Co., Philadelphia

PROCESS CONTROL LABORATORY
IC-691

Credit: 2 **Contact: 3P**

1. Study of Flow, Level, Pressure, Temperature processes and construction of the P&I diagram in accordance with ISA guidelines/standards.
2. Study of a typical temperature control loop having furnace suitable, suitable final control elements, Temperature transmitter, conventional PID controller/ control system.
3. Study of typical pressure control loop having pressure source, Pressure transmitter, Motorized/Pneumatic control valve and conventional PID controller/control system
4. Study of typical flow control loop having suitable flow meter, motorized/pneumatic control valve and conventional PID controller/control system
5. Study of typical level control loop having suitable flow meter, motorized/pneumatic control valve and conventional PID controller/control system
6. Study of typical air duct flow monitoring and control.
7. PLC programming through PC
8. Study of a PC based automation software /simulation software.
9. PLC and DCS based instrumentation experiments.

Institute may develop experiments based on the theory taught in addition to experiments mentioned.

SOFTWARE ENGINEERING LABORATORY
IC-694(a)

Credit: 2 **Contact: 3P**

Pre-requisite: For the software Engineering Lab, design a project proposal which will be used throughout the lab for performing different experiments using CASE tools.

1. Preparation of requirement document for proposed project in standard format.
2. Project schedule preparation using tools like MSP project, Generation of Gnatt and PERT chart from schedule. Prepare project management plan in standard format..
3. Draw Use case diagram, Class diagram, Sequence diagram and prepare Software design document using tools like Rational Rose.
4. Estimate project size using Function Point (FP)/Use Case Point. Use Excel/Open Office template for calculation.
5. Design Test Script/Test Plan (both Black box and White Box approach) for a small component of the proposed project. (Develop that component using programming languages like c/Java/VB etc.)
6. Generate test result and perform defect cause analysis using Pareto or Fishbone diagram.
7. Compute Process and Product Metrics (e.g. Defect Density, Defect Age, Productivity, Cost etc.)
8. Familiarization with any Version control system like CVS/VSS/PVCS etc.

Following projects can be used as dummy projects:

- Library management system
- Railway reservation system
- Employee payroll
- Online banking system
- Online Shopping Cart
- Online Examination

Institute may develop experiments based on the theory taught in addition to experiments mentioned.

DATE BASE MANAGEMENT SYSTEM LABORATORY
IC-694 (b)

Credit: 2 **Contact: 3P**

1. Creating Database:

- Creating a Database
- Creating a table
- Specifying Relational Data Types
- Specifying Constraints
- Creating Indexes.

2. Table and record Handling

a. INSERT statement
b. Using SELECT and INSERT together
c. DELETE, UPDATE, TRUNCATE statements
d. DROP, ALTER statements

3. Retrieving Data from Database

- The SELECT statement
- Using the WHERE clause
- Using Logical Operators in the WHERE clause
- Using IN, BETWEEN, LIKE, ORDER,BY GROUP BY and HAVING

4. Clause

- Using AGGREGATE function
- Combining Tables using JOINS
- Sub queries

5. Database Management.

- Creating views
- Creating Column Aliases
- Creating Database Users
- Using GRANT and REVOKE

Institute may develop experiments based on the theory taught in addition to experiments mentioned.

OBJECT ORIENTED PROGRAMMING LABORATORY
IC-694(c)

Credit: 2 **Contact: 3P**

1. Assignments on class, constructor, overloading, inheritance, overriding.
2. Assignments on wrapper, class, arrays.
3 Assignments on developing interfaces-multiple inheritance, extending interfaces.
4. Assignments on creating and accessing packages.

14. Assignments on multithreaded programming.
15. Assignment on applet programming

Note: Use Java for programming
Preferably download"**java_ee_sdk-6u4-jdk7-windows.exe"** from
http://www.oracle.com/technetwork/java/javaee/downloads/java-ee-sdk-6u3-jdk-7u1-downloads-523391.html

Institute may develop experiments based on the theory taught in addition to experiments mentioned.

OPERATING SYSTEM LABORATORY
IC-694 (d)

Credit: 2 **Contact: 3P**

1. **Shell programming:** creating a script, making a script executable, shell syntax (variables, conditions, control structures, function, commands)

2. **Process:** starting new process, replacing a process image, duplicating a

process image, waiting for a process, zombie process.

3. **Signal:** signal handling, sending signal, signal interface, signal set.

4. **Semaphore**: programming with semaphores (use functions semctl, semget, semop, set_semvalue, del_semvalue, semaphore_p, semaphore_v).

5. **POSIX Threads:** programming with pthread function (viz. pthread_create, pthread_join, pthread_exit, pthread_attr_init, pthread_cancel).

6. **Inter-process communication**: pipes (use functions pipe, popen, pclose) , named pipes (FIFOs, accessing FIFO)

Institute may develop experiments based on the theory taught in addition to experiments mentioned.

