VIDYASAGAR UNIVERSITY

ELECTRONICS

(Honours & General)

Under Graduate Syllabus

(3 Tier Examination Pattern)

w.e.f. 2014-2015

REVISED

Vidyasagar University

Midnapore 721 102

West Bengal

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ELCTRONICS (HONOURS)

Full Marks: 800

Part-I: 200 Marks (Examination at the end of first year)
Part-II: 300 Marks (Examination at the end of second year)
Part-III: 300 Marks (Examination at the end of third year)

Each theory paper full marks: 100
(University written examination: 90 marks and internal assessment in college: 10 marks)
Examination period for a theoretical paper: 4 hours.
Examination period for a practical paper: 6 hours.

Part-I

Paper—I (Theory)	**Marks-100**
Group-A: Mathematical Methods	40 Marks (45 classes)
Group-B: Classical Mechanics	25 Marks (30 classes)
Group-C: Optics	20 Marks (25 classes)
Group-D: Electrostatics and Magnetostatics	15 Marks (20 classes)

Paper—II (Theory)	**Marks-100**
Group-A: Quantum Mechanics	40 Marks (45 classes)
Group-B: Statistical Mechanics	20 Marks (25 classes)
Group-C: Thermal Physics	15 Marks (20 classes)
Group-D: Circuit Theory	25 Marks (30 classes)

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Part-II

Paper—III (Theory)	**Marks-100**
Group-A: Solid State Physics	25 Marks (30 classes)
Group-B: Semiconductor Devices and Circuits-I	35 Marks (40 classes)
Group-C: Opto-electronics	15 Marks (20 classes)
Group-D: Electronic Materials	25 Marks (30 classes)

Paper—IV (Theory)	**Marks-100**
Group-A: Electromagnetic Theory	30 Marks (35 classes)
Group-B: Semiconductor Devices and Circuits-II	30 Marks (35 classes)
Group-C: Propagation of Radio Waves	15 Marks (20classes)
Group-D: Computer Fundamentals	25 Marks (30 classes)

Paper—V (Practical)	**Marks-100**
Group-A: Experiment on Electricity	50 Marks (60 classes)
Group-B: Experiment on Solid state Devices and Circuits	50 Marks (60 classes)

Part-III

Paper—VI (Theory)	**Marks-100**
Group-A: Digital Electronics	30 Marks (35 classes)
Group-B: Communication Engineering	25 Marks (30 classes)
Group-C: Instrumentation	20 Marks (25 classes)
Group-D: Microprocessor	25 Marks (30 classes)

Paper—VII (Practical)	**Marks-100**
Group-A: Digital Electronics	50 Marks (60 classes)
Group-B: Microprocessor	50 Marks (60 classes)

Paper—VIII (Practical)	**Marks-100**
Group-A: Computer Practical (FORTRAN 77)	50 Marks (60 classes)
Group-B: Project Work with seminar	(40+10) Marks

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Part- I

Paper -I (Theory)
Full Marks: 100
(University Written Examination -90 and Internal Assessment in College -10)
(Examination: At least one question is to be answered from each group).

Group -A: Mathematical Methods: **40 Marks**

1. ***Vector Analysis***
   Vector algebra, products, polar and axial vector, differentiation, Gradient, Divergence and curl of vector and applications to simple problems, Vector Integration: Line, Surface and Volume integral, Gauss' divergence theorem, Stokes' theorem , Green's theorem and related integral theorems, Curvilinear coordinates.
2. ***Matrix:***
   Inverse of a matrix, Matrix algebra, Hermitian and Unitary matrices. Similarity transformation, Diagonalisation of matrices with non degenerate Eigen values, Eigen values and Eigen vectors.
3. ***Differential equations:***
   First order, second order differential equations with constant coefficient, partial differential equations and its solutions for simple problems with separation of variable methods, Bessel, Legendre, Hermite polynomial differential equation, generator recursion relation, Rodrigue formula, orthogonal properties, Nonlinear Differential equation – Preliminary.
4. ***Laplace Transform and inverse Laplace Transform:***
   Definitions, Conditions for existence of Laplace transforms, Lerch's theorem, important properties, Methods of finding transforms.

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5. ***Fourier Analysis:***

Fourier theorem, Fourier series, evaluation of coefficient, Analysis of simple waveform using Fourier series, Fourier integrals, Relationship of Fourier and Laplace transforms.

6. ***Complex Variable:***

f(z) its limit and continuity, Derivative of f(z), Cauchy- Riemann equations, Analytic function, Harmonic functions, Orthogonal systems, Applications to flow problem, Geometrical representation of f(z),Conformal transformation, Integration of complex functions, Cauchy's theorem.

Group-B: Classical Mechanics: **25 Marks**

Conservation Principals (laws), constrained motion, degrees of freedom, Generalized Co-ordinate, Generalized motion.

Variational Principle and Lagrangian formulation, Calculus of variation, delta variation, Euler- Lagrange differential equation, Conservative and non conservative systems, Hamiltonian variational principal, Concept of Lagrange and equation of motion, D- Alembert's principle, Rayleigh's dissipation function, Conservation of momentums, Conservation of Energy (Jacobi's Integral), Concept of Symmetry, Homogeneity and Isotropy, Hamiltonian formulation of Mechanics.

Phase space, Hamiltonian, Hamiltonian's canonical equation of motions, Principle of least action, Canonical Transformation.

Group -C: Optics: **20 Marks**

1. ***Physical Optics:***

Fermat's principle and its applications - Matrix method of Paraxial optics. Magnification, Helmholtz -Lagrange Laws, Cardinal points of

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an optical system-thick lens and lens combinations, telephoto lenses, paraxial approxin1ation. Aberration in images, Seidal aberration, Aplenetic points of sphere, Ach- romantic combination of lenses, oil immersion objectives, eye pieces Ramsdan & Huygen.

2. ***Interference:***

Interference of light waves, spatial and temporal coherence, Young's experiment, intensity distribution, Fresnel biprism, interference in thin film, Fringes of equal thickness and equal inclination, Newton's ring.

3. ***Diffraction:***

Diffraction of light waves, Fresnel and Fraunhofer class, Fresnel's half period zones, explanation of rectilinear propagation of light, zone plate, Fraunhofer diffraction due to single slit, double slit, grating.

Group-D: Electrostatics and Magneto statics: **15 Marks**

1. ***Electrostatics:***

Introduction: Fundamental relations of the electrostatics field, Gauss law, The potential function, Field due to a continuous distribution of charge, Equipotential Surface, Divergence theorem, Possion's equation and Laplace equation, Capacitance, Electrostatics Energy, Boundary conditions, The electrostatics uniqueness theorem, Dirac Delta representation for a point charge, Dirac delta representation for an infinitesimal dipole (Elementary Ideas).

2. ***Magneto statics:***

Theories of the Magnetic Field, Magnetic Induction and Faradays law, Magnetic flux density, Magnetic field strength and Magneto motive force, Ampere's work law, Permeability, Energy stored in Magnetic Field, Ampere's law for a current element, Volume distribution of current element and the Dirac delta, Ampere's law, Magnetic vector potential, Analogies between Electric and Magnetic field.

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Books Recommended

- *"Mathematical methods for Physicists"*, by G. Arfken, Academic Press, New York.
- *"Mathematical Methods in the Physical Sciences"*, by M. L Boas, John Wiley & Sons, Inc., New York,
- *"Introduction to Mathematical Physics"*, by Harper, PHI Learning, New Delhi.
- *"Higher Engineering Mathematics"*, by B.S.Grawel, Khanna Publishers.
- *"Vector Analysis"*, by M.R. Spiegel, McGraw Hill Professional.
- *"Mathematical Method"*, by M. C. Potter and J. Goldberg, Prentice Hall.
- *"Advanced Engineering Mathematics"*, by M.D. Greenberg, Pearson Education.
- *"Complex Variables and Applications"*, by R V Churchill, McGraw-Hill Higher Education.
- *"Theory and problems on Laplace Transforms"*, by M.R Spiegel, McGraw-Hill, New York.
- *"The Variational Principles of Mechanics"*, by C. Lanczos, New York, Dover Publications, Inc.,
- *"Classical Mechanics"*, by Takwal and Puranik, Tata MacGraw-Hill Education.
- *"Classical Mechanics"*, by H.Goldstein, Narosa Publishing House, New Delhi.
- *"Classical Mechanics"*, by Gupta and Kumar, Pragati Prakashan.
- *"Classical Mechanics"*, by N.C. Rana, Tata MacGraw Hill Education.
- *"Classical Mechanics"*, by G. Aruldhas, PHI Learning, New Delhi.

