Indian Institute of Space Science and Technology

Department of Space, Govt. of India

Thiruvananthapuram

Curriculum and Syllabus for

B.TECH AVIONICS - R 2007

FIRST SEMESTER

Course Code	Course Title	L	T	P	C
MA111	Mathematics I	3	1	0	4
PH 111	Physics I	2	1	0	3
CH111	Chemistry I	2	1	0	3
AE111	Basic Mechanical Engineering I	2	0	0	2
AV111	Basic Electrical and Electronics Engineering I	2	1	0	3
HS111	Communication Skills and Humanities	2	0	2	3
PH131	Physics Lab I	0	0	3	1
CH131	Chemistry Lab I	0	0	3	1
AE131	Mechanical Engineering Lab I	0	0	3	1
AE 132	Engineering Drawing	1	0	3	2
AV131	Electrical and Electronics Engineering Lab I	0	0	3	1
Total		**14**	**4**	**17**	**24**

SECOND SEMESTER

Course Code	Course Title	L	T	P	C
MA121	Mathematics II	4	1	0	5
PH121	Physics II	4	1	0	5
CH121	Chemistry II	2	1	0	3
AE121	Basic Mechanical Engineering II	3	0	0	3
AV121	Basic Electrical and Electronics Engineering II	3	0	0	3
MA141	Programming Lab	0	0	2	1
AE141	Mechanical Engineering Lab IIA	0	0	6	2
AV141	Electrical and Electronics Engineering Lab II	0	0	3	1
Total		**16**	**3**	**11**	**23**

THIRD SEMESTER

Course Code	Course Title	L	T	P	C
MA211	Mathematics III	3	1	0	4
MA212	Partial Differential Equations, Numerical Methods and Programming Language	3	0	0	3
AV211	Analog Electronic Circuit	3	0	0	3
AV212	Semi Conductor Devices and IC Technology	3	0	0	3
AV213	Networks Signal and Systems	3	1	0	4
AE215	Engineering Mechanics	3	0	0	3
MA231	Programming Lab	0	0	3	1
AV231	Analog Electronic Circuit Lab	0	0	3	1
AV232	E-CAD Lab	0	0	3	1
Total		**18**	**2**	**9**	**23**

FOURTH SEMESTER

Course Code	Course Title	L	T	P	C
MA221	Mathematics IV	3	1	0	4
AV221	Digital Electronics and VLSI Design	4	0	0	4
AV222	Microprocessor and Microcontrollers	3	0	0	3
AV223	RF and Microwave Communication	3	0	0	3
CH221	Environmental Science and Engineering	2	0	0	2
AV241	Digital Electronics Lab	0	0	3	1
AV242	VLSI Design Lab	0	0	3	1
AV243	Microprocessor and Microcontroller Lab	0	0	3	1
AV244	RF and Microwave Communication Lab	0	0	3	1
Total		**15**	**1**	**12**	**20**

FIFTH SEMESTER

Course Code	Course Title	L	T	P	C
AV311	Digital Signal Processing	3	0	0	3
AV312	Digital Communication	3	0	0	3
AV313	Computer Organization and OS	3	1	0	4
AV314	Control and Guidance Systems	4	0	0	4
AV315	Instrumentation and Measurement	3	0	0	3
HS 311	Introduction to Social Science and Ethics	2	0	0	2
AV331	Digital Signal Processing Lab	0	0	3	1
AV332	Digital Communication Lab	0	0	3	1
AV333	Control and Guidance Lab	0	0	3	1
AV334	Instrumentation and Measurement Lab	0	0	3	1
Total		**18**	**1**	**12**	**23**

SIXTH SEMESTER

Course Code	Course Title	L	T	P	C
AV321	Computer Networks	3	0	0	3
AV322	Power Electronics	3	1	0	4
AV323	Radar Systems	3	0	0	3
E01	Stream Elective I	3	0	0	3
HS 321	Principles of Management Systems	3	0	0	3
AV341	Computer Networks Lab	0	0	3	1
AV342	Power Electronics Lab	0	0	3	1
Total		**15**	**1**	**6**	**18**

AV451 Summer Internship and Training 3

SEVENTH SEMESTER

Course Code	Course Title	L	T	P	C
AV411	Navigation Systems and Sensors	3	1	0	4
E02	Stream Elective II	3	0	0	3
E03	Stream Elective III	3	0	0	3
E04	Department Elective	3	0	0	3
I01	Institute Elective	3	0	0	3
AV431	Navigation Systems and Sensors Lab	0	0	3	1
AV452	Seminar	0	0	0	2
Total		15	1	3	19

EIGTH SEMESTER

Course Code	Course Title	L	T	P	C
AV453	Comprehensive Viva-Voce	0	0	0	3
AV454	Project Work	0	0	0	12
Total		**0**	**0**	**0**	**15**

ABBREVIATIONS

MA – Mathematics; PH – Physics; CH – Chemistry; HS – Humanities; AE – Aerospace Engineering; AV – Avionics; L – Lecture; T – Tutorial; P – Practical; C – Credits.

DEPARTMENT ELECTIVE COURSES

Sl No.	Course Code	Course name
1	AV461	Advanced Control Theory
2	AV462	Embedded Systems and Real Time OS
3	AV463	Soft Computing
4	AV464	Advanced DSP and Adaptive Filter
5	AV465	Robust and Optimal Control
6	AV466	Estimation and Stochastic Theory
7	AV467	Introduction to Optimization and OR
8	AV468	Digital Control System
9	AV469	EMI/EMC
10	AV470	Digital Image Processing
11	AV471	VLSI Design
12	AV472	Opto-Electronics and Fiber Optics Communication
13	AV473	Information Theory and Coding
14	AV474	Cryptography
15	AV475	Mobile Communication
16	AV476	Microwave Integrated Circuits
17	AV477	Antenna Engineering
18	AV478	Satellite Communication
19	AV479	Computer Graphics
20	AV480	Graph Theory and OR
21	AV481	Modern Algebra and Tensors
22	AV482	Data Structure and DBMS
23	AV483	Software Engineering

SEMESTER I

MA111	MATHEATICS I	(3- 1 - 0) 4 credits

Calculus and Differential Equations

Calculus: Taylor's theorem, partial differentiation, maxima and minima by using Lagrangian Multipliers. Improper Integrals. Application of differentiation and Integration, concavity and convexity of a curve, points of inflexion, asymptotes, curvature, curve tracing. Lower and upper Integrals, the Riemann integral and its properties, The fundamental theorem of Calculus , differentiation, mean value theorems. Double and triple integrals, Change of variables in double integral, Polar and Spherical transforms, Jacobians of transformations, Differentiation under integral sign.

Differential Equations: Introduction to Mathematical Modelling and Simulation. First order differential equations. Classification of differential equation: Linear, nonlinear, homogeneous and non-homogeneous, constant coefficient and variable coefficient equations. Hadamard,s problem, existence and uniqueness of solution of y'=f (x,y). Higher order linear differential equations with constant coefficients. Solution of second order system with forcing terms. Method of variation of parameters and method of undetermined coefficients.

Series Solutions to Differential Equations: Real numbers, sequences of real numbers, limits, series, convergence of series, power series solutions to Differential equations, Regular singular points, Fobeneous Method to solve variable coefficient Differential Equations. Special functions of mathematical physics: Legebdre polymonials, Besel's functions, Gamma function and their properties, Sturm-Liouvllie Problems, Self adjoint operators, Green's functions.

Text Books:

1. Erwin Kreyszig, Advanced Engineering Mathematics, 9th ed., John Wiley, 2005
2. James Stewart, Calculus : Early Transcendentals, Books/Cole Pub Co, NY, 2007

Reference Books:

1. Simmons, G.F. Differential Equations with Historical Notes, Tata McGraw-Hill, NY, 1972
2. Thomas, G.B. and Finney, Calculus and Analytic geometry, 9thed., Pearson Education, 2003
3. Jain, R.K. and Iyengar, S.R.K., Advanced Engineering Mathematics, Narosa, New Delhi, 2005.
4. Robert L Borrelli, Differential equations – A modeling prospective, 2nded. Wiley, 2004.
5. Hidebrand, Francis B, Advanced Calculus for Aplications, Englewood Cliffs, Prentice-Hall, 1962.
6. Taylor, Angus E, Advanced Calculus, Walthom Xerox college publishing, 1955.
7. Bear, H.S – Understanding Calculus, John Wiley. 2nded., 2003.
8. Daniel Alexander Murray, Introductory Course in Differential equations for students in Classical and Engineering College, Merchant books, 2007.
9. Protter, Murray H, Basic Elements of Real Analysis, Springer-Verlag, New York, Inc., 1998.
10. Tom M Apostol, Calculus, Vol. 1, 2nd ed., John Wiley.

PH111	PHYSICS I	(2- 1 - 0) 3 credits

Essentials of Physics

Physics as natural philosophy: Making observations, accuracy of observations, making measurements, creation of hypothesis and verification, units and dimensions, Error analysis
Mechanics and Gravitation: Solar system, Geocentric & heliocentric theories, planetary orbits, Keplor's laws Newton's laws of motion, Galilean invariance, concepts of inertia, momentum, force, work and energy, conservation laws, gravitation, Newton's inverse square law
Optics: Understanding of light phenomenon, corpuscular and wave theories of light, reflection, refraction, interference, diffraction, polarization, dispersion, lenses and mirrors, telescope, microscope, human eye, lasers
Oscillations and Waves: In nature, damped and forced oscillations, coupled oscillators, travelling waves, superposition of waves, wave energy, energy transfer by waves, sound waves, Doppler effect
Heat and Temperature: heat transfer, laws of thermodynamics, connection between heat and statistical behaviour of molecular, kinetic theory, disorder and concept of entropy
Electricity and Magnetism: Electric and magnetic properties of materials, relationship between electricity and magnetism, electromagnetic waves
Relativity: Constancy of Speed of light, relativity, relativity principle, Lorentz contraction and time dilation, mass energy relation
Quantum Mechanics: Black body radiation, inadequacy of classical mechanics, quantum theory, Planck's law, light quantum, photoelectric effect, wave particle duality, de Broglie hypothesis, formulation of quantum mechanics, probability interpretation, Heisenberg's uncertainty principle, Schrodinger's equation

Text Books

1. Raymond, A.S. and Jewett, J.W., Principles of Physics: A Calculus Based Text, 3rd ed., Thomson Brooks/Cole, 2006.
2. David Halliday, Robert Resnick and Jearl Walker, Fundamentals of Physics, 6th ed., John Wiley & Sons Inc., 2001

Reference Books

1. Hugh D. Young and Roger A Freedman, Sears and Zemansky's University Physics, 11th ed., Pearson Education, 2004.
2. Feynman, R.P., Leighton, R.B and Sands, M., The Feynman Lectures on Physics, Narosa Publishing House, 1986.
3. Arthur Beiser, Concepts on Modern Physics, 6th ed., Tata McGraw-Hill, 2003.
4. Ajoy Ghatak, Optics, Ajoy Ghatak, 3rd ed., Tata McGraw-Hill Publishing Company Limited, 2005.
5. Tipler, P.A. Physics, CBS Publishers and Distributors.
6. Leighton, R.B, Principles of Modern Physics, International Series of Pure and Applied Physics.
7. Giancoli, D.C., Physics: Principles with Applications, 5th ed., Prentice Hall.

CH111	CHEMISTRY I	(2- 1 - 0) 3 credits

Basic Concepts of Chemical bonding: different types of bonds (Structure and bonding-Hybridisation-VSEPR etc, VB and MO).
Organic Chemistry: Classification of Compounds, aliphatic and aromatic. Synthesis and reactions of saturated and unsaturated compounds. Isomerism-functional groups and types of reactions.

Spectroscopy: General features, fundamentals of UV-VIS and IR Spectroscopy. Beer-Lambert's law, Electronic absorption and emission spectroscopy. Introduction to important spectroscopic techniques.

Thermodynamics: Laws of thermodynamics, Concept of internal energy and entropy. Thermodynamics and chemical reactions.

Electrochemical systems: Electrochemical cells and EMF, Applications of EMF measurements: Thermodynamic data, activity coefficients, solubility product and PH.

Polymer Chemistry: Monomers, polymeriozability, Degree of polymerization, molecular weights, thermal transitions, Classification of polymers, Method of polymerization, Step growth and addition (free radical, ionic). Introduction to copolymers, block and graft copolymers. Polymers for space applications.

Chemical Engineering: Laboratory and industrial manufacture of chemicals. Unit process and unit operators, Technical and economic feasibility, Block diagrams and process flow diagrams , Material and energy balances, industrial reactors, Manufacture of Ammonia, petroleum refining

Propellants and explosives: Primary and secondary explosives, RDX, HMX, Plastic bonded explosives, initiators, detonators, explosion, detonation. Classification of propellants-solid, liquid and hybrid propellants.

Text Books:

1. Jain, P.C and Jain, M., Engineering Chemistry, 15th ed., Dhanpat Rai Publishing Company, New Delhi, 2007
2. Krishnamurthy, N., Vallinayagam, P. and Madhavan, D., Engineering Chemistry, Prentice-Hall of India Pvt. Ltd., New Delhi, 2007.

Reference Books:

1. Atkins, P. and J De Paula, Atkins' Physical Chemistry, 8th ed., Oxford University Press, 2007
2. Kuriakose, J.C. and Rajaram, J., Chemistry in Engineering & Technology, Volume I, Tata McGraw-Hill, 1984
3. Paula Y Bruice, Organic Chemistry, Pearson Education, New Delhi, 2006.
4. Lee, J.D., Concise Inorganic Chemistry, 5th ed., Tata Mcgraw-Hill, 2007.
5. Barrow, G.M., Physical Chemistry, 5th ed., Tata Mcgraw-Hill, 2007.
6. Young, R.J and Lovell, P.A., Introduction to Polymers, 2nd ed., Chapman & Hall, London, 1991.
7. McCabe, W.L., Smith, J.C. and Harriott, P., Unit Operations of Chemical Engineering, 7th ed., Mcgraw-Hill International Edition, 2005.
8. Urbensky, Chemistry and Technology of Explosives, Vol.2, Vol.3 and Vol.4, Pergamon Press, New York, 1988.