LOGIC AND DISTRIBUTED CONTROL SYSTEM
IC-701

Credit: 4 **Contact: 3L+1T**

Module	Content	Hour
1	**Review of computers in process control:** Data loggers, Data Acquisition Systems (DAS), Direct Digital Control (DDC) .Supervisory Control And Data Acquisition Systems (SCADA), Sampling considerations. Functional block diagram of computer control systems. Alarms, interrupts. Characteristics of digital data, controller software, linearization. Digital controller modes: Error, proportional, derivative and composite controller modes.	08
2	**Programmable logic controller(PLC) basics:** Overview of PLC systems, input/output modules, power supplies and isolators. General PLC programming procedures, programming on- off inputs/ outputs. Auxiliary commands and functions, PLC Basic Functions, register basics, timer functions, counter functions	10

3	**PLC intermediate functions:** Arithmetic functions, number comparison functions, Skip and MCR functions, data move systems. PLC Advanced functions: Alternate programming languages, analog PLC operation, networking of PLC, PLC-PID functions, PLC installation, troubleshooting and maintenance. Design of interlocks and alarms using PLC, creating ladder diagrams from process control descriptions.	10
4	**Interface & bus standard:** Interface and backplane bus standards for instrumentation systems. Field bus: Introduction, concept. HART protocol: Method of operation, structure, operating conditions and applications. Smart transmitters, IEEE 1451 protocol, smart valves and smart actuators	06
5	**Distributed Control Systems (DCS):** Definition, Local Control unit (LCU) architecture, LCU languages, LCU -Process interfacing issues, communication facilities, configuration of DCS, displays, redundancy concept -case studies in DCS.	06

Text Books:

1. Programmable Logic Controllers -Principles and Applications, F John. W .Webb Ronald A Reis, Fourth edition, Prentice Hall Inc., New Jersey, 1998.
2. Distributed Control Systems, Lukcas M.P Van Nostrand Reinhold Co., New York, 1986.
3. Programmable Logic Controllers, Frank D. Petruzella Second edition, McGraw Hill, Newyork, 1997.

Reference books:

1. Elements of Process Control Applications, P.B. Deshpande and R.H. Ash, ISA Press, New York, 1995.
2. Process Control Instrumentation Technology, Curtis D. Johnson Seventh edition, Prentice Hall, New Delhi, 2002
3. Computer-based Industrial Control, Krishna Kant Prentice Hall, New Delhi, 1997.

DATA COMMUNICATION & TELEMETRY

IC-702

Credit: 4 **Contact: 3L+1T**

Module	Content	Hour
1	**Linear Modulation:** Introduction , Amplitude Modulation (AM) , modulators and demodulators, power in AM wave , spectrum of AM wave , DSB/SC, SSB and VSB signals, their spectra and circuitry for generation and demodulation. Phase modulation.	08
2	**Pulse analog modulation:** Practical aspects of sampling, reconstruction of a message process from its samples, Time Division Multiplexing (TDM), comparison of TDM and FDM , Pulse Amplitude Modulation (PAM), Pulse Width Modulation (PWM), circuitry for generation and recovery. Pulse digital modulation: Pulse Code Modulation (PCM), noise PCM system, Differential Pulse Code Modulation (DPCM), Delta Modulation (DM), Digital multiplexers, T1 System.	10
3	**Telemetry :** Fundamentals of telemetry, signal conditioning, FDM / FM telemetry, PAM, PWM telemetry systems. Multiplexing, decommutation, PCM telemetry systems. Signal generations, bit word and frame synchronization. Power line carrier communication. Spread spectrum techniques.	08
4	**Introduction to data communication:** Data transfer modes, parallel I/O and serial I/O, asynchronous and synchronous data transfer schemes, USART for data transfer, interface standards for serial I/O and parallel I/O, protocols for synchronous communication ,BISYNC and HDLC, stop	08

	and wait, go back N and selective repeat request protocols.	
5	**Data communication through telephone network**: Data communication through telephone network, the basic telephone, telephone office function, Telephone line Echoes. Digital Private Automatic Branch Exchanges (PABX), modems, modem functions, interface between modem and USART, synchronous and statistical multiplexers.	06

Text Books:

1. Communication Systems, A. Carison Bruce, Third edition,McGrawHill,New York 1987.
2. Telecommunication and Switching systems and Networks, T .ViswanathanPrentic Hall, New Delhi, 1992
3. Telemetry Principles, D. Patranabis, Tata McGraw Hill, New Delhi, 1999.

Reference books:

1. Principles of Communication Systems, Taub& Schilling ,Tata Mcgraw Hill, New Delhi, 1991.
2. Microprocessors and Interfacing, Dauglas Hall, fourth edition, Tata McGraw Hill, 1990.
3. Tele control Methods and Applications of Telemetry and Remote Control, G. Swoboda , Reinhold Publishing Corp., London, 1991.