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- *"Classical Mechanics"*, by C.R. Mondal, Prentic Hall of India, New Delhi.
- *"Classical Mechanics"*, by K.N. Srinivasan Rao, University Press, Hyderabad.
- *"Classical Mechanics"*, by V.B. Bhatia, Narosa Publishing House, New Delhi.
- *"Classical Mechanics: A course of lecture"*, Oxford University Press,Kolkata.
- "*Classical Mechanics: an undergraduate text"*, by R.G. Doglus, Cambridage University Press, Cambridge.
- *"Dynamics of particles of rigid bodies"*, by S.L. Loney, G.K. Publishers.
- *"Introduction to Electrodynamics"*, by Griffith, Addison-Wesley Professional.
- *"Classical Electrodynamics",* by J.D. Jackson, John Willey and Sons Ltd.
- *"Introduction to Electromagnetic Engineering"*, R.F. Harrington, Dover Publicatins.
- *"Electromagnetic Waves & Radiating Systems"*, by Jordan and Balmian PHI Ltd, New Delhi.
- *"Electricity and Magnetism"*, by Mahajan and Rangwala, Tata McGraw-Hill Publishing, New Delhi.
- *"Electrodynamics"*, by Y.V. Novozihlov, Y.A.Yappa, V.I.Kysin, Mir Publishers, Moskow.
- *"Electrodynamics: Electricity and Magnetism"*, by Gupta, Kumar, Singh, Pragati Prakashan, Meerut.
- *"Electrodynamics: Lecturer on Theoretical Physics"*, by A.Sommefeld, E.G.Ramberg, Levant Books, Kolkata.
- *"Electricity and Magnetism"*, by M.H. Neyfeh, M.K. Brussel, John Willey and Sons, New York.

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- *"Electricity and Magnetism"*, by D.P. Acharaya, Oxford University Press, New Delhi.
- *"Electricity and Magnetism"*, by J.H. Fewkes, J. Yarwood, Oxford University Press.
- *"Electricity and Magnetism"*, E.M. Purcell, McGraw-Hill International Book, New Delhi.
- *"Electricity and Magnetism"*, by B. Belenary, Oxford University Press.
- *"Microwave propagation and technique"*, by D.C. Sarkar, S. Chand and Company.
- *"Optoelectronics: an Introduction"*, by Wilson and Hawkes, Prentic Hall of India.
- *"Optics"*, by Ajoy Ghatak, MaGrawhill Education, India.
- *"Optics"*, by J.P.Sing and S.P.Aarwal,Pragati Prakashani, Meerut.
- *"Optics"*, by V.K.Miles and E.F.Thomas, John Willey and Sons, New Jersey.
- *"Optics"*, E.Hecht, A.R.Ganesan, Pearson Education, New Delhi.
- *"Optics: Principal and Application"*, by K.K.Sharma, Elsvier India, New Delhi.
- *"Optics and Optoelectronics: theory, device and applications"*, by O.P.Nijhawan, Narosa Publishing House, New Delhi.
- *"Optics: Lecturers on Theoretical Physics"*, by A. Sommerfeld, Levant Books, Kolkata.
- *"Optoelectronics and Fiber optics communication"*, by C.K.Sarkar, D.C. Sarkar, New Age International, New Delhi.
- *"Introduction to Fiber Optics"*, by Ghatak and Thyagrajan, Cambridge University Press.
- *"Optoelectronic and Fiber Optic Technology"*, by Tricker Ray, Newnes Burlington.

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- *"Optoelectronics and Optical fiber sensors"*, by A.S. Maity, PHI Learning, New Delhi.
- *"Optoelectronics and Photonics: Principal and Practice"*, by Pearson Education Asia, Delhi.

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Paper -II (Theory)

Full Marks: 100

(University Written Examination -90 & Internal Assessment in College -10)
(Examination: At least one question is to be answered from each group)

Group -A: Quantum Mechanics: **40 Marks**

Plank's hypothesis, radiation formula, photoelectric effect, Compton scattering.Wave nature of material particles, de-Broglie hypothesis, phase and group velocity, wave particle duality in nature, de-Broglie wavelength, wave packet, Davision-Germer experiment, Heisenberg's uncertainty principle.

Concepts of wave function particle system, postulates of quantum mechanics, time independent and dependent Schiodinger equation, probability current density, dynamical variables as operator, Hermitian operators, Schrodinger representation of position, momentum and angular momentum operators, Time dependent. Schrodinger equations, Expectation values, Bound state wave functions. Discrete energy levels in one-dimensional box with rigid walls, (extension to three-dimensional box), free particle solution, one dimensional step potential, transmission of particles through a potential barrier, linear harmonic oscillator, wave functions and energy eigen values, Quantum mechanical Tunneling, hydrogen atom problem, discrete eigen values as a consequence of boundary conditions, application to simple problems.

Central forces, Orbital angular momentum. Angular momentum operators and their commutation relations, L_2, L_+ & L-operator – as step operators. Eigen values of L^2 and L_z. Angular momentum operators in spherical polar co-ordinates, evaluation of eigen functions -degeneracy Schrodinger equation of hydrogen atom in

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spherical polar co-ordinates, separation of variables -spherical harmonics.

Angular momentum and magnetic moment of electron due to orbital motion. Bohr-magnetron, Stern –Gerlach experiment, electron spin. Pauli's method of spin variable in Schrodinger equation. Eigen values and Eigen function of spin operator. Function of spin operator. Pauli spin operators & commutation relation.

Group -B: Statistical Mechanics: **20 Marks**

Phase space, macro and micro states, thermodynamic probability, MB, BE and FD statistics, Classical limit of quantum statistics, Application of statistical mechanics of Plank's law, Rayleigh-Jean's law, Wien's law.

Group -C: Thermal Physics: **15 Marks**

Maxwell's law of velocity distribution, first law of thermodynamics and its applications, Equipartition of energy, Mean free path, Reversible and Irreversible processes, Isothermal and adiabatic changes, Carnot's cycle, Second law of thermodynamics, Entropy, Enthalpy, Joule-Thomson effect, Gibb's paradox, T-S diagrams, Helmotz and Gibb's free energy, condition of equilibrium, Maxwell's thermodynamic relations and their applications, phase transitions and Gibb's phase rules, Triple point of water.

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Group - D: Circuit Theory: **25 Marks**

Network Analysis: Kirchoff's current and voltage laws, examples of loop and nodal analysis, Network theorems: Superposition theorem, Reciprocity theorem, Thevenin's theorem, Norton's theorem, Maximum power transfer theorem, Millman's theorem, Bisection theorem, T-Π and Π -T transformations, Delta-star transformation, Generalized Wheat-stone bridge, Anderson bridge, De-Sauty bridge, Maxwell's bridge, Schering bridge, Wien bridge, simple problems. Basic electricity and circuits: Direct currents: Growth and decay of current in LR circuit, charging and discharging of capacitors in CR and LCR Circuits, oscillatoty discharge, time constant, measurement of high resistance, energy stored in inductance, induction coil, Ballistic Galvanometer, Problems of transients. Alternating current: LR, CR and LCR circuits in sinusoidal application of imaginary operator, phase diagram, power factor, series and parallel resonant circuits, Q-factor, selectivity, Transformer: construction, equivalent circuit simple problems.

Books Recommended

- *"Quantum Mechanics"*, by Agarwal and Hariprakash, PHI Learning Pvt. Ltd.
- *"Introductory Quantum Mechanics"*, by R. L. Liboff, Addison-Wesley Publishing Company.
- *"Introduction to Quantum Mechanics"*, by D. J. Griffiths, Prentice Hall.
- *"Quantum Mechanics"*, by S.N. Ghoshal, S.Chand Publishing Group, New Delhi.

