DEPARTMENT OF PHYSICS
KAKATIYA UNIVERSITY
WARANGAL–506 009

Date: 19-10-2015

Department of Physics, Kakatiya University is offering M.Sc. (Physics) course with four semesters with three specializations: E**lectronics**, **Solid State physics** and **Nanoscience** under Choice Based Credit System (CBCS) pattern in University College and affiliated colleges.

1. Each semester contains four theory papers (400 marks equivalent to 16 credits), two practical papers (200 marks equivalent to 08 credits) and one seminar (25 marks equivalent to 01 credit). For four Semesters, the total marks are 2500 and credits are 100.
2. Each theory paper carries 100 marks (20 marks for internal assessment examination and 80 marks for semester end examination) equivalent to 04 credits.
3. The internal assessment question paper contains 10 compulsory questions carrying 2 marks each. Total 20 marks. The duration of internal assessment examination is 90 minutes. Answers should be written in the ascending order of question number only.
4. Each theory paper consists of four units. Question paper consists of five questions. First question will be compulsory which consists of four short answered questions (one question from each unit). Next four questions from four units with internal choice (one question from each unit). The duration of end examination is 3 hours.
5. In theory papers, the candidate should get a minimum of 40% marks to pass the examination including internal assessment examination with a condition that the candidate should get a minimum of 40% marks in the semester end examination.
6. The practical examination will be conducted at the end of each semester. Each practical paper carries 100 marks (**90 for experiment** and **10 for record)** equivalent 04 credits. A minimum of 40 marks out of 100 is needed to pass the examination.
7. All the subject concerned theory papers and practical papers of 1^{st} and 2^{nd} Semesters are common to all students.

19.10.2015
Chairperson
BOARDS OF STUDIES
DEPARTMENT OF PHYSICS
KAKATIYA UNIVERSITY
WARANGAL-506 009 (T.S)

8. Specializations will be offered at the beginning of 3rd Semester. Each student has to choose one specialization. Papers with code **3.1, 3.2 and 3.5 in 3rd Semester** and **4.1, 4.2 and 4.5 in 4th Semester** are common to all the students irrespective of their specializations. Specialization allotted student should take the papers mentioned against the specializations as given below:

Specialization	**3rd Semester**	**4th Semester**
Electronics	3.3A, 3.4A and 3.6A	4.3A, 4.4A and 4.6A
Solid State Physics	3.3B, 3.4B and 3.6B	4.3B, 4.4B and 4.6B
Nanoscience	3.3C, 3.4C and 3.6C	4.3C, 4.4C and 4.6C

Distribution of Marks and Credits:

Papers	Max. Marks	No. of Credits
Theory (4 Semesters)	4 x 4x 100 = 1600	4 x 4 x 4 = 64
Practical (4 Semesters)	4 x 2 x 100 = 800	4 x 2 x 4 = 32
Seminars (4 Semesters)	4 x 1 x 25 = 100	4 x 1 x 1 = 04
Total	**2500**	**100**

19.10.2015
Chairperson
BOARDS OF STUDIES
DEPARTMENT OF PHYSICS
KAKATIYA UNIVERSITY
WARANGAL-506 009 (T.S)

I-Semester (w.e.f. 2015-2016 academic year)

Paper code	Comp. code	Title of the paper	Internal Exam Marks	End Exam		Total Max. Marks	Total Min. Marks	No. of credits
				Max. Marks	Min. Marks			
		Theory						
1.1	101	Mathematical Physics	20	80	32	100	40	04
1.2	102	Classical Mechanics	20	80	32	100	40	04
1.3	103	Solid State Physics	20	80	32	100	40	04
1.4	104	Electronic Devices and Circuits	20	80	32	100	40	04
		Practical						
1.5	105	General Physics – I	--	100	40	100	40	04
1.6	106	Electronics - I	--	100	40	100	40	04
Seminar			--	25	10	25	10	01
Total						**625**		**25**

II-Semester (w.e.f. 2015-2016 academic year)

Paper code	Comp. code	Title of the paper	Internal Exam Marks	End Exam		Total Max. Marks	Total Min. Marks	No. of credits
				Max. Marks	Min. Marks			
		Theory						
2.1	201	Statistical Mechanics	20	80	32	100	40	04
2.2	202	Quantum Mechanics	20	80	32	100	40	04
2.3	203	Digital principles and Integrated circuits	20	80	32	100	40	04
2.4	204	Computer Programming and Numerical Methods	20	80	32	100	40	04
		Practical						
2.5	205	General Physics – II	--	100	40	100	40	04
2.6	206	Electronics - II	--	100	40	100	40	04
Seminar			--	25	10	25	10	01
Total						**625**		**25**

19.10.2015
Chairperson
BOARDS OF STUDIES
DEPARTMENT OF PHYSICS
KAKATIYA UNIVERSITY
WARANGAL-506 009 (T.S)

III-Semester (w.e.f. 2016-2017 academic year)

Paper code	Comp. code	Title of the paper	Internal Exam Marks	End Exam		Total Max. Marks	Total Min. Marks	No. of credits
				Max. Marks	Min. Marks			
		Theory						
3.1 3.2	301 302	Quantum Mechanics -II Nuclear Physics	20 20	80 80	32 32	100 100	40 40	04 04
3.3A 3.3B 3.3C	303A 303B 303C	Solid state Physics: (Special – I) **(OR)** Electronics: (Special -I) Microprocessors **(OR)** Nanoscience: Special -I Material Science – I	20	80	32	100	40	04
3.4A 3.4B 3.4C	304A 304B 304C	Solid state Physics: (Special –II) **(OR)** Electronics:(Special -II) Comm. Systems **(OR)** Nanoscience: Special -II Nanoscience – I	20	80	32	100	40	04
		Practical						
3.5	305	General Physics – II	--	100	40	100	40	04
3.6A 3.6B 3.6C	306A 306B 306C	Solid State Physics (*Special-I*) **(OR)** Electronics (*Special-I*) **(OR)** Nanoscience (*Special-I*)	-- -- --	100	40	100		04
Seminar			--	25	10	25	10	01
Total						**625**		**25**

19.10.2015
Chairperson
BOARDS OF STUDIES
DEPARTMENT OF PHYSICS
KAKATIYA UNIVERSITY
WARANGAL-506 009 (T.S.)

IV-Semester (w.e.f. 2016-2017 academic year)

Paper code	Comp. code	Title of the paper	Internal Exam Marks	End Exam Max. Marks	End Exam Min. Marks	Total Max. Marks	Total Min. Marks	No. of credits
		Theory						
4.1	401	Electromagnetic Theory and Optics	20	80	32	100	40	04
4.2	402	Molecular Resonance and Spectroscopy	20	80	32	100	40	04
4.3A 4.3B 4.3C	403A 403B 403C	Solid state Physics: (Special – III) **(OR)** Electronics: (Special -III) Microcontrollers **(OR)** Nanoscience: Special -III Material Science – II	20	80	32	100	40	04
4.4A 4.4B 4.4C	404A 404B 404C	Solid state Physics: (Special –IV) **(OR)** Electronics:(Special -IV) Optical, Satellite and Mobile Comm. Systems **(OR)** Nanoscience: Special -IV Nanoscience –II	20	80	32	100	40	04
		Practical						
4.5	405	General Physics – II	--	100	40	100	40	04
4.6A 4.6B 4.6C	406A 406B 406C	Solid State Physics (*Special-I*) **(OR)** Electronics (*Special-I*) **(OR)** Nanoscience (*Special-I*)	--	100	40	100	40	04
Seminar			--	25	10	25	10	01
Total						**625**		**25**

19.10.2015
Chairperson
BOARDS OF STUDIES
DEPARTMENT OF PHYSICS
KAKATIYA UNIVERSITY
WARANGAL-506 009 (T.S.)

M.Sc. Physics I-Semester Theory

1.1 MATHEMATICAL PHYSICS

Unit I : Legendre differential equation and Legendre functions, Generating function of Legendre polynomials, Rodrigues formula for Legendre polynomials, orthogonal property of legndre polynomials, recurrence formula. Hermite differential equation and polynomials, Generating function for Hermite polynomials, Integral formula for Hermite polynomial, recurrence formula, Rodrigues formula, orthogonality of Hermite polynomials.

Unit II : Laguerre differential equations and polynomials, Generating function for Laguerre polynomials, recurrence relation, Rodrigues formula for Laguerre polynomials, orthogonality property. Beta and gamma functions: symmetry property, evaluation and transformation of Beta function, evaluation of gamma function, transformation of gamma function, relation between beta and gamma functions. Evaluation of integrals using Beta & gamma functions.

Unit III : Hypergeometric equation, Hypergeomatric function: Differentiation of hyper geometric function and its integral representation, linear transformations, representation of various functions in terms of hyper geometric functions, confluent hyper geometric functions, representation of various functions in terms of hyper geometric functions.

Unit IV : Integral transforms, fourier transforms and their properties, convolution theorem for Fourier transforms, Parseval's theorem, simple applications of Fourier transforms. Evaluation of integrals, solution of boundary value problems. Laplace transforms and their properties, Laplace transform of derivatives and integrals. Laplace transform of periodic functions, initial and final value theorem, Laplace transform of some special functions, inverse Laplace transforms, Convolution theorem.

Text and reference books:

1. Mathematical methods for Physicists – **Geroge B.Arfken & H.J. Weber** *(Academic Press)*
2. Mathematical methods in Physics and Engineering – **L.A.Pipes**
3. Mathematical Physics **- Satyaprakash** *(Pragati Prakashan)*
4. Mathematical Physics - **B.D. Gupta** *(Vikas Publishing House Pvt.* Ltd).