Advanced Process Control
IC-703(a)

Credit: 3 **Contact: 3L**

To be Incorporated

Power Plant Instrumentation
IC-703(b)

Credit: 3 **Contact: 3L**

To be Incorporated

BIO-MEDICAL INSTRUMENTATION
IC-703(c)

Credit: 3 **Contact: 3L**

Module	Content	Hour
1	**Fundamentals:** Introduction to Physiological Systems –Organism, Cardiovascular, Respiratory, Renal, Hepatic, Gastrointestinal, Endocrinal, Nervous, Muscular, Cellular. Biological Signals – Bioelectric events, Biomechanical Systems, Cellular & Membrane phenomenon. The Action Potential and Propagation through Nervous System. The Peripheral Nervous Systems and sensory mechanisms. Biomaterials. Fundamentals of Electrophysiology –EKG, EEG, EMG, Evoked potentials. Quantification of Biological Signals.	08
2	**Measurement & Analysis:** Biological Sensors- Bio-electrodes, Biosensors and Transducers for Cardiology, Neurology, Pulmonary, Oxygen saturation & gaseous exchange, flow measurement, goniometry, Endoscopy, Impedance Plethysmography. Biological Amplifiers –Instrumentation Amplifiers for Electrophysiology (ECG, EMG, EEG, EOG), Filters, Power Supplies. Recording and Display systems, Digital Conversion for storage, Electrical Hazards in measurements, Isolation Circuits, calibration, alarms & Multi-channel re-constitution. Hospital requirements – Multi-parameter bed-side monitors, Central Nursing Stations, Defibrillators, Ventilators, Catheters, Incubators.	10
	Life-Support & Treatment: Cardiac Support: Implantable & programmable Pacemakers, External & Internal	

3	Defibrillators, Coronary Angiography. Electro-physiotherapy: Shortwave & ultrasonic diathermy, Transcutaneous. Nerve Stimulators in pain relief, Traction Systems, Ultrasound in bone fracture regeneration, hypothermia & hyperthermia systems. Lasers in treatment and surgery :Opthalmic, Ablators, Endoscopic. Assists and Artificial limbs- Orthoses , passive and powered Prostheses	10
4	**Imaging:** Fundamentals of X-Rays, Radiological Imaging, Digital Radiology, DSA. Computer Tomography, Image Processing, solid state sensors, whole-body scans. Gamma camera & radio- isotope imaging. Ultrasonography- Transducers, Signal Conditioners, 2D & 3D scans, Doppler &Colour Doppler. Fundamentals of Magnetic Resonance Imaging and PET – scans.	12

Text Books:

1. Handbook of Biomedical Instrumentation , R S Khandpur, Tata –Mcgraw Hill Education [Partly Downloadable]
2. Understanding the Human Machine- A Primer for Bioengineering, M E Valentiniuzzi [Freely Downloadable in PDF], World Scientific Publishing Co.
3. Biomedical Instrumentation and Measurements, L Cornwell, F.J. Weibell& E.A. Pfeiffer, Prentice Hall.
4. Medical Instrumentation – Application & Design, J G Webster & J W. Clark , Houghton Miffin Publication.
5. Introduction to Bio-medical Equipment Technology, J J Carr & JM Brown Regents , Prentice Hall.
6. Design of Micro- controller based Medical Instrumentation, J Tompkins & J G Webster, Prentice Hall Inc

Reference Books:

1. A systems approach to Biomedicine, W.B. Blesser , McGraw Hill..
2. Biomedical Engineering, J H U Brown, J E Jacobs & L Stark, Davis Co, Philadelphia, USA.
3. Principles of Applied Biomedical Instrumentation, L A Geddes & L E Baker, John Wiley & sons.
4. Biological Control Systems, J H Milsum, McGraw Hill.
5. Bioelectric Phenomena, R Plonsey, McGraw-Hill.

POWER ELECTRONICS
IC-704(a)

Credit: 3 **Contact: 3L**

Module	Content	Hour
1	**Introduction:** Concept of power electronics, application of power electronics, uncontrolled converters, advantages and disadvantages of power electronics converters, power electronics systems, power diodes, power transistors, power MOSFETS, IGBT and GTO.	04
2	**PNPN devices:** Thyristors, brief description of members of Thyristor family with symbol, V-I characteristics and applications. Two transistor model of SCR, SCR turn on methods, switching characteristics, gate characteristics, ratings, SCR protection, series and parallel operation, gate triggering circuits, different commutation techniques of SCR.	05
3	**Phase controlled converters:** Principle of operation of single phase and three phase half wave, half controlled, full controlled converters with R, R-L and RLE loads, effects of free wheeling diodes and source inductance on the performance of converters. External performance parameters of converters, techniques of power factor improvement, single phase and three phase dual converters.	06
4	**DC-DC converters:** Principle of operation, control strategies, step up choppers, types of choppers circuits based on quadrant of operation, performance parameters, multiphase choppers and switching mode regulators.	05

5	**Inverters:** Definition, classification of inverters based on nature of input source, wave shape of output voltage, method of commutation & connections. Principle of operation of single phase and three phase bridge inverter with R and R-L loads, performance parameters of inverters, methods of voltage control and harmonic reduction of inverters. Brief idea of Resonant Pulse inverters.	10
6	**AC controllers:** Principle of on-off and phase control, single phase and three phase controllers with R and R-L loads. Principle of operation of cycloconverters, circulating and non circulating mode of operation, single phase to single phase step up and step down cycloconverters, three phase to single phase Cycloconverters, three phase to three phase Cycloconvetter.	06
7	**Applications:** Speed control of AC and DC motors. HVDC transmission. Static circuit breaker, UPS, static VAR controller.	04

Problems based on the topics to be solved in the class.