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- *"Quantum Mechanics"*, by Ghatak and Loknathan, Springer.
- *"Quantum Mechanics"*, by Schiff, Tata McGraw-Hill Edition.
- *"Solid State Physics"*, by D.L. Bhattacharya
- *"Introduction to Solid State Physics"*, by C. Kittel, Willey India Edition.
- *"Solid state physics"*, by Dekker, Macmillan Press.
- *"Solid State Physics"*, by S.O. Pillai, New Age International, New Delhi.
- *"Solid State Physics"*, by R.L.Singhal, Kedarnath Ramnath, Meerut.
- *"Solid State Physics"*, by Babbar and Puri, S. Chand, New Delhi.
- *"Statistical and Thermal Physics"*, by Loknathan, PHI Learning Pvt. Ltd.
- *"Introduction of Statistical Mechanics"*, by B.B. Laud, New Age International (P) Ltd.
- *"Statistical Mechanics"*, by R.K. Pathria, Elsveir India, New Delhi.
- *"Statistical Mechanics: An elementary outline"*, by Avijit Lahiri, Universities Press, Hyderabad.
- *"Statistical Mechanics: a set of lecturers"*, by R.P.Feynman.
- *"Statistical Mechanics: an introductory text"*, by J.K. Bhattarachhaya, Allied Publishers, New Delhi.
- *"Statistical Mechanics for beginners: a text book for undergraduate"*, B.L. Gilles, World Scientific Publishing, Singapore.
- *"Statistical Mechanics"*, by Gupta and Kumar, Pragati Prakashan, Meerut.
- *"Heat and Thermodynamics"*, by R.H. Dittman and M.W. Zeemansky, Tata McGraw –Hill.

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- *"A text book on heat"*, by Saha and Srivastava, The Indian Press Ltd.
- *"Circuit theory"*, by Chattopadhay and Rakshit, New Age International Publishers.
- *"Network analysis"*, by Van Valkenberg, Prentice Hall of India.
- *"Electronic circuit analysis and design"*, by Hyat and Neudeck, Houghton Miffiin.
- *"Basic Circuit Theory"*, by L.P Huelsman, Prentice-Hall.

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Part-II
Paper -III (Theory)
Full Marks: 100
(University Written Examination -90 & Internal Assessment in College -10)
(Examination: At least one question is to be answered from each group)

Group - A: Solid State Physics: **25 Marks**

1. **Crystal Physics:**
   Crystal binding, ionic, covalent, metallic and Vander Wall bonds, Unit Cell, Bravais lattice, symmetries (rotation, reflection and inversion), wave nature of matter, Diffraction of X-rays by crystals, Bragg's law, Millar indices, Reciprocal lattice, vector from of Bragg equation, Ewald construction, lattice point and space lattice, Basis and crystal structure, Unit Cells an lattice parameters, Unit cell vs. primitive cells, Crystal systems, Crystal symmetry.
2. **Thermal properties of solid:**
   Dulong and Petit law, theories of specific heat, Classical free electron theory: Electrical properties of metals, relaxation time and mean free path, Fermi energy and Fermi surface parameters, Electrical conductivity, Wiedemann-Franz law, Thermionic emission, Richardson Dushman equation, Qualitative discussion of Block function, Kronig-Penney model, E-K diagram, reduced zone representation, Brillouin zone, concept of effective mass and holes.

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Group -B: Semiconductor Devices and Circuits-I: **35 Marks**

Intrinsic and Extrinsic semiconductor and their band structure, Semiconductor diodes: Band structure, Majority and minority carriers, Junction formation, Laws of Junction, Einstein relation, V-I Characteristics, junction capacitance, breakdown phenomena, Clipper and Clamper circuit, Voltage doubler, Diode as rectifier (Half and Full wave), Zener diode, load and line regulations, regulated power supply.

Transistor: Current flow mechanism, Current components, Ebers-Moll Model, Transistor as two port network, Z, Y and h parameters, CE, CB and CC configurations, comparison and their equivalent circuits, Determination of h parameters from static characteristics, Transistor Biasing and stabilization- different methods, h parameter equivalent circuit, small signal amplifiers, Transistor amplifier analysis, frequency response: cut-off frequencies, emitter follower.

Metal semiconductor contact, Schottky diode, JEFT structures and characteristics, Biasing of FET, Small signal AC Equivalent circuit of FET, FET as an amp1ifier, hybrid parameters, CS and CD amplifiers, Structure of MOSFET, enhancement and depletion MOSFETs, P and N channel MOSFETs, complementary MOSFET, common source and common drain configurations, NMOS, CMOS and VMOS an elementary idea, High frequency response, MOS logic, CMOS logic, inverter, NAND gate, NOR gate.

Silicon Controlled rectifier: Triggering Circuits. UJT, DIAC, TRIAC, Typical applications

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Group –C: Opto-Electronics: **15 Marks**

Optical fiber in digital and analog communication, Single mode and multimode Optical fiber, Numerical aperture of optical fiber, V-number, LED, LDR, Photodiode and phototransistor, photo-detector, Opto-couplar.

Laser: Laser as a coherent source of light Einstein's A and B coefficients, Population inversion, Laser resonator, He-Ne Laser, Ruby laser, Dye and Tunable laser, principle of holographic recording and reconstruction.

Digital optics: Opto-electronic and optical logic operations, opto-electronic and optical switching elements, Binary and tri state logic (idea only). Advantages of digital optical logic operations in high speed data processing.

Group-D: Electronic Materials: **25 Marks**

Classification of solids as metals, insulators and semiconductor, intrinsic and extrinsic semiconductor, degenerate and non-degenerate, direct and indirect band gap, drift and diffusion process, elemental and compound semiconductors, donor and acceptor, ionization energy of impurity semiconductor, Fermi – Dirac Statics and electron distribution in solids, Density of states and Fermi energy, Fermi distribution function, Electron scattering and source of resistance in metals, Variation resistivity with temperature and pressure, Schottky effect, calculation of Fermi level of semiconductor, mobility, Mathiesen's law, photo conduction in semiconductors.

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Books Recommended

- *"Electrical Engineering Material"*, by Dekker, Prentice-Hall of India Private Limited, New Delhi.
- *"Solid State Electronic Devices"*, by Streetman, Pearson Education, Limited.
- *"Introduction Semiconductor Materials and Devices"*, by M.S. Tyagi, John Willey and Sons Pte Ltd.
- *"Solid State Electronic Engineering Materials"*, by S.O. Pillai, John Wiley.
- *"Microelectronic Circuits and Devices"*, by Horenstein, Prentice Hall
- *"Microelectronic Circuits"*, by AS. Sedra and KC. Smith, Oxford University Press.
- *"Microelectronics"*, by Millman and Taub, Tata McGraw-Hill Edition.
- *"Circuit theory"*, by Chattopadhay and Rakshit, New Age International Publishers.
- *"Network analysis"*, by Van Valkenberg, Prentice Hall of India.
- *"Electronic circuit analysis and design"*, by Hyat and Neudeck, Houghton Miffiin.
- *"Basic Circuit Theory"*, by L.P Huelsman, Prentice-Hall.
- *"Electronic Devices and Circuit Theory*", by Boylested and Nashelaky, Pearson Education.
- *"Electronic Devices and Circuits"*, by Mottershed, Prentice Hall of India.
- *"Integrated Electronics"*, by Millman and Halkias, Tata McGraw-Hill Edition.
- *"Electronics Principles"*, by Malvino, Tata McGraw-Hill Edition.

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- *"Electronics Fundamental and Application"*, by Chattopadhyay and Rakshit, New Age International.
- *"Application and Design of Analog Integrated Circuits"*, by Jacob, Reston Pub. Co.
- *"Operational Amplifiers and Linear Integrated Circuits"*, by Coughing and Driscol.
- *"OP-AMPS Linear Integrated Circuits"*, by Gaykwad, Prentice Hall.
- *"Solid state physics"*, by Dekker, Macmillan Press.
- *"Solid State Physics"*, by S.O. Pillai, New Age International, New Delhi.
- *"Solid State Physics"*, by R.L.Singhal, Kedarnath Ramnath, Meerut.
- *"Solid State Physics"*, by Babbar and Puri, S. Chand, New Delhi

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Paper -IV (Theory)

Full Marks: 100

(University Written Examination -90 & Internal Assessment in College -10)

(Examination: At least one question is to be answered from each group).