19.10.2015
Chairperson
BOARDS OF STUDIES
DEPARTMENT OF PHYSICS
KAKATIYA UNIVERSITY
WARANGAL-506 009 (T.S)

1.2 CLASSICAL MECHANICS

Unit I : The Lagrangian formalism: Mechanics of a system of particles, constraints of motion, generalized coordinate, Hamilton's variational principle and Lagrange equations, Lagrangian of a free practicle and a system of particles with interaction, Lagranges equations from D' Alembert's principle, velocity dependent forces, dissipative function, Generalised momentum, conservation of momentum, cyclic coordinates and conservation of energy.

Unit II : **Hamiltonian formalism:** Hamiltonian and its physical significance, Hamilton's equations, Hamilton's equations in different coordinate systems. Examples: Harmonic oscillator, motion of a particle in central force field, charged particle in an electromagnetic field. Compound pendulum, Routh's procedure, the Routhian, Poisson brackets, angular momentum and Poisson brackets, a modified variational principle, canonical tranformations, Poissons brackets and canonical transformations.

Unit III : Rigid body dynamics: Fixed and moving coordinate systems of a rigid body, The Eulerian angles, angular momentum and kinetic energy of rigid body, equations of motion of a rigid body, Euler's equations, free rotation and precession of a symmetrical top, motion of a charged rotating particle in a uniform magnetic field.
Theory of Small Oscillations : Formulation of problem. The eigenvalue equation. Frequencies of free vibrations and normal coordinates. Free vibrations of a linear triatomic molecule. Forced vibrations and the effect of dissipative forces.

Unit IV : Hamilton-Jacobi theory: The Hamilton-Jacobi equation for Hamilton's principle function, the harmonic oscillator problem, Hamilton-Jacobi equation from Hamilton's characteristic function, Seperation of variables in the Hamilton–Jacobi equation, Action-angle variables in a system of one degree of freedom, action-angle variables for completely separable systems. The Kepler problem in action-angle variables, Hamilton-Jacobi theory – application to geometrical optics and wave mechanics.

Text and reference books:

1. Classical Mechanics of Particles and Rigid Bodies – **Kiran C. Gupta** (*New Age International Publishers*)
2. Classical Mechanics – **Goldstein** (*Narosa Publishing House*)
3. Classical Mechanics – **JC Upadhyaya** (*Himalya Publishers*)

19.10.2015
Chairperson
BOARDS OF STUDIES
DEPARTMENT OF PHYSICS
KAKATIYA UNIVERSITY
WARANGAL-506 009 (T.S)

1.3 SOLID STATE PHYSICS

Unit I : Crystallography: Introduction to crystal structures – Atomic packing in solids – s.c., b.c.c., f.c.c. and hcp. Reciprocal lattice, X-ray diffraction Laue equations from X-ray diffraction, Bragg's law, equivalence of Laue and Bragg's equations, diffraction in reciprocal space, Ewald sphere, limiting sphere. Electron and neutron diffraction (qualitative).
Nanomaterials: Introduction – nanoparticles – metal nanoclusters – semiconductor nanoparticles, nanostructures – carbon clusters, carbon nanotubes, quantum nanostructures. Applications of nanomaterials. Classification of methods of preparation of nanomaterials

Unit II : Lattice vibrations: Elastic vibrations of continuous media, group velocity and phase velocity. Vibrations of monoatomic and diatomic linear lattice; concept of phonon – experimental determination of dispersion relations, inelastic scattering of neutron by phonons. Infrared absorption by ionic crystals. Thermal expansion and thermal conductivity –Normal and Umklapp processes.

Unit III : Band theory of solids: Bloch theorem, Kronig penny model, effective mass. Distinction between materials, insulators and semiconductors; concept of a hole. Motion of electrons in a three dimensional lattice, constant energy surface and Brillouin Zones. Concentration of electrons and holes in an intrinsic semiconductor, model for an impurity semiconductor.

Unit IV : Magnetism : Laugeuin's theory of Diamagnetism. Quantum theory of paramagnetism, the rare-earth ions, iron group ions; quenching of orbital angular momentum. Ferromagnetism – characteristic behavior of ferromagnetic materials, spontaneous magnetization, Curie-Weiss law and hysteresis, interpretation in terms of the exchange integral, temperature dependence of spontaneous magnetization. Saturation magnetization at absolute zero. Ferromagnetic domains, anisotropy energy, transition between domains .Origin of domains, coercive force and hysteresis, concept of magnons.

Text and reference books:

1. Introduction to Solid State Physics-**C.Kittel**. (*Jhon Wiely & Sons.*)
2. Solid State Physics-**A.J.Dekker**(Machmillan Student Editions)
3. Solid State and Semiconductor Physics-**J.P.Mc kelvy** (Krieger Publications).
4. Principles of Solid State Physics – **R.A. Levy** (Academic Press)
5. Elements of Solid State Physics – **J.P. Srivastava** (Prentice-Hall of India)
6. Quantum theory of Magnetism – ***W. Nolting and A. Ramakanth***, Springer

19.10.2015
Chairperson
BOARDS OF STUDIES
DEPARTMENT OF PHYSICS
KAKATIYA UNIVERSITY
WARANGAL-506 009 (T.S)

1.4 ELECTRONIC DEVICES AND CIRCUITS

Unit I : Special purpose, electronic devices: LED, photo diode, Laser diode, varactordiode, BJT as a switch, solar cell – characteristics – opto coupler, photo transistor. FET – constructions – V.I. characteristics – FET as Voltage Variable Resistor (VVR) - Automatic gain control (AGC). SCR – construction – V.I. characteristics – controlled power rectification. UJT – construction – V.I. characteristics, UJT as a relaxation oscillator.

Unit II : Transistor biasing: The operating point, Bias stability, Collector-to-Base bias, Emitter-Feedback bias, Collector-Emitter Feedback bias, Self bias, Emitter bias (voltage-divide bias), Stabilization against variation of V_{BE} and β for the self-bias circuit**. Voltage regulators:** Zener diode voltage regulators Transistor series voltage regulator, switch mode power supply IC voltage regulators: LM78XX, LM79XX and LM317 series.

Unit III : Fundamentals of amplifiers: Feed back topologies classification. Analysis of RC coupled C.E. amplifier: low, mid and high frequency – response – Bode plot-Emitter follower- frequency response. Darlington pair, cascade connection. Large signal amplifiers: classification – class A, Class B – pushpull amplifier – harmonic distortion – class AB amplifier – class C – tuned amplifier.

Unit IV : Oscillators: Barkhausen criterion – RC oscillators; Phase shift oscillator and Wein bridge oscillator, LC oscillators: Hartley oscillator, Colpitts oscillator and crystal oscillator. Multivibrators: astable, monostable and bistable.

Text and reference books:

1. Integrated Electronics – **Millman & Halkias** (Tata McGraw Hill)
2. Electronic Principals – **Malvino & Bates** (Tata McGraw Hill 7th edition)
3. A first course in electronics – **Anwar Khan & Kanchan Dey** (Prentice-Hall of India, 2006)
4. Electronic Devices and Circuit theory **– Robert L.Boylestad & Louis Nashelsky** (Prentice-Hall of India 8th edition)
5. Electronic Devices and Circuits – **Bogart** (Pearson education)
6. Electronic Devices and Circuits – **David A. Bell** (Prentice-Hall of India)

19.10.2015
Chairperson
BOARDS OF STUDIES
DEPARTMENT OF PHYSICS
KAKATIYA UNIVERSITY
WARANGAL-506 009 (T.S)

M.Sc. Physics I-Semester Practical's

1.5 General Physics –I Laboratory

1. Viscosity of liquid by oscillating disc method.
2. Specific heat of a solid (cylindrical graphite sample).
3. Determination of elastic constants (y,n,k) by Newton's rings (uniform bending).
4. Diffraction grating – Determination of wavelength of laser beam.
5. Hallow prism – Refractive index of liquids.
6. Determination of Stefan's constant.
7. Diffraction of laser light due to single slit – study of intensity of distribution.
8. Lloyd's mirror – Determination of wavelength of monochromatic light.
9. Determination of Rydberg's constant

1.6 Electronics – I Laboratory

1. Verification of Maximum Power Transfer theorem, Thevinin's theorem and Norton's theorem.
2. V-I characteristics of FET-Determination of parameters.
3. V-I characteristics of UJT and UJT as relaxation oscillator.
4. V-I characteristics of SCR-Phase controlled rectification.
5. RC-coupled common source amplifier-study of gain frequency response.
6. Transistor RC Coupled amplifier
7. Collector coupled astable multivibrator.
8. Hartley oscillator-study of variation of frequency with capacitance in the tank circuit.
9. Colpitt's oscillator.
10. Emitter Follower
11. IC Voltage Regulators (78XX and 79XX).

Text and reference books:

1. Advanced practical Physics – **Wornsop & Flint.**
2. Advanced Practical Physics vol.1 – **SP Singh** (Pragatiprakashan).
3. A Text Lab manual in Electronics – **ZBAR** (Tata McGraw Hill).
4. Linear Integrated Circuits – **Shail B.Jain & B.Ray Choudhury** (New Age International Publishers, 2nd edition).
5. Linear Integrated Circuits – **Shalivahanan & VS Bhaaskaran** (Tata McGraw Hill, 2008).

19.10.2015
Chairperson
BOARDS OF STUDIES
DEPARTMENT OF PHYSICS
KAKATIYA UNIVERSITY
WARANGAL-506 009 (T.S)

M.Sc. Physics II-Semester Theory

2.1 STATISTICAL MECHANICS

Unit I: <u>Fundamentals of statistical mechanics :</u>Macrostates and Microstates of a system – principle of equal apriori probability –phase space – quantization of phase space –concept of ensemble – ensemble average – density distribution function in phase space – Liouville's theorem – Maxwell – Boltzman (MB), Fermi-Dirac(FD), Bose-Einstein(BE) distributions – classical limit – entropy and probability – entropy of a two level system.