Text Books:

7. Power Electronics, M.D. Singh and K.B. Khanchandani, Tata McGraw Hill. 2007
8. Power Electronics, V.R. Moorthi, Oxford, 2005
3. Power Electronics, M.H. Rashid, PHI, 3rd Edition
4. Power Electronics, P.S. Bhimra, Khanna Publishers, 3rd Edition.

Reference Books:

16. Modern Power Electronics & AC drives, B.K. Bose, Prentice Hall
17. Power Electronics, Mohan,Undeland&Riobbins, Wiley India
18. Element of power Electronics, Phillip T Krein, Oxford, 2007
19. Power Electronics systems, J.P. Agarwal, Pearson Education, 2006
20. Power Electronics, M.S. Jamal Asgha, PHI, 2007
21. Analysis of Thyristor power conditioned motor, S.K. Pillai, University Press.
22. Power Electronics : Principles and applications, J.M. Jacob, Thomson

VLSI & MICROELECTRONICS
IC-704 (b)

Credit: 3 **Contact: 3L**

Module	Content	Hour
1	**Introduction to VLSI Design**: VLSI Design Concepts, Moor's Law, Scale of Integration (SSI, MSI, LSI, VLSI, ULSI – basic idea only), Types of VLSI Chips (Analog & Digital VLSI chips, General purpose, ASIC, PLA, FPGA), Design principles (Digital VLSI – Concept of Regularity, Granularity etc), Design Domains (Behavioral, Structural, Physical), Y-Chart, Digital VLSI Design Steps.	8

2	**MOS structure**: E-MOS & D-MOS, Charge inversion in E-MOS, Threshold voltage, Flat-band voltage, Potential balance & Charge balance, Inversion, MOS capacitances. **Three Terminal MOS Structure:** Body effect. **Four Terminal MOS Transistor**: Drain current, I-V characteristics. Current-voltage equations (simple derivation). **Scaling in MOSFET**: Short Channel Effects, General scaling, Constant Voltage & Field scaling.] **CMOS**: CMOS inverter, Simple Combinational Gates - NAND gate and NOR Gate using CMOS.	12
3	**Micro-electronic Processes for VLSI Fabrication**: Silicon Semiconductor Technology- An Overview, Wafer processing, Oxidation, Epitaxial deposition, Ion-implantation & Diffusion, Cleaning, Etching, Photo-lithography – Positive & Negative photo-resist **Basic CMOS Technology** – (Steps in fabricating CMOS), Basic n-well CMOS process, p-well CMOS process, Twin tub process, Silicon on insulator **Layout Design Rule**: Stick diagram with examples, Layout rules.	10
4	**Hardware Description Language** – VHDL or Verilog Combinational & Sequential Logic circuit Design.	10

Problems to be solved in the class.

Text Books:

1. Digital Integrated Circuit, J.M.Rabaey, Chandrasan, Nicolic, Pearson Education.
2. CMOS Digital Integrated Circuit, S.M.Kang&Y.Leblebici, TMH.
3. Modern VLSI Design, Wayne Wolf, Pearson Education.
4. VHDL, Bhaskar, PHI.
5. Advance Digital Design Using Verilog , Michel D. Celliti, PHI

References:

1. Digital Integrated Circuits, Demassa&Ciccone, John Willey & Sons .
2. Modern VLSI Design: system on silicon, Wayne Wolf; Addison Wesley Longman Publisher
3. Basic VLSI Design, Douglas A. Pucknell& Kamran Eshranghian, PHI
4. CMOS Circuit Design, Layout & Simulation, R.J.Baker, H.W.Lee, D.E. Boyee, PHI

Advanced Sensors
IC-704(c)

Credit: 3 **Contact: 3L**

To be Incorporated

System Programming & Operating System
IC-705(a)

Credit: 3 **Contact: 3L**

To be Incorporated

EMBEDDED SYSTEM
IC-705(b)