Group -A: Electromagnetic Theory: **30 Marks**

Equation of continuity for time varying fields, Inconsistency of Ampere's law, Maxwell's equation, Conditions at boundary surface, wave equation-solution for free space conditions, uniform plane wave propagation, wave equations for conducting medium, Skin effect, Lorentz theory of dispersion (normal and anomalous) classifications of conductors and dielectrics, loss tangent, Polarisation, Poynting theorem, Instantaneous, average and complex poynting vector, reflection and refraction of plane waves at the boundary of two dielectrics (Normal and oblique incidence), reflection and transmission coefficients, Brewster's law, Reflection by a perfect conductor (Normal and oblique incidence), Parallel-plane transmission line, line loss, transmission line theory (Line charts are not required),Smith Chart (Basic ideas).

Rectangular guide, TM waves in Rectangular guides, TE Waves in rectangular guides, solution of field equations, Cylindrical coordinates, wave impedances and characteristic impedances, transmission line analogy of wave guide, attenuation factor and Q of wave guides.

Group - B: Semiconductor Devices and Circuits-II: **30 Marks**

Transistor as an amplifier, R-C coupled amplifier.

Tuned Amplifier: Frequency selective networks, LC circuits, single and double tuned amp1ifiers, Analysis of voltage gain and selectivity, RF and IF amplifiers.

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Power amplifiers: Class A, B, C and AB amplifiers, Direct coupled amplifier, Transformer coupled amplifier, Push pull amplifiers, Class A & B Push pull circuits, Harmonic distortion, complementary symmetry amplifier,

Feed back in Amplifier: General theory of feedback, negative and positive feedback, advantages of negative feedback, types of negative feedback in transistor amplifiers, current series, voltage series, current shunt- voltage amplifiers, Darlington amplifier,

Oscillator circuits: Positive feedback and oscillation, Barkhausen Principle, Hartley, Colpitt, Wien Bridge and phase shift oscillators, Multivibrators (using transistors and 555 timers).

Operational Amplifier: Ideal OPAMP characteristics, offset current and offset voltage, inverting and non-inverting amp1ifiers, Transfer characteristics, Differential amplifiers, CMRR, Basic OP-AMP applications, adder, phase shifter, scale changer, voltage to current and current to voltage converters, analog integration and differentiation, Comparator, Schmitt trigger, solutions of simultaneous liner and S.H.M. equation, AC coupled amplifier, AC voltage follower,

Microwave Devices: Tunnel diode, Gunn diode, IMPATT diode, PIN diode.

Group -C: Propagation of Radio waves: **15 Marks**

Different types of radio waves and their propagation characters, Classification of radio waves in order of its frequencies and application, reflection of radio waves from ionosphere, Secant law, Skip distance, MUF, single and multihop transmission, Ray trajectories in ionosphere, Day and night transmission of radio waves through ionosphere.

Group -D: Computer Fundamentals: **25 Marks**

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Fundamentals:

Types of computer, classifications, computing concept, input devices, processing unit, output devices, external storage devices, the software, assembly and machine languages, high level languages, interpreter, translator, program execution modes.

Problem Solving and Flowcharts:

Problem Solving, Algorithm, flowchart, branching, looping data structure, list stack, que, sorting: bubble, quick, searching: linear, binary, tree, B+ tree.

Language:

FORTRAN and Basic: program analysis, Solving of some fundamental arithmetic problems, Matrix algebra, and string manipulation programming efficiency and testing.

Operating system: DOS and WINDOWS (Basic idea).

Books Recommended

- *"Digital computer Design"*, by M. Mano, Prentice-Hall.
- *"Fundamentals of Computer"*, by Rajaraman, Prentic Hall of India.
- *"Introduction to Digital Computer Design"*, by Rajaraman and Radhakrishnan, Prentice Hall of India.
- *"How to solve it by Computer"*, by Dromey, Pearson Education.
- *"BASIC Programming"*, by Balagureswamy, Tata McGraw-Hill.
- *"Basic, Fortan-77"*, by Schaum's Outline Series, McGraw Hill Professional.

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- *"Fortran 77 and Numerical Methods"*, by C. Xavier, New Age Publication.
- *"Introduction to Electrodynamics"*, by Griffith, Addison-Wesley Professional.
- *"Classical Electrodynamics"*, by J.D. Jackson, John Willey and Sons Ltd.
- *"Introduction to Electromagnetic Engineering"*, by R.F. Harrington, Dover Publicatins.
- *"Electromagnetic Waves & Radiating Systems"*, by Jordan and Balmian PHI Ltd, New Delhi.
- *"Electricity and Magnetism"*, by Mahajan and Rangwala, Tata McGraw-Hill Publishing, New Delhi..
- "Electrodynamics", by Y.V.Novozihlov, Y.A.Yappa,V.I.Kysin, Mir Publishers, Moskow.
- *"Electrodynamics: Electricity and Magnetism"*, by Gupta, Kumar, Singh, Pragati Prakashan, Meerut.
- *"Electrodynamics: Lecturer on Therital Physics"*, by A. Sommefeld, E.G. Ramberg, Levant Books, Kolkata.
- *"Microelectronic Circuits and Devices"*, by Horenstein, Prentice Hall
- *"Microelectronic Circuits"*, by A.S. Sedra and K.C. Smith, Oxford University Press.
- *"Microelectronics"*, by Millman and Taub, Tata McGraw-Hill Edition.
- *"Circuit theory"*, by Chattopadhyay and Rakshit, New Age International Publishers.
- *"Network analysis"*, by Van Valkenberg, Prentice Hall of India.
- *"Electronic circuit analysis and design"*, by Hyat and Neudeck, Houghton Miffin.
- *"Basic Circuit Theory"*, by L.P Huelsman, Prentice-Hall.

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- *"Electronic Devices and Circuit Theory"*, by Boylested and Nashelaky, Pearson Education.
- *"Electronic Devices and Circuits"*, by Mottershed, Prentice Hall of India.
- *"Integrated Electronics"*, by Millman and Halkias, Tata McGraw-Hill Edition.
- *"Electronics Principles"*, by Malvino, Tata McGraw-Hill Edition.
- *"Electronics Fundamental and Application"*, by Chattopadhyay and Rakshit, New Age International.
- *"Application and Design of Analog Integrated Circuits"*, by Jacob, Reston Pub. Co.
- *"Operational Amplifiers and Linear Integrated Circuits"*, by Coughing and Discol.
- *"OP-AMPS Linear Integrated Circuits"*, by Gaykwad, Prentice Hall.

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Paper –V (Practical)

Full Marks : 100

(One experiment from Group-A [Electricity] and one experiment from Group-B [Solid-state devices and circuits) are to be performed)

Group -A : Experiments on Electricity : **50 Marks**

1. Measurement of self-inductance by Anderson bridge. To find the total inductance of those two coils in series and hence estimate the co-efficient of coupling between the coils.
2. Verification of Thevenin's theorem using a resistive Wheat-stone bridge, d. c. source and d. c. meters.
3. Verification of Norton's theorem.
4. Verification of maximum power transfer theorem.
5. To calibrate a thermocouple and hence
   i) to measure an unknown temperature.
   ii) to measure the thermoelectric power at particular temperature.
6. To determine Fourier spectrum of (i) square, (ii) triangular, iii) sinusoidal waveforms by CRO.
7. Measure of magnetic flux by using a search coil and a ballistic galvanometer.
8. Investigation of inductance in ac circuits
   i) to verify the current voltage relationship for an inductance in a.c. circuit and hence measure the value of the inductance.
   ii) to measure the reactance of an inductance coil in L¢R circuit
   iii) to study the variation of reactance of an inductive coil with frequency of the a.c. source and hence to measure its inductance.

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9. i) Investigation of capacitance in an alternating current circuit: to measure the reactance and loss factor of a Capacitor of a C-R circuit.
   ii) to study the variation of reactance of a capacitor with frequency of the alternating current source and hence to measure the capacitance.
10. To draw resonance curve of a series LCR circuit and hence to determine the Q-factor of the circuit.

Group-B: Experiment on Solid State Devices and circuits: **50 Marks**

1. Study of P-N junction diode

i. to draw V-I characteristics for forward bias and calculation of impedance.
ii. to study ripple factor of half-wave, full-wave and bridge rectifier without and with filters (to study wave from in CRO).
iii. to study load and line regulation of a full wave unregulated power supply.

2. Study of Zener diode

i. to study forward and reverse bias characteristics of a Zener diode.
ii. to study the load and line regulation of a Zener diode as a voltage regulator.

3. To draw the characteristics of photoelectric cell and to determine the stopping potential of the material of cathode by drawing the characteristics response curves.

4. To study transistor

i. to draw the static characteristics of P-N-P and N-P-N transistors in CB, CB, CC modes.
ii. to find the hybrid parameters in D. C. mode.

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iii. to determine the hybrid parameters of a transistor using a.c. source.
iv. to construct and study the frequency response of a voltage amplifier using a transistor in C-E mode and to find its band width.
v. to study R-C coupled amplifier.
vi. to study a push-pull amplifier (to plot frequency response curve).
vii. to study a tuned transistor circuit.

5. To study FET characteristics. (Static and frequency response).

6. To measure the input offset voltage, input bias currents and input offset current of an OP AMP and to use it as an inverting amplifier, adder, differential comparator, integrator, differentiator.

7. To construct multivibrators and study its wave form on CRO (with 555).
i. Bistable multivibrator.
ii. Astable mutivibrator.

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Part III

Paper -VI (Theory)

Full Marks: 100

(University Written Examination -90 & Internal Assessment in College -10)
(Examination: At least one question is to be answered from each group)

Group - A: Digital Electronics **30 Marks**

Number Systems: Decimal numbers, binary number, octal numbers, hexadecimal numbers, BCD numbers (weighted and unweighted codes), Excess three code, Gray code, parity conversions, arithmetic operations, ASCII, Extended ASCII codes, 9's and 10's complement code.

Boolean algebra: Boolean relations, commutative, associative and distributive laws, OR, AND, and NOT operations, De Morgan theorems.

Logic Gates: Inverters, OR, AND and NOR gates, EX-OR and EX-NOR gates, Simplification of Boolean expressions using Boolean algebra and De-Morgan's theorems, sum of products and products of sum forms, Karnaugh-map, NAND and NOR gates as universal building blocks.

Logic Families : Digital integrated circuits, levels of integration, DTL and TTL circuits, DTL , TTL TTL, DCTL, RTL (comparisons only),7400 series, TTL characteristics, TTL,CMOS comparison.

Combinational Logic: Circuits of AND,OR,NOT, NAND, NOR gates using TTL and CMOS, Binary adder, half adders, full adders, BCD adder, half substractor, full substractor, Decoder and Encoder, Multiplexer and Demultiplexer, Comprator, Code converter (Binary to BCD, Binary to Gray, Gray to Binary, BCD to Excess three).

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Sequential Circuits: Latches, edge triggered flip-flops, R-S flip-flop, J-K flip-flop, Master - slave flip-flop, D-flip-flop, T flip-flop, registers, counter: Design of Asynchronous and synchronous counters, Different mod N counters, Ripple counters, ring counters, Johnson Counter.

Memory: RAM, ROM, PROM, EPROM.

Group -B: Communication Engineering: **25 Marks**

Analogy between vectors and signals, orthogonal functions (Elementary ideas), Representation of a periodic function by Fourier series over the time interval, The Fourier transform, Time-domain and frequency-domain representations of a signal, Convolution theorem, time convolution, frequency convolution, convolution properties, Fourier transforms of some useful functions (single sided exponential signal, double exponential signal, Gate function), Gaussian pulse, Triangular pulse, exponential pulse, sampling function, Fourier transforms for following cases : Impulse function, a constant, step function u(t), periodic functions Sin wt, Cos wt, etc., properties of FT, symmetry property, linearity property, scaling property, frequency shifting property, time shifting property. Signal transmission through 1inear systems, the filter characteristics of linear systems, distortion less transmission, Bandwidth of system, ideal filters, the energy density spectrum, interpretation of energy density, the power density spectrum, power density, spectrum of a periodic signal.

Communication systems: communication an introduction, electrical communication, need for modulation, Amplitude modulation, suppressed carrier systems, Frequency translation, modulating systems, demodulation, detection, chopper amplifier, envelope detector, power calculations of side bands and carriers in AM.

Angle modulation: Phase and frequency modulations, narrow band FM, power contents of the carriers and the side bands in angle modulated

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carriers, generation of FM signals, direct and indirect modulator, demodulator, frequency division multiplexing, time division multiplexing,

Digital Signal Processing: pulse modulation, PAM, transmission of PAM signal, other forms of pulse modulation.

Noise: Classification of noise: External noise, Internal noise, Extraterrestrial noise, Voltage and current model of noise resistor, S/N ratio, Noise figure, Noise temperature.

Group -C: Instrumentation **20 Marks**

Signal Generator: Basic oscillator circuits, pulse and square wave generators, laboratory square wave and pulse generators, standard signal generators, description with block diagram sweep frequency generators, function generator for different frequency ranges.

Cathode Ray Oscilloscope*:* Motion of charged particles in dielectric and magnetic fields, in simultaneous electric and magnetic field (crossed and parallel), Block diagram of CRO, CRO construction, principles of focusing a deflection of electron beam, CRT screens, vertical deflection systems, basic elements, attenuator, vertical amplifier, delay line, horizontal amplifier, CRO probes, application of CRO, dual trace and dual beam CRO.

Meters: Basic Q meter, measurement methods, Voltmeter, Ammeter, Analog and Digital Multimeter, True RMS meter.

Frequency Counter: Electronic counter, principle of frequency measurement, block diagram of the electronic counter in the frequency mode operation.

Transducers: Piezoelectric, Photoelectric, Hall effect.

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Thermoelectricity: Thermoelectric effect, Seebeck, Peltier and Thomson effects, laws of thermo-electricity, thermo-electric power, thermo-couple and its uses.

Group-D: 8085A Microprocessor **25 Marks**

Architecture and Organization, The ALU, Register, Timing and Control Unit, Pin configuration, Decoding of Address and data bus, Microprocessor bus diagram, Memory and I/O Interface. Intel 8085 Assembly Language Programming: Instruction set and classification of instruction sets of 8085/8085A, Loops in Programs, Uses of Subroutine, Delay Subroutine. Concepts of Interrupts (Software and hardware),PPI IC chip 8255.

Books Recommended

- *"Digital Electronics"*, by Gothmann, Prentice-Hall.
- *"Digital Principles and Applications"*, by Malvino and Leach, McGraw-Hill.
- *"Digital Electronics and Microprocessors Problems and Solutions"*, by R.P. Jain, McGraw-Hill Education.
- *"Digital Electronics"*, by Malvino, Tata McGraw -Hill.
- *"Digital Computer Electronics"*, by Malvino and Brown, Tata Mcgraw-Hill.
- *"Digital Circuits and Design"*, by S. Salivanan, Vikash Publishing House.
- *"Digital Fundamentals"*, by T.L. Floyd, Pearson Education, New Delhi.
- *"Digital Circuits"*, by D. Ray Chaudhuri, Platinum Publishers, Kolkata,

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- *"Digital Circuits: an introduction"*, by D. Ray Chaudhuri, Eureka Publishers, Kolkata.
- *"Microprocessor Architecture, Programming, and Applications with the 8085"*, by Gaonkar, Prentice Hall PTR.
- *"Communication Systems"*, by Kennedy, Tata McGraw-Hill.
- *"Communication Systems"*, by B. Carlson, McGraw-Hill Higher Education.
- *"Communication Systems"*, by Sanjay Sharma, S.K. Kataria and Sons.
- *"Principle of Communication Systems"*, by D. Schilling and H. Taub, Tata McGraw-Hill.
- *"Analog and Digital Communications"*, by Roden, Shroff Publishers & Distributors Pvt. Limited.
- *"Electronic communication"*, by Roddy and Coolen, Pearson Education.
- *"Modern Electronic Instrumentation and Measurement Techniques"*, by Helfrick and Cooper, Prentice-Hall of India.
- *"Modem principles of Measurements and Instrumentation"*, by Morris, Planta Tree.
- *"Transducer and Instrumentation"*, by Murthy, Prentic Hall India.
- *"Electronic Measurements"*, by Kalshi, Tata McGraw-Hill.

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Paper-VII (Practical)
Full Marks: 100
(Examination: One experiment from Group-A and one experiment from Group-B are to be performed)

Group- A (Digital Electronics): **50 Marks**

1. To construct OR, AND, NOR, NAND and NOR gates using discrete components on bread board and verify their truth tables.
2. Verify De-Morgan's theorems.
3. Implementation of Boolean expressions with NAND/NOR gates.
4. To construct half adder and full adder using NAND/NOR gates.
5. BCD adder.
6. To construct half substractor and full substractor using NAND/NOR gates
7. To construct encoder, decoder, multiplexer, demultiplexer.
8. To construct half adder and full adder and half substractor and full substractor using MUX/DEMUX
9. To study and use of D/A and A/D converters.
10. To construct R-S flip-flop, J-K flip-flop, Master-Slave flip-flop, D type flip-flop, T type flip-flop using NAND/NOR gates and clock pulses.
11. Up-down counter/decade counter, Divide by N counter.

Group -B (Microprocessor - 8085A): **50 Marks**

Expt. No.-1: Addition of two 8 bit and 16 bit numbers.
Expt. No.-2: Detection of even and odd data.
Expt. No. - 3. Addition of BCD numbers.
Expt. No.-4: Subtraction of two 8 bit and 16 bit number.
Expt. No.-5: Multiplication of

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i) two eight bit numbers .
ii) one eight bit and one 16 bit number.

Expt. No.-6: To arrange an array of numbers in ascending/ descending order.

Expt. No.-7: To transfer a block of data from one memory zone to other.

Expt. No.-8: To find one's and two's complement of eight bit number.

Expt. No.-9: To find one's and two's complement of sixteen bit number.

Expt. No.-10: To find a smallest and largest number from an array

Apart from executing the programs prescribed in the syllabus, students should be encouraged to execute other problems associated with Microprocessor 8085 with similar complexity. Problems other than those listed above may also be set in final examination of similar complexity.

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Paper-VIII (Practical)

Full Marks: 100

(Examination: One experiment from Group-A and one experiment from Group- B are to be performed)

Group A: Computer programming and numerical analysis: **Marks 50**

General arithmetic and algebraic problem framing and solution with FORTRAN 77. Practical should be carried out on the following basis

i) Input output statements
ii) Control statements.
iii) DO loops.
iv) Arrays and subscripted arrays
v) Sub program.
vi) Data files

Write FORTRAN program to solve the following types of problems on the computer.

i. Find the real root of an equation by the method of successive approximation.

ii. Derive Taylor series expansion of a function.

iii. Derive the Maclaurin's series function of a function.

iv. Solve a system of equations by Gauss elimination method and Gauss Jordan Elimination method.

v. Problem solving on linear interpolation, Quadratic interpolation and Lagrange interpolation.

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vi. Solve of Algebraic equation by Newton Rapshon method.

vii. Matrix Multiplication.

Apart from executing the programs prescribed in the syllabus, students should be encouraged to execute other problems associated with FORTRAN Programming Language with similar complexity. Problems other than those listed above may also be set in final examination of similar complexity.

Group· B: Project work: **(40+10) Marks**

(40 marks for project work and 10 for presentation in a seminar along with viva-voce)

The Project work may be done on any of the following areas but the list is not exhaustive.

- Experimental electronics.
- Theoretical electronics.
- Instrumentation.
- Optical or opto-electronics.
- Applied optics.
- Communication.
- Computer and Microprocessor.

(Examination)

The project report will be examined by presentation and viva-voice in a seminar in the presence of an external examiner. Department should organize such seminar.

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ELECTRONICS (GENERAL)
Full Marks: 400

Part - I 100 Marks (Examination at the end of first year).
Part-II 200 Marks (Examination at the end of second year).
Part-III 100 Marks (Examination at the end of third year).
Each theory paper, full marks: 100
(University written examination: 90 Marks, and Internal Assessment in college: 10 Marks)
Examination period for a theoretical paper: 3 hours
Examination period for a practical paper: 6 hours

Part-1 **Theory-100 Marks**		
Paper	**Marks**	**Lecture / Period**
IA: Electron Device and Passive Circuits	50	55
IB: Linear Active Circuit	50	55
Part-II **Theory -100Marks**		
IIA: Digital Electronics	50	55
IIB: Electronic Instrumentation	50	55
Practical-100		
IIIA: Semiconductor Devices and Circuits	50	55
IIIB: Instrumentation and Digital Electronics	50	55
Part-III **Theory -65, Practical-15, Project-20**		
IVA: Communication Electronics and Microwave	40	45
IV B: Microprocessor and their applications	25	30
IVC: Microprocessor based laboratory Experiment	15	20
IVD: Project Work	20	25

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Part-1
Paper-1 (Theory)
Full Marks-100
(University written examination-90 and Internal Assessment in college-10)

1A: Electron Devices and Passive Circuits **50 Marks**

i) Physics of Semiconductor:

Energy band theory of crystals: Metals, Insulator and Semiconductors, Intrinsic and Extrinsic Semiconductors, charge carrier density, Mobility, Effective mass, Diffusion and Recombination of carriers, Photoconductivity (Qualitative)

ii) P-N Junctions in Semiconductors:

Space charge region in a semiconductor junction, potentials and fields, band diagrams, P-N junction as a rectifier, current components, V –I characteristics, temperature effects, varactors, Metal-semiconductor junctions, Reverse breakdown, Zener diodes. (No derivation of expression needed) other applications, Light emitting diodes.

iii) Bipolar Transistors:

The junction transistor, transistor current components, current gain, Transistor as an amplifier, Common Base configuration: Static Characteristics, Saturation, active and cut of regions. Two port parameters, Relationship between input and output voltages and currents, Impedance and admittance parameters, hybrid parameters, voltage gain, current gain, output impedance, attenuations, gain, phase shift, Decibels.

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iv) Silicon controlled Rectifiers:
Structure and characteristic Curves, simple applications, DIAC and TRIAC

v) Unijunction Transistors: Structures and characteristics, Applications.

vi) Metal-oxide Semiconductor Devices:
The Junction Fields Effect Transistors (JFET): Structure static characteristics, structure of MOSFETs, Enhancement and Depletion MOSFETs, p and n-channel MOSFET complementary FETs, common source and common drain configurations, small signal AC equivalent circuits, FET as an amplifier, CS and CD amplifiers, High frequency response JFET equivalent circuit, other applications.

vii) Circuit Elements
Resistors, capacitors, color code of resistor and capacitors Inductors: construction, Ratings, Series and parallel combinations of resistors, inductors and capacitors

viii) Transformer:
Construction, Equivalent Circuit, Frequency response, Autotransformer, Application in Electronic Circuits.

ix) Network Theorems:
Superposition, Reciprocity, Thevenin, Norton, Maximum Power Transfer, Miller, Millman and Bisection theorems.

x) Transient response:
Response of LR; CR and LCR circuits to step voltages, Differentiation and integration, switching circuit problems.

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xi) Resonance:
Series and parallel resonance of LCR circuits, Effect of resistance, Q-factor, simple problems.

xii) Loop and Nodal Analysis:
Kirchhoff's Current and voltage laws, Example of loop and nodal analysis, T-Π and Π-T transformations, simple problems.