AE111 BASIC MECHANICAL ENGINEERING I (2- 0 - 0) 2 credits

Introduction to Mechanical Engineering: Mechanical Systems, examples, role of Mechanical Engineering in industry with emphasis on aerospace industry – a historical overview of evolution of mechanical systems.

Materials: Introduction to engineering materials – different types of metals, alloys and composites – basic mechanical properties.

Manufacturing Processes: Basics of conventional design and manufacturing processes, Concept of concurrent engineering

Engineering measurements and control: Uses, functions of an instrument, performance characteristics: Zero and first order instruments. Errors. Control systems

Metrology: Objectives, Standards: line, end and wavelength standards, Geometric dimensioning and tolerencing, Indian standards. Metrology in quality assurance.

Text Books:

- Lecture Notes

Reference Books:

1. Shanmugam, G., Basic Mechanical Engineering, Tata McGraw-Hill, 2007.
2. Sawhney, G.S,. Fundamentals of Mechanical Engineering: Thermodynamics, Mechanics and Strength of Materials, Prentice Hall of India, 2007
3. Doebelin, E.D., Measuremnt Systems: Application and Design, 5th Edition, Tata McGraw-Hill, 2007.
4. Murthy, V.S.R., Structure and Properties of Engineering Materials, Tata McGraw-Hill, 2007.
5. Rao.P.N., Manufacturing Technology, Tata McGraw-Hill, 2007.
6. Cengel. Y.A. and Boles, M.A., Thermodnamics, 5th Ed., Tata McGraw-Hill, 2007

AV111	BASIC ELECTRICAL AND ELECTRONICS ENGINEERING I	(2- 1 - 0) 3 credits

Elementary DC circuits: Kirchhoff's Current law and Voltage law. Basic circuit elements : resistors, capacitors, inductors.

Basic circuit analysis method: Nodal, mesh and modified nodal-analysis. Network theorems: Tellegen's theorem, Superposition theorem, Thevenin's theorem and Norton's theorem, substitution theorem, Reciprocity theorem, Maximum power-transfer theorem.

Analysis of simple AC circuits: Phasors, phasor diagrams; impedance and admittance concepts, Power measurement in 1 and 3 phase AC circuits, Active and Reactive power, Power factor; Series and parallel resonance-Q factor; step response and Transient analysis of RL, RC and RLC circuits.

Basic Electronics. Semiconductor diode characteristics and applications in rectifiers and power suppliers. Transistor charecteristics, Biasing circuits, small signal and low frequency transistor model, field Effect Devices: JFET/HFET MOSFET operation.

Text Books:

1. Edward Hughes, Electrical & Electronic Technology, Pearson Education, 2002
2. Robert L Boylsted and Louis Nashelsky, Electronic Device and Circuits, Pearson Education.

Reference Books:

1. Hayt, W.H. and Kemmerley, J.E., Engineering Circuit Analysis, 4th International Student Edition, McGraw-Hill, 1986
2. Murthy, K.V.V and Kamath, M.C. Basic Circuit Analysis, 1st ed., Reprinted Jaico Publishing, 1998
3. Vincent D Eltoro, Principles of Electrical Engineering, 2nd ed., Prentice Hall, 1986.
4. Kothari, D.P., Nagrath, I.J., Theory and Problems of Basic Electrical Engineering, Prentice Hall, 2000
5. Allen Mottershed, Electronic Devices and Circuits, An Introduction, 12th Indian Reprint, EEE Publication, 1989.
6. Bapat, Y.N., Electronic Devices and Circuits, 9th Reprint, Tata Mcgraw-Hill, 1989.

7. Malvino, A.P., Electronic Principles, 3rd TMH ed., 12th Printing, Tata McGraw Hill, 1989.
8. Floyd, Electronic Device, Pearson Education.

HS111 COMMUNICATION SKILLS AND HUMANITIES (2- 0 - 2) 3 credits

Economics for a Developing World

Principles and Concepts

Economics: Definitions, importance, schools of thought, resource allocation, its nature and importance for developing countries.

Economic Systems: Basics of capitalism, Socialism Mixed economy, Market economy anf Third World Economies

Basic Concepts and principles: Micro and Macro economics, Demand and Supply, Elasticity, Production-factors of production and production function, Costs- TC, AC, MC and OC, VC, FC, Short Run and Long Run costs, Market-Basics of Perfect competition, Monopoly, Monopsony and Oligopoly, Concept of equilibrium, Consumer surplus, National income and BOP.

Economic Problems and Policies

Developing countries and developed countries, differences, characteristics, LCD's.

Meaning of Development- Development Vs growth, Measuring development, Problems of growth, lessons and controversies, Indian situation.

Poverty and Inequality – vicious circle of poverty

Population and Development- Demographic transition theory, optimum population, importance of population, problems of population growth.

Agriculture and Rural Development- importance, problems, agrarian conditions in India.

Development Planning : Theory and Practice

Meaning of Planning, importance, types, Case for and against planning, objectives and strategies of planning, methodology of planning, India's planning experience-planning commission, NDC, brief review of five year plans, achievements and problems.

Communication Skills

Introduction to phonetic and organs of speech. Phonetic script. Practice of sounds in the language lab, pronunciation drills with emphasis on stress, rhythm and intonation; learning: listening skills, reading skills along with interactive and interpersonal skills.

Basics of Grammar, vocabulary exercise, group discussions, teaching language through visual aids like photographs, audio-video clippings or movies and exercise in augmenting conversational skills.

Text Books:

1. Dewett K.K., Modern Economic Theory.
2. Sowell, Thomas, Basic Econimics: A Citizen's Guide to Economy.
3. Lipsey, Richard/Chrysta K Alec, Economics
4. Thirlwall A.P., Growth and Development with special reference to Developing Economics.
5. Sundaram K.P.M. and Ruddar Dutt, Indian Economy.
6. Lekhi, Economics of Development and Planning.

Reference Books:

1. Meir, Gerald M. And James E Rauch, Leading issues in Economic Development.

2. Todaro, Michael P and Stephen C Smith, Economic Development.
3. Aggarwal A.N., Indian Economy, Problems of Development and Planning.
4. Pearce, David W., McMillan Dictionary of Modern Economics.
5. Economic Survey, Ministry of Finance, Govt.of India.
6. The Hindu Business Line, National daily.
7. David E.O'Connor, The Basics of Economics.
8. Kapila, Uma, Indian Economy Since Independence.
9. Misra, S.K, and Puri, V.K., Indian Economy: its Development Experience.

PH131 PHYSICS LAB I (0- 0 - 3) 1 credit

Properties of matter and Thermal Physics

1. Young's modules – Cantilever (Pin and Microscope and Dynamics)
2. Rigidity modulus – Static Torsion (Mirror and Telescope)
3. Viscosity of liquid – Constant and variable pressure head
4. Surface Tension – Capillary rise method
5. Thermal conductivity of a bad conductor (Lee's disc method)
6. Specific heat of a liquid using steam

Mechanics and sound

1. Moment of inertia – Flywheel
2. 'g' – Compound pendulum (symmetric)
3. Kater's pendulum (precise setting and analysis)
4. Frequency of tuning fork (Sonometer)

Optics

1. Focal length – Convex and Concave lens
2. Refractive index – Spectrometer 1-d curve
3. Refractive index – Small angle prism
4. Spectrometer grating – Wavelength of spectral lines (normal incidence)
5. Grating : (a) minimum deviation (b) Oblique incidence

CH131 CHEMISTRY LABI (0- 0 - 3) 1 credit

Inorganic Chemistry

1. Acidimetry and Alkalimetry
2. Permanganometry
3. Dichrometry
4. Iodometry and Iodimetry

Physical Chemistry

1. Chemical Kinetics
2. Viscosity of sugar solution
3. Potentiometry
4. Conductometry
   i) Strong acid with strong base
   ii) Weak acid against strong base
   iii) Mixture of acids

Organic Chemistry

1. Determination of purity of phenol
2. Synthesis of aspirin
3. Synthesis of paracetamol

Polymer Chemistry

1. Synthesis of polystyrene

AE131	MECHANICAL ENGINEERING LAB I	(0- 0 - 3) 1 credit

Objective: To provide basic exposure in manufacturing methods and to make aware the means of metal working and machine tools.

1. Carpentry: Study of tools and joints – planning, chiselling, marking and sawing practice. Joints – cross and tee joints – dove tail joint, mortise and tenon joint.
2. Fitting: Study of tools – practice in chipping, filling, cutting, drilling, taping and dyeing – male and female joints-stepped joints.
3. Sheet metal work: Study of tools, Making of Cylinder & Cone using development of surface – types of joints, riveted, brazed and welded joints – type of weld joints and their preparation.
4. Study of machine-tools: Lathes, Milling Machines, Drilling Machines, Grinding Machines.

AE132	ENGINEERING DRAWING	(1- 0 - 3) 2 credits

Introduction to Engineering drawings and graphics: Lettering, paper sizes, types of pencils, drawing conventions, scales – Dimensioning Principles and conventions – Construction of Plane curves – cycloid, trochoid, hypocycloid, involute, ellipses, parabola, hyperbola.

Projection of points and lines: Projection of points, lines and planes, Projection of solids (orthographic, isometric), sections of solids, intersection of solids, development of surfaces.

Introduction to CAD: Model and Paper Spaces – Local and global co-ordinate systems – views – creation of simple 2D drawings – introduction to GD&T- creation of dimensions and tolerances in CAD – Creation of simple drawing – detailing – plotting

Solid modelling of simple components – Auxiliary projections – sectional views

Text Books:

1. Siddique, Khan, Engineeirng Drawing with a Premier on AUTOCAD, Prentice Hall of India, 2007
2. Varghese, P.I., Engineering Graphics, VIP Publishers, 2007.

References:

1. Gill, P.S., Engineering Graphics and Drafting, S.K. Kataria & Sons, 2007
2. Bethune, J.D., Engineering Graphics with AUTOCAD, Prentice Hall, 2007
3. Maguire, D., Engineering Drawing from first principles using AutoCAD, John Wiley & Sons Inc, 2007

AV131	ELECTRICAL AND ELECTRONICS ENGINEERING LAB I	(0- 0 - 3) 1 credit

Electrical

1. Study and usage of ammeters, voltmeters, multimeters
2. Verification of KCL and KVL
3. Wheatstone bridge
4. Kelvin double bridge
5. Measurement of power – in single and three phase AC circuits

Electronic

1. Study and usage of CRO, Signal Generators, RLC meter, Power meter, Frequency meter etc.
2. PN junction diode and Zener diode characteristics.
3. Study of Transistor characteristics
4. Transient Analysis of RLC circuit
5. JFET Characteristics

SEMESTER II

MA121	MATHEATICS II	(4- 1 - 0) 5 credits

Vector Calculus, Linear Algebra & Numerical Analysis

Vector Calculus, Scalar and vector fields, level surfaces, directional derivatives, gradient, curl, divergence, Laplacian, line and surface integrals, theorems of Green, Gauss and Stokes, orthogonal curvilinear coordinates, operators in cylindrical and spherical polar coordinates.

Vector Spaces and Linear Transformations on R^n. Group, ring and field. Vector spaces, subspaces, linear dependence and independence, basis, dimension, inner product, Gram-Schmidst orthogonalization Process, Linear Transformations, null-spaces and nullity, Range space and rank of linear transformation.

Matrix representation of Linear Transformation. Solution space of system of equation Ax = b. Inverse of linear operators. Similar matrices. Eigen values and eigen vectors. Vayley-Hamilton theorem, Bounds and Eigen values, Hermitian, skew-Hermition, Unitary and normal matrices (including symmetric, skew-symmetric, and orthogonal matrices). Positive/Negative definite and semi-definite matrices, quadratic form.

Numerical Solution of Algebric and Transcendental Equations: Iterative method, Bisection method and Newton-Raphson Method.

Solution of system of linear equations: Direct method: Gauss Elimination Method, Iterative Methods: Jacobi and Gauss-Seidel Method.

Numerical Integration: Trapezoidal Method, Simpson's 1/3 rule, Simpson's 3/8 rule.

Solution of Ordinary Differential equations: Predictor-Corrector Method, Runge-Kutta Method for first order and higher order equations.

Interpolation and Curve fitting: Finite differences, forward, backward and central differences, Newton's forward difference, backward difference and central defference interpolating polynomials, Lagrange polynomials, Linear interpolation, Least square curves, cubic splines, etc.

Text Books:

1. Erwin Kreyszig, Advanced Engineering Mathematics, 9th ed., John Wiley, 2005.
2. Jain, R.K. and lyengar, S.R.K., Advanced Engineering Mathematics, Narosa, New Delhi, 2005.

Reference Books:

1. James Stewrat, Calculus : Early Transcendetals, Brooks/Cole Pub Co, NY, 2007.
2. Herstein, I.N., Topics in Algebra, Wiley Eastern, 2003.
3. Lang, S., Linear Algebra, Addison-Wesley, 1973.
4. Sastry, S.S., Introductory Methods of Numerical Analysis, Prentice Hall India, 2002.
5. Atkinson, Numerical Analysis Prentice Hall India, 2002.
6. Conte and deBoor, Numerical Analysis, Mcgraw-Hills, 1994.
7. Gerald, C.F. and Wheatley, P.O., Applied Numerical Analysis, Pearson, 2004.
8. Richard Bronson, Schaums Outlines on Matrix Operations, 1988.
9. Gantmacher, F.R., Applications of the Theory of Matrices, Chelsea, 2005.
10. Krishnamurthy V., Introduction to Linear Algebra, East-West Press, 1976.

PH121	PHYSICS II	(4- 1 - 0) 5 credits

Part I

Vector Calculus: Use of vectors in practical mechanics. Unit vectors in spherical and cylindrical polar coordinates. Conservative vector fields and their [potential functions – gravitational and electrostatic examples. Gradient of a scalar field. Equipotentials, states of equilibrium. Work and energy, Conservation of energy. Motion in a central force and conservation of angular momentum. Physics concepts in vector fields, Continuity equations and conservation principle for matter, energy and electrical charge. Flux, divergence of a vector. Gauss' theorem, physical applications in gravitational and electrostatics. Irrigational versus rotational vector fields. Physical significance of circulation, curl of a field. Stokes' theorem, physical applications. Oscillatory motion, wave motion in one dimension. Wave equation and travelling waver solutions. Wave velocity, group velocity and dispersion. Shallow water waves. Wave equation in three dimensions, spherical waves.

Electromagnetic Theory: Electrostatic potential and field due to discrete and continuous Charge distributions. Dipole and quadrupole moments. Energy density in an electric field. Dielectric polarization. Conductors and capacitors. Electric displacement vector, electric susceptibility. Biot Savart's law and Ampere's law in magneto statics. Magnetic induction due to configurations of current carrying conductors. Magnetization and surface currents. Energy density in a magnetic field. Magnetic permeability and susceptibility. Force on a charged particle in electric and magnetic fields. Time-varying fields. Farday's law of electromagnetic induction. Self and mutual inductance. Resonance and oscillations in electric circuits. Displacement current. Maxwell's equations in free space and in linear media. Scalar and vector potentials, gauges. Plane electromagnetic waves. Electromagnetic energy density., pointing vector. Wave guides.

Text Book:

1. David J. Griffith, Introduction to Electrodynamics, Prentice Hall Publishers.
2. Daniel Kleppner and Robert Kolenkow, An introduction to Mechanics, McGraw-Hill.

Reference Books

1. Kitel, C., Knight, W.O and Ruderman, M.A. Mechanics – Berkeley Physics course, Vol. 1, Tata MvGraw-Hill.
2. Purcell, E.M. Electricity and Magnetism, Berkeley Physics course Vol.2, Tata MvGraw-Hill.
3. Crawford.F.S., Waves and Oscillations Berkeley Physics course Vol.3, Tata MvGraw-Hill.
4. Feynman, R.P., Leighton, R.B. and Sands, M., The Feynman Lectureson Physics, Narosa Publishing House, 1986.
5. Reitz, J.R., Milford, F.J. and Christy, R.W. Foundations of Electromagnetic Theory, Narosa Publishing House.
6. Wangsness, R.K., ElectromagneticFields, Wiley.
7. Murray R. Spiegel, Schaum's Outline of Vector Analysis, MvGraw-Hill.

Part II

Introduction to Astronomy

Coordinate System, electromagnetic spectrum, flux, magnetic scale, interstellar reddening, telescopes, stellar spectrum, H-R diagram, interstellar medium, star formation and evolution, solar system, cosmology.

Introduction to Atmospheric Physics

Earth's atmosphere, structure, classification, constituents, greenhouse effect, radiation budget, differential heating, general circulation, cloud formation and classification, sun and solar radiation, interaction with planetary atmospheres

Introduction to Space Technology

Basics of orbital mechanics- conic sections, orbital elements, types of orbits, motion of planets and satellites, launch of a space vehicle, position in an elliptical orbit, orbit perturbation, orbit maneuvers

Reference Books:

1. Carroll, B.W. and Ostile, D.A., an Introduction to modern Astrophysics, Pearson, Addison Wesley.
2. Frank Shu, The Physical Universe – An introduction to Astronomy, University Science Books.
3. Stacey Palen, Schaum's Outline series on Astronomy, McGraw-Hill.
4. Narlikar, J.V., Introduction to Cosmology, Cambridge University Press.
5. Wallace, J.M. and Hobs, P.V., Atmospheric Science : An introduction Survey, Academic Press.
6. Houghton, J.T., The Physics of Atmosphere Cambridge University Press.
7. Goody, R.M. Walker, J.C.G. and Lee, M.A. Atmospheres, Prentice Hall.
8. Iqbal, M., Introduction to Solar Radiation, Academic Press.
9. Das, P.K., The Monsoons, National Book Trust, India.
10. Rishbeth, H and Garriott, O.K., Introduction to Ionospheric Physics, Academic Press.
11. Curtis, H.D., Orbital Mechanics for Engineering students, Elsevier.

CH121 CHEMISTRY II (2- 1 - 0) 3 credits

Chemical Kinetics: Basic Concepts of chemical kinetics, Reaction stichiometry, rates of consumption and formation, extent of reaction, rate of reaction, volume change during reaction, empirical rate reactions, composites and chain reactions, catalysis and inhabitation, first order reactions, second order reactions, reactions on nth order, half life, influence of temperature on reaction rates, Arrhenius equation.

Dynamics of Chemical Processes: Basic composites, composite reactions, opposing, parallel, and consecutive reactions, reaction mechanisms, chain reactions (stationary and nbon-stationary); enzyme kinetics; theries of reaction rates (collision theory and classical transition state theory); unimolecular reactions.

Electrochemistry: Weak and strong electrolyte, specific conductance, equivalent conductance, activity, ionic strength, ionic atmosphere. Kohlraqusch law, Arrhenius theory of electrolyte dissociation, Ostwald's dilution law, determination of degree of dissociation, transport number-Hittorf method, moving boundary method, Electrochemical series, thermodynamic quantities of cell. Concentration cell, determination of K_a, K_{sp}, conductometric titrations. Potentiometric titrations, determination of pH.

Corrosion: Theories of corrosion, Chemical corrosion, Electrochemical corrosion, Galvanic cell corrosion, pitting corrosion, inter granular corrosion, water line corrosion, stress corrosion, factors influencing corrosion, testing and measurement of corrosion, protection against corrosion, protective coatings-metallic and organic coatings.

Spectroscopic Techniques: NMR spectroscopy and Mass spectroscopy.

Thermal Characterization Techniques: Thermo Gravimetric Analysis (TGA), Differential Scanning Calorimetry (DSP), Differential Thermal Analysis (DTA).

Surface Characterization: An Introduction to Electron spectroscopy for Chemical Analysis (ESCA), Scanning Electron Microscopy (SEM), Atomic Force Microscopy (AFM), Transmission Electron Microscopy (TEM).

Advanced Composite Materials: General characteristics and applications of composite materials. Classification of composites, metal-matrix composites, ceramic-matrix composites and polymer matrix composites, fibre composites, particulate composites, nano-composites. Factors influencing composite properties, Fiber reinforced polymer (FRP) –Types of fibers, Composite processing techniques like bag moulding, compression moulding, pulrtusion ,Hand lay up, spray lay up etc.

Composite Propellants: Binder systems, polysulfides, polyurethanes and polybutadienes. High-energy composite propellants.

Text Books:

1. Jain, P.C. and Jain, M., Engineering Chemistry, 15th ed., Dhanpat Rai Publishing Company, New Delhi, 2007.
2. Krishnamurthy, N. , Vallinayagam, P. and Madhavan, D., Engineering Chemistry, Prentice-Hall of India Pvt. Ltd., New Delhi, 2007.

Reference Books:

1. Keith J. Laidler, Chemical Kinetics,3rd ed., Pearson Education Pvt. Ltd ., New Delhi. 2005.
2. Atkins, P., J. De Paula, Atkin's Physical Chemistry, 8th ed., Oxford University Press, 2007.
3. Kemo, W., Organic Spectroscopy, 3rd ed., Palgrave, New York, 2007.
4. Hull, D., An introduction to Composite Materials, Cambridge University Press, London, 1981.
5. Tsai, S.W. and Hahn, H.T., introduction to Composite Materials, Technomic Publication, Westport, Conn, 1980.
6. Skoog, West and Holler, Fundamentals of Analytical Chemistry, 8th ed.., Thomson Brooks/Cole, 2004.
7. Crow, D.R., Principles and Applications of Electrochemistry, 3rd, Chapman and Hall, 1988.
8. Sharma, B.K., Instrumental Methods of Chemical Analysis , 16th ed., Goel Publishing House, Meerut, 1997.
9. James W. Dodd and Kenneth H. Tonge, Thermal Methods, John Wiley and Sons, 1987.

AE121 BASIC MECHANICAL ENGINEERING II (3- 0 - 0) 3 credits

Testing of Materials: Properties, method to evaluate mechanical properties of metallic materials.

Advanced Manufacturing Processes: Automation of manufacturing process, Robotics, Mechantronics.

Mechanisms: Mechanism and their role-introduction to simulation and analysis in design and manufacturing.

Combustion: Combustion thermodynamics; Fundamentals of combustion kinetics.

Heat Transfer: Steady and unsteady State conduction in one-dimensional systems. Convection and Radiation heat transfer.

Analysis of Experimental Data: Uncertainty analysis-Probability distribution of errors-Regression analysis.

Introduction to space Systems: History, Classification, subdivisions of aerospace engineering: Indian aerospace activities.

Text Books:

- Lecture Notes

Reference Books:

1. Cengel,Y.A., Heat and Mass Transfer, 3rd ed., Tata McGraw-Hill, 2007.
2. Kalpakjian, S. and Schmid, S.R., Manufacturing Engineering and Technology, 4th ed., Prentice Hall, 2001.
3. Cenegel, Y.A. and Boles, M.A. Thermodynamics, 5th ed., Tata McGraw-Hill, 2007.
4. Rattan, S.S., Theroy of machines, 2nd ed., Tata McGraw-Hill, 2007.
5. Nayar, A., Testing of Metals, Tata McGraw-Hill, 2007.
6. Holman, J.P., Experimental methods for Engineers, 7th ed., Tata McGraw-Hill, 2004
7. Anderson Jr., J.D., Introduction to Flight, 5th ed., Tata McGraw-Hill, 2007.

AV121	BASIC ELECTRICAL AND ELECTRONICS ENGINEERING II	(3- 0 - 0) 3 credits

Magnetic Circuits: Principles of magnetic circuits, dc excitation, hysteresis loop, B-H curve, reluctance, air gap, interactive design, ac excitation, eddy current losses. Energy in magnetic field, production of force, EMF, Relays.

Transformer: Equivalent circuits, Ayto Transformer, efficiency and voltage regulation, SC and OC test.

Electro-mechanical energy conversion: Principles of rotating machines. DC motors and generators- Principle of operation, speed Torque characteristics, Speed control. Alternator and induction motors-operating principle, equivalent circuit, Speed Torque and characteristics, No load Test.

Operational Amplifiers: Introduction, Parameters and characteristics-Differential amplifier-differential and common mode operation common mode rejection ratio (CMRR). Inverting and non inverting mod and its operation. Typical applications of op-amps in analogy computations-Adder, Subtractor, Comparator, Differentiator, Integrator, Active filters-First order and second order Low pass and high pass filter.

Digital circuits: Introduction, Boolean algebra, Basic Logic gates, Implementation of basic gates using Universal gates. Combinational circuits – half adder, full adder. Sequential circuits – flip flops.

Introduction to microprocessors: Architecture of 8 bit microprocessor (8085). Introduction to Assembly Language Programming. Computer architecture-functional block diagram.

Power Semiconductor devices: SCR, TRIAC, DIAC, UJT-Working characteristics. Typical applications in DC/DC Convertors, Invertors, UPS.

Transducers: Working principle, Applications in Aerospace, Use of Thermistors.

Storage batteries: Different technologies, Characteristics, Specifications, maintenance. Usage in aerospace applications.

Principles of Communication: Need for modulation, Types of modulation, (AM, FM, PM). Basic block diagram of a communication system. Overview of satellite communication.

Text Books:

1. Vincent Deltoro, Principles of Electrical engineering, 2nd ed., Prentice Hal, 1986.
2. Thomas L. Floyd, Digital Fundamentals, Pearson Education.

Reference Books:

1. Pal, M.A., Introduction to Electrical Circuites and Machines, Affiliated East West Press, 1975.
2. Say, M.G., performance and Design of Ac Machines, CBS publications.
3. Langsdorf, A., The Theory of Alternating Current Machinery, TMH publications.
4. Milman and Halkias, Integrated Electronics – Analog and Digital Systems, McGraw-Hill.

5. Taub and Schilling, D., Digital Integrated Electronics, McGraw-Hill, 1977.
6. Hodges, D.A. and Jackson, H.G., Analysis and Design of Digital Integrated Circuits, International students Edition, McGraw-Hill, 1983.
7. John G. Kassakian, Martin F. Schlecht and George C. Verghese, Principles of Power Electronics, Addison-Wesley series in Electrical Engineering.
8. Erickson, R.W., Fundamentals of Power Electronics, New York, NY: Chapman and Hall, 1997.
9. Mohan, N., Undeland, T., and Robbins, W., Power Electronics: Convertors, Applications and Design, 2nd ed., New York, NY: John Wiley, 1995.
10. Jain, R.P., Modern Electronics, McGraw-Hill.
11. Morris Mano, M., Digital design, Prentice Hall, 2002.
12. Ramesh S Gaonkar, Microprocessor Architecture – Programming and Applications with the 8085/8080A.
13. Edward Hughes, Electrical and Electronic Technology, Pearson Education, 2002.
14. Ramakant A. Gaykward, operational Amplifier Principles and Linear Integrated Circuits.
15. George Kennedy, Electronic Communication Systems, McGraw-Hill Education, 1977.

MA141 PROGRAMMING LAB (0- 0 - 2) 1 credit

1. Introduction to Linux
2. Introduction to Matlab/Scilab and 2D and 3D graphs
3. M files and function files in Matlab/Scilab.
4. Programming using Matlab/Scilab : for loop, while loop and switch case.
5. Control Structiures-if, elseif, break statements.
6. Bisection method & Fixed point iterations.
7. Newton-Raphson Method for solving nonlinear equations.
8. Solution of system of equation-consistency check, Jacobi's Method, Gauss-Seidel Method.
9. Numerical Integration by Simpson's methods.
10. Numerical solution of differential equations (Euler's Method and RungeKutta methods).
11. Interpolation by Newton's method and Lagrange method.
12. Curve fitting by least square techniques.

Text Book:

- Erwin Kreyszig, Advanced Engineering Mathematics, John Wiley 9ed., 2005

Reference Books:

1. Getting started with Linux: http"//www.linux.org/lessons/beginner/toc.html.
2. Rudra Pratap, Learning Matlab 7, Oxford Press, 2006.
3. Stephen. J. Chapman, Matlab Programming for Engineers, Thomson Learning, 2004.
4. Duence Hanselman and littlefield, B., Mastering Matlab 7, Pearson Education, 2005.
5. Jerald, C.F., and Wheatley,P.O., Applied Numerical Analysis, Addison-Wesley, 1988.
6. Balachandra Rao, S and Santha, C.K., Numerical Methods, University Press, Hyderabad, 2004.
7. Jain, M.K., lyengar, S.R.K. and Jain, R.K., Numerical Methods for Scientific and Engineering Computation, New Age International Publishers, 2004.