Credit: 3 **Contact: 3L**

Module	Content	Hour

1	**Introduction to Embedded systems:** Introduction – Features – Microprocessors – ALU - Von Neumann and Harvard Architecture - CISC and RISC - Instruction pipelining. Microcontroller: characteristics and Features, Overview and architectures of Atmel 89C52 and Microchip PIC16F877 and 18F452. Examples of embedded Systems: Bar-code scanner, Laser printer, Underground tank monitoring.	10
2	**PIC Microcontroller:** PIC Microcontrollers: 16F877 Architecture and Instruction Set. External Interrupts, Timers, watch-dog timer, I/O port Expansion, analog-to-digital converter, UART, I2C and SPI Bus for Peripheral Chips, Accessories and special features	08
3	**Software architecture and RTOS:** Software Architecture: Round Robin- Round Robin with interrupts -Function Queue. Scheduling Architecture RTOS: Architecture -Tasks and Task States -Tasks and Data -Semaphores and Shared Data - Message Queues -Mail Boxes and pipes -Timer Functions -Events -Memory Management Interrupt Routines	08
4	**Basic design using a real time operating system:** Overview. General principles. Design of an embedded system.	6
5	**Software development tools and debugging techniques:** Development Tool: Cross-Compiler, Cross-Assemblers, Linker/locator. PROM Programmers, ROM Emulator, In-Circuit Emulators. Debugging Techniques. Instruction set simulators. The assert macro. Testing using laboratory tools.	08

Text Books:

1. Raj Kamal, Embedded Systems Architecture, Programming and Design, TMH, 2008.
2. Simon, D. E., An Embedded Software Primer, Pearson Education, 1999.
3. Peatman, J. B., Design with PIC Microcontrollers, Pearson Education, 1998

Reference Books:

1. Steve Heath Embedded Systems Design, Second Edition-2003, Newnes,
2. Wayne Wolf, Computers as Components; Principles of Embedded Computing System Design – Harcourt India, Morgan Kaufman Publishers, First Indian Reprint. 2001
3. Frank Vahid and Tony Givargis, Embedded Systems Design – A unified Hardware /Software Introduction, John Wiley, 2002.

ARTIFICIAL INTELLIGENCE
IC-705(c)

Credit: 3 **Contact: 3L**

Module	Content	Hour

1	**Introduction:** Intelligent Agents – Agents and environments - Good behavior – The nature of environments – structure of agents - Problem Solving - problem solving agents – example problems – searching for solutions – uniformed search strategies - avoiding repeated states – searching with partial information.	06
2	**Searching techniques:** Informed search and exploration – Informed search strategies – heuristic function – local search algorithms and optimistic problems – local search in continuous spaces – online search agents and unknown environments - Constraint satisfaction problems (CSP) – Backtracking search and Local search for CSP – Structure of problems - Adversarial Search – Games – Optimal decisions in games – Alpha – Beta Pruning – imperfect real-time decision – games that include an element of chance.	09
3	**Knowledge representation:** First order logic – representation revisited – Syntax and semantics for first order logic – Using first order logic – Knowledge engineering in first order logic - Inference in First order logic – prepositional versus first order logic – unification and lifting – forward chaining – backward chaining - Resolution - Knowledge representation - Ontological Engineering - Categories and objects – Actions - Simulation and events - Mental events and mental objects.	09
4	**Learning:** Learning from observations - forms of learning - Inductive learning - Learning decision trees - Ensemble learning - Knowledge in learning – Logical formulation of learning – Explanation based learning – Learning using relevant information – Inductive logic programming - Statistical learning methods - Learning with complete data - Learning with hidden variable - EM algorithm - Instance based learning - Neural networks - Reinforcement learning – Passive reinforcement learning - Active reinforcement learning - Generalization in reinforcement learning.	09
5	**Applications:** Communication – Communication as action – Formal grammar for a fragment of English – Syntactic analysis – Augmented grammars – Semantic interpretation – Ambiguity and disambiguation – Discourse understanding – Grammar induction - Probabilistic language processing - Probabilistic language models – Information retrieval – Information Extraction – Machine translation.	07

Text Books:

1. Artificial Intelligence – A Modern Approach", Stuart Russell, Peter Norvig, 2nd Edition, Pearson Education / Prentice Hall of India, 2004.

Reference Books:

1. Artificial Intelligence: A new Synthesis, Nilsson. J. Nils , Harcourt Asia Pvt. Ltd., 2000.
2. Artificial Intelligence, Rich Elaine & Knight Kevin, 2nd Edition, Tata McGraw-Hill, 2003.
3. Artificial Intelligence-Structures and Strategies for Complex Problem Solving, Geogre F. Luger, Pearson Education / PHI, 2002.

VIII Semester

Theory

Organisational Behaviour
HU801A
Contracts: 2L
Credits- 2

1. Organizational Behaviour: Definition, Importance, Historical Background, Fundamental Concepts of OB, Challenges and Opportunities for OB. **[2]**
2. Personality and Attitudes: Meaning of personality, Personality Determinants and Traits, Development of Personality, Types of Attitudes, Job Satisfaction. **[2]**
3. Perception: Definition, Nature and Importance, Factors influencing Perception, Perceptual Selectivity, Link between Perception and Decision Making. **[2]**
4. Motivation: Definition, Theories of Motivation - Maslow's Hierarchy of Needs Theory, McGregor's Theory X & Y, Herzberg's Motivation-Hygiene Theory, Alderfer's ERG Theory, McClelland's Theory of Needs, Vroom's Expectancy Theory. **[4]**
5. Group Behaviour: Characteristics of Group, Types of Groups, Stages of Group Development, Group Decision Making. **[2]**
6. Communication: Communication Process, Direction of Communication, Barriers to Effective Communication. **[2]**
7. Leadership: Definition, Importance, Theories of Leadership Styles. **[2]**
8. Organizational Politics: Definition, Factors contributing to Political Behaviour. **[2]**
9. Conflict Management: Traditional vis-a-vis Modern View of Conflict, Functional and Dysfunctional Conflict, Conflict Process, Negotiation – Bargaining Strategies, Negotiation Process. **[2]**
10. Organizational Design: Various Organizational Structures and their Effects on Human Behaviour, Concepts of Organizational Climate and Organizational Culture. **[4]**