Unit II : <u>Ensembles</u> : Microcanonical ensemble(MCE) – Thermodynamics in MCE- Entropy of an ideal gas in MCE – Gibbs Paradox – Sackur – Tetrode equation – Canonical ensemble(CE) – Thermodynamics in CE – Ideal gas in CE- Maxwell's velocity distribution – Equipartition energy theorem – Grand Canonical Ensembel(GCE) – Thermodynamics in GCE – Ideal gas in GCE – Fermi – Dirac and Bose-Einstein distribution functions from grand canonical partition function.

Unit III : Bose Systems : Equation of state for ideal BE and FD gases – Photons – Planks distribution law – Phonons – Specific heat of solids – Einstein and Debye's theories – Bose Einstein condensation – Liquid He-Two Fluid model – Phonons – Rotons – Superfluidity.

Unit IV: Fermi systems: Ideal Fermi gas – Free electron model – electronic specific heat – thermionic emission – Pauli paramagnetism –Landau diamagnetism- white dwarfs – Boltzman transport equation – Electrical conductivity – Thermal conductivity – Wiedermann – Franz law – Non-equilibrium semiconductors – Electron-hole recombination – Classical Hall effect – Quantum Hall effect. Ising model and its 1-D solution.

Text and reference books:

1. Statistical Mechanics – **Agarwal & Melvin Eisner** (New age international).
2. Statistical Mechanics – **Kerson Huang** (John Wiley & Sons).
3. Statistical Mechanics – **R.K. Srivastava & J.Ashok** (Prentice-Hall of India).
4. Statistical Physics – **L.D. Landau & E.M.Lifshits (Pergamon)**
5. Statistical Mechanics – **D.A. McQuarrie (Harper & Row).**

2.2 QUANTUM MECHANICS-I

Unit-I: Bra and Ket Notation: Principles of superposition. Bra and Ket vectors, linear operators. Hermitian conjugate. Eigen values and Eigen vectors of Hermitian operators. Complete set of states. Complete set of commuting operators. Continuous spectrum of Eigen values. Orthogonality.

Unit-II: Representations: Properties of Dirac – Delta function. Orthogonal basis. Representation for ket, bra and operator. Wave function as a representation of ket, position and momentum representations. Poissons brackets, Quantum conditions. Equation of motion, Schroedinger Heisenberg and interaction pictures. Ehrenfest theorem. Harmonic oscillator problem in terms of creation and annihilation operators.

Unit-III: Exactly solvable problems: Spherically symmetric potentials in 3 dimensions, orbital angular momentum operator. Commutation relations, Eigen vectors and Eigen values of L^2 an $L_{Z.}$ Pauli spin operators. The hydrogen atom problem, Vibrating rotator, rigid rotator and 1D harmonic oscillator.

Unit-IV: Approximate methods:

i) Time independent perturbation theory: Non-degenerate levels. Application to normal He atom and anharmonic oscillator. Degenerate levels-application to first order stark effect in hydrogen atom with n=2 and to normal Zeeman effect.

ii) Time dependent perturbation theory: Transition amplitude in first and second order, first order transition constant perturbation, Fermi golden rule, harmonic perturbation. Emission and absorption probabilities. Einstein A and B Coefficients.

iii) Variation method, application to normal Helium, atom.

Text and reference books:

1. Quantum Mechanics – **Ajoy Ghatak & S.Loknathan** (Macmillan India Ltd.)
2. The principles of Quantum Mechanics – **P.A.M. Dirac** (Oxford University Press).
3. Quantum Mechanics – **L.I. Schiff** (McGraw hill)
4. A Text Book of Quantum mechanics – **P.M. Mathews & K.Venkatesan** (Tata McGraw Hill).

19.10.2015
Chairperson
BOARDS OF STUDIES
DEPARTMENT OF PHYSICS
KAKATIYA UNIVERSITY
WARANGAL-506 009 (T.S)

2.3 DIGITAL PRINCIPLES AND INTEGRATED CIRCUITS

Unit- I : Logic gates, positive and negative logic, Boolean laws, logic simplifications using Boolean Algebra and Karnaughmap method.4 bit Binary Adder, Encoders & Decoders, parity generator and checker Multiplexer and DeMultiplexer. RS,D,JK & MS-JK flipflops, their operating principles and truth tables, shift registers and their operations, counters: Asynchronous 4 bit binary counter and with feedback for different modulo – Synchronous counters – Ring counter.

Unit II : Logic families and Memory Devices: Logic families and their performance characteristics – RTL, DTL, I^2R Logic, TTL, ECL, PMOS, NMOS & CMOS logic, Tristate logic (TSL). Semiconductor memories: Diode ROM, EPROM, E^2PROM, Memory organization and expansion – Memory devices: 8155 RAM, 2716 EPROM – 8355 ROM with I/O ports.

Unit III : Operational Amplifiers characteristics and Applications: OP-AMP Basic Structure – Difference amplifier circuits using BJTs only. OP-AMP-dc and ac performance characteristics – open and closed loop configurations, virtual ground concept; Inverting and Non inverting Amplifier – voltage follower – Adder, Subtractor, Differentiator, Integrator & difference amplifier, Analog computation – solution of second order differential equation – Log and antilog amplifiers. Waveforms generators: sinewave, squarewave, traiangular and sawtooth wave voltage comparators.

Unit IV : Active filters & Timer circuits: comparison between passive and active filters, first order low pass, high pass active filters, band pass, band reject and all pass filters. 555 timer – description of functional diagram – Astable and monostable operations, VCO, Schmitt trigger. Phase locked loop (IC565): Basic Principles – frequency multiplication/division, analog phase detector.

Text and reference books:

1. Modern Digital Electronics – **RP Jain** (Tata McGraw Hill 3rd edition)
2. Fundamentals of digital circuits – **A.Anand Kumar** (Prentice-Hall of India)
3. Linear Integrated circuits – **Shail B.Jain & Roy choudhury** (New Age International Publishers 2nd edition)
4. Operational Amplifiers – **Ramakanth A GayKwad** (Prentice-Hall of India)
5. Linear Integrated circuits – **S.Salivahanan & V.S. Bhaaskaran** (Tata McGraw Hill)
6. Microprocessor Architecture, Programming and applications with 8085 – **Ramesh S Goankar** (Wiley Eastern Edition)
7. Digital Principles and Applications – **Malvino & Leach** (Tata McGraw Hill).

19.10.2015
Chairperson
BOARDS OF STUDIES
DEPARTMENT OF PHYSICS
KAKATIYA UNIVERSITY
WARANGAL-506 009 (T.S)

2.4 COMPUTER PROGRAMMING AND NUMERICAL METHODS

Unit I : C-I Character set, Identifiers and key words, data types, constant, variables, and arrays, declarations, expressions, statements, symbolic constant, arithmetic operators, Unary operator, relational and logical operators, assignment operators, conditional operator, library functions, getchar, putchar, scanf, printf, gets, puts functions. Control statements – while, do-while, for statements, nested loops, if-else, switch, break, continue statements, comma operator; go to statement.

Unit II : C-II Functions – defining and accessing a function – passing arguments to a function, specifying argument data types, functions prototypes. Storage classes, automatic variables, external variables, static variables, multi file programs. Arrays – defining an array, processing an array passing arrays to functions, multi dimensional arrays, array to a function, pointers – pointer declarations, passing pointers on pointers, pointers and multi dimensional arrays, arrays of pointers, passing functions to other functions, structures and unions – defining a structure, processing a structure, user defined data types, structures and pointers, passing structure to a function, self-referential structures – unions.

Unit III : Numerical Methods – I : Finding the roots of a transcendental equation – Bisection method, Newton – Raphson method – solving of problems - writing programs in C-language for these methods.Rate of convergence – methods for multiple roots. Finding the roots of polynomial equations – Berge viata, Baristow and Graffee root squaring methods - Solving of problems. Writing programs in C-language for these methods.

Unit IV : Numerical Methods – II Solution of simultaneous equations – Cramer's rule, Gauss elimination method, triangularization method. Jacobi, Gauss-siedel and successive over relaxation methods. Problems: Writing of programs in C-language for these methods.

Text and reference books:

1. Numerical Mathematical Analysis – **U.B. Scarborough** (OXFORD & IBH publishing Co. Pvt. Ltd.)
2. Numerical Methods for Scientific and Engineering Computation **– M.K.Jain, S.R.K.Iyengar & R.K.Jain** (New Age International Pvt. Ltd.)
3. Programming with C-**Byron S.Gottfried** (Tata McGraw Hill Edition)
4. Let us C-**Kanitkar** (BPB Publications)
5. Computer Oriented Numerical Methods – **V.Rajaraman** (Prentice – Hall of India Pvt.Ltd.

19.10.2015
Chairperson
BOARDS OF STUDIES
DEPARTMENT OF PHYSICS
KAKATIYA UNIVERSITY
WARANGAL-506 009 (T.S)

M.Sc. Physics II-Semester Practical's

2.5 General Physics – I Laboratory

1. Determination of Cauchy's constants for a) glass b) quartz c) calcite.
2. Biprism – Determination of wave-length of monochromatic light (sodium light).
3. Michelson interferometer - Determination of λ
4. Velocity of ultrasonic waves in organic liquids – using Interferometer.
5. Thermal expansion by Fizeau's method (Coefficient of linear expansion of brass).
6. Diffraction due to single slit – Determination of λ
7. Michelson interferometer – Determination of λ
8. Computer Programming – Least square fitting of s straight line.

2.6 Electronics – I Laboratory

1. Operational Amplifiers – Measurement of
   a) Bias current and offset voltage b) CMRR
2. Operational Amplifiers – Measurement of
   a) Slew rate b) output impedance
3. Op-amplifier – study of gain frequency response
   a) Inverting Op-amplifier – study of gain frequency response
   b) Non-inverting op-amplifier – study of gain frequency response.
4. a) Op-amp as differentiator b) Op-amp as Integrator.
5. Phase shift oscillator using IC741.
6. IC555 timer – Monostable multivibrator.
7. IC555 timer – Schmitt trigger.
8. IC555 timer – a) Astable Multivibrator b) Voltage controlled oscillator.
9. Digital experiments: a) Verification of DeMorgans Theorem. b) Construction and verification of half and full adder circuits and c) Universal Building block

Text and reference books:

6. Advanced practical Physics – **Wornsop & Flint.**
7. Advanced Practical Physics vol.1 – **SP Singh** (Pragatiprakashan).
8. A Text Lab manual in Electronics – **ZBAR** (Tata McGraw Hill).
9. Linear Integrated Circuits – **Shail B.Jain & B.Ray Choudhury** (New Age International Publishers, 2nd edition).
10. Linear Integrated Circuits – **Shalivahanan & VS Bhaaskaran** (Tata McGraw Hill, 2008).