AE141 MECHANICAL ENGINEERING LAB IIA (0- 0 - 6) 2 credits

Introduction to laboratory instrumentation: Computerized data acquisition. Statistical analysis of data. Transducers for measurement of solid, fluid and dynamical quantities.

Evaluation of mechanical properties of metallic materials.
Performance of various energy systems such as compressors, turbines, fans, refrigerators, and combustion engines.
Study of NC Machine Tools-CNC Lathe, CNC Milling Machine.
Study of CNC Controls, Basic NV Programming, and Simulation of program.
Principles of CAM, study of typical CAM system, creation of typical NC Program. CAD/CAM Concept-design-Manufacturing cycle using CAD/CAM.

AV141	ELECTRICAL AND ELECTRONICS ENGINEERING LAB II	(0- 0 - 3) 1 credit

Electrical

1. Characteristics of florescent and incandescent lamp.
2. Measurement of current, voltage and power in RLC series circuits excited by single-phase ac supply.
3. OC and SC test for transformer.
4. Speed control of DC motor.
5. Study of induction motor-No load test.

Electronic

1. Inverting and non-inverting Operational Amplifier circuit.
2. Frequency response of First order Low pass and high pass filter.
3. Realization of logic circuit using Universal gates.
4. Realization of half adder and full adder circuits.
5. Study of Flip Flops using NAND gates.

SEMESTER III

MA211	MATHEMATICS III	(3- 1 - 0) 4 credits

COMPLEX ANALYSIS, FOURIER SERIES AND INTEGRAL TRANSFORMS

Complex Variable: Complex numbers and their geometrical representation. Functions of complex variable, limit continuity and derivative of functions of complex variable, analytical functions and applications, harmonic functions. Transformations and conformal mappings, bilinear transformation, Contour integration and Cauchy's theorem , convergent series of analytic functions, Laurent and Taylor series, zeroes and singularities , zeroes and singularities, calculation of residues, residue theorem and applications.

Fourier Series: Fourier series expansion of periodic functions with period 2 (Fourier series of even and odd functions, half-range series. Fourier series of functions with arbitrary period, conditions of convergence of Fourier series.

Laplace Transform: Laplace Transforms of elementary functions, Inverse Laplace Transforms, Linearity property, First and second shifting theorem. Laplace Transforms of derivatives and integrals, Laplace Transform of Dirac Delta functions, Applications of Laplace Transform in solving ordinary differential equations.

Fourier Transform: Fourier Integral, The Fourier Transform pair, algebraic properties of the Fourier transform, Convolution, Modulation and Translation, Transforms of derivatives, and derivatives of transform, Inversion theory.

Text book:

1. Erwin Kreyszig, Advanced Engineering Mathematics, John Wiley, 9th ed., 2005.

Reference Books:

1. R.V. Churchill and James Ward Brown, Complex Variables and Applications, 6th ed., McGraw-Hill, 2004.
2. John H. Mathews and Russel Howell, Complex Analysis for Mathematics and Engineering, Narosa Publishing House, 2005.
3. C. Ray Wylie and L.C. Barrett, Advanced Engineering Mathematics, McGraw-Hill, 2002.
4. R.K. Jain and S.R.K. Iyengar, Advanced Engineering Mathematics, Narosa, 2005.
5. M.D. Greenberg , Advanced Engineering Mathematics, Pearson Education, 2007.
6. G. James, Advanced Modern Engineering Mathematics, Pearson Education, 2004.

MA212	PARTIAL DIFFERENTIAL EQUATIONS,NUMERICAL METHODS AND PROGRAMMING LANGUAGE	(3- 0 - 0) 3 credits

PARTIAL DIFFERENTIAL EQUATIONS

Introduction to PDE, Modeling Problems related and General II order PDE, Classification of PDE - hyperbolic, elliptic and parabolic PDE; Canonical form, Scalar first order Partial differential equations, Method of Characteristics, Charpits method. Quasi-linear first order equations shocks and rarefactions. Solution of Heat, Wave and Laplace equations using separable variable techniques and using Fourier series.

NUMERICAL METHODS

Solution of algebraic and transcendental Equations - Solution of System of Linear equations - Numerical Integration - Solution of Ordinary Differential equations - Interpolation and Curve fitting.

INTRODUCTION TO PROGRAMMING

Variables, Assignment, Expressions, Input/Output; Conditionals and Branching; iteration; Functions; Recursion; Arrays; Pointers; Structures; Introduction to Data-Procedure Encapsulation; Dynamic allocation; (A programming language like C/C++ may be used as a basis language. The same language must be used for the laboratory).

Text books:

1. Brian Kerningham and Dennis Ritchie, The C programming Language, Prentice-Hall, 1978.
2. Erwin Kreyszig, Advanced Engineering Mathematics, 9th ed., John Wiley, 2005.

References Books:

1. M.K. Jain, S.R.K. Iyangar and R.K. Jain, Numerical Methods for Scientific and Engineering Computation, New Age International, 2003.
2. I.N. Sneddon, Elements of Partial Differential Equations, McGraw-Hill, 1986.
3. Rudra Pratap, Getting started with MATLAB 7, Oxford Press, 2007.
4. Renardy and Rogers, An introduction to PDE's, Springer-Verlag, 1999.
5. M.D. Greenberg, Advanced Engineering Mathematics, Pearson Education, 2007.
6. Robert C. McOwen, Partial Differential Equations – methods and Applications, 2nd ed., Pearson Education, 2003.

AV211	ANALOG ELECTRONIC CIRCUIT	(3- 0 - 0) 3 credits

Basic stability and device stabilization techniques (BJT). Small signal low & high frequency models for (BJT, FET, MOSFET), Large signal amplifiers, Tuned amplifiers, Feedback amplifiers, Oscillators, Multivibrators, Wave shaping circuits.

Text book

1. J. Millman and C.C. Halkias, Integrated Electronics-Analog and Digital circuit system,

McGraw Hill, 1996.

References

1. David A.Bell, Electronic Devices and Circuits, Prentice Hall of India, 2006.
2. Donal L. Schilling and Charles Beloue, Electronic Circuits, Third Edition, McGraw Hill, 2005.
3. David A. Bell, Solid State Pulse Circuits, Prentice Hall of India, 1992.
4. John D. Ryder, Electronic Fundamental and Applications - Integrated and Discrete system, Prentice Hall of India, 1999.
5. J. Millman and H. Taub, Pulse Digital and Switching waveform-Devices and circuits, McGraw Hill International, 1965.

AV212	SEMICONDUCTOR DEVICES AND IC TECHNOLOGY	(3- 0 - 0) 3 credits

Semiconductor fundamentals, crystal structure, Fermi level, energy-band diagram, intrinsic and extrinsic semiconductor, carrier concentration, scattering and drift of electrons and holes, drift current , diffusion mechanism, generation and recombination and injection of carriers, transient response, basic governing equations in semiconductor, physical description of p-n junction, transport equations, current – voltage characteristics and temperature dependence, tunneling current, small signal ac analysis.

BJT equivalent circuits and modeling frequency response of transistors, pnpn diode, SCR, MOS structure, flat-band threshold voltages, MOS static characteristics, small signal parameters and equivalent circuit, charge – sheet model, strong, moderate and weak inversion, short channel effects, scaling laws of MOS transistors, LDD MOSFET, NMOS and CMOS IC technology, CMOS latch –up phenomenon, ideal Schottky barrier, current voltage characteristics, MIS diode heterojunctions devices, optical absorption in a semiconductor, photovoltaic effect, solar cell, photoconductors, PIN photodiode, avalanche photodiode, LED, semiconductor lasers; negative conductance in semiconductors, transit time devices, IMPATT, Gunn device, BiCMOS device

Text book:

1. Ben G. Streetman and Sanjay Kumar Banerjee, *Solid State Electronic Devices*, Dorling Kindersley, 2007.

Reference Books:

1. Sima Dimitrijev, *Principles of Semiconductor Devices*, Oxford University Press, 2006.
2. Robert.F. Pierret, *Semiconductor Device Fundamentals*, PHI, 2007.

AV213	NETWORKS SIGNALS AND SYSTEMS	(3- 1 - 0) 4 credits

NETWORKS

Network graphs: matrices associated with graph; Incidence, fundamental cut set and fundamental Tie-set. Two port networks.

SIGNALS AND SYSTEMS

Classification of signals and systems, Types of signals, Types of systems, Analysis of Continuous Time Signals and LTI systems: Fourier series, Fourier Transform, Laplace Transform, Differential Equation, State Space Matrix, Anlaysis of Discrete Time Signals and LTI DT systems: Discrete Time

Fourier Transform, Discrete Fourier Transform, Z Transform, Difference Equations, State variable equation and matrix, some applications – communication, control systems etc.

Text books

1. B.P. Lathi, Linear Systems and signals, 2nd ed., Oxford University Press, 1998.
2. Simon Haykin, Barry Van Veen, Signals and Systems, John Wiley and Sons (Asia) Private Limited, 2005.
3. A.V. Oppenheim, A.S. Willsky and I.T. Young, Signals and Systems, Prentice Hall, 2006.

References

1. R.F. Ziemer, W.H. Tranter and D.R. Fannin, Signals and Systems - Continuous and Discrete, Prentice Hall, 2006.
2. Douglas K. Lindner, Introduction to Signals and Systems, Mc-Graw Hill International, 1999.
3. Robert A. Gabel, Richard A. Roberts, Signals and Linear Systems, John Wiley and Sons (SEA) Private Limited, 1995.
4. M. J. Roberts, Signals and Systems - Analysis using Transform methods and MATLAB, Tata McGraw Hill, 2003.
5. I. J. Nagrath, S. N. Sharan, R. Ranjan, S. Kumar, Signals and Systems, Tata McGraw Hill, New Delhi, 2001.
6. Ashok Ambardar, Analog and Digital Signal Processing, 2nd Ed., Brooks/ Cole Publishing Company, 2006.
7. A. Papoulis, Circuits and Systems: A Modern Approach, HRW, 1980.
8. B.P. Lathi, Signal Processing and Linear Systems, Oxford University Press, 1998.

AE215 ENGINEERING MECHANICS (3- 0 - 0) 3 credits

Basics of statics – Fundamental principles and concepts – Analysis of structures – Trusses, frames, machines, beams, cables – Friction – Center of mass and area moments of inertia – Mass moment of inertia – Virtual work and energy method – Applications of energy method for equilibrium – Stability of equilibrium – Review of particle dynamics – Plane kinematics of rigid bodies, rotation – Plane kinetics of rigid bodies – Introduction to vibration.

Text book

S. Timoshenko, and D.H. Young, Engineering Mechanics, 4th ed., Tata McGraw-Hill, 2007.

References

1. F.P. Beer, and E.R. Johnston, Vector Mechanics for Engineers: Statics (Vol.1), Dynamics (Vol.2), 3rd SI ed., Tata McGraw-Hill, 1998.
2. J.L. Meriam, and L.G. Kraige, Engineering Mechanics: Statics (Vol.1), Dynamics (Vol.2), 5th ed., Wiley, 2002.
3. I.H. Shames, Engineering Mechanics: Statics and Dynamics, 4th ed., Prentice Hall, 1996.

MA231	PROGRAMMING LAB	(0- 0 -3) 1 credit

1. Introduction to Linux
2. Introduction to Matlab and 2D and 3D graphs
3. M files and FUNCTION files in Matlab
4. Programming using Matlab
5. Control Structures
6. Application to Mathematics

AV231	ANALOG ELECTRONIC CIRCUIT LAB	(0- 0 -3) 1 credit

1. Feedback amplifier
2. LC and RC oscillators
3. Tuned amplifier
4. Multivibrators
5. Schmitt Trigger
6. Wave shaping circuits
7. Differential Amplifiers, CMRR measurements

AV232	E-CAD LAB	(0- 0 -3) 1 credit

1. Simulation of analog electronics circuits using ORCAD (PSpice)
2. PCB layout using ORCAD
3. Application to electronic system design

SEMESTER IV

MA221 MATHEMATICS IV (3- 1 -0) 4 credits

PROBABILITY AND STATISTICS

Probability Distributions: Random Variable, Discrete and continuous Random variables. Binomial distribution, Hyper geometric distribution, Poisson approximation to the Binomial, Geometric distribution, Normal distribution, Normal approximation to Binomial distribution, Uniform distribution, Gamma distribution, Beta distribution, Weibull distribution, Mathematical Expectation, Mean, Variance, Moment generating function, Characteristic function.

Sampling Distributions and Inference concerning Means: Population and Samples, Central limit theorem, The Sampling distribution of the mean (σ known and σ unknown), Sampling distribution of variance, Point estimation, Confidence interval for mean, variance and proportions, Tests of Hypotheses, The null hypotheses and the significance tests.

Control charts for variables and attributes, acceptance sampling by attributes, simple, double and sequential sampling plans, Design of experiments.

Correlation and regression analysis: Curve fitting, the method of least squares, chi-square test of goodness of fit, contingency tables, inference based on the least square estimators, Regression, Correlation and Inference concerning correlation coefficient.

Markov chains: Stochastic processes: Markov chains with finite and countable state space, classification of states, limiting behavior of n-step transition probabilities, continuous Markov process. Hidden Markov chain with applications.

Text books:

1. S.P. Gorden and F.S. Gorden, Contemporary Statistics, a computer approach, McGraw-Hill, 1994.
2. J. Medhi, Stochastic Processes, Wiley Eastern Ltd, 1982.

Reference Books:

1. R.I. Levin, and D.S. Rubin, Statistics for Management, 7th ed., Prentice Hall, 1998.
2. J.S. Milton, Jesse C.Arnold, Introduction to Probability and Statistics: Principles and Applications for Engineering and the Computing Sciences, McGraw-Hill, 2002.
3. S.M. Ross, Introduction to Probability and Statistics for Engineers and Scientists, 3rd ed., Academic Press, 2004.
4. W. Feller, An introduction to Probability Theory and Its Applications, Vol.1 & Vol.2, John Wiley & Sons, 1968.
5. R.V. Hogg, T. Craig, Introduction to Mathematical Statistics, 6th ed., Prentice Hall, 2004.
6. Hogg and Tannis, Probability and Statistical Inference, 6th ed., Prentice Hall, 2005.
7. Larsen and Marx, An Introduction to Mathematical Statistics and Its Applications, 4th ed., Prentice Hall, 2005.
8. Mendenhall, Wackerly and Scheffer, Mathematical Statistics with Applications, 6th ed., Duxbury Press, 2001.
9. K.L. Chung, Elementary Probability Theory with Stochastic Processes and an Introduction

to Mathematical Finance, 4th ed., Springer, 2006.
10. T.A. Johnson, Miller & Freund's Probability and Statistics for Engineers, 6th ed., Prentice Hall, 2000.

AV221 DIGITAL ELECTRONICS AND VLSI DESIGN (4- 0 -0) 4 credits

Number systems, Boolean Algebra, standard representation and Minimization Procedures. Logic families, combinational circuits, asynchronous and synchronous sequential circuits, Memories. Introduction to VLSI systems- CMOS logic and fabrication-MOS transistor theory- Layout design rules- Circuit characterization and performance estimation- Circuit simulation- Combinational and sequential circuit design- Static and dynamic CMOS gates- Memory system design- Design methodology and tools- HDL.

Text books:

1. Morris Mano, Digital Design, 4th ed., Prentice-Hall, 2006.
2. John.F.Wakerly, Digital Design Principles and Practice, 3rd ed., Pearson Education, 1990.

Reference Books:

1. William I. Fletcher, An Engineering Approach to Digital Design, Prentice-Hall, 1980.
2. T.L. Floyd, Digital Fundamentals, Charles E. Merrill publishing Company, 1982.
3. R.L. Tokheim, Digital Electronics - Principles and Applications, Tata McGraw Hill, 1999.
4. R.P. Jain, Modern Digital Electronics, Tata McGraw Hill, 1999.
5. N. Weste and D. Harris, CMOS VLSI Design: Circuits and Systems Perspective, Addison Wesley, 2004.
6. Wayne Wolf, Modern VLSI Design, Prentice Hall, 1998.
7. Peter J. Ashenden, The Designer's Guide to VHDL, Harcourt Asia private Limited & Morgan Kauffman, 1996.
8. Douglas A. Pucknell and Kamran Eshraghian, Basic VLSI Design Systems and Circuits, Prentice Hall of India, 1993.

AV222 MICROPROCESSOR AND MICROCONTROLLERS (3- 0 -0) 3 credits

Microprocessor family - internal architecture, addressing modes, interrupts, assembly Language programming, Instruction types, Interrupts & its application for 8085 and 8086 – 8254, 8259, 8255- interfacing devices, coprocessors. DMA, DRAM, Cache memories, Coprocessor & EDA tools - Applications.

Micro controllers - Types of micro controller, Processor Architecture, 8051 features, Addressing Modes, Instruction set. Timers, Serial I/O, Parallel I/O Enhanced features & programming. Application Design emulators, real time operating systems. Case study of a sample Microprocessor / Microcontroller based system.

Text books:

1. R. Gaonkar , Microprocessor Architecture, Programming, and Applications with the 8085,

Penram International Publisher India Ltd, 5th ed., 2007.

2. Kenneth J. Ayala, The 8051 Microcontroller- Architecture, Programming and Applications, Penram International, 1996.

Reference Books:

1. Barry B. Brey , The Intel Microprocessors 8086/8088, 80186/80188, 80286, 80386, 80486, Pentium, and Pentium Pro Processor Architecture, Programming and Interfacing, Prentice Hall, 2005.

AV223 RF AND MICROWAVE COMMUNICATION (3- 0 -0) 3 credits

Introduction to RF communication, RF transmitter, RF receiver, Microwave Network Analysis; Scattering matrix parameters, Transmission matrix, Signal flow graph, Impedance matching, Single and double stub tuning, problems. Microwave wave-guide and planar-based passive devices, Microwave resonators, Power dividers, directional couplers and filters, Isolator, Circulator, phase shifter, Microwave signal generators: Klystron, magnetron and TWT. Microwave systems design, Amplifier design, Gain and stability, Oscillator design, Broadband systems.

Text books:

1. David M. Pozar, Microwave Engineering, 2nd ed., John Wiley & Sons, 2004.
2. Radamesh, RF Electronics, 2nd ed., Pearson Education, 2006.

Reference Books:

1. John G. Proakis, Fundamentals of communication systems, 1nd ed., Pearson Education, 2005.
2. R.E. Collin, Foundations for Microwave Engineering, McGraw-Hill, 1992.
3. S.M. Liao, Microwave Devices and Circuits, Prentice Hall, 1996.
4. P.A. Rizzi, Microwave Engineering, Prentice-Hall, Englewood Cliffs, 1988.
5. T.S. Laverghetta, Modern Microwave Measurements and Techniques, Artech House, Norwood, 1988.

CH221 ENVIRONMENTAL SCIENCE AND ENGINEERING (2- 0 -0) 2 credits

Awareness of the impact of environment on quality of Life-Bio-geo chemical cycles- P^E-P^H diagram-chemical processes; water treatment operations- water sampling–storage-quality measurement-oxygen demand-detection of pollutants- water transmission and distribution - clarifier-separation tanks; current environmental issues- pollutants- global warming-causes and consequences- air pollution-organic and inorganic air pollutants- smog - acid mine drainage- accumulation of salts in water -oxygen sag curve -analysis of gases and particulates in atmosphere-soil formation - micro and macro nutrients in soil- pollutants in soil; Green chemistry- an alternative tool for reducing pollution; Engineering interventions-flow sheets-waste minimization-e waste management-ASP-reverse osmosis-trickling filter; Environmental management-solid, liquid waste management hazardous wastes -ISO standards- ecomark- green production- Kyoto Protocol-Montreal Protocol- Euro norms.

Text book:

1. Venugopal Rao, Textbook of Environmental Engineering, Prentice Hall of India, 2002.

Reference Books:

1. Colin Baird and Michael Cann, Environmental Chemistry, Third Edition, W.H. Freeman and Company, 2005.
2. Manual on water supply and Treatment, CPHEEO, Ministry of Urban Development, GOI, 1999.
3. Manual on Sewerage and Sewage Development, CPHEEO, Ministry of Urban development, GOI, 1993.
4. B.A. Hauser, Practical Hydraulics Hand Book, Lewis Publishers, 1991.
5. M.J. Hammer, Water and Wastewater Technology, Regents/Prentice Hall, 1991.
6. J. P. Sharma, Comprehensive Environmental Studies, Laxmi Publications, 2004
7. Santosh Kumar Garg, Environmental Engineering, (Vol. I and II), Khanna publishers, 2004.
8. Gerard Kiely, Environmental Engineering, McGraw Hill, 1997.
9. Erach Bharucha, Textbook of Environmental Studies, University Grants Commission, 2004.
10. Gary W. vanLoon and Stephen J. Duffy, Environmental Chemistry, A Global Perspective, Oxford University Press, 2000.

AV241	DIGITAL ELECTRONICS LAB	(0- 0 -3) 1 credit

1. Design and implementation of combinational circuits using basic gates for arbitrary functions, code converters, parity generator / checker, magnitude comparator etc.
2. Design and implementation of application using multiplexers, Decoders/encoders.
3. Design and implementation of synchronous & asynchronous sequential circuit.

AV242	VLSI DESIGN LAB	(0- 0 -3) 1 credit

1. Modeling of Combinational Digital system using VHDL/Verilog
2. Modeling of Sequential Digital system using VHDL/Verilog.
3. Writing Test Benches Using Verilog / VHDL
4. Design and Implementation of ALU using FPGA.

AV243	MICROPROCESSOR AND MICROCONTROLLER LAB	(0- 0 -3) 1 credit

1. Programming with 8085 – 8-bit / 16-bit multiplication/division using repeated addition/subtraction
2. Programming with 8085-code conversion, decimal arithmetic, bit manipulations.
3. Programming with 8085-matrix multiplication, floating point operations
4. Programming with 8086 – String manipulation, search, find and replace, copy operations, sorting. (PC Required)
5. Experiment based on Interfacing and control application
6. 8051 Microcontroller based experiments – Simple assembly language programs (cross assembler required).
7. 8051 Microcontroller based experiments – Simple control applications (cross assembler required).

AV244	RF AND MICROWAVE COMMUNICATION LAB	(0- 0 -3) 1 credit

RF Experiments

1. Analyze the radiation patterns of the different antennas.

2. Experiments on Coaxial Line Section:
   - Measurement of VSWR
   - Measurement of unknown impedance
   - Stub matching
3. Design and Testing of RF Circuits:
   - RF Tuned Amplifier
   - RF Oscillator
   - RF Crystal Oscillator
   - IF Amplifier
   - RF Mixer
   - RF Filters (LP, HP, BP, Notch Filter)

Microwave Experiments

1. Characteristics of Reflex Klystron Oscillator
2. Characteristics of Gunn Diode Oscillator
3. Study of Power Distribution in directional coupler, E / H Plane Tee, Magic Tee.
4. Radiation pattern of Horn Antenna.
5. Frequency Measurement
6. Impedance measurement by Slotted Line Method.

SEMESTER V

AV311	DIGITAL SIGNAL PROCESSING	(3 - 0 - 0) 3 credits

Discrete time signals and systems- DFS, DTFT, DFT – FFT computations using DIT and DIF algorithms Infinite Impuse Response Digital Filters, Finite Impulse Response Digital filters, Finite Word length effect, Introduction to Multirate Signal Processing, Introduction to programmable DSPs-Architecture of TMS 320C5X.

Textbook:

1. John G Proakis, Dimtris G Manolakis, Digital Signal Processing Principles, Algorithms and Application, PHI, 3rd Edition, 2000.
2. B.Venkataramani & M. Bhaskar, Digital Signal Processor Architecture, Programming and Application, TMH 2002.

Reference Books:

1. Alan V Oppenheim, Ronald W Schafer, John R Back, Discrete Time Signal Processing, PHI, 2nd Edition 2000
2. Avtar singh, S.Srinivasan, DSP Implementation using DSP microprocessor with Examples from TMS32C54XX, Thamson / Brooks cole Publishers, 2003
3. S.Salivahanan, A.Vallavaraj, Gnanapriya, Digital Signal Processing, McGraw-Hill / TMH, 2000.
4. Johny R.Johnson, Introduction to Digital Signal Processing, Prentice Hall, 1984.
5. S.K.Mitra, Digital Signal Processing- A Computer based approach, Tata McGraw-Hill, 1998, New Delhi.

AV312	DIGITAL COMMUNICATION	(3 - 0 - 0) 3 credits

Fundamentals of Digital communications, channel capacity, bit error rate, media characteristics, FDM, TDM, TDD,FDD,CDMA, Statistical Multiplexing; Framing and Synchronization; M-array modulation – Formatting – Pulse schemes – Pulse code modulation – Sampling – Quantization– Correlative coding, Base Band Demodulation/Detection - Maximum Likelihood - Matched Filter, Inter Symbol Interference, Equalization. Signal-space Analysis-Band-pass Modulation: Amplitude Shift Keying, Frequency Shift Keying, Phase Shift Keying, Demodulation-correlative receiver. Communication Link Analysis, Synchronization, Source-Coding, Multiplexing and Multiple Access, Spread Spectrum Techniques, Fading Channels.

Textbook:

1. Simon Haykin, Digital Communication, John Wiley & Sons Paperback edition, 2005.

Reference Books:

1. Bernard Sklar, Digital Communication, 2nd Ed., Pearson Education, 2001.
2. Couch L.W., , Digital and Analog Communication Systems, Prentice Hall, 1996.
3. Rodger E Ziemer/William H Tranter, Principle of Communications, 5th Ed., Wiley publications.

4. R P Singh, S D Sapre, Communication Systems Analog and Digital, Tata McGraw-Hill.
5. John G Proakis, Digital Communications, 4th Ed., McGraw-Hill International, 2000.
6. John G Proakis, Mosoud Salehi, Fundamentals of Communication Systems, Pearson Education,
7. M K Simen, Digital Communication Techniques, Signal Design and detection, Prentice Hall of India,1999.

AV313 COMPUTER ORGANIZATION AND OS (3 - 1 - 0) 4 credits

Overview: functions of Operating systems, layered architecture; basic concept; interrupt architecture, system calls and notion of a process and threads; synchronization and protection issues; scheduling; memory management including virtual memory management including virtual memory and paging techniques; i/o architecture and device management; file systems; distributed file systems; Case studies of Unix , Windows NT Introduction to computer organization: Structure and function of a computer - Processing unit: Characteristics of CISC and RISC processors - Performance of a processing unit. Memory subsystem : Memory hierarchy - Main memory unit - Internal organization of a memory chip - Organization of a main memory unit - Error correction memories - Interleaved memory units - Cache memory unit - Concept of cache memory - Mapping functions - organization of a cache memory unit - Fetch and Write mechanisms - Memory management unit - Concept of virtual memory - Address translation - hardware support for memory management. Input / Output subsystem: Access of I/O devices - I/O ports. - I/O control mechanisms - Program controlled I/O - Interrupt controlled I/O - DMA controlled I/O - I/O interfaces - System buses - peripherals - Terminals - Video displays - Magnetic storage disks - magnetic tapes - CD ROMs. High-Performance processors: Instruction pipe lining - Pipe line - Hazards - Super scalar processors - Performance considerations. Multi processor systems: Shared memory systems - Interconnection networks - Caches in multi processor systems.

Textbook:

1. Abraham Silberschatz, Peter Baer Galvin and Greg Gagne Operating System Concepts, 7th Edition, Wiley publications, 2005.

Reference Books:

1. Tanenbaum A.S., Operating systems:Design and implementation, Prentice Hall, 1992.
2. Tanenbaum A.S., Structured computer organization, 4th edition, PHI, 1999.
3. Stallings W, Operating systems, second edition, prentice Hall, 1995.
4. Hayes, J.P, Computer architecture and Organisation, McGraw Hill, 1998.

AV314 CONTROL AND GUIDANCE SYSTEMS (4 - 0 - 0) 4 credits

Control systems: Introduction to control theory- control system components, Modeling of physical -transfer function, block diagram, signal-flow graph and state-space representation. Time domain and Frequency domain response -relationship between the time and frequency domain responses. Stability - concept of pole and zero - Routh-Hurwitz Criteria, Nyquist criteria, Root locus and Bode-plot; P-I, P-D, P-I-D controller design, tuning of controllers; lead and lag compensators. Sampled-data systems sample and hold operations for digital control, controller

design for digital control systems.

Guidance: Fundamentals of guidance Basic results in interception and avoidance Taxonomy of guidance laws, command and booming guidance, classical guidance laws Comparative study of guidance laws from the point of view of time, missdistance, launch boundaries, control effort and implementation difficulties. Basic concepts of launch vehicle guidance, Explicit and Implicit guidance, Flat Earth guidance, Perturbation guidance, Velocity to be gained guidance concept, Delta guidance, Q guidance, Cross product steering, linear perturbation guidance, Open loop and Closed loop guidance.

Textbook:

1. Katsuhiko Ogata, Modern Control Engineering, 4th Edition, Prentice Hall of India publishers, New Delhi, 2006.

Reference Books:

1. Gopal I and Nagrath N, Control systems, Wiley Eastern Ltd, NewDelhi, 1985.
2. Norman S Nise, Control Systems Engineering, Wiley India, 4th edn, 2003
3. D'Azzo, Houpis, Feedback Control System Analysis and Synthesis, CRC Press, 2007
4. M.Gopal, Control systems, Principle and Design, Tata McGraw Hill publishing Co,m New Delhi, 1997.
5. Kuo B.C., Automatic control systems, Prentice Hall India ltd, New Dehli, 1995.
6. Mutambara, Design and Analysis of Control Systems, CRC Press, 2008
7. Xue, Chen, Atherton, Linear Feedback Control Analysis and Design with MATLAB, SIAM Publications, 2006.
8. Qiu, Zhou, Introduction to Feedback Control, Prentice Hall, 2009.

AV315 INSTRUMENTATION AND MEASUREMENT (3 - 0 - 0) 3 credits

Introduction to measurement, error analysis, Static and dynamic performance characteristics of instruments. Basic voltmeter and Ammeter wattmeter and energy meter design, Electronic voltmeter, Digital Measurement systems (DMM, Frequency, A/D and D/A), spectrum analyzer, filter design, Hall effect devices. DC bridges for resistance measurements. A.C. Bridges-Measurement of inductance and capacitance, Earth resistance measurements. Frequency and Power factor meters, Potential and Current Transformers, D.C. and A.C. potentiometer, Instrumentation amplifiers. Transducers - strain gauges, inductive and capacitive transducers, piezoelectric and Hall-effect transducers, Temperature sensors, photo-diodes & transistors, digital transducers, signal conditioning and telemetry, introduction to smart sensors and MEMS, Data Acquisition Systems.

Textbook:

1. A.K. Sawhney, A course in Electrical and Electronics Measurements and Instrumentation, Dhanpat Rai and Sons, New Delhi, 2006.

Reference Books:

1. Doebelin, E.O., Measurement systems: Application and Design, 5th ed., McGraw hill, 2003.
2. Golding E.W. and Widdis F.E., Electrical measurements and measuring instruments, Sir Issac Pitman and Sons pvt ltd, 1995.
3. Albert D. Helfrick, William D. Cooper, Modern Electronic Instrumentation and Measurement Techniques., Prentice Hall of India Private Limited.

HS311	INTRODUCTION TO SOCIAL SCIENCE AND ETHICS	(2 - 0 - 0) 2 credits

Social Science: Introduction to sociology, anthropology – social science research design and sampling.

Ethics: Professional and personal ethics – values & norms and human rights.

Textbook:

- Lecture Notes.

Reference Books:

1. Perry, J. and Perry, Contemporary Society: An Introduction to Social Science, 11thed., Allyn & Bacon (2005).
2. Giddens, A., Sociology, 5th Edition. Wiley (2006).
3. Flyvberg, B, Making Social Science Matter, Cambridge Univ. Press (2001).
4. Singer, P., A Companion to Ethics, Wiley-Blackwell (1993).

AV331	DIGITAL SIGNAL PROCESSING LAB	(0 - 0 - 3) 1 credit

1. Study of DFT
2. IIR Filter Design
3. FIR Filter Design
4. FIR Kaiser and Equiripple Filter Design
5. Comparison of FIR and IIR Filter Design
6. Study of Simulink and Signal Processing Tool Box
7. Multirate Signal processing
8. DSP Processor,TMS 320C6713,DSK Experiments
9. TMS 320C6713-Real Time Processing

AV332	DIGITAL COMMUNICATION LAB	(0 - 0 - 3) 1 credit

1. Design and implementation of Pulse Amplitude Modulator and Demodulator.
2. Design and implementation of ASK, FSK, and PSK modulators and demodulators
3. Design and implementation of PWM and PCM modulators and demodulators
4. Design and implementation of DM and ADM modulators and demodulators
5. Design and study Time Division Multiplexer.
6. Design and study Frequency Division Multiplexer.
7. Eye Diagram -for studying the effects of intersymbol interference and other channel

impairments.

8. Analysis of signal space constellation of different modulation schemes.
9. Comparison of different modulation with Bit Error rate using Simulink

AV333 CONTROL AND GUIDANCE LAB (0 - 0 - 3) 1 credit

1. Modeling Simulation, control and implementation for
   Inverted pendulum
   Magnetic Levitation system
   Twin Rotor MIMO system
2. Realization and practical issue of PID controller
3. Actuator control for launch vehicle control
4. Hands on experience with LEGO Programmable Robots

AV334 INSTRUMENTATION AND MEASUREMENT LAB (0 - 0 - 3) 1 credit

1. Resistance measurement through Wheatstone bridge
   - DC excitation
   - AC excitation
2. Measurement of capacitance
   - Wein bridge
   - Schering bridge
   - Small variation in capacitance
3. Inductive transducers
   - Inductance measurement
   - LVDT
4. Variable resistivity transducers
   - Strain guage
   - Resistance of a salt solution
   - Variable area transducer
5. Measurement of temperature
   - Thermocouple
   - Thermistor
   - RTD
6. Light detector
   - Photo resistor
   - Photo transistor
   - Photo diode
7. Calibration of flow and level
8. Calibration of Value and pressure gauges
9. Dead weight tester for pressure calibration
10. PC based temperature calibrator

SEMESTER VI

AV321	COMPUTER NETWORKS	(3 - 0 - 0) 3 credits

Network Topology, OS layers, Point to point and broadcast communications, Multi access protocols: Aloha, CSMA and its variations, Token Ring; Error Control Techniques; Flow control; Bridges, Repeaters, Switches and the spanning tree protocol. Network: Routing, Congestion control, LAN, WAN, MAN, Ethernet, TCP/IP protocols; Multicast and mobile routing, Sensor networks.

Textbook:

1. Andrew S. Tannenbaum, Computer Networks, PHI, Fourth Edition, 2003.

Reference Books:

1. James .F. Kurouse & W. Rouse, Computer Networking: A Topdown Approach Featuring, Pearson Education.
2. Behrouz A. Foruzan, Data communication and Networking, Tata McGraw-Hill, 2004.
3. William Stallings, Data and Computer Communication , Sixth Edition, Pearson Education, 2000.

AV322	POWER ELECTRONICS	(3 - 1 - 0) 4 credits

Elements of Power Electronics ; Converters - Converter Dynamics and Control; DC to DC conversion - Buck, Boost and Buck-Boost converters - circuit configuration and analysis with different loads ; Inverters - single phase and three phase bridge inverters and PWM inverters, Single phase AC voltage regulators and cyclo converter ; Applications - Drive application of power electronic converter, UPS, SMPS active power filters, electronic ballast, induction heater and advanced control of power electronic circuits using microprocessors, Introduction to conductor EMI.

Textbook:

1. M.H. Rashid, Power Electronics – Circuits, devices and applications, PHI, New Delhi, 1995.

Reference Books:

1. P.C. Sen, Modern Power Electroncis, Wheeler Publishers, New Delhi, 1998.
2. G.K. Dubey Doradia, S.R. Joshi and R.M. Sinha, Thyristorised Power Controllers, New Age International Publishers, New Delhi, 1996.
3. Ned Mohan, Tore M. Undeland, William P. Robbins, Power Electronics: Converters, Applications, and Design, 2nd Ed., 2005.

AV323	RADAR SYSTEMS	(3 - 0 - 0) 3 credits

Nature of Radar and Applications, Simple form of Radar Equation, Radar Block Diagram and Operation, Prediction of Range Performance, Minimum Detectable Signal, Radar Receivers, Receiver Noise and SNR, Integration of Radar Pulses, Radar Cross Section of Targets, Transmitter

Power, CW and Frequency Modulated Radar, MTI and Pulse Doppler Radar, Tracking Radar, Detection of Radar Signals in Noise, Airborne Radar, Space borne Radar, Synthesis aperture radar, SHAR and MST radar.

Text/Reference Books:

1. M.I. Skolnik, Introduction to Radar Systems, McGraw hill, 2000.
2. M.I. Skolnik, Radar Handbook, McGraw hill, 2nd edition, 1990.
3. A.K. Sen and A.B. Battacharya, Radar Systems andRadar Aids to Naviation, Khanna Publications, 1988.

E01	STREAM ELECTIVE I	(3 - 0 - 0) 3 credit

HS321	PRINCIPLES OF MANAGEMENT SYSTEMS	(3 - 0 - 0) 3 credits

Personnel Management: Introduction – changing role of personnel manager – new people management – manpower planning – recruitment and selection – performance appraisal – workers participation in management – grievance handling.

Industrial Management: Management Functions – organization – principles of planning – management by objectives – organization structures – principles of organizing – span of control – delegation, leadership, directing, and controlling.

Project Management: Development of project network – project representation – project scheduling – linear time-cost trade-offs in projects: a heuristic approach – project monitoring and control with PERT.

Reference Books:

1. Koontz H., O'Donnel, C., and Weihrich, H., Essentials of Management, McGraw-Hill (1990).
2. Venkataratnam, C. S. and Srivastava, B. K., Personnel Management and Human Resources, Tata McGraw-Hill (1991).
3. Mazda F., Engineering Management, Prentice Hall (1997).
4. Gido, J. and Clements, J. P., Successful Project Management, 2nd ed., South-Western College Publishing (2003).
5. Khanna, O. P., Industrial Engineering and Management, Dhanpat Rai Publications (P) Ltd. (2003).
6. Memoria, C. B. and Gankar, S. V., Personnel Management - Text and Cases, Himalaya Publishing House (2007).

AV341	COMPUTER NETWORKS LAB	(0 - 0 - 3) 1 credit

1. Basics of Network Simulator NS-2
2. Usage of 'awk' parser and trace file formats.
3. Goodput Vs Throughput measurement
4. Comparison of Static Vs Dynamic Routing
5. Ethernet behaviour

6. Early Packet Drop Regimes
7. Switching schemes
8. Routing Protocols
9. Multicast Routing Protocols
10. TCP Congestion Control methods

AV342	POWER ELECTRONICS LAB	(0 - 0 - 3) 1 credit

Part I – Simulation using MATLAB and PSpice

1. Uncontrolled and Controlled rectification
2. Dc-dc converters
3. Inverters
4. Drives

Part II – Laboratory practice

1. Study of SCR and determination of SCR parameters
2. R and RC firing circuits for thyristors
3. Controlled and uncontrolled rectifier circuits.
4. Dc Motor Speed Control
5. Linear and Switching Regulator
6. DC - DC converter design
7. Motor Drive experiments
8. Solar power array simulation.

AV451	SUMMER INTERNSHIP AND TRAINING	(0 - 0 - 0) 3 credits

SEMESTER VII

AV411	NAVIGATION SYSTEMS AND SENSORS	(3 - 1 - 0) 4 credits

Introduction to navigation, vehicle modeling, beacon-based navigation systems. Introduction to Inertial Sensors and Inertial Navigation. Initial Calibration and Alignment algorithms. Global Positioning System (GPS). GPS /INS data fusion algorithms. Simultaneous Localization and Mapping (SLAM), Practical applications of vehicle navigation systems in both structured and unstructured environments, sensor fusion.

Text /Reference Books:

1. Slater J.M., Donnel C.F.O, Onertial Navigation analysis and design, McGraw Hill, New York, 1964.
2. Myron Kyton, Walfred Fried, Avionics Navigation systems, 2nd edition, John Willy & Sons, 1997.
3. Albert D Helfrick, Modern Aviation Electronics: 2nd Ed., PHI, 1994.

E02	STREAM ELECTIVE II	(3 - 0 - 0) 3 credits

E03	STREAM ELECTIVE III	(3 - 0 - 0) 3 credits

E04	DEPARTMENT ELECTIVE IV	(3 - 0 - 0) 3 credits

I01	INSTITUTE ELECTIVE	(3 - 0 - 0) 3 credits

AV431	NAVIGATION SYSTEMS AND SENSORS LAB	(0 - 0 - 3) 1 credits

- 3D Gyro
- Servo Accelerometer
- Checkout Systems
- Un manned aerial vehicle system
- Hexapod

AV452	SEMINAR	(0 - 0 - 0) 2 credits

SEMESTER VIII

AV453	**COMPREHENSIVE VIVA-VOCE**	**(0 - 0 - 0) 3 credits**

AV454	**PROJECT WORK**	**(0 - 0 - 0) 12 credits**

ELECTIVE COURSE

AV461 ADVANCED CONTROL THEORY (3 - 0 - 0) 3 credits

State space Approach: State space modeling of physical systems – diagonal and Jordan canonical forms - Solution of Linear Time Invariant (LTI) state equation – Cayley Hamilton theorem – Controllability and Observability Tests – Kalman decomposition technique - Controller design by state feedback – Full order/reduced order observer design – observer based state feedback control - stability definitions in state space domain.

Adaptive control theory: System Identification – Frequency – Impulse – Step Response methods –Off-line – on line methods – Least square – Recursive least square – fixed memory – stochastic approximate method. MRAS & STC: The gradient approach – MIT rule Liapunov Functions – Pole placement control – minimum variance control – Predictive control.

Text Books:

1. Karl.J.Astrom, Bjorn Witten Mark, Adaptive Control, 2nd Ed., Pearson Education Pvt. Ltd.
2. M.Gopal, 'Digital Control Systems and State Space Method', 3rd Ed., TMH, 2008.