References:

1. Robbins, S. P. & Judge, T.A.: Organizational Behavior, Pearson Education, 15th Edn.
2. Luthans, Fred: Organizational Behavior, McGraw Hill, 12th Edn.
3. Shukla, Madhukar: Understanding Organizations – Organizational Theory & Practice in India, PHI
4. Fincham, R. & Rhodes, P.: Principles of Organizational Behaviour, OUP, 4th Edn.
5. Hersey, P., Blanchard, K.H., Johnson, D.E.- Management of Organizational Behavior Leading Human Resources, PHI, 10th Edn.

ANALYTICAL INSTRUMENTATION
IC-801 (a)

Credit: 3 **Contact: 3L**

Module	Content	Hour
1	**Introduction to Analytical Instrumentation**: Difference between analytical and other instruments. Classification, types of Instrumental methods. **Measurement of Humidity**: Dry & wet psychrometer, Hair hygrometer, electrical type, Electrolysis type hygrometer, Dew point meter. **Moisture:** Electrical conductivity type, Capacitive method type, IR method, Microwave method, Crystal oscillator method. **Viscosity:** Poiseuilles formula, Saybolt's viscometer, Rotameter type viscometer, Friction tube viscometer, Searle's rotating cylinder type. **Density:** Pressure head type, Buoyancy effect type, Gow-Mac densitometer, Radioactive type, Photoelectric type, Displacer type. **Gas Analysis:** a) Thermal conductivity method. b) Heat of Reaction method. **Oxygen Analysis:** a) Magneto Dynamic instrument(Pauling cell) b) Thermomagnetic type or Hot wire type instrument. c) Zirconia oxygen analyzer. d) Mackerth type galvanic analyzer for dissolved oxygen analysis.	10

2	**Liquid analysis:** a) Electrodes-Ion selective, Molecular selective types- their variations. b) pH analysis: pH electrodes, circuit for pH measurement and applications. c) Conductivity cells – standards, circuits. d) Polarography- apparatus, circuits and techniques-pulse polarography, applications **e)** Colorimetry	10
3	**Spectroscopic Methods :** Introduction, Laws relating to absorption of radiation, Molecular Absorption Spectroscopy in UV & VIS ranges: sources, wavelength selectors, sample container, detectors, Spectrophotometers (Single beam & Dual beam arrangement). Atomic Absorption & Emission spectroscopy : Atomizers, sources, single & dual beam arrangement Plasma Spectroscopy : Sequential & Simultaneous multichannel Instruments. Atomic X Ray spectrometry: Absorption & diffraction phenomena, sources, detectors, techniques. IR Spectroscopy: sources, monochromators, detectors. IR Spectrometer, FT-IR spectrometers.	12
4	**Chromatography:** Introduction, basic definitions, some relationships. Gas chromatography: basic parts, columns, detectors, techniques. LC: types, HPLC : basic parts, sample injection system, column, detectors, Applications.	08

Text Books:

1. Principles of Industrial Instrumentation- D.C. Patranabis, Tata McGraw Hill.
2. Handbook of Analytical Instruments- R.S. Khandpur, Tata McGraw Hill
3. Principles of Instrumental Analysis- Skoog, Holler, Nieman, Thomson Brooks/Cole

NON DESTRUCTIVE TESTING & ULTRASONIC INSTRUMENTATION
IC-801 (b)

Credit: 3 **Contact: 3L**

Module	Content	Hour
1	Introduction and importance of NDT. General Principles and Basic Elements of NDT. Surface feature inspection and testing: General, Visual, Chemical, and Mechanical. Magnetic-magnetization, flux, and Electro potential, Electrical resistivity, Electromagnetic-eddy current techniques.	12
2	Ultrasonic waves, principle and propagation of various waves, Characterization Ultrasonic transmission, reflection and transmission coefficients, intensity and attenuation of sound beam, power level, generation of ultrasonic waves, Magnetostrictive and Piezoelectric effect, search unit , types, construction, characteristics.	12
3	Ultrasonic Test methods: Echo, Transit time, Resonance, Direct contact and immersion types Ultrasonic methods of measuring thickness, depth, flow, level etc. Various parameters affecting ultrasonic testing and measurements, their remedy. Ultrasonic in medical diagnosis and therapy, Acoustical holography.	12

Text Books:

1. NDT Handbook, Mclutive p , American Society for NDT, 1989.
2. Non Destructive Testing, Hull B and John V , FI BS/McMillan.