1B. Linear Active Circuits **50 Marks**

i) Diode circuits:
Diode as a circuit element, Diode as a rectifier, half wave and full wave rectifiers, Peak inverse voltage, Bridge rectifiers, Effect of filters, Diode as regulator, Regulated power supply: basic idea, Diode detectors.

ii) Transistor Biasing:
Different methods of biasing, stability factors, operating point.

iii) Small Signal Transistor Amplifiers:
Transistor as a two-port network, Z and Y-parameters, hybrid parameters, h-parameter equivalent circuits for CE, CB and CC configurations, Determination of h parameters from static characteristics, Analysis of low frequency amplifier characteristics, current voltage, power gains, input and output resistances, Frequency response, cut off frequencies, Emitter Followers, Darlington pair.

iv) Amplifiers:
R-C coupled amplifier. Frequency selective networks, LC circuits, single and double tuned amplifiers, Analysis of voltage gain and selectivity, RF and IF amplifiers, feed back in amplifier.

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v) Power Amplifiers:

Class A, B and C amplifiers, direct coupled, transformer coupled amplifiers, Push-pull amplifiers, Class A and B Push pull circuits, Harmonic distortion, complementary symmetry amplifier (Qualitative).

vii) Oscillator Circuits:

Positive feedback and oscillation, Hartle, Colpitts, Wien Bridge and phase shift oscillators, crystal oscillators.

viii) Operational Amplifiers:

Differential amplifier, Transfer characteristics, Ideal OP AMP characteristics, Inverting and non-inverting OPAMPS, Basic OP AMP applications: Adder, Substractor, phase shifter, voltage to current converter, Differential amplifier, AC coupled amplifier, AC voltage follower, Analog Integration and differentiation.

Books Recommended

- *"Microeletronic Circuits and Devices"*, by Horenstein, Prentice Hall.
- *"Microelectronic Circuits"*, by A.S. Sedra and K.C. Smith, Oxford University Press.
- *"Microelectronics"*, by Millman and Taub, Tata McGraw-Hill Edition.
- *"Circuit theory"*, by Chattopadhyay and Rakshit, New Age International Publishers.
- *"Network analysis"*, by Van Valkenberg, Prentice Hall of India.
- *"Electronic circuit analysis and design"*, by Hyat and Neudeck, Houghton Miffiin.

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- *"Basic Circuit Theory"*, by L.P Huelsman, Prentice-Hall.
- *"Electronic Devices and Circuit Theory"*, by Boylested and Nashelaky, Pearson Education.
- *"Electronic Devices and Circuits"*, by Mottershed, Prentice Hall of India.
- *"Integrated Electronics"*, by Millman and Halkias, Tata McGraw-Hill Edition.
- *"Electronics Principles"*, by Malvino, Tata McGraw-Hill Edition.
- *"Electronics Fundamental and Application"*, by Chattopadhyay and Rakshit, New Age International.
- *"Application and Design of Analog Integrated Circuits"*, by Jacob, Reston Pub. Co.
- *"Operational Amplifiers and Linear Integrated Circuits"*, by Coughing and Discolt.
- *"OP-AMPS Linear Integrated Circuits"*, by Gaykwad, Prentice Hall

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Part-II
Paper-II (Theory)
Full Marks-100
(University written examination-90 and Internal Assessment in college-10)

IIA: Digital Electronics **50 Marks**

i) Number Systems:
Decimal numbers, Binary numbers, why Binary Numbers are used, Hexadecimal Numbers, BCD Numbers, Conversions one number system to another.

ii) Boolean Algebra:
Boolean Relations: Commutative Associative and Distributive laws, OR and AND operations, De Morgan's theorems.

iii) Logic Gates:
Inverters, OR, AND, NAND and NOR Gates, Exclusive OR and Exclusive NOR Gates, Use of Boolean algebra and De Morgan's Theorems in describing operation of Gates. Simplification by K- Map, Sum of Products Method, Product of sum form.

iv) Elements of Logic Families:
Digital integrated circuits, levels of Integration, Diode Transistor Logic, Transistor-Transistor Logic, Direct Coupled Transistor logic, Transistor Logic, MOS Logic, CMOS Logic, comparison of Logic Families.

v) Combinational Circuits:
TTL overview, implementing logic circuits with NAND and NOR Gates, Standard Gate Assemblies, Binary Adders, Half Adders, Full Adders, Half

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substractor, Full Substractor, BCD adder, Decoders, Multiplexer, Encoder, Code converter (binary to gray and vice versa), Binary Comparator.

vi) Sequential Circuits:
RS latches, D latches, Edge triggered D flip flop, Edge triggered JK flip flop, T- flip flop, Master-Slave flip flop, Registers, , Ripple Counter, Synchronous Counters, Ring Counters, Mod N counters, Applications of counters, Read only Memory, Random Access Memory.

vii) Data Converters: Weighted registered D/A converter, R-2R ladder network.

IIB: Electronic Instrumentation: 50 Marks

i) Electronic Voltmeter:
DC Voltmeters, AC Voltmeters, RMS responding voltmeter, considerations in choosing Analog Voltmeters.

ii) Power Meter:
Single-phase voltmeter, Poly phase type, Watt hour Meter.

iii) Regulated Power Supply:
Use of filter in rectifiers, Principle of regulations, Regulated Power supply using Zener and Transistors, Regulated Power Supply using ICs, Short circuit protection, constant current supply, positive and Negative supplies,

iv) LCR Bridges:
General form of AC Bridges: Inductance comparison Bridges, Maxwell, Hay and Scherring Bridges, Universal Impedance Bridge.

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v) Signal Generators:

Basic Oscillator circuits and pulse and square wave generators, laboratory square wave and pulse generators, standard signal generators, Description with Block Diagrams, Noise Generators, Signal Generators for different frequency ranges.

vi) Cathode Ray Oscilloscope:

Basic CRO operation: Block Diagram of a CRO, Cathode Ray Tube, construction, Brief idea about principles of focussing and deflection of Electron beam, CRT screens, vertical electronic systems, Basic Elements, Attenuator, vertical amplifier, delay line, Horizontal Deflection systems, Sweep Generator, Synchronization of sweep, Horizontal Amplifier, CRO probes, Applications of CRO, Dual Trace and Dual Beam CRO, Lissajious figure.

vii) Q-meter:

Basic Q Meter circuit, Measurement methods.

viii) Digital Voltmeter:

General characteristics, Ramp type, Integrating, continuous Balance, successive Approximation DVM, Digital Ammeter and Voltmeter,

ix) Frequency Counter:

Review of Electronic Counter, principle of frequency measurement, Block diagram of the Electronic Counter in the Frequency Mode of Operation.

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BOOKS RECOMMENDED

- *"Digital Electronics"*, by Gothmann, Prentice-Hall.
- *"Digital Principles and Applications"*, by Malvino and Leach, McGraw-Hill.
- *"Digital Electronics and Microprocessors Problems and Solutions"*, by R.P. Jain, McGraw-Hill Education.
- *"Digital Electronics"*, by Malvino, Tata McGraw -Hill.
- *"Digital Computer Electronics"*, by Malvino and Brown, Tata Mcgraw-Hill.
- *"Digital Circuits and Design"*, by S. Salivanan, Vikash Publishing House.
- *"Digital Fundamentals"*, by T.L.Floyd, Pearson Education, New Delhi.
- *"Digital Circuits"*, by D. Ray Chaudhuri, Platinum Publishers, Kolkata,
- *"Digital Circuits: an introduction"*, by D. Ray Chaudhuri, Eureka Publishers, Kolkata.
- *"Modern Electronic Instrumentation and Measurement Techniques"*, by Helfrick and Cooper, Prentice-Hall of India.
- *"Modern principles of Measurements and Instrumentation"*, by Morris, Planta Tree.
- *"Transducer and Instrumentation"*, by Murthy, Prentic Hall India.
- *"Electronic Measurements"*, by Kalshi, Tata McGraw-Hill.

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Paper-III (Practical)
Full Marks-100

IIIA: Semiconductor Devices and circuits **50 Marks**

1. Study of P-N junction diode

i) To draw V-I characteristics for forward bias and calculation of impedance.
ii) To study load and line regulation of a full wave power supply.
iii) To study Ripple factor of half-wave and full wave rectifier with II type filters, to study wave form on CRO.
iv) To Study forward and reverse bias characteristics of a Zener diode.
v) To Study the load and line regulation of a Zener diode as a voltage regulator.
vi) To Study load regulation of power supply with Zener diode as voltage regulator.
vii) To study percentage regulation and ripple factor of stabilized variable power supply.

2. Study of Transistor:

i) To draw the static characteristic of a PNP or NPN transistor in CE CB and CC mode.
ii) To find the hybrid parameters of a transistor in the D.C. mode.
iii) To study R-C coupled amplifier (To plot frequency response curve and to find the bandwidth).
iv) To study a push-pull amplifier (To plot the Frequency response curve of the circuit).
v) To study tuned transistor circuit (To find the value of Q).

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IIIB: Instrumentation and Digital Electronics 50 Marks

3. Studies with CRO:

i) **Study of multivibrator:**

a) To generate square wave using astable multivibrator and to see waveform on CRO.

b) To measure the frequency of square wave on CRO.

c) To study the effect of changing base resistor or coupling capacitor on the frequency of the square wave.

ii) To observe the output wave shape of differentiating and integrating circuits on CRO (with LCR Bridge).

iii) To use integrating and differentiating circuit with linear IC and study the wave forms.

i) Measurement of phase and frequency with CRO.

ii) Measurement of phase using Lissajious figure.

4. Experiments with IC (741):

Offset voltage, Offset current, Adder, Comparator, integrator, differentiator. Smith trigger.

5. Experiments with Digital IC Trainer Kit:

i. Verification of truth table of basic logic gates.

ii. Verification of Boolean expressions

iii. Design of Half adder, full adder, half subtractor, full subtractor, MUX, DMUX using basic gates.

iv. BCD adder.

v. Design of RS,JK,MS,D and T type flip-flop using NAND/NOR gates.

vi. Different MOD –N counters (asynchronous/synchronous using TTL IC chip)

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6. Experiments with Q-Meters:

i) Measurement of L and C by a Q-meter.

ii) Measurement of Q of a coil at different frequencies by a Q- meter.

PART- III
Paper-IV
Full Marks -100
(University Written Examination - 60 &Internal Assessment in Colleges 05)
Theory -65
IVA: Communication Electronics and Microwaves 40 Marks

1. Electrostatics:

Introduction: Fundamental relations of the electrostatics field, Gauss law, The potential function, Field due to a continuous distribution of charge, Equipotential Surface, Divergence theorem, Divergence theorem, Possion's equation and Laplace equation, Capacitance, Electrostatics Energy, Boundary conditions.

2. Magnetostatics:

Theories of the Magnetic Field, Magnetic Induction and Faradays law, Magnetic flux density, Magnetic Field Strength and Magneto motive force, Ampere's law, Permeability, Energy stored in Magnetic Field, Magnetic vector potential, Analogies between Electric and Magnetic field.

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3. **Electromagnetic Theory:**
Equation of continuity for time varying fields, Inconsistency of Ampere's law, Maxwell's equation, Conditions at boundary surface, wave equation- solution for free space conditions, uniform plane wave propagation, wave equations for conducting medium, Skin effect, Poynting theorem, Instantaneous, average and complex pointing vector.

4. **Transmission Lines:**
Primary constants, Transmission line theory, Lumped and Distributed parametrs, Secondary constants, Lumped parameter equivalent circuit of transmission line, Telegraphers equation, Characteristic impedance, Propagation constants, Attenuation and phase constants, Phase and Group velocity, Standing Wave Ratio (SWR), Determination of SWR, Line distortion, Distortion less line.

5. **Wave Guide:**
Types of Wave-guides, Rectangular Waveguide, Cylindrical Waveguide, E and H plane Tee, hydride junctions, Direction coupler.

6. **Modulation:**
Types of Modulation, Amplitude Modulation, Double side bands, Amplitude modulated single side band, Spectrum and Power in amplitude modulated (AM) signal, Frequency and phase modulation, Bandwidth requirements. Digital Modulation: PAM, PCM, PWM

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7. **Antenna:**
Radiation from Hertzian dipole, Concept of far and near field, Fundamental parameters of antennas, Isotropic, Directional and Omni directional patterns, principal patterns, radiation patterns lobe, Radiation power density, Radiation Intensity, Directivity, Antenna Gain, Antenna efficiency, Half power beamwidth, Beam width, Polarizations, Input impedance, Effective length and area, Receiving antenna and its characteristics, Preliminary ideas on antenna array.

8. **Radio Wave Propagation:**
Characteristic of electromagnetic wave, Propagation of radio waves at different frequencies, Structure of atmosphere, Ground wave, Critical frequency and Virtual height, Maximum usable frequency and skip distance.

IVB: Microprocessor and their applications 25Marks

The Microprocessor System: Hardware, software, CPU, Arithmetic-Logic section, Accumulator, Status registers, ALU, General purpose registers, Control Registers, Program counter, Stack pointer, Timing and control unit, The Clock, Reset, Interrupt, Hold, Read and Write, I/O Read and write, Memory read and write, Address latch enable.

1. **The 8085A Microprocessor:**
Architecture and Organization, The ALU, Register, Timing and Control Unit, Pin configuration, Interface with memory. Intel 8085 Assembly Language Programming: Instruction set for

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8085/8085A, Data movement instruction, PUSH and POP, Increment/Decrement, Rotate/shift, Set, compliment and Decimal adjustment, Add, Subtract and Compare, AND, OR, EXOR, JUMP, CALL, RESTRAT Conditional JUMP CALL and RETURN, Loops in Programs, Uses of Subroutine, Delay Subroutine.

2. **Memories:**
Semiconductor Memories, Nonvolatile RAM, Pin configuration of RAM, EPROM and EEPROM, DRAM, Memory maps.

Practical-35 **(15+20) Marks**

IVC: Microprocessor based laboratory Experiments: 15 Marks

Expt. No.-1	Addition of 8 bit and 16 bit numbers
Expt. No.-2	Detection of even and odd data
Expt. No.-3	Subtraction of two eight bit number
Expt. No.-4	Multiplication of two eight bit numbers
Expt. No.-5	To arrange an array of numbers in ascending/ descending order
Expt. No.-6	To transfer a block of data from one memory zone to other
Expt. No.-7:	To find one's and two's complement of eight bit number.
Expt. No.-8:	To find one's and two's complement of sixteen bit number.
Expt. No.-10:	To find a smallest and largest number from an array

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IVD: Project work **20 Marks**

The Project work may be done on any of the following areas but the list is not exhaustive.

- Experimental electronics.
- Theoretical electronics.
- Instrumentation.
- Optical or opto-electronics.
- Applied optics.
- Communication
- Computer and Microprocessor.

(Examination)

The project report will be examined by presentation and viva-voice in a seminar in the presence of an external examiner. Department should organize such seminar.

Books Recommended

- *"Introduction to Electrodynamics"*, by Griffith, Addison-Wesley Professional.
- *"Classical Electrodynamics"*, by J.D. Jackson, John Willey and Sons Ltd.
- *"Introduction to Electromagnetic Engineering"*, by R.F. Harrington, Dover Publications.
- *"Electromagnetic Waves & Radiating Systems"*, by Jordan and Balmian, PHI Ltd, New Delhi.
- *"Electricity and Magnetism"*, by Mahajan and Rangwala, Tata McGraw-Hill Publishing, New Delhi..

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- *"Electrodynamics"*, by Y.V. Novozihlov, Y.A. Yappa,V.I. Kysin, Mir Publishers, Moskow.
- *"Elctrodynamics: Electricity and Magnetism"*, by Gupta, Kumar, Singh,Pragati Prakashan, Meerut.
- *"Electrodynamics: Lecturer on Theoretical Physics"*, by A.Sommefeld, E.G.Ramberg, Levant Books, Kolkata
- *"Microprocessor Architecture, Programming, and Applications with the 8085"*, by Gaonkar, Prentice Hall PTR.
- *"Communication Systems"*, by Kennedy, Tata McGraw-Hill.
- *"Communication Systems"*, by B. Carlson, McGraw-Hill Higher Education.
- *"Communication Systems"*, by Sanjay Sharma, S.K.Kataria and Sons.
- *"Principle of Communication Systems"*, by D. Schilling and H.Taub, Tata McGraw-Hill.
- *"Analog and Digital Communications"*, by Roden, Shroff Publishers & Distributors Pvt. Limited.
- *"Electronic communication"*, by Roddy and Coolen, Pearson Education.

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