19.10.2015
Chairperson
BOARDS OF STUDIES
DEPARTMENT OF PHYSICS
KAKATIYA UNIVERSITY
WARANGAL-506 009 (T.S)

M.Sc. Physics III-Semester Theory

3.1 QUANTUM MECHANICS –II

Unit I : Symmetry in Quantum Mechanics: Space and time displacements. Unitary displacement operator. Equation of motion. Symmetry and degeneracy. Matrix elements for displaced states. The group concept. Time displacement. Rotational symmetry. Infinitesimal rotation generators. **General Angular momentum**: Angular momentum operators. Eigen values of J^2 and J_z. Pauli spin operators. Matrix representation of J in |jm> basis. Addition of angular momenta and Clebsh- Gordon coefficients.

Unit II : Scattering theory: The scattering cross-section. Wave mechanical picture of scattering – the scattering amplitude, Green's functions. Formal expression for scattering amplitude. The Born and Eikonal approximations. Partial wave analysis. Scattering amplitude in terms of phase shifts. Optical theorem. Exactly solvable problems – scattering by a square well potential, hard sphere and Coulomb potential.

Unit III : Relativistic Quantum Mechanics: Klein- Gordon equation – plane wave solution – charge and current densities. Interaction with electromagnetic field for hydrogen like atom. Non- relativistic limit. Dirac equation. Dirac matrices. Plane wave solution and energy spectrum. Properties of Dirac spinors. Positive and negative energy states. Free Dirac particle in an external electromagnetic field. Spin-orbit interaction.

Unit IV : a) Many – Particle system: Identical particles, permutation operator, symmetrization, slater determinant. Pauli exclusion principle. Central field approximation. Thomas Fermi statistical model. Evaluation of the potential. Hartree self consistent field – connection with variation method. **b) Molecular bonding**: Bonding, anti-bonding and non-bonding orbitals. Fundamental principles of molecular orbital theory. LCAO approximation. Molecular orbital theory of hydrogen molecular ion and hydrogen molecule. Discussion of improved wave functions for H_2^+ ion; Valence bond theory of hydrogen molecule. Comparison of molecular orbital and valence bond theories.

Text and Reference Books:

1. Quantum Mechanics - ***L.I. Schiff***., McGraw Hill, New York.
2. A Text Book of Quantum Mechanics - ***P.M. Mathews and K. Venkatesan***, TMH.
3. Quantum Mechanics - ***A.K. Ghatak and S. Lokanathan***, *MacMillan*
4. Introduction to Molecular Orbital Theory – ***Turner,*** PHI.**.**
5. Molecular structure and Spectroscopy-***G. Aruldas***, PHI.
6. A text book of Quantum Mechanics-***G.Aruldas***, PHI.
7. Quantum Mechanics – ***Max Born***

19.10.2015
Chairperson
BOARDS OF STUDIES
DEPARTMENT OF PHYSICS
KAKATIYA UNIVERSITY
WARANGAL-506 009 (T.S)

3.2 NUCLEAR PHYSICS

Unit I : Properties of Atomic Nucleus: Theories of Nuclear Composition- Proton-Electron, Proton-Neutron, Neutron-Positron and Antiproton-Neutron. Binding Energy, Semi-empirical Mass Formula (nuclear stability), Quantum Numbers for individual nucleons, Quantum Properties of nuclear states, Nuclear Angular Momentum. Nuclear Magnetic Dipole moment with determination methods, Classical Multipole Moments for point charges, Electric Quadrupole Moment, Potential well, Quantum Statistics.

Unit II : Nuclear Forces: Deuteron-properties nuclear force, Number of excited S-states, Range and depth of potential, excited states of the deuteron. Neutron-Proton scattering at low Energies - scattering length, phase shift, spin dependence, coherent scattering, shape independent effective range theory, Proton-Proton scattering at low energies. Similarity between (*nn*) and (*pp*) forces, non-central forces - experimental evidence for the existence of non-central forces, general form of this force, its properties, ground state of the deuteron, *n-p* scattering below 10 Mev, High energy n-p and p-p scattering, Meson theory of nuclear forces.

Unit III: Nuclear Fission and Fusion: Nuclear fission-Types of fission, distribution offission products, Neutron emission in Fission. Fissile and Fertile materials, spontaneous fission, Deformation of liquid drop; Bohr and Wheeler's theory, Quantum effects, Nuclear Fusion and thermo nuclear reactions, controlled thermonuclear reactions - Hydrogen bomb, different methods for the production of fusion reactions.

Unit IV: Introduction to Elementary Particles: Introduction, Classification of Elementary Particles, Particle Interactions - Gravitational, Electromagnetic, strong and weak, Conservation laws, Invariance under charge, parity, C.P., time and C.P.T.; Lepton and Baryon number. Elementary particle symmetries – SU(2) and SU(3) symmetries. Quarks.

Text and Reference Books:

1. Nuclear Physics - ***D.C.Tayal***, Himalaya Publishing House.
2. Introductory Nuclear Physics - ***Kenneth S Krane***, John Wiley.
3. Elements of Nuclear Physics - ***M.L.Pandya and R.P.S.Yadav***, Sarika Offset Press, Meerut.
4. Atomic and Nuclear Physics - ***Shatendra Sharma***, Pearson Education.
5. Nuclear Physics - ***R.P.Roy and B.P.Nigam***, New Age International Ltd.

19.10.2015
Chairperson
BOARDS OF STUDIES
DEPARTMENT OF PHYSICS
KAKATIYA UNIVERSITY
WARANGAL-506 009 (T.S.)

3.3A SOLID STATE PHYSICS - SPECIAL - I

Unit – I : X-ray Crystallography: Experimental methods - Debye – Scherrer method, Laue method, Rotating crystal method, Weissenberg method. Determination of lattice parameter by powder method applied to cubic and tetragonal crystals. Accurate determination of lattice parameters – Systematic errors, graphical extrapolation method.

Unit II : Crystal structure determination: Factors affecting intensities. calculation of structure factors of some simple structures, obtaining structure factors from measured intensities. Fourier analysis of electron density – electron density sections and projections. The phase problem, Patterson synthesis, isomorphic replacement and heavy atom methods, structure refinement by least squares method. Limitations of X-ray diffraction – advantages of neutron diffraction. Applications of neutron diffraction to hydrogen containing structures and magnetic structures.

Unit III : Dielectrics : Static dielectric constant of solids, dielectric polarization, polarizability and dielectric constant, various contributions to the Polarizability. The local electric field – Clausius Mossotti relation. Dielectric response of an ionic crystal – difference between static and high frequency dielectric constants. Dielectric in an alternating field, the complex dielectric function, dielectric constantand dielectric loss, Debye's equations, dielectric dispersion, electronic polarisability and optical absorption, Ionic polarization and infrared absorption.

Unit IV : Ferroelectricity: Characteristic properties and classification of ferroelectrics, spontaneous polarization, phase transition and temperature variation of dielectric constant. Behaviour of some representative ferroelectrics like KH_2PO_4, Rochelae salt and $BaTiO_3$. Theoretical aspects: 1. Dipole theory of ferroelectrics 2. Thermodynamic theory of ferroelectrics and 3. Ionic displacement of ferroelectrics. Ferroelectric catastrophe. Domain structure of ferroelectrics: Description of domain structure, Domains and hysteresis, display of hysteresis loop and methods for observation of domain structure. Applications of ferroelectrics, Anti-ferro electricity.

Text and Reference Books:

1. Introduction to X-ray Crystallography **– *Woolfson*,** Vikas, New Delhi.
2. Crystal structure analysis **– *M J Burger*,** John Wiley & Sons.
3. Solid State Physics **– *A J Dekker***, MacMillan.
4. Basics of X-ray diffraction and its applications - ***K. Ramakanth Hebbar,*** I.K.International Pub. House.
5. X-ray diffraction procedures - ***Klug and Alexander,*** Wiley Easter Ltd.
6. Atomistic Properties of Solids – ***D.B. Sirdeshmukh, L. Sirdeshmukh and K.G. Subhadra***, Springer

19.10.2015
Chairperson
BOARDS OF STUDIES
DEPARTMENT OF PHYSICS
KAKATIYA UNIVERSITY
WARANGAL-506 009 (T.S)

3.4A SOLID STATE PHYSICS – SPECIAL -II

Unit I : Crystal Growth: Methods of crystal growth- Solution growth. Solubility diagrams for different substances and their importance. Driving force for crystallization. Crystal morphology. Possible types of interfaces. Growth on rough sharp interface and growth on perfect sharp singular interfaces. Crystal size and nuclei. Study of growth rate versus supersaturation. Possible growth mechanisms at different supersaturations (qualitative). Flux and gel growth methods (qualitative). Melt growth-Bridgman, Czochralski, Verneuili's and zone melting techniques in detail and zone refining. Role of dislocations in crystal growth. Frank's theory of crystal growth (qualitative).

Unit II : Point Defects: Classification of lattice imperfections. Vacancy, Interstitial, Schottky and Frenkel defects. Equilibrium concentration of Schottky and Frenkel defects. Diffusion-mechanisms of diffusion. Direct evidence of point defects. Fick's laws of diffusion. Interpretation of diffusion in alkali halides, ionic conductivity, role of impurities on ionic conductivity, Kirkendall effect. Induced point defects - Color centers, Production of color centers by irradiation, additive coloration and electrolysis. Color centers in alkali halides – the F centre model and its aggregate centers. F-F conversion. V_K- centers. Ivey-Mollwo relation. Smakula's relation. Detection of color centers. Experimental methods for estimation of color centers.

Unit III : Line defects: Plastic deformation in solids. Tensile stress-stress curve. Interpretation of slip –Frenkel model. Concept of Dislocations – Edge and Screw dislocations. Burger's circuit. Stress field around screw and edge dislocations. Interaction between dislocations. Frank-Read mechanism. Grain boundaries, twin boundary. Effect of grain size and solute atoms on dislocation motion. Creep and its mechanism. Experimental methods of observation of dislocations: 1. The etch pit method, 2. Decoration method 3. Field ion microscope and 4. X-ray topography method. Hardness studies in crystals – Mohs hardness. Brinnell, Vickers and Knoop techniques. Correlation of hardness with some physical properties. Effect of impurities on hardness.

Unit IV : Plasmons, Polaritons, Polarons and Excitons : Dielectric function of the electron gas, plasmons, electrostatic screening, poloritons – LST relation. Electron-Phonon interaction, polarons, Optical reflectance, Kramers-Kronig relation, Excitons-Frenkel excitons, weakly bound excitons. Raman effect in crystals.

Text and Reference Books:

1. 1.Crystal growth from liquids **– *J.C.Brice,*** North Holland Publishers.
2. Crystal growth from melt **– *J.C.Brice***, North Holland Publishers.
3. Introduction to Solid State Physics – ***C.Kittel,*** Wiley Easter Lts..
4. Solid State Physics **– *A.J.Dekker.*** MacMillan.
5. Nano Structured Materials and Nanotechnology-***Hari Singh Nalwa,*** Acad. Press.
6. Materials Science **- *Raghavan***, PHI.
7. Atomistic Properties of Solids – ***D.B. Sirdeshmukh, L. Sirdeshmukh and K.G. Subhadra***, Springer

19.10.2015
Chairperson
BOARDS OF STUDIES
DEPARTMENT OF PHYSICS
KAKATIYA UNIVERSITY
WARANGAL-506 009 (T.S)

3.3B ELECTRONICS SPECIAL – I (Microprocessors)

Unit I : Introduction to 8 bit microprocessors: Intel 8085 microprocessor-Organization and architecture of 8085, Signal diagram, description. Timing diagrams for instruction, machine, fetch and execute cycles. Timing diagram for opcode fetch, memory read, I/O read, memory write and 1/O write for an instruction.- Instructions set of 8085. Structure of flag registers, explanation of special purpose registers (PC and SP). Stack operation and subroutines.

Unit II : Assembly Language Programming and Peripheral Devices and their Interfacing: Assembly language programming – Examples. Address space partitioning. Data Transfer Schemes. Memory and I/O interfacing. Programmable D M A controller (8257) – Interrupts in 8085 Microprocessor. I/O Ports: programmable peripheral Interface (PPI) – Intel 8255. Programmable counter/timer-8253.

Unit III : Microprocessor Data Acquisition Systems and Applications: Digital to Analog Converters (DAC) (i)Binary weighted, resistor type, (ii) R-2R Ladder network type: Interfacing DAC-0800 to microprocessor. Programming examples for generating D.C voltage and sine wave using DAC. Analog to Digital Converter (ADC): Successive Approximation type ADC. Realization of A/D converter using DAC. Applications: Delay sub-routines using one and two registers. Microprocessor based stepper motor interfacing.

Unit IV: Introduction to Advanced Microprocessors: Intel 8086/8088 Microprocessors-Architecture, organization and Addressing Modes- Instruction set. Assembly language programs for 8086/88 and interfacing of peripheral devices. Architecture and introduction to the 80286, 80386 and 80486. Pentium processors.

Text and Reference Books:

1. Microprocessors and Microcomputers – ***B. Ram***, TMH.
2. Introduction to Microprocessors – ***Aditya P. Mathur***, TMH.
3. Microprocessors: Architecture and Programming and Applications with 8085 - ***Ramesh S. Gaonkar***, Penram Intl' Publishing.
4. The Intel microprocessors - 8086/8088,80186/80188, 80286/80386, 80486, Pentiums and Pentium Pro-processors - Architecture, Programming and Interfacing, ***Barry, B. Brey***, PHI.
5. Advanced Microprocessors and Interfacing - ***Badri B. Ram***.-TMH.
6. Advanced Microprocessors and Peripherals - ***A.K. Ray, K.M. Bhurchandi***. TMH.

19.10.2015
Chairperson
BOARDS OF STUDIES
DEPARTMENT OF PHYSICS
KAKATIYA UNIVERSITY
WARANGAL-506 009 (T.S)

3.4B ELECTRONICS – SPECIAL -II (Communication Systems)

Unit I: Analog signal transmission: Need for modulation, Amplitude modulation, Frequency spectrum for sinusoidal A.M, Average power for sinusoidal and non-sinusoidal A.M, Generation of A.M. waves- Collector modulator, Balanced modulator, A.M transmitter (Block diagram approach), Detection of A.M waves – Square law detector, Frequency and Phase modulation, Frequency spectrum for sinusoidal F.M, Average power for sinusoidal F.M, Varactor diode F.M modulator, Balanced slope F.M detector, Ratio F.M detectors.

Unit II: Digital transmission of analog signals: Sampling theorem, Pulse amplitude modulation (PAM), Natural sampling, Flat-top sampling, Signal recovery through holding, Quantization of signals, Quantization error, Pulse Code Modulation (PCM), Companding, Multiplexing PCM signals, Differential PCM.**Digital modulation techniques:** Amplitude Shift Keying (ASK), Phase Shift Keying (PSK), Frequency Shift Keying (FSK) and Differential Phase Shift Keying (DPSK) and their generation and detection (qualitative).

Unit III: Transmission lines: Introduction, Primary line constants, Phase velocity and line wavelength, Characteristic impedance, Propagation coefficient, Phase and group velocities, Standing waves, Lossless line at radio frequencies, VSWR, Slotted-line measurements at radio frequencies, Transmission lines as circuit elements, Smith chart.

Unit IV: Microwave propagation and devices: Introduction to rectangular and circular wave guides, Solution of wave equations in cylindrical coordinates, TE and TM modes, Power transmission and loss in circular wave guides, Excitation of modes in circular wave guide, Microwave tunnel diode, Gun effect diode (GaAs), Microwave generation and amplification.

Text and Reference Books:

1. Communication Systems – ***R.P. Singh and S.D. Sapre,*** TMH
2. Electronic Communications **–** ***Dennis Roddy and John Coolen***, PHI
3. Electronic Communication System **–** ***G. Kennedy***
4. Microwave devices and circuits – ***Samuel Y Liao***, Pearson Education.
5. Principles of Communication Systems – ***H. Taub and D. L. Schilling*** (2^{nd} edition) TMH
6. An Introduction to Analog and Digital Communications – ***Simon Haykin***, 2^{nd} Ed., Wiley
7. Communication Sytems – ***B. P. Lathi***, BSP.
8. Electronic Communication Systems **–** ***Wyane Tomasi***, Pearson Education.

19.10.2015
Chairperson
BOARDS OF STUDIES
DEPARTMENT OF PHYSICS
KAKATIYA UNIVERSITY
WARANGAL-506 009 (T.S)

3.3C NANOSCIENCE – SPECIAL- I (Materials Science – I)

Unit I : Classification of materials, atomic bonding in solids, crystalline and non-crystalline materials. Imperfections in solids. Point defects, line defects, plane defects and volume defects. Diffusion in solids, laws of diffusion, effect of temperature and concentration on diffusion, Kirkendall effect and mechanism of diffusion.

Unit II : Elastic properties (behaviour) of materials, atomic model of elastic behaviour, anelastic behaviour and relaxation process, viscoelastic behaviour, plastic deformation, stress-strain curves, plastic deformation by slip, shear strength of perfect and real crystals, effect of temperature on the stress to move a dislocation. Multiplication of dislocations, effect of grain size, solute atoms and precipitate particles on dislocation motion. Strengthening methods. Mechanisms of creep. Creep resistant materials.

Unit III : Dielectric materials, polarization and dielectric constant, dielectric loss, mechanism of polarization, frequency dependence, polarisability in condensed state, dielectric strength, electrostriction, piezoelectricity, pyroelectric materials, applications of dielectric materials.

Unit IV: Classification of ferroelectrics, ferroelectric phase transitions, relaxor ferroelectrics, ferroelectrics with perovskite type structures. Domain structure in ferroelectrics, orientation of domain pairs, domain switching, hysteresis loop, polycrystal ferroelectrics, composites with dielectrics, applications of ferroelectric materials, multi ferroics. **Liquid Crystals** : Introduction, classification of liquid crystals, structure of liquid crystals, Order parameter, Identification of liquid crystal phases, Lyotropic systems, Polymer liquids crystals, Application of liquid crystals.

Text and Reference Books:

1. Materials Science and Engineering – ***W.D.Callister***, *John Wiley and sons Inc.*
2. Materials Science and Engineering **–** ***C.M.Srivastava***.
3. Materials Science - ***Raghavan***, PHI.
4. Materials Science – ***I.P.Singh*****, Jain Brothers**, New Delhi.
5. Materials Science – **Van Vlack**.
6. Principles of Electronic Materials and Devices – ***S.O. Kasap***, TMH.
7. The Physics of Liquid Crystals – de Gennes and J. Prost
8. Liquid Crystals and Polymers – G.D Arora

19.10.2015
Chairperson
BOARDS OF STUDIES
DEPARTMENT OF PHYSICS
KAKATIYA UNIVERSITY
WARANGAL-506 009 (T.S)

3.4C NANOSCIENCE SPECIAL - II (Nanoscience – I)

Unit I : Band Structure and conduction mechanism at Nanoscale: Introduction. Energy bands. Density of states at low-dimensional structures. Electronic transport in nanostructures. Various conduction mechanisms in 3D(bulk), 2D(thin film) and low dimensional systems- Thermionic emission, field enhanced thermionic emission(Schottky effect), field assisted thermionic emission from traps (Poole-Frenkel effect), Arrhenius type thermally activated conduction, variable range hopping conduction, polaron conduction.

Unit II : Quantum mechanical concepts at Nanoscale: Introduction, size effects in smaller systems. Pre-quantum, quantum behaviour of nanometric world. Applications of Schroedinger equation-infinite potential well a confined particle in 1D, potential step: reflection and tunneling. Quantum leak, penetration of barrier, potential box: trapped particle in 3D; Nanodot, electron trapped in 2D plane; Nano sheet, electron moving in 1D; Nanowire/rod/belt. Quantun confinement in nanomaterials.

Unit III : Synthesis of Nanomaterials - Physical methods: Mechanical methods, methods based on evaporation, sputter deposition, chemical vapor deposition(CVD), electric arc deposition. Ion beam techniques(ion implantation). Molecular Beam Epitaxy(MBE). Lithography: Introduction. Lithography using photons (UV-VIS, Laser or X-rays), lithography using particle beams, scanning probe lithography, soft lithography.

Unit IV: **Synthesis of Nanomaterials**: Chemical methods: Colloids and colloids in solutions. Growh of Nanoparticles – synthesis of metal nanoparticles by colloidal routes, synthesis of semiconductor nanoparticles by colloidal routes, Langmuir Blodgett(L-B) method, microemulsions, Sol-Gel method.**Biological methods**: Introduction to biomaterials. Synthesis using micro-organisms, synthesis using plant extracts, use of proteins and templates like DNA.

Text and Reference Books:

1. Introduction to Nanoscience and Nanotechnology – K.K. *Chatopadhyay and A.N. Benerjee*, PHI
2. Nanotechnology: Principles and Practices – *Sulabha K Kulkarni.* Capital Publishing Company, New Delhi.
3. Nanostructured Materials and Nanotechnology – *Hari Singh Nalwa*. AP.
4. Nanostructures and Nanomaterials-Synthesis, Properties and Applications – *Cao, Guozhong.*

19.10.2015
Chairperson
BOARDS OF STUDIES
DEPARTMENT OF PHYSICS
KAKATIYA UNIVERSITY
WARANGAL-506 009 (T.S)

M.Sc. Physics III Semester Practical's

3.5 General Physics-II Laboratory

1. Determination of 'g' factor using ESR spectrometer.
2. Analysis of square wave, clipped sine wave, saw tooth wave using Fourier analysis.
3. To study the characteristics of a given photo conductive cell and the spectral response.
4. To study the characteristics of G M counter and to find out its operating voltage.
5. Verify the inverse square law for γ-rays using G M counter.
6. Determination of energy gap of an intrinsic semiconductor by Four Probe Method.
7. Determination of e/m of an electron using helical method.

3.6A Solid State Physics Special – I Laboratory

1. Determination of co-efficient of thermal conductivity of a single crystal.
2. Determination of the ferromagnetic Curie temperature of monel metal.
3. Determination of paramagnetic susceptibility using Guoy balance.
4. Indexing of Laue pattern.
5. Indexing of a Debye-Scherrer film – Accurate determination of lattice constant using least squares method.
6. Determination of lattice constant using symmetric focusing camera.
7. Determination of lattice constant using X Ray Diffractometer.

3.6B Electronics Special - I Labaratory

Part-I

1. Active filters - Low, High and Band pass filters using IC741.
2. Universal Active filter using IC-FLTU2.
3. D/A converter using R-2R network.
4. A to D converter
5. Positive and Negative clippers using IC741.
6. Analysis of Sample and Hold circuit using IC-LF398.
7. To study OP-AMP dc milli-voltmeter.
8. To study Pulse width Modulator – IC555 timer.
9. To study Pulse Position Modulator – IC555 timer.
10. To study Phase locked loop – FSK Demodulator IC565.

19.10.2015
Chairperson
BOARDS OF STUDIES
DEPARTMENT OF PHYSICS
KAKATIYA UNIVERSITY
WARANGAL-506 009 (T.S)

Part-II: Microprocessor Experiments:

(Assembly Language Programming and Interfacing with 8085 -)

1. Programs for data transfer, arithmetic and logical operations.
2. Programs for array operations – finding out the longest and smallest in a data array.
3. Programs for arranging hex. numbers in ascending and descending order.
4. Programs to find the square root, finding the sum of 'n' natural numbers and finding the sum of squares of the 'n' natural numbers.
5. Program to convert digital signals to analog signals (DAC) – conversion of digital to DC voltages (-5 V to +5V) using DAC-0800.
6. Programs to generate waveforms viz., square, saw tooth and triangular using DAC.
7. Program to generate tones of different frequencies.
8. Program to demonstrate stepper motor control.
9. Familiarization of 8086 microprocessor and performing some basic experiments using 8086 microprocessor kit.

3.6C Nanoscience Special - I Laboratory

1. To determine the resistivity of a graphite sample using four probe method
2. To study the Curie temperature of a ferromagnetic material.
3. To study the magneto resistance behavior of Ge crystal at room temperature.
4. Determination of lattice constant using XRD.
5. Sol-Gel synthesis of nanoparticles
6. Synthesis of Silver nanoparticles.
7. Synthesis of porous silicon..
8. Grain size estimation using XRD and AFM.

19.10.2015
Chairperson
BOARDS OF STUDIES
DEPARTMENT OF PHYSICS
KAKATIYA UNIVERSITY
WARANGAL-506 009 (T.S)

M.Sc. Physics IV-Semester Theory

4.1 ELECTROMAGNETIC THEORY AND OPTICS

Unit I : Potentials and Fields: Electrostatics in dielectrics: Polarization, field due to a dielectric medium, field within a dielectric, field of a point charge in a dielectric. Boundary conditions for dielectric, lines of electric displacement, measurement of dielectric constant (Hopkinson's circuit). Electrical potential, Poisson's equation and Laplace equation. Electrostatic boundary conditions. Energy of point charge and continuous charge distribution. The work done to move a charge. Magnetic vector potential, magnetic boundary conditions. Scalar and vector potentials, Gauge transformations, Coulomb gauge and Lorentz gauge. Retarded potentials, Jefimenko's equations, Lienard-Wiechart potentials. The fields of a point charge in motion.

Unit II : Electrodynamics: Introduction - Maxwell's equations and Magnetic charge. Maxwell's equations inside matter, boundary conditions, continuity equation, Poynting theorem. Newton's third law of electrodynamics. Maxwells' Stress tensor, conservation of momentum, conservation of angular momentum.

Unit III : Electromagnetic waves and Radiation: Monochromatic plane waves in vacuum and non-conducting media, energy and momentum of electromagnetic waves, propagation through linear media, reflection and transmission at normal incidence, oblique incidence, the modified wave equation, monochromatic plane waves in conducting media, reflection and transmission at a conducting surface. Electric dipole radiation, Magnetic dipole radiation, radiation from an arbitrary distribution of charges and currents, power radiated by a point charge.

Unit IV : Non-linear Optics: Harmonic generation, second and third harmonic generation, phase matching, optical mixing, parametric generation of light and oscillator, self focusing of light, multi-quantum photoelectric effect, theory of two phonon processes, experiments in two photon processes, violation of square law dependence, Doppler-free two photon spectroscopy, multi-photon processes, frequency up-conversion, phase conjugate optics.

Text and Reference Books:

1. Introduction to Electrodynamics – ***D.J.Griffiths***, PHI.
2. Electrodynamics – ***B.B.Laud***, New Age International..
3. Lasers and Non linear optics – ***B.B.Laud***, New Age International.
4. Optical Electronics – ***Ajay Ghatak and Tyagarajan,*** Cambridge.
5. Electrodynamics – ***Jordan***, PHI.
6. Electrodynamics – ***Jackson,*** TMH.

19.10.2015
Chairperson
BOARDS OF STUDIES
DEPARTMENT OF PHYSICS
KAKATIYA UNIVERSITY
WARANGAL-506 009 (T.S)

4.2 MOLECULAR AND RESONANCE SPECTROSCOPY

Unit I : Microwave and Infrared spectroscopy: Rotational energy levels and Rotational spectra of diatomic molecules. Rigid and non-rigid rotator models, effect of isotopic substitution on rotational spectra, microwave spectrometer. Information derived from rotational spectra. Vibrational spectra of a diatomic molecule, Harmonic, anharmonic and vibrating Rotator – models. Born-Oppenheimer approximation. Vibration of poly atomic molecules, Fermi resonance, Hydrogen bonding. Infrared spectrometer – instrumentation, Fourier Transform Infrared spectrometer (FTIR) . structure elucidation employing IR spectroscopy, Micro-wave oven

Unit II : Electronic and Raman Spectroscopy: Electronic spectra of diatomic molecules. Vibrational coarse structure. Intensity of vibrational – electronic spectra. Franck – Condon principle. Dissociation Energy. Rotational fine structure of Electronic–vibration transitions-Fortrat diagram. Deslanders table. Molecular polarizability. Classical and quantum theories of Raman effect. Rotational Raman spectra of diatomic molecules. Vibrational Raman spectra of diatomic and polyatomic molecules. Rotation – Vibration Raman spectra of diatomic molecules. Structure determination from Raman and IR spectroscopy. Raman spectrometer – Instrumentation.

Unit III : Magnetic Resonance Spectroscopy: Nuclear Magnetic Resonance-resonance condition, classical theory and Bloch's equations, Relaxation processes, spin –lattice and spin-spin relaxations, chemical shift, NMR instrumentation and MRI. Electron spin resonance : Principles of ESR. Conditions for resonance. Spin Hamiltonian. Hyper fine structure. ESR spectra of free radicals, ESR-instrumentation.

Unit IV : Mossbauer and NQR Spectroscopy: Recoilless emission and absorption of gamma rays. Mossbauer spectrometer. Isomer shift, Quadrupole interaction, magnetic hyperfine interaction. Elucidation of molecular structure, crystal symmetry and magnetic structure. Principles of Nuclear Quadrupole resonance, Half integral and Integral spins. NQR Instrumentation, Studies on chemical and hydrogen bonding and solid state applications.

Text and Reference Books:

1. Fundamentals of molecular spectroscopy **- *Colin N. Banwell and Elaine,*** TMH.
2. Molecular structure and spectroscopy - ***G Aruldhas,*** PHI.
3. Introduction to Molecular spectroscopy **- *Gordon M. Barrow,*** McGraw Hill.
4. Spectroscopy – Vol 1 and 2 **– *B P Straughan and S Walker,*** Chapman & Hall.
5. Principles of magnetic resonance **– *C P Slitcher,*** Harper & Row NY J W Hill.
6. Introduction to magnetic resonance **– *Carrington A and Mc Lachlan A.D***
7. Electron Spin Resonance – ***Wertz and Bolton***
8. Introduction to Mossbauer Spectroscopy – ***Ed by May L.***
9. Nuclear Quadrupole resonance spectroscopy **– *Das T P and Hahn E L***

19.10.2015
Chairperson
BOARDS OF STUDIES
DEPARTMENT OF PHYSICS
KAKATIYA UNIVERSITY
WARANGAL-506 009 (T.S)

4.3A SOLID STATE PHYSICS - SPECIAL - III

Unit I : **Magnetism**: Origin of exchange interaction – two electron system – Heisenberg model. Dispersion relation for magnons in a ferromagnet, $T^{3/2}$ – law. Antiferromagnetic order – susceptibility – Neel temperature. Molecular field theory of antiferromagnetism. Dispersion relation for magnons in antiferromagnet. Superexchange in MnO. Ferrimagnetic order – Curie temperature and susceptibility. Band magnetism – Hubbard model- Stoner approximation. Concepts of nanomagnetism.

Unit II : **Energy bands and Fermi surface:** Tight binding approximation, Wigner-Seitz approximation. deHaas-Van Alphen effect, cyclotron resonance, magneto resistance, Giant magneto resistance (GMR) and Colossal magneto resistance (CMR) materials and their applications – Spintronic devices.

Unit III : **Superconductivity–I**: Experimental survey – occurrence of superconductivity, effect of magnetic field - Meissner effect , Type I, Type II super conductors, energy gap, Specific heat, isotope effect, Thermodynamics of the transition (I and II order) - entropy, specific heat, thermal conductivity, flux quantization supercurrents, vortex state.

Unit IV : **Super conductivity–II**: London’s equation, penetration depth, coherence length. Ginzburg – Landau theory – G- L equations. Single particle tunneling (N-I-N) (S-N-S), (S-I-S) Josephson tunneling – DC Josephson effect, DC- SQUID. Electron-phonon interaction – Cooper instability – Cooper pairs. BCS theory (Qualitative – ground state, results of BCS theory). High T_c superconductivity. Applications of superconductivity.

Text and Reference Books:

1. Introduction to Solid State Physics – ***C Kittel,*** John Wiley & Sons.
2. Material Science and Engineering – ***W D Callister,*** John Wiley & Sons.
3. Solid State Physics – ***N. Ashcroft and N.D. Mermin,*** Thomson Books.
4. Solid State Physics: Structure and Properties of Materials – ***M.A.Wahab***, Narosa
5. Quantum theory of Magnetism – ***W. Nolting and A. Ramakanth***, Springer
6. Principles of Nanomagnetism – ***Alberto P. Guimaraes***, Springer

19.10.2015
Chairperson
BOARDS OF STUDIES
DEPARTMENT OF PHYSICS
KAKATIYA UNIVERSITY
WARANGAL-506 009 (T.S)

4.4A SOLID STATE PHYSICS – SPECIAL -IV

Unit I : Thin Films: Theories of thin film nucleation and growth. Thin film preparation – common substrate materials, sputtering processes, chemical vapour deposition (CVD) – thickness measurements. Electrical and optical properties of thin films. Commonly measured quantities for thin films, sheet resistance, magneto resistance in thin films – applications.

Unit II : Characterisation Techniques: Phase contrast microscopy, Electron microscopy – Scanning Electron Microscopy (SEM), Transmission Electron Microscopy (TEM), Atomic Force Microscopy (AFM) and Magnetic Force Microscopy (MFM). X-ray powder diffractometry (XRD). Qualitative identification of crystalline powders, the ASTM diffraction data file, identification and interpretation of data. Atomic Absorption Spectroscopy (AAS). Thermo Gravimetric Analyser (TGA) and Differential Scanning Calorimeter (DSC).

Unit III : Nano-structured materials: Nano-crystalline materials, XRD patterns, General methods of preparation of nanostructured metals, alloys and semiconductors by physical and chemical routes. Inert gas condensation technique and sol-gel process. Particle size estimation by XRD/SPM/STM/AFM techniques. Size quantization effects, Band gap expansion (Blue shift) in semiconductors, charge transfer processes. Quantum wells, wires and dots – density of states. Applications of nano materials with specific examples.

Unit IV : Polymers and Ceramics: Classification of polymers, polymer molecules, chemistry of polymer molecules, molecular weight. Molecular shape, molecular structure of polymers. Polymer crystallinity, Polymer crystals. Mechanical and thermal characteristics, stress - strain behaviour. Deformation of semi - crystalline polymers, strengthening of polymers. Methods of moulding plastics. Industrial uses of polymers, Biopolymers - applications. Classification of ceramics, structure of ceramics – AX type, A_mX_p, $A_mB_nX_p$ type crystal structures. Silicate ceramics, imperfections in ceramics. stress – strain behaviour of ceramics, mechanism of plastic deformation. Ceramic materials as insulators. Ferro-electrics, piezo electrics, semiconductors and magnets.

Text and Reference Books:

1. Introduction to Solid state physics – ***C.Kittel,*** John Wiley & Sons**.**
2. Thin film Fundamentals **–** ***Goswami,*** New Age International**.**
3. Solid State Physics: Structure and Properties of Materials – ***M.A.Wahab***, Narosa**.**
4. Nano structured Materials and Nanotechnology-***Hari Singh Nalwa,*** Academic Press**.**
5. Nanotechnology – Principles and Practices – ***S. Kulkarni ,*** Saujanya Books, Delhi.
6. Material Science and Engineering **–** ***W.D. Callister*****,** John Wiley & Sons**.**

19.10.2015
Chairperson
BOARDS OF STUDIES
DEPARTMENT OF PHYSICS
KAKATIYA UNIVERSITY
WARANGAL-506 009 (T.S)

4.3B ELECTRONICS – SPECIAL – III (Microcontrollers)

Unit I : Introduction to Microcontrollers and Embedded Systems: Overview and block diagram of 8051. Architecture of 8051 – Pin assignments. Program counter and Data pointer – Flags and PSW – Internal RAM – Special function Registers – Register banks and stack – I/O ports and circuits – External Memory – Counters and Timers – Serial Data I/O, Interrupts.

Unit II : Addressing modes, instruction set and Assembly Language Programming of 8051: Addressing modes – Instruction set-Moving data – External Data moves, push and pop opcodes, Data Exchanges, Logical: Byte and Bit level operations Rotate and Swap operations, Arithmetic: Flags, Increment, Decrement, Addition, Subtraction, Multiplication and Division; JUMP and CALL Instructions: Jumps, Calls, subroutines, interrupts and returns. Programming examples.

Unit III : Interfacing of peripherals to Microcontrollers: Interfacing of PPI 8255, LCD & Key Board with 8051. Interfacing of stepper motor, ADC, DAC and sensors with 8051. Interfacing to external memory.

Unit IV : Other Microcontrollers: Atmel Microcontrollers, Architectural details and pin description of Atmel 89C51 and 89C2051 microcontrollers. Using flash memory devices Atmel 89CXX and 89C20XX. Applications of Atmel 89C51 and 89C2051 Microcontrollers: generation of sine, square and staircase ramp waves, PIC Microcontrollers: Overview and features, PIC16C6X/7X, FSR (file selection register), PIC Reset Actions, PIC oscillator connections, PIC memory organization.

Text and Reference Books:

1. The 8051 Microcontroller – *Kenneth Ayala*, DELMAR CENGAGE learning.
2. The 8051 Microcontroller and Embedded systems using Assembly and C – *M.A.Mazidi, J,G.Mazidi and R.D.McKinlay* – PHI.
3. Microcontrollers – Theory and Applications - *A.V.Deshmukh*, TMH.
4. Programming and customizing the 8051 Microcontroller – *Myke Predko*, TMH.

19.10.2015
Chairperson
BOARDS OF STUDIES
DEPARTMENT OF PHYSICS
KAKATIYA UNIVERSITY
WARANGAL-506 009 (T.S)

*4.4B ELECTRONICS–SPECIAL-IV (*Optical, Satellite and Mobile Communication*)*

Unit I: Optical Fiber Communication: Introduction, Optical Fiber, Numerical aperture, Step index and graded index fiber, Scalar wave equation and the modes of a fiber, Modal analysis for a step index fiber, Modal analysis of parabolic index medium, Pulse dispersion, Single mode fibers and Multimode fibers with optimum profiles, Splice loss, First and second generation optical fiber communication systems.

Unit II: Satellite Communication – I: Satellite orbits and positioning, Satellite height, Speed, Angle of inclination, Geo synchronous orbits, Position coordinates, Azimuth and elevation, Repeaters and Satellite Transponders, Frequency allocations for Transponder channels, Satellite sub-systems, Transponder configurations, Multi channel Architecture, Satellite orbit control, Power sub-systems, Telemetry, Command and Control sub-systems.

Unit III: Satellite Communication – II : Ground station, Antenna sub-systems, Receiver sub-systems, Transmitter sub-systems, International and Regional satellites, Domestic satellites**.** Satellite Applications: Communication satellites, Surveillance satellites, Navigation satellites, Global Positioning Systems (GPS), Space segment, Control segment, GPS receivers, GPS Applications.

Unit IV: Mobile Communications: Introduction, Significance of Cellular Mobile systems, Frequency spectrum allocation, Trunking efficiency, Basic Cellular system, Performance criteria, Operation of Cellular systems, Hexagonal shaped cells, Planning a Cellular system, Elements of Cellular system design, Frequency re-use, Co-channel interference reduction factor, Hand-off mechanism, Cell splitting, Components of Cellular systems.

Text and Reference Books:

1. Optical Fiber Communication – ***Gower***, PHI
2. Optical Fiber Communication – ***J. M. Senior***, PHI
3. Optical Fiber Communication – ***Kaiser***, TMH
4. Principles of Electronic Communication Systems – ***Louis E. Frenzel*** (3^{rd} Ed.) MGH
5. Composite Satellite and Cable Television**–*R. R. Gulati*** (Revised 2^{nd} Ed.) New Age Int.
6. Mobile Cellular Communications – ***William C. Y. Lee*** (2^{nd} Ed.)MGH
7. Mobile Communications – ***Jochen H. Schiller***
8. Wireless Digital Communications **– *Kamilo Feher***
9. Communications **– *Dennis Roddy and John Coolen***, PHI
10. Principles of Communication Systems – ***H. Taub and D. L. Schilling*** (2^{nd} edition) TMH

19.10.2015
Chairperson
BOARDS OF STUDIES
DEPARTMENT OF PHYSICS
KAKATIYA UNIVERSITY
WARANGAL-506 009 (T.S)

4.3C NANOSCIENCE – SPECIAL -III (Materials Science – II)

Unit I : Luminescence and Luminescent Materials: General consideration of Luminescence, excitation, absorption and emission processes of luminescence, configuration coordinate diagram, energy level diagram. Radiative and non-radiative processes. Different kinds of Luminescence – Electroluminescence, photoluminescence. Color centers, different kinds of color centers in the context of luminescence in alkali halides.

Unit II : Ceramics and Composites: Ceramic structures, silicate structures. The structure of glass ceramic phase diagrams-examples of two oxide systems. Brittle fracture of ceramics, stress-strain behaviour of ceramics, micro-structure of ceramics, grain growth in ceramics. Reinforcement in composite materials. Fibers, types of fibers, laminar composites. Design of composite materials. Metal matrix composites, polymer matrix composites, ceramic matrix composites, carbon-carbon composites, hybrid composites. Applications of composites.

Unit III : Magnetic materials: Classification of magnetic materials. Soft and hard magnetic materials. Materials for magnetic recording, properties of magnetic materials. Domain and magnetization process, structure and magnetic domain, magnetic anisotropy in cubic and hexagonal crystals. Magneto striction in cubic and hexagonal crystals and poly crystals. Magneto resistance, domain wall motion, magneto static energy, domain wall energy, hysteresis and its significance, soft ferrites, hard ferrites, applications of ferrites.

Unit -IV: Polymers: Nomenclature, definitions, thermodynamics of polymeric materials. Formation of free energy of polymer system. Fbory-Huggins free energies, phase diagrams in polymer blends, characterization of molecular distribution. Viscosity of polymers, structure of polymers, glass transition, crystalline vs amorphous polymers. Elastomers, mechanical properties, electrical properties, deformation, stress-strain behaviouur.Viscoelasticity, fracture and adhesion. Conducting polymers.

Text and Reference Books:

1. Luminescence materials – *G. Blosse*.
2. Composite materials – *S.C. Sharma*.
3. Materials Science and Engineering – *W.D.Callister, Jr*, John Wiley and Sons Inc.
4. Materials Science and Engineering – *C. M. Srivastava*.
5. Materials Science – *I.P.Singh*, Jain Brothers.
6. Principles of Electronic Materials and Devices – *S.O.Kasap*, TMH.

4.4C NANOSCIENCE – SPECIAL -IV (Nanoscience – II)

Unit I : **Characterization Techniques**: Commonly used techniques in materials analysis. Microscopes – Scanning Electron Microscope (SEM), Tunneling Electron Microscope (TEM), Scanning Probe Microscope (SPM), Scanning Tunneling Microscope (STM), Atomic Force Microscope (AFM), Magnetic Force Microscope (MFM), SNOM. XRD – diffraction from different types of samples, diffraction from nanoparticles.

Unit II : **Properties of Nanomaterials**: Mechanical properties, structural properties, melting of nanomaterials. Electrical conductivity. Optical properties of metallic and semiconductor nanoparticles. Luminesence in semiconductor nanoparticles,. Nanomagnetic materials.

Unit III : **Carbon based Nanomaterials**: CNTs–synthesis of carbon nanotubes. Growth mechanism, electronic structure of carbon nanotubes, preparation and characterization of fullerenes and graphene. Nanodiamond, BN nanotubes. Nanoelectronics-single electron transistor, molecular machine. Nano biometrics.
.

Unit IV : **Advanced Nanomaterials**: CNTs–synthesis of carbon nanotubes. Growth mechanism, electronic structure of carbon nanotubes, Porous silicon preparation-mechanism of pores formation, properties of porous silicon. Aerogels- types of aerogels, properties and applications of aerogels. Zeolites synthesis, properties. Ordered porous materials using micelles as templates. Self assembled nanomaterials, inorganic, organic and bio templates.

Text and Reference Books:

1. Nanostructured Materials and Nanotechnology – ***Hari Singh Nalwa,*** AP.
2. Introduction to Nanotechnology – ***C.P. Poole Jr and F.J. Owens,*** John Wiley and Sons Inc.
3. Introduction to Nanoscience and Nanotechnology **– *K.K. Chattopadhyay and A.N. Benarjee,*** PHI.
4. Nanotechnology: Principles and Practices – ***Sulabha K Kulkarni,*** Capital Publishing Company, New Delhi.
5. Instrumental Methods of Analysis –
6. Physical Principles of Electron Microscopy – ***Ray F Egerton***.

19.10.2015
Chairperson
BOARDS OF STUDIES
DEPARTMENT OF PHYSICS
KAKATIYA UNIVERSITY
WARANGAL-506 009 (T.S)

M.Sc. Physics IV-Semester Practical's

4.5 General Physics-II Laboratory

1. Determination of susceptibility of a given salt using Quinke's tube method.
2. To study the characteristics of a given solar cell.
3. To verify Beer's law using spectrophotometer.
4. To determine the γ-attenuation coefficients for lead, copper, and aluminum using G M counter.
5. Analysis of hysteresis loop for a given ferromagnetic material and to determine its saturation magnetization, retentivity and co-ercivity.
6. Determination of numerical aperture of an optical fiber.
7. To study the characteristics of a given Laser Diode.
8. Analysis of an audio amplifier using optical fiber.

4.6A Solid State Physics special-II Laboratory

1. Determination of the ferroelectric Curie temperature of $BaTiO_3$ Polycrystalline pellet.
2. Determination of the dispersion curves of monatomic and diatomic lattice analogs using Lattice Dynamic kit.
3. Estimation of colour centre density of X- ray irradiated alkali halide crystal using spectrophotometer.
4. Determination of photoelastic constants using Babinet compensator.
5. Determination of energy band gap of a semi-conductor thin film using spectrophotometer..
6. Determination of refractive index of a single crystal –Brewster angle method using He-Ne Laser.

4.6B Electronics Special-II Laboratory

Part-I: Microcontroller Experiments using 8051

1. Program for multiplication of two Hexa decimal numbers.
2. 2. Program for division of two Hexa decimal numbers.
3. Programs to pick the smallest and largest numbers in a given set of numbers.
4. Programs for arranging given 'n' numbers in ascending and descending order.
5. Program for generation of specific time delay.
6. Program to interface a D A C and generate saw tooth, square and rectangular waveforms.
7. Program to flash an LED connected at a specified output terminal.

19.10.2015
Chairperson
BOARDS OF STUDIES
DEPARTMENT OF PHYSICS
KAKATIYA UNIVERSITY
WARANGAL-506 009 (T.S)

8. Program to interface a stepper motor, rotate it in clockwise and anticlockwise through given angle steps.
9. Programming using Keil software.
    a) To pick the smallest among a given set of numbers.
    b) To pick the largest among a given set of numbers.
    c) To arrange a given set of numbers in an ascending order and descending order.
    d) To generate a rectangular waveform at a specified port terminal.

Part-II: Digital Communications:

1. Study of sampling techniques.
    a) Natural sampling.
    b) Sample and Hold.
    c) Flat top sampling.
2. Study of various sampling frequencies and Duty cycles.
3. Study of order of the low pass filter.
4. Study of TDM with different receiver and synchronization techniques.
5. Study of Pulse Code Modulation and Demodulation.
6. Study of various carrier modulation and demodulation techniques.
7. Study of Delta Modulation and demodulation.
8. (i) Study of continuously variable slope detector and modulation and demodulation (ii). Study of companding system .
9. (i) Study of pulse width modulation and demodulation. (ii) Study of pulse position modulation and demodulation.
10. Voice communication/Optical Fiber Communication.

4.6C Nanoscience Special –II Laboratory

1. To study the dielectric behavior of PZT ceramic by determining dielectric constant.
2. To prepare nanoparticles using ball mill.
3. DSC/DTA/TGA studies for the thermal analysis of materials
4. To draw the B-H loop of a ferromagnet.
5. Synthesis of CdS nanoparticles.
6. Synthesis of ZnO particles.
7. Synthesis of Fe2O3 nanoparticles.
8. Optical absorption of Silver nanoparticles
9. Carbon nano tubes.

19.10.2015
Chairperson
BOARDS OF STUDIES
DEPARTMENT OF PHYSICS
KAKATIYA UNIVERSITY
WARANGAL-506 009 (T.S)