3. Ultrasonic Testing of materials, Krantkramer ,Springer 2005
4. Handbook of Nondestructive Testing, Mc Graw Hill, 1998
5. Digital Holograpy, U. Schnars, W. Jeuptner ,Springer, 2005
6. Nuclear radiation Detection, W. J. Price Mc Graw Hill, New York, 1958
7. Ultrasonic Testing of Materials, Krauthsamer J and Krauthsamer H ,Springer Verlag, Berlin, New York.
8. Biomedical Ultrasonic, Wells N T, Academic Press, London.

OPTOELECTRONICS & LASER BASED INSTRUMENTATION
IC-801 (c)

Credit: 3 **Contact: 3L**

Module	Content	Hour
1	**Optical fibers and their properties:** Introduction to optical fibers - Light guidance - Numerical aperture - Dispersion - Different types of fibers and their properties. Light Sources for fiber optics, Photo detectors, source coupling, splicing and connectors.	05
2	**Opto-electronic components:** LASER fundamental, Laser configuration - Q-Switching - Mode locking - Different types of Lasers - Ruby, Nd-Yag, He-Ne, CO2, Orgon ion. LED, LD, PIN & APD, Electro-optic, Magneto optic and Acousto-optic Modulators.	08
3	**Fiber optic sensors:** IR sources and detectors - Interferometer method of measurement of length - Moire fringes - Measurement of pressure, Temperature, Current, Voltage, Liquid level and strain - fiber optic Gyroscope - Polarization maintaining fibbers - Applications.	08
4	**LASER instrumentation:** Industrial applications of lasers - Bio-medical application - Laser Doppler velocity meter - Laser heating. **Holography:** Principle, Methods, Holographic Interferometers and applications. **Medical application:** Lasers and tissue interaction, Laser instruments for surgery, removal tumors of vocal cords, plastic surgery, DERMATOLOGY.	10
5	**Opto-electronic instruments:** Light power meter, wave length meter, optical time domain refractometer (OTDR).	04

Text Books:

1. An Introduction to Optical fibers.- Allen H.C. McGraw Hill, Singapore,
2. Optics - A.K. Ghatak, Second edition, Tata McGraw Hill, New Delhi.
3. Optoelectronics-an introduction, Wilson and Hawkes, 3rd edition, PHI.
4. Lasers: Theory and Applications, K. Thyagarajan and A.K. Ghatak, Plenum Press, New York.
5. Lasers and Optical Engineering, P. Das, Springers International Students Edition, 1991.
6. Laser and Applications, W.O.N. Guimarass andA. Mooradian, Springer Verlag, 1981.

DIGITAL IMAGE PROCESSING
IC-802(a)

Credit: 3 **Contact: 3L**

Module	Content	Hour

1	**Digital Image Processing Systems**: Introduction to structure of human eye, Image formation in the human eye, Brightness adaptation and discrimination, Image sensing and acquisition, storage, Processing, Communication, Display Image Sampling and quantization, Basic relationships between pixels.	05
2	**Image Transforms (implementation):** Introduction to Fourier transform, DFT and 2-D DFT, Properties of 2-D FT, FFT, IFFT, Walsh transform, Hadamard transform, Discrete cosine transform, Slant transform, Optimum transform: Karhunen – Loeve Hotelling) transform.	07
3	**Image Enhancement in the Spatial and Frequency Domain:** Gray level transformations, Histogram processing, Arithmetic and logic operations, Spatial filtering: Introduction, Smoothing and sharpening filters. Frequency domain filters: Homomorphic filtering.	07
4	**Image Data Compression:** Fundamentals, Redundancies: Coding, Inter pixel Psycho-visual, fidelity criteria, Image compression models, Error free compression, Lossy compression, Image compression standards: Binary image and Continuous tone Still Image compression standards, Video compression standards.	07
5	**Morphological Image Processing:** Introductions, Dilation, Erosion, Opening, closing, Hit -or-miss transformation, Morphological algorithm operations on binary Images, Morphological algorithm operations on gray-scale Images.	07
7	**Image Segmentation, Representation and Description:** Detection of discontinuities, Edge linking and Boundary detection, Thresholding region based segmentation, Image Representation schemes, Boundary descriptors, and Regional descriptors.	07

Numerical problems to be solved in the class.

Text Books:

1. Digital Image Processing, R.C Gonzalez and R. Woods, Pearson publication.
2. Digital Image Processing, Anil K. Jain, Prentice-Hall, India.

Reference Books:

1. Digital Image Processing, W.K. Pratt 2nd Edition, John Wiley & Sons.
2. Digital Image Processing and Analysis, B. Chanda & D. Dutta Majumder Prentice-Hall, India.
3. Image Processing- Theory, Algorithms & Architecture, M. A. Sid-Ahmed, McGraw-Hill.

4. COMPUTER NETWORKS

5. IC-802(b)

6. Credit: 3 **Contact: 3L**

Module	Content	Hour
1	**Overview of Data Communication and Networking:** Introduction, Data communications: components, data representation (ASCII, ISO etc.), direction of data flow (simplex, half duplex, full duplex); network criteria, physical structure (type of connection, topology), categories of network (LAN, MAN, WAN); Internet: brief history, Protocols and standards; Reference models: OSI reference model, TCP/IP reference model, their comparative study. **Physical Level:** Overview of data (analog & digital), signal (analog & digital), transmission (analog & digital) & transmission media (guided & unguided); Circuit Switching: time division & space division switch, TDM bus; Telephone Network.	10

2	**Data link Layer:** Types of errors, framing (character and bit stuffing), error detection & correction methods; Flow control; Protocols: Stop & wait ARQ, Go-Back-N ARQ, Selective repeat ARQ, HDLC;] **Medium Access sub layer:** Point to Point Protocol, LCP, NCP, Token Ring; Reservation, Polling, Multiple access protocols: Pure ALOHA, Slotted ALOHA, CSMA, CSMA/CD, CSMA/CA Traditional Ethernet, fast Ethernet (in brief).	10
3	**Network layer:** Internetworking & devices: Repeaters, Hubs, Bridges, Switches, Router, Gateway; Addressing : IP addressing, sub netting; Routing : techniques, static vs. dynamic routing , Unicast Routing Protocols: RIP, OSPF, BGP; Other Procols: ARP, IP, ICMP, IPV6. **Transport layer:** Process to Process delivery; UDP; TCP; Congestion Control: Open Loop, Closed Loop choke packets; Quality of service: techniques to improve QoS: Leaky bucket algorithm, Token bucket algorithm,	12
4	**Application Layer:** Introduction to DNS, SMTP, SNMP, FTP, HTTP & WWW; Security: Cryptography (Public, Private Key based), Digital Signature, Firewalls. **Modern topics:** ISDN services & ATM, DSL technology, Cable Modem: Architecture and operation in brief. Wireless LAN: IEEE 802.11, Introduction to blue-tooth.	08

7.

8. Numerical problems to be solved in the class.

9.

10. Text Books:

11. 1. Data Communications and Networking (3rd Ed.), A. Forouzan , TMH
12. 2. Computer Networks (4th Ed.), A. S. Tanenbaum, Pearson Education/PHI
13. 3. Data and Computer Communications (5th Ed.), W. Stallings, PHI/ Pearson Education

14.

15. Reference Books:

16. 1. Computer Networking -A top down approach featuring the internet, Kurose and Rose
17. Pearson Education
18. 2. Communication Networks, Leon, Garica, Widjaja, TMH
19. 3. Communication Networks, Walrand, TMH.
20. 4. Internetworking with TCP/IP, vol. 1, 2, 3(4th Ed.), Comer, Pearson Education/PHI

MOBILE COMPUTING
IC-802(c)

Credit: 3 **Contact: 3L**

Module	Content	Hour
1	**Introduction to Personal Communications Services (PCS):** PCS Architecture, Mobility management, Networks signalling. Global System for Mobile Communication (GSM) system overview: GSM Architecture, Mobility management, Network signalling.	05
2	**General Packet Radio Services (GPRS)**: GPRS Architecture, GPRS Network Nodes. Mobile Data Communication: WLANs (Wireless LANs) IEEE 802.11 standard, Mobile IP.	05

3	**Wireless Application Protocol (WAP):** The Mobile Internet standard, WAP Gateway and Protocols, wireless mark up Languages (WML). Wireless Local Loop(WLL): Introduction to WLL Architecture, wireless Local Loop Technologies.	07
4	**Third Generation (3G) Mobile Services:** Introduction to International Mobile Telecommunications 2000 (IMT 2000) vision, Wideband Code Division Multiple Access (W-CDMA), and CDMA 2000, Quality of services in 3G.	07
5	**Global Mobile Satellite Systems**; case studies of the IRIDIUM and GLOBALSTAR systems. Wireless Enterprise Networks: Introduction to Virtual Networks, Blue tooth technology, Blue tooth Protocols.	07
6	**Server-side programming in Java**, Pervasive web application architecture, Device independent example application	08

Text Books:

3. Pervasive Computing, Burkhardt, Pearson
4. Mobile Communication, J. Schiller, Pearson
5. Wireless and Mobile Networks Architectures, Yi-Bing Lin & Imrich Chlamtac, John Wiley & Sons, 2001
6. Mobile and Personal Communication systems and services, Raj Pandya, Prentice Hall of India, 2001.

Reference Books:

21. Guide to Designing and Implementing wireless LANs, Mark Ciampa, Thomson learning, Vikas Publishing House, 2001.
22. Wireless Web Development, Ray Rischpater, Springer Publishing,
23. The Wireless Application Protocol, Sandeep Singhal, Pearson.
24. Third Generation Mobile Telecommunication systems, by P.Stavronlakis, Springer Publishers,