References:

1. Katsuhiko Ogata, 'Modern Control Engineering', PHI -India, New Delhi 1989.
2. Fairman, 'Linear Control Theory: State Space Approach', John Wiley, 1998.
3. John S. Bay, 'Fundamentals of Linear State Space Systems', McGraw Hill, 1998.
4. Isermann R, 'Digital Control System vol. I & II', Narosa Publishing House, Reprint 1993.
5. Mendal JM, 'Discrete Technique of Parameter Estimate', Marcel Dekkas, New York, 1973.

AV462 EMBEDDED SYSTEM AND REAL TIME OS (3- 0 - 0) 3 credits

Review of Embedded Hardware: Gates - Timing Diagram- Memory –microprocessors. Interrupts Microprocessor Architecture-Interrupt Basics-Shared Data Problem-Interrupt latency. Software Development: Round–Robin, Round robin with Interrupts, function-Queue- Scheduling Architecture, Algorithms. Introduction to - Assembler- Compiler –Cross Compilers and Integrated Development Environment (IDE). Object Oriented Interfacing, Recursion, Debugging strategies, Simulators. Embedded Microcomputer Systems - Motorola MC68H11: Motorola MC68H11 Family Architecture, Interfacing methods Microchip PIC Micro controller: Introduction, CPU Architecture- Registers- Instruction sets addressing modes- Loop timing- Timers- Interrupts, Interrupt timing, I/O Expansion, I2C Bus Operation Serial EEPROM, Analog to Digital converter, UART-Baud Rate-Data Handling-Initialization, Special Features – Serial Programming-Parallel Slave Port.

Real Time Operating Systems: Task and Task States, Tasks and data, Semaphores and shared Data Operating system Services-Message queues-Timer function-Events-Memory Management, Interrupt Routines in an RTOS environment, Basic design using RTOS.

Text/Reference Books:

1. Wayne Wolf, Computers as Components - Principles of Embedded Computer System Design, Morgan Kaufmann Publisher, 2006.
2. David E-Simon, An Embedded Software Primer, Pearson Education, 2007.
3. K.V.K.K.Prasad, Embedded Real-Time Systems: Concepts, Design & Programming, dreamtech press, 2005.
4. Tim Wilmshurst, An Introduction to the Design of Small Scale Embedded Systems, Pal grave Publisher, 2004.

5. Sriram V Iyer, Pankaj Gupta, Embedded Real Time Systems Programming, Tata Mc-Graw Hill, 2004.
6. Tammy Noergaard, Embedded Systems Architecture, Elsevier,2006.

AV463 SOFT COMPUTING (3- 0 - 0) 3 credits

Introduction of Soft-computing tools - Neural Networks, Fuzzy Logic, Genetic Algorithm, and Probabilistic Reasoning; Neural network approaches in engineering analysis, design and diagnostics problems; Applications of Fuzzy Logic concepts in Engineering Problems; Engineering optimization problem solving using genetic algorithm; applications of probabilistic reasoning approaches.

Text/Reference Books:

1. S. Rajasekaran and G.A.Vijaylakshmi Pai.. Neural Networks Fuzzy Logic, and Genetic Algorithms, Prentice Hall of India.
2. K.H.Lee.. First Course on Fuzzy Theory and Applications, Springer-Verlag.
3. J. Yen and R. Langari.. Fuzzy Logic, Intelligence, Control and Information, Pearson Education.

AV464 ADVANCED DSP AND ADAPTIVE FILTER (3- 0 - 0) 3 credits

Discrete Random Process: Expectation, Variance and Co-variance, Uniform, Gaussian and Exponentially distributed noise, Hillbert space and inner product for discrete signals, Energy of discrete signals, Parseval's theorem, Wiener Khintchine relation, power spectral density, Sum decomposition theorem, Spectral factorization theorem. Spectrum Estimation : periodogram, Non – parametric methods of spectral estimation Correlation method, WELCH method –AR, MA, ARMA models. Tule – Walker method. Linear Estimation and Prediction: ML estimate – Efficiency of estimator, Cramer Rao bound - LMS criterion. Wiener filter – Recursive estimator – Kalman estimator – Linear prediction, Analysis and synthesis filters, Levinson resursion, Lattice realization. Adaptive filters: FIR adaptive filter – Newton's Steepest descent algorithm – Widrow Hoff LMS adaptation algorithms – Adaptive noise cancellation, Adaptive equalizer, Adaptive echo cancellors.

Text/Reference books:

1. M. Hays: Statistical Digital Signal Processing and Modelling, John Willey and Sons, 1996.
2. Simon Haykin: Adaptive Filter Theory, Prentice Hall, 1996
3. "Adaptive Filters :Theory and Applications", by B. Farhang-Boroujeny, John Wiley and Sons, 1999.
4. John G Proakis and Manolakis, " Digital Signal Processing Principles, Algorithms and Applications", Pearson, Fourth Edition, 2007.
5. Sophocles J. Orfanidis, Optimum Signal Processing, An Introduction, McGraw Hill,1990.

AV465 ROBUST AND OPTIMAL CONTROL (3- 0 - 0) 3 credits

Signals and systems, Vector space, Norms, Matrix theory: Inversion formula, Schur's complement, Singular Value Decomposition, Positive definiteness; Linear Matrix Inequality: Affine function, Convexity, Elimination lemma, S-procedure; Calculus of variation, Euler's Theorem, Lagrange multiplier. Linear fractional transformation (LFT), Different uncertainty structures: Additive, Multiplicative, Uncertainty in Coprime factors; Concept of loop shaping, Bode's Gain and phase relationship, Small Gain theorem. LQR, LQG, Hamiltonian matrix, Riccati

equation, H-infinity control, H-infinity Controller design via DGKF and LMI techniques, H-infinity loop shaping technique, Structured singular value (mu) synthesis, Design examples.

Text/Reference Books:

1. D.S.Naidu, Optimal Control Systems, CRC Press
2. Sinha, Linear Systems Optimal and Robust Control, CRC Press
3. D.E.Kirk, Optimal Control Theory An Introduction, PHI.
4. K.Morris, Introduction to Feedback Control, Academic Press.
5. Helton, Merino, Classical Control using H∞ Methods, 1/e, SIAM Publications
6. Ozbay, Introduction to Feedback Control Theory, CRC Press
7. Gu, Petkov, Konstantinov, Robust Control Design with MATLAB, Springer India
8. Qiu, Zhou, Introduction to Feedback Control, Prentice Hall, 2009.

AV466 ESTIMATION AND STOCHASTIC THEORY (3- 0 - 0) 3 credits

Elements of probability theory - random variables-Gaussian distribution-stochastic processes-characterizations and properties-Gauss-Markov processes-Brownian motion process-Gauss-Markov models - Optimal estimation for discrete-time systems - fundamental theorem of estimation-optimal prediction.

Optimal filtering - Weiner approach-continuous time Kalman Filter-properties and implementation-steady-state Kalman Filter-discrete-time Kalman Filter-implementation-sub-optimal steady-state Kalman Filter-Extended Kalman Filter-practical applications.

Optimal smoothing - 0ptimal fixed-interval smoothing optimal fixed-point smoothing-optimal fixed-lag smoothing-stability-performance evaluation.

Text/Reference books:

1. M.D. Srinath, P.K. Rajasekaran and R. Viswanathan: Statistical Signal Processing with Applications, PHI, 1996.
2. D.G. Manolakis, V.K. Ingle and S.M. Kogon: Statistical and Adaptive Signal Processing, McGraw Hill, 2000.
3. S. M. Kay: Modern Spectral Estimation, Prentice Hall, 1987.
4. H. V. Poor, "An Introduction to Signal Detection and Estimation", Springer, 2/e, 1998.
5. S. M. Kay, "Fundamentals of Statistical Signal Processing: Estimation Theory", Prentice Hall PTR, 1993.
6. M.S. Grewal, A.P. Andrews, “Kalman filtering : Theory and Practice”, Second edition, John Wiley & Sons, 2001.
7. C.K. Chui, G. Chen, “Kalman Filtering with Real-Time Applications”, Third edition, Springer-Verlag,1999.
8. R.G. Brown, Y.C. Hwang, “Introduction to Random Signals and Applied Kalman Filtering”, Second edition, John Wiley & Sons, 1992.

AV467 INTRODUCTION TO OPTIMIZATION AND OR (3- 0 - 0) 3 credits

Vector spaces and matrices, transformations, eigenvalues and eigenvectors, norms; geometrical concepts -- hyperplanes, convex sets, polytopes and polyhedra; unconstrained optimization -- condition for local minima; one dimensional search methods -- golden section, fibonacci, newtons, secant search methods; gradient methods -- steepest descent; newton's method, conjugate direction methods, conjugate gradient method; constrained optimization -- equality conditions, lagrange condition, second order conditions; inequality constraints -- karush-kuhn-tucker condition; convex optimization; introduction to assignment problem, decision analysis,

dynamic programming and linear programming;

Text/Reference Books:

1. An Introduction to Optimization, Edwin K. P. Chong and Stanislaw H. zak, Wiley Interscience, 2008.
2. D. G. Luenberger, Optimization by vector space methods, New York, Wiley, 1969.
3. Convex Optimization Theory, D. P. Bertsekas, Athena Scientific optimization and computation series, 2009
4. Introduction to Operations Research, rederick S. Hillier, Gerald J. Lieberman, McGraw-Hill, 2010

AV468 DIGITAL CONTROL SYSTEM (3- 0 - 0) 3 credits

Digital control systems – sample and hold systems - Jury stability criterion – Implementation of digital controllers – tunable PID controllers – Digital compensator design using root locus and frequency response methods.

Linear versus nonlinear systems - Describing function analysis - common nonlinearities - Analysis of non-linear systems using phase plane technique - condition for stability - Stability in the sense of Lyapunov and absolute stability - Popov's stability criterion - Lure's Transformation. Non-linear control system design problem - Concept of variable - structure controller and sliding control.

Text Book:

1. M.Gopal, 'Digital Control and State variable methods: Conventional and Intelligent control systems', Tata McGraw Hill, 3rd Ed., 2009.

Reference books:

1. H. K. Khalil, 'Nonlinear Systems', Prentice Hall, 3rd Ed., 2002.
2. S.Sastry, 'Nonlinear Systems: Analysis, Stability and Control', Springer, 1999.
3. Nijmeijer, Henk, Schaft, Arjan van der, 'Nonlinear Dynamical Control Systems', Springer, 1990.
4. Graham, McRuer, Analysis of Nonlinear Control Systems.

AV469 EMI / EMC (3- 0 - 0) 3 credits

Aspects of EMC with examples, Common EMC units, EMC requirements for electronic systems, Radiated emissions, Conducted emissions, ESD. Application of EMC design, Wires, PCB lands, Component leads, resistors, capacitors, inductors, and ferrites. Electromechanical devices, Digital circuit devices. Mechanical switches (as suppression) , Simple emission models for wires and PCB lands, Lice impedance stabilization network (LISN) , Power supply filters. Power supplies including SMPS. Three conductor lines and crosstalk, Shielded wires, Twisted wires, Multiconductor lines and effects of incident fields, Shielding, Origin effects, prevention of ESD event, its hardware and immunity. System design for EMC, Grounding, System configuration, PCB design.

Text/Reference books:

1. William Duff G., & Donald White R. J, "Series on Electromagnetic Interference and Compatibility", Vol. 5, EMI Prediction and Analysis Technique – 1972.

2. V.P. Kodali, “Engineering Electromagnetic Compatibility”, S. Chand, 1996.
3. Weston David A., “Electromagnetic Compatibility, Principles and Applications”, 1991.
4. Kaiser B. E., “Principles of Electromagnetic Compatibility”, Artech House, 1987.

AV470 DIGITAL IMAGE PROCESSING (3- 0 - 0) 3 credits

Digital Image Fundamentals: Elements of visual perception – Image sampling and quantization Basic relationship between pixels – Basic geometric transformations.
Image fundamentals and image restoration: Spatial Domain methods-Spatial filtering:- Frequency domain filters –Model of Image Degradation/restoration process – Noise models – Inverse filtering -Least mean square filtering – Constrained least mean square filtering – Blind image restoration – Pseudo inverse – Singular value decomposition.

Multi-resolution Analysis and Compression: Multi Resolution Analysis: Image Pyramids – Multi resolution expansion – Wavelet Transforms. Image compression: Fundamentals Elements of Information Theory – Error free compression – Lossy Compression – Compression Standards. Wavelet coding – Basics of Image compression standards: JPEG, MPEG, Basics of Vector quantization.

Image Segmentation and Image Analysis: Edge detection – Thresholding - Region Based segmentation – Boundary representation: boundary descriptors: Texture, Motion image analysis. Color Image Processing – Color Models-Color Image enhancement-Segmentation
Object Recognition and Image Understanding: Patterns and pattern classes - Decision-Theoretic methods - Structural methods-3D Vision

Text Books:

1. Rafael C Gonzalez, Richard E Woods 2nd Edition, Digital Image Processing - Pearson Education 2009.

References:

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

AV471 VLSI DESIGN (3- 0 - 0) 3 credits

Introduction, Manufacturing process: CMOS integrated circuits, Device Physics: MOSFET, CMOS inverter: Characteristics, Static and Dynamic Logic Gates, Sequential logic Gates, Implementation for Digital ICs. Timing Issues in Digital Circuits, Designing Memory and Array Structures.

Text Book:

1. Jan M Rabaey,Anantha Chandrakasan,Borivoje Nikolic, Digital Integrated Circuits, Prentice Hall, 2002.

Reference Books:

1. Pucknell, Basic VLSI Design, Prentice Hall, 2008.
2. Fabricius, Eugene D, Introduction to VLSI Design, McGraw-Hill, 1990.

3. Neil H E Weste,Kamran Eshraghian, Principles of CMOS VLSI Design,A system perspective, Addison-Wesley, 1985.
4. R Jacob Baker ,Harry ,David E, CMOS Circuit Design ,Layout ,and Simulation, Willy, 2011.

AV472	OPTO - ELECTRONICS AND FIBER OPTICS COMMUNICATION	(3- 0 - 0) 3 credits

Review of P-N jn-characteristics – semiconductor-hetero junction-LEDs (-spontaneous emission-LED structure-surface emitting-Edge emitting-Injection efficiency- recombination efficiency-LED characteristics-spectral response-modulation-Band width. Laser diodes-Basic principle-condition for gain-Laser action-population inversion-stimulated emission-Injection faster diode-structure-temperature effects-modulation-comparison between LED and ILDs. Optical detectors-principle-absorption coefficient-detector characteristics-Quantum efficiency-responsivity-response time-bias voltage-Noise in detectors P-N junction-photo diode -B. W-Noise-photo transistor. Optical Fibre-structure - propagation-wave equation-phase and group velocity-transmission characteristics-attenuation-absorption-scattering losses-dispersion-fibre bend losses-source coupling, splices and connectors-wave length division multiplexing. Optical fibre system-system design consideration-fibre -source limitations -pre-amplifier-equalization-Fibre-optic link analysis-typical lira design.

Text Books:

1. Gerd Keiser, Optical Fiber Communications, 3rd Edition, McGraw Hill Publications, 2000.

Reference Books:

1. Pallab Bhattacharya, Semiconductor Opto electronics Devices, Pearson Education
2. John M Senior Optical fibre Communication Systems-Principles and practice, PHI.
3. John Gower, Optical communication Systems, PHI.

AV473	INFORMATION THEORY AND CODING	(3- 0 - 0) 3 credits

Sources-memoryless and Markov; Information; Entropy; Extended sources; Shannon's noiseless coding theorem; Source coding; Mutual information; Channel capacity; BSC and other channels; Shanon's channel capacity theorem; Continuous channels; Comparison of communication systems based on Information Theory; Channel Coding-block and convolutional. Block codes-majority logic decoding; Viterbi decoding algorithm; Coding gains and performance.

Text/Reference books:

1. Shu Lin & Daniel J. Costello.Jr., Error Control Coding : Fundamentals and Applications, Prentice Hall Inc.,Englewood Cliffs, NJ.
2. Thomas M. Cover, Joy A. Thomas, Elements of Information theory, 2nd ed., John Wiley & Sons Pvt. Ltd.
3. Simon Haykin. Communication Systems, 3rd ed., John Wiley & Sons Pvt. Ltd.
4. Taub & Schilling. Principles of Communication Systems, 2nd ed., TataMcGraw Hill, New Delhi.
5. Das, Mullick & Chatterjee. Principles of Digital Communication, Wiley Eastern Ltd.
6. The theory of error-correcting codes by F. J. MacWilliams and N. J. A. Sloane (North-Holland publishers).
7. Algebraic codes for data transmission by Richard Blahut (Cambridge).

AV474 CRYPTOGRAPHY (3- 0 - 0) 3 credits

Introduction to number theory – Symmetric key and Public key crypto systems which includes pseudorandom functions and permutations, block ciphers, symmetric encryption schemes, security of symmetric encryption schemes, hash functions, message authentication codes (MACs), security of MACs, PKI, public-key(asymmetric) encryption, digital signatures, security of asymmetric encryption and digital signature scheme.

Chaos base cryptography systems – quantum computing – introduction to smartcard technology.

Text/Reference books:

1. William Stallings, "Cryptography And Network Security – Principles and Practices", Pearson Education, Third Edition, 2003.
2. Behrouz A. Foruzan, "Cryptography and Network Security", Tata McGraw-Hill, 2007
3. Bruce Schneier, "Applied Cryptography", John Wiley & Sons Inc, 2001.
4. Wade Trappe and Lawrence C. Washington , " Introduction to Cryptography with coding theory" , Pearson Education, 2007.
5. Wenbo Mao, " Modern Cryptography Theory and Practice" , Pearson Education, 2007.
6. Thomas Calabrese, "Information Security Intelligence: Cryptographic Principles and Applications", Thomson Delmar Learning,2006.

AV475 MOBILE COMMUNICATION (3- 0 - 0) 3 credits

Cellular Concept: Frequency Reuse, Channel Assignment, Hand Off, Interference and System Capacity, Tracking And Grade Of Service, Improving Coverage and Capacity In Cellular Systems.

Mobile Radio Propagation : Free Space Propagation Model, Outdoor Propagation Models, Indoor Propagation Models, Small Scale Multipath Propagation, Impulse Model, Small Scale Multipath Measurements, Parameters Of Mobile Multipath Channels, Types Of Small Scale Fading, Statistical Models For Multipath Fading Channels.

Modulation Techniques: Minimum Shift Keying, Gaussian MSK, M-ARY QAM, M-ARY FSK, Orthogonal Frequency Division Multiplexing, Performance of Digital Modulation In Slow-Flat Fading Channels And Frequency Selective Mobile Channels.

Equalization: Survey of Equalization Techniques, Linear Equalization, Non-Linear Equalization, Algorithms for Adaptive Equalization. Diversity Techniques, Rake Receiver. **Coding:** Vocoders, Linear Predictive Coders, Selection of Speech Coders for Mobile Communication, GSM Codec and RS Codes for CDPD.

Multiple Access Techniques: FDMA, TDMA, CDMA, SDMA, Capacity of Cellular CDMA and SDMA.

Wireless Systems and Standards: Second Generation and Third Generation Wireless Networks and Standards, WLL, Blue Tooth. AMPS, GSM, IS-95 and DECT

Text Book:

1. T. Rappaport, "Wireless Communication: Principles and Practice", Prentice Hall PTR

References:

1. Palanivelu, T. G. ,Nakkeeran, R, "Wireless And Mobile Communication", PHI.
2. **Stüber**, Gordon L.," Principles of Mobile Communication**"** 2nd ed., Springer publications.

AV476 MICROWAVE INTEGRATED CIRCUITS (3- 0 - 0) 3 credits

Introduction to microwave integrated circuits: Active and passive components. Analysis of microstrip lines: variational method, conformal transformation, numerical analysis; losses in

microstrip lines; Slot line and Coupled lines; Design of power dividers and combiners, directional couplers, hybrid couplers, filters. Microstrip lines on ferrite and garnet substrates; Isolators and circulators; Lumped elements in MICs. Technology of MICs: Monolithic and hybrid substrates; thin and thick film technologies, computer aided design.

Text/Reference books:

1. Davis W. Alan, Van, Microwave Semiconductor Circuit Design, Nostrand, Reinhold, 1984.
2. Gonzalez G., Microwave Transistor Amplifier: Analysis and Design, Prentice Hall 1984.
3. Samuel Y. Liao, Microwave Circuit Analysis and Amplifier Design, Prentice Hall 1987.
4. Ralph S. Carson, High Frequency Amplifier, Wiley Interscience, 1982.

AV477 ANTENNA ENGINEERING (3- 0 - 0) 3 credits

Antenna Fundamentals -Common Types of Antennas -Fundamentals and Definitions - Directivity -Antenna Gain and Efficiency -Antennas in Communications Links -Wire Antennas- Radiation Integrals and Auxiliary Potential Functions - Solutions of the Inhomogeneous Vector Potential Wave Equation - Linear Wire Antennas – The Ideal Dipole - Electrically Short or Small Dipoles - The Half-Wave Dipole - The Dipole of Arbitrary Length - Antennas on or Near PEC Ground Planes - Antenna Arrays and Impedance - Antenna Arrays - Graphical Method for Developing the Radiation Pattern- Pattern Multiplication Theorem with Examples - Half-Power Beam Width (HPBW) -Directivity - Even Element Linear Array with Uniform Spacing and Nonuniform Excitation - Directivity for Binomial Arrays -Planar Arrays -Mutual Impedance and Driving Point Impedance of Antenna Arrays -Yagi-Uda Antennas

Text/Reference Books:

1. Constantine A. Balanis, Antenna Theory, Analysis and Design, Second edition, John Willey and Son, Inc.
2. Warren L. Stutzman, Gary A. Thiele, Antenna Theory and Design, 2nd Edition, John Willey and Son, Inc.

AV478 SATELLITE COMMUNICATION (3- 0 - 0) 3 credits

Basic Principles- General features, frequency allocation for satellite services, properties of satellite communication systems. Satellite Orbits- Kepler's laws, orbital dynamics, orbital characteristics, satellite spacing and orbital capacity, angle of elevation, eclipses, launching and positioning, satellite drift and station keeping. Satellite Construction - attitude and orbit control system; telemetry, tracking and command; power systems, communication subsystems, antenna subsystem, equipment reliability and space qualification. Satellite Links-, general link design equation, system noise temperature, uplink design, downlink design, complete link design, effects of rain. Earth Station - earth station subsystem, different types of earth stations. The Space Segment Access and Utilization-space segment access methods, TDMA, FDMA, CDMA, SDMA, assignment methods.

Text Book:

1. Dennis Roddy, Satellite Communications, McGraw-Hill Publication Third edition 2001

Reference Books:

1. Timothy Pratt – Charles Bostian & Jeremy Allmuti, Satellite Communications, John Willy & Sons (Asia) Pvt. Ltd. 2004.
2. Wilbur L. Pritchars Henri G.Suyder Hond Robert A.Nelson, Satellite Communication Systems Engineering, Pearson Education Ltd., Second edition 2003.
3. M.Richharia, Satellite Communication Systems Design Principles, Macmillan Press Ltd. Second Edition, 2003.

AV479 COMPUTER GRAPHICS (3- 0 - 0) 3 credits

Graphics hardware and display devices; graphics primitives- drawing lines and curves; 2d and 3d transformations; segments and their applications; generating curves, surfaces and volumes in 3d, wire-frame models, Bezier and spline curves and surfaces; geometric modeling- elementary geometric algorithms for polygons, boundary representations, constructive solid geometry, spatial data structures; hidden surface and line elimination; rendering- shading, light models, realistic image synthesis techniques, textures and image-based rendering; video games and computer animation.

Text/Reference Books:

1. Foley, van Dam, Feiner and Hughes, Computer Graphics (Principles and Practice), Addisen Wesley.
2. D Hearn and P M Baker, Computer Graphics, Printice Hall of India.
3. D F Rogers, Mathematical Elements for Computer Graphics, McGraw Hill.
4. D F Rogers, Procedural Elements for Computer Graphics, McGraw Hill.
5. Edward Angele, Interactive Computer Graphics, A top-down approach with OpenGL, Addisen Wesley.
6. G Farin, Curves and Surfaces for Computer Aided Geometric Design, Academic Press.

AV480 GRAPH THEORY AND OR (3- 0 - 0) 3 credits

Graphs -- paths and circuits, trees and fundamental circuits, cut-sets and cut-vertices, planar and dual graphs, vector spaces of graphs, matrix representation of graphs; transport networks, maximal flow, linear programming, minimal cut, maxflow-mincut theorem, minimal-cost flows, multicommodity flow, activity network, game theory.

Text/Reference Books:

1. Narsingh Deo, Graph Theory With Applications To Engineering And Computer Science, PHI, Indi, 1974
2. T. B. Boffey, Graph theory in operations research, Macmillan, 1982

AV481 MODERN ALGEBRA AND TENSORS (3- 0 - 0) 3 credits

Sets, groups, fields, rings, isomorphisms, vector spaces, modules; vectors and tensors in a finite-dimensional space, vector and tensor analysis in euclidean space, curves and surfaces in three-dimensional euclidean space, eigenvalue problem and spectral decomposition of second-order tensors, fourth order-tensors.

Text/Reference Books:

1. William J. Gilbert, W. Keith Nicholson, Modern Algebra with Applications, John Wiley and Sons, 2004.
2. Mikhail Itskov, Tensor Algebra and Tensor Analysis for Engineers, Springer, 2008.

AV482 DATA STRUCTURE AND DBMS (3- 0 - 0) 3 credits

Review of basic data structures and their realization in object oriented environment. The following topics will be covered with emphasis on formal analysis and design, Dynamic Data structures; 2-3 trees, Red-black trees, binary heaps, binomial and Fibonacci heaps, Skip lists, universal hashing. Data structures for maintaining ranges, intervals and disjoint sets with applications. Basic algorithmic techniques like dynamic programming and divide- and-conquer, Sorting algorithms with analysis, integer sorting algorithms with analysis, integer selection, Graph algorithms like DFS with applications, MSTs and shortest paths.

Database System Architecture - Data Abstraction, Data Independence, Data Definition and Data Manipulation Languages. Data Models - Entity-Relationship, Network, Relational and Object Oriented Data Models, Integrity Constraints, and Data Manipulation Operations. Relational Query Languages: Relational Algebra, Tuple and Domain Relational Calculus, SQL and QBE. Relational Database Design: Domain and Data dependency, Armstrong's Axioms, Normal Forms, Dependency Preservation, Lossless design. Query Processing and Optimization: Evaluation of Relational Algebra Expressions, Query Equivalence, Join strategies, Query Optimization Algorithms. Storage Strategies: Indices, B-trees, Hashing; Transaction Processing : Recovery and Concurrency Control, Locking and Timestamp based Schedulers, Multi-version and Optimistic Concurrency Control schemes. Advanced Topics; Object-oriented and Object Relational Databases, Logical Databases, Web Databases, Distributed Databases, Data Warehouse and Data Mining.

Text/Reference Books:

1. Gregory L. Heileman , Data Structure, Algorithm and OOP, Tata Mc Graw Hill, NewDelhi.
2. Adam Drozdek, Data Structures & Algorithm in C++,Vikas publication House.
3. Silberschatz, H. Korth, Database System Concepts, 5th Edition, McGraw-Hill.
4. Raghu Ramakrishnan, Database Management Systems, Johannes Gehrke 4th Edition, McGraw-Hill

AV483 SOFTWARE ENGINEERING (3- 0 - 0) 3 credits

S/W life cycle; problem of S/W production and the need for S/W engineering; Concepts and techniques relevant to production of large software systems: Structured programming, top-down design and development, information hiding; strength, coupling and complexity measures; procedural, data, and control abstraction; specifications; organization and management of large software design projects; program libraries; documentation, design methods and testing; several programming projects of varying size undertaken by students working singly and in groups using software specification tools, S/W project management; parameter for cost estimation.

Text/Reference Books:

1. Roger Pressman.S., Software Engineering : A Practitioner's Approach,(3rd Edition), McGraw Hill, 1997.
2. I Sommerville, Software Engineering V edition: , Addison Wesley, 1996.
3. P fleeger, Software Engineering, Prentice Hall, 1999.
4. Carlo Ghezzi, Mehdi Jazayari, Dino Mandrioli, Fundamental of Software Engineering, Prentice Hall of India 1991.