GAUHATI UNIVERSITY

Syllabus for
Undergraduate Course (Three year)
under
Semester system
in
PHYSICS
2010

GAUHATI UNIVERSITY
Gopinath Bordoloi Nagar
Guwahati-781014
Assam: India

Undergraduate Course Syllabus Under semester system
Physics Major

1. The undergraduate Course of the Gauhati University is a three year Course. There are six university examinations during the course, the Semester-I, Semester-II, Semester-III,

Semester-IV, Semester-V, and Semester-VI held each at the end of six months covering three calendar years.

2. The subject Physics can be studied as Major Course or General/Subsidiary Course.
3. A student pursuing Major Course in Physics should have Mathematics and another subject as General/Subsidiary Course subject. For a student having Major Course in Physics, General/Subsidiary Course subjects are completed during first four semesters.
4. English is a compulsory subject in Semester-I and Semester-II and Environmental studies is another compulsory subject in the Semester-III and semester-IV.
5. A student pursuing General/Subsidiary Course in Physics has to study two other subjects of General/Subsidiary Course (out of these two one should be Mathematics) during the first four semesters along with compulsory subjects English (during 1st and 2nd semester) and Environmental studies (during 2nd and 3rd semester). During last two semesters of the course a student has to study any one of the General/Subsidiary Course subjects studied during the first four semesters along with General/Subsidiary Course of Physics
6. The structure of detailed syllabus for Semester-I, Semester-II, Semester-III, Semester-IV, Semester-V, and Semester-VI for the Physics Major and General/Subsidiary Courses, including number of Papers in each Semester is given below in detail.
7. Credit = Number of Classes per week. 20% Internal Assessment for all papers.

Abbreviations used:

Yr=Year
Sem=Semester
C=Credit
Th=Theory
Pr=Practical
Prj=Project
L=Lecture (1Lecture=45 minutes)
M=Major, G=General
Gen=General/Subsidiary Subject
Ex=External
In=Internal

Grand Total Marks =1700(Major) + 900(General) = 2600
Grand Total Credit =136(Major) + 72(General) = 208

Structure of Physics Major Course under Semester System

Yr	Sem	Subjects	TotalMark MajorPrac (In + Ex)	Total Marks MajorTheory (In + Ex)	TotalMark GenerlPract (In + Ex)	Total Marks GenerlTheory (In + Ex)	Totalcredit (C)	
							M	G
1st	I	**Physics Major -101Th**		15+60=**75**			**6**	
		Physics Major -102Th		15+60=**75**			**6**	
		Physics Major -103Pr	**10+40=50**				**4**	
		Elective –E101(Math)				15+60=75		6
		Elective –E102				15+60=75		6
		English				10+40=50		4
		Physics Major -201Th		15+60=**75**			**6**	

	II	**Physics Major -202Th**		15+60=**75**			**6**	
		Physics Major -203Pr	**10+40=50**				**4**	
		Elective-E201(Maths)				15+60=75		6
		Elective-E202				15+60=75		6
		English				10+40=50		4
2nd	III	**Physics Major -301Th**		15+60=**75**			**6**	
		Physics Major -302Th		15+60=**75**			**6**	
		Physics Major -303Pr	**10+40=50**				**4**	
		Elective-E301(Maths)				20+80=100		8
		***Elective-E302			**10+40=50**	10+40=50		4+4
		Environmental Studies				10+40=50		4
	IV	**Physics Major -401Th**		15+60=**75**			**6**	
		Physics Major -402Th		15+60=**75**			**6**	
		Physics Major -403Pr	**10+40=50**				**4**	
		Elective-E401(Maths)				20+80=100		8
		***Elective-E402**			**10+40=50**	10+40=50		4+4
		Environmental Studies				10+40=50		4
Total			**200**	**600**	100	800	**64**	72

Yr	**Sem**	**Subjects**	**Total Marks inMajor Practical(In + Ex)**	**Total Marks in Major Theory(In + Ex)**	**Total Credit(C) (Major)**
3rd	V	**Physics Major -501Th**		15+60=75	**6**
		Physics Major -502Th		15+60=75	**6**
		Physics Major -503Th		15+60=75	**6**
		Physics Major -504Th		15+60=75	**6**
		Physics Major -505Pr	15+60=75		**6**
		Physics Major -506Pr	15+60=75		**6**
	VI	**Physics Major -601Th**		15+60=75	**6**
		Physics Major -602Th		15+60=75	**6**
		Physics Major -603Th		15+60=75	**6**
		Physics Major -604Th		15+60=75	**6**
		Physics Major -605Pr	15+60=75		**6**
		Physics Major -606Prj	15+60=75		**6**
Grand Total				**800+900=1700**	**64+72=136**

***For Elective with Practical.**

Marks distribution for Physics Major Course

Yr	**Sem**	**Paper**	**Topics**	**Marks (Ex)**	**Total Marks (Ex)**	**Total Marks (In)**	**Grand Total Marks**	**Total Credit (C)**
1st	I	101(Th)	(a) Mathematical Methods-I	20	60	15	75	6
			(b) Mechanics	40				
		102(Th)	(a) Waves and Oscillations	40	60	15	75	6
			b) Ray Optics	20				
		103(Pr)					50	4
	II	201(Th)	(a) Mathematical Methods-II	35	60	15	75	6
			(b) Properties of Matter	25				
		202(Th)	Heat and Thermodynamics	60	60	15	75	6

		203(Pr)					50	4
2nd	III	301(Th)	(a)MathematicalMethods-III	25	60	15	75	6
			(b) Electrostatics	35				
		302(Th)	(a) Current Electricity	45	60	15	75	6
			(b) Magnetostatics	15				
		303(Pr)				50	50	4
	IV	401(Th)	(a) Mathematical Methods-IV	40	60	15	75	6
			(b) Introduction to Computer and Computer Language	20				
		402(Th)	(a) Wave Optics	40	60	15	75	6
			(b)Special theory ofRelativity	20				
		403(Pr)					50	4
3rd	V	501(Th)	(a)Mathematical Methods-V	30	60	15	75	6
			(b) Classical Mechanics	30				
		502(Th)	Atomic Physics	60	60	15	75	6
		503(Th)	(a) Quantum Mechanics	40	60	15	75	6
			(b) Astrophysics	20				
		504(Th)	Electronics	60	60	15	75	6
		505(Pr)					75	6
		506(Pr)					75	6
	VI	601(Th)	Nuclear Physics	60	60	15	75	6
		602(Th)	(a)Mathematical Methods-IV	15	60	15	75	6
			(b) Solid state Physics	45				
		603(Th)	(a) Modern Optics	40	60	60	75	6
			(b) Electromagnetic Theory	20				
		604(Th)	(a) Statistical Mechanics	30	60	15	75	6
			(b)Computer Applications	30				
		605(Pr)					75	6
		606(Prj)					75	6
			Total				**900**	**72**

Grand Total Marks =1700(Major) + 900(General) = 2600
Grand Total Credit =136(Major) + 72(General) = 208

Syllabus for Physics Major Course

FIRST SEMESTER

PAPER: 101 (THEORY) Total Marks: 60

(a) MATHEMATICAL METHODS-I: Total marks: 20

1. ***Vector analysis***: Vectors, Scalars, Vector algebra, Product rules, Vector fields, scalar fields.
2. ***Vector differentiation***: Ordinary derivatives of vectors, space curves, Partial derivatives of vectors, Differentials of vectors, Concept of gradient, divergence and curl. Application of above concept to simple physical phenomena. **20 Lectures**

(b) MECHANICS: Total Marks: 40

1. Non-inertial systems and fictitious forces, rotating frame of reference, fictitious/apparent force in a rotating co-ordinate system, Coriolis force, Coriolis and centrifugal forces produced as a result of earth's rotation. Deflection of a freely falling body, effect of

Coriolis force on the horizontal straight line motion of a body on the surface of the earth.

8 Lectures

2. Work-energy theorem, integral of the equation of motion, conservative forces, potential energy, conservative force as the negative gradient of potential energy, curl of a conservative force, non-conservative forces, general law of conservation of energy.

7 Lectures

3. Mechanics of a system of particles, centre of mass, motion of the centre of mass, conservation of momentum, calculation of centre of mass of (i) non-uniform rod, (ii) semicircular arc (iii) semi-circular disk and (iv) solid hemisphere. Laboratory frame of reference and centre of mass frame of reference, two dimensional elastic collision in laboratory frame of reference and centre of mass frame. **10 Lectures**

4. Angular momentum, angular momentum of a system of particles in terms of the centre of mass co-ordinate, conservation law of angular momentum, angular momentum and fixed axis rotation of a rigid body, moment of inertia, calculation of moment of inertia for spherical bodies (shell, hollow and solid). The compound pendulum, determination of g by Kater's pendulum. **9 Lectures**

5. Gravitation, gravitational field and potential due to spherical shell and solid sphere.

6Lectures.

Suggested books:

(a)

1. Mathematical methods for physicists, Arfken and Weber (Academic Press)
2. Mathematical Methods, M.C. Potter, J. Goldberg (Prentice Hall, India)
3. Mathematical Physics, Rajput and Yogprakash (Pragati Prakashan, Meerut)
4. Vector Analysis, Murray R. Spiegel (Schaum Series)

(b)

1. An Introduction to Mechanics, D. Kleppner and R. J. Kolenkow
2. Mechanics, D.S. Mathur
3. Mechanics, .S. Hans, S.P. Puri
4. Physics Part-I, Halliday and Resnick

PAPER: 102 (THEORY) Total Marks: 60

(a) WAVES AND OSCILLATIONS: Total marks: 40

1. ***Harmonic Motion***: Simple Harmonic motion, Composition of two simple harmonic oscillations at right angles, Lissajous figures. Free, damped and forced oscillations, resonance, and sharpness of resonance. **10 Lectures**
2. ***Wave Motion***: Wave motion in an elastic medium, characteristic of progressive waves, mathematical representation of a progressive wave. Differential wave equation in one dimension, solution of wave equation (method of separation of variables). Energy density of plane progressive waves, Superposition of waves. Stationary waves, characteristics of stationary waves. **10 Lectures**
3. ***Sound Waves***: Velocity of longitudinal waves in a solid bar. Intensity of sound wave. Units of intensity. Acoustics of auditorium, reverberation, Sabine's law. **6 Lectures**
4. ***Fourier analysis***: Fourier analysis and evaluation of Fourier coefficients. Application of Fourier analysis to square and saw tooth waves. Equation of transverse vibration of a stretched string, energy of vibrating string, plucked string and struck string.

14 Lectures

(b) RAY OPTICS: Total Marks: 20

1. ***Fermat's principle:*** Fermat's principle and its application in establishing laws of reflection and refraction at spherical and plane boundaries. **5 Lectures**
2. ***Matrix method:*** Translation matrix and Refraction Matrix, use of matrix method in

refraction at a spherical surface and refraction through thin lens. **3 Lectures**

3. ***Lens system:*** Sign convention, conjugate foci, relation for refraction of paraxial rays at single spherical surface, interrelation among lateral, longitudinal and angular magnification, Lagrange's law and Helmholtz equation and its modification for telescopic system. **5 Lectures**
4. ***Defects of image:*** Spherical aberration and its magnitude for thin lens for object at finite distance and condition for minimum aberration when object is at infinity, Minimization of spherical aberration by using suitable lens of different radii of curvature and by aplanatic surface, Qualitative idea about coma, astigmatism and distortion, Chromatic aberration, circle of least confusion, achromatism of two thin lenses separated by a distance. **7 Lectures**

Suggested books:

(a)

1. Text book of Sound- K.Bhattacharjee;
2. Sound- P.K.Chakraborty and S.B.Choudhury;
3. Physics of vibrations and waves- H.J. Pain
4. A Text Book of Sound- N. Subramanyam and Brij Lal

(b)

1. Light – K.G. Mazumdar
2. A Text book of Light- B Gosh and K G Mazumdar.
3. Geometrical and Physical optics – P.K. Chakraborty
4. Optics – A. Ghatak
5. Optics – E Hecht

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PAPER: 103 (TEST OF LABORATORY SKILL AND PRACTICAL) Total Marks: 50

(a) TEST OF LABORATORY SKILL: Total Marks: 20

(Time allotted for Test of laboratory skill is one hour)

1. Identification of active and passive components of an electronic circuit.
2. Familiarization with operation of basic measuring and test equipments(analog and digital multimeters, function generator, Cathode ray oscilloscope)
3. To use a multimeter for identification of different terminals of (i) diode and (ii) transistor.
4. To find the value of resistor from colour code and verify by measuring the resistance by multimeter.
5. To make connections using soldering.
6. To measure small distances and angles using different varnier scales attached to (i) traveling microscope, (ii) polarimeter and (iii) spectrometer.
7. To check the condition of a lead-acid battery – (i) acid strength by common hydrometer, (ii) acid level and (iii) emf(using multimeter).
8. To check the condition of capacitor using multimeter.

(b) PRACTICAL: Total Marks: 30

(One experiment should be performed in three hours)

1. To measure the extension of an experimental wire due to different pulling forces using Searle's apparatus and hence determine the Young's modulus of the material of the wire.

2. Study the variation of angle of twist of a given rod at different lengths from the fixed end, with torque & then determine the rigidity modulus of the material of the rod.
3. To study the variation of time period of a bar pendulum about different point of suspension and use the result to find the value of g at a place.
4. To determine the frequency of a tuning fork by Melde's experiment.
5. To determine the moment of inertia of a cylinder or a rectangular parallelopiped about two different axes of symmetry by torsional oscillation method.
6. To determine the spring constant and mass from vertical oscillations of a loaded spring and hence to determine the modulus of rigidity of the material of the spring.
7. To determine the surface tension of fruit juice extracted from various citrus fruit using Jagers method. **(Additional experiment for those Colleges having Star College Scheme)**

Minimum number of experiments to be completed by each student during the semester is five.

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SECOND SEMESTER

PAPER: 201 (THEORY) Total Marks: 60
(a) MATHEMATICAL METHODS-II: Total marks: 35

1. ***Integration of vectors***: Ordinary integration of vectors. Line integral, surface integral and volume integrals and their applications to simple problems.Green's theorem in the plane Gauss's divergence theorem, Stokes' theorem and their applications. **12 Lectures**
2. ***Curvilinear co-ordinate system***: Curvilinear co-ordinates, Unit vectors and scale factors in curvilinear co-ordinates systems, orthogonal curvilinear co-ordinates, plane polar co-ordinates, right circular cylindrical co-ordinates and spherical polar co-ordinates. Arc length, area and volume elements in each of these systems. Divergence, curl and Laplacian in plane polar co-ordinates, right circular cylindrical co-ordinates and spherical polar co-ordinates. Application of above concept to simple physical phenomena. **15 Lectures**
3. ***Gamma and Dirac Delta function***: Elementary introduction to Gamma function and Dirac Delta function. **8 Lectures**

(b) PROPERTIES OF MATTER: Total Marks: 25

1. ***Elasticity***: Different type of elastic constants and relation among them. Energy in a strained body, torsion of a rod, torsional oscillation, bending of beam, bending moment, cantilever, depression of a cantilever considering the weight of the beam. **12 Lectures**
2. ***Surface tension***: Surface tension, relation between surface tension and surface energy E=S-T dS/dT, excess pressure inside a curved liquid surface. Determination of surface tension by ripple method. **7 Lectures**
3. ***Viscosity***: Poiseullie's equation for flow of a liquid through narrow tube. Determination of viscosity by rotating viscometer. **6 Lectures**

Suggested Books:

(a)

1. Introduction to Mathematical Physics, C. Harper (Prentice Hall, India)
2. Mathematical methods for physicists, Arfken and Weber (Academic Press)

3. Mathematical Methods, M.C. Potter, J. Goldberg (Prentice Hall, India)
4. Introduction to Electrodynamics (for vector analysis part), D. J. Griffith.
5. Mathematical Physics, Rajput and Yogprakash (Pragati Prakashan, Meerut)
6. Vector Analysis, Murray R. Spiegel (Schaum Series)

(b)

1. Properties of Matter, D.S. Mathur
2. General Properties of Matter, Newman and Searle
3. Physics Part-I, Halliday and Resnick
4. General Properties of Matter, Sengupta and Chatterjee

PAPER: 202 (THEORY) Total Marks: 60
HEAT AND THERMODYNAMCS: Total Marks: 60

1. Kinetic theory of gases, pressure exerted by a gas using spherical polar coordinates, degree of freedom, law of equipartition of energy, Maxwell Law of velocity distribution, Maxwellian mean free path, transport phenomena – viscosity, Brownian motion (Einstein's – Langevin's theory), experimental determination of Avogadro's number, examples of Brownian motion. **15 Lectures**
2. Equation of state of a gas, Andrew's experiment, Van der Waal's equation of state, critical constants and law of corresponding states. Thermal conductivity, Fourier equation for rectilinear flow of heat and its solution. Platinum resistance thermometer Thermal conductivity, Fourier equation for rectilinear flow of heat and its solution. Platinum resistance thermometer. **15 Lectures**
3. Zeroth and first law of thermodynamics, specific heats of gases, isothermal and adiabatic processes. Reversible and irreversible processes, conversion of heat into work, Carnot cycle, Carnot's theorem. Second law of thermodynamics: Heat engine, Kelvin-Planck statement of second law, Clausius' statement of second law, equivalence of Kelvin-Planck and Clausius' statements, Kelvin's thermodynamical scale of temperature and its relation to perfect gas scale, Clausius formulation of entropy, entropy changes in reversible and irreversible processes, entropy of ideal gas, relation between entropy and probability. **15 Lectures**
4. Enthalpy, Gibbs-Helmholtz function, Maxwell's thermodynamic relations and their applications, Gibbs phase rule, triple point, Joule-Thomson effect, adiabatic demagnetization. Black body radiation, Kirchoff's law of radiation, radiation pressure, Stefan-Boltzmann law, Wein's displacement law, Rayleigh-Jean's law, Planck's radiation law. **15 Lectures**

Suggested books:

1. A treatise on Heat - Saha and Srivastava
2. Advanced Textbook on Heat – P.K.Chakravarty
3. Heat and Thermodynamics- Zemansky and Dittman
4. Thermodynamics, Kinetic Theory and Statistical Thermodynamics – Sears and Salinger.

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PAPER: 203 (PRACTICAL) Total Marks: 50

(One experiment should be performed in four hours)

1. To determine the focal length of a given convex mirror with the help of a convex lens.
2. To determine the coefficient of linear expansion of the material of given metal rod by

optical lever method.

3. To determine the value of J, the mechanical equivalent of heat by Joule's calorimeter.
4. To study the variation of resistance of a thermistor with temperature and then to measure an unknown temperature of a liquid with it.
5. To determine the refractive index of a liquid by using a plane mirror and a convex lens.
6. To determine the thermal conductivity of the material of an Indian Rubber Pipe.
7. To create a desired potential drop in a potentiometer and then determine the emf of a given cell with the help of it.
8. To convert a given galvanometer into a voltmeter of given range and than calibrate it with help of an ammeter and standard resistance.
9. To determine the temperature of the filament of a torch bulb by studying the change of its resistance with current and known value of temperature coefficient of the material of the filament.
10. Determination of surface tension of water solutions of minerals or organic compounds using capillary method and study the variation of surface tension with concentration. (**Additional experiment for those Colleges having Star College Scheme).**

Minimum number of experiments to be completed by each student during the semester is seven.

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THIRD SEMESTER

PAPER: 301 (THEORY) Total Marks: 60
(a) MATHEMATICAL METHODS-III: Total Marks: 25

1. Properties of matrices, Transpose matrix, complex conjugate matrix, Hermitian matrix, special square matrix, unit matrix, diagonal matrix, co-factor matrix, adjoint of a matrix, self-adjoint matrix, symmetric matrix, anti-symmetric matrix, unitary matrix, orthogonal matrix, trace of a matrix, inverse matrix.
   12 Lectures
2. Eigenvalue problems, Cayley-Hamilton Theorem, Diagonalization of matrices.
   6 Lectures
3. Co-ordinate transformations, rotation in two dimensions, rotation in three dimensions.

   7 Lectures

(b) ELECTROSTATICS: Total Marks: 35

1. Electric field, Electric field due to a uniformly charged (a) wire, (b) ring, and (c) disc. **4 Lectures**
2. Divergence of Electric field, Gauss's law in integral and differential form, Applications of Gauss's law. Curl of an electric field, Electric potential, electric potential due to a uniformly charged - (a) wire, (b) ring, and (c) disc. Electric dipole, Potential and field due to a dipole, dipole in a uniform external electric field, dipole-dipole interaction. Multipole expansion of electrostatic potential due to a volume distribution of charge. **10 Lectures**
3. Electrostatic boundary conditions. Electrostatic energy: Energy of (a) an assembly of point charges, (b) uniformly charged sphere. Laplace's and Poisson's equations, boundary conditions and Uniqueness theorem, Solutions of Laplace's equation in one

dimension: Electric potential and intensity (a) inside an infinite parallel plate capacitor, (b) inside spherical capacitor, and (c) due to a long and uniformly charged conductingwire. **10 Lectures**

4. Method of electrical image with examples of (a) infinite grounded conducting plane and (b) grounded conducting sphere. **4 Lectures**
5. Dielectrics: induced dipoles, atomic polarisability, polar and nonpolar molecules, polarization. The electric field of a polarized object, bound charges, The electric field inside a dielectric, Gauss's law in the presence of dielectrics, Electric displacement, linear dielectrics, susceptibility, permitivity and dielectric constant, Clausius-Mossotti equation. **7 Lectures**

Suggested Books:

(a)

1. Introduction to Mathematical Physics, C.Harper (Prentice Hall of India).
2. Mathematical methods for physicists, Arfken and Weber (Academic Press, Harcourt India Private Ltd).
3. Mathematical Methods, M.C. Potter, J Goldberg (Prentice Hall of India).

(b)

1. Introduction to Electrodynamics - David J.Griffiths
2. Electrostatics and Magnetostatics - B.B.Laud

PAPER: 302 (THEORY) Total Marks: 60

(a) CURRENT ELECTRICTY: Total Marks: 45

1. Electric current density, continuity equation, Ohm's law, Applications of Kirchoff's law to solve electrical network problem, Kelvin double bridge for low resistance measurement, moving coil ballistic galvanometer and its sensitivity. **10 Lectures**
2. Electromagnetic induction: Self and mutual induction, coefficient of coupling, reciprocity theorem, self induction of a long solenoid, mutual induction of two solenoids, measurement of L and M using d.c. source and ballistic galvanometer.

10 Lectures

3. Transient growth and decay of current in LR, CR and LCR circuits, oscillatory discharge. Thermo electricity: Coefficients of thermo-emf, thermoelectric power.

8 Lectures

4. Alternating current: Generation of alternating current, Phasor (complex number method) method of analyzing a.c. circuits, current and potential across resistive, inductive and capacitive elements and their phase relationships, power factor, LR, CR and LCR (series and parallel) circuits, quality factor, resonance; Maxwell's LC bridge and Anderson's bridge. **10 Lectures**
5. Rotating magnetic field, a.c. motor, transformer, reflected impedance in transformer, use of transformer. **7 Lectures**

(b) MAGNETOSTATICS: Total Marks: 15

1. Magnetic field, Lorentz force, Cyclotron motion, cycloid motion, Biot-Savart law, Magnetic field due to a steady current in (a) straight conductor and (b) a circular coil.

Divergence and Curl of a magnetic field. **7 Lectures**

2. Ampere's circuital law: magnetic field due to a (a) long straight conductor and (b) an infinite solenoid carrying a steady current, Magnetic scalar and vector potential. Force and torque on a current loop in a uniform magnetic field, Current loop as a magnetic dipole. **8 Lectures**

Suggested Books:

(a)

1. Electricity and Magnetism - D.Chattopadhyay and P.C.Rakshit.
2. Electricity and Magnetism - Berkeley Series.

(b)

1. Electrostatics and Magnetostatics – B.B.Laud

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PAPER: 303 (PRACTICAL) Total Marks: 50

(One experiment should be performed in five hours)

1. To determine the horizontal component of earth's magnetic field using deflection and vibration magnetometer.
2. To determine the horizontal component of earth's magnetic field with the help of a tangent galvanometer and copper voltameter.
3. To determine the current flowing through an external circuit using potentiometer.
4. To compare the values of two given low resistances using a potentiometer.
5. To determine the internal resistance of a given cell using a potentiometer.
6. To study the growth and decay of current in an RC circuit for three different values of R. Compare the experimental values of time constant with theoretical values.
7. To determine the value of a given low resistance by drop of potential method using a meter bridge.
8. To determine the end correction of a meter bride and than to determine the specific resistance of the material of a given wire with help of the meter bridge using end correction.
9. To convert a given galvanometer into an ammeter of given range and than calibrate it with the help of a copper voltameter.
10. Preparation of a scientific and technical report on a given topic through internet browsing. (**Additional experiment for those Colleges having Star College Scheme**).

Minimum number of experiments to be completed by each student during the semester is seven.

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FOURTH SEMESTER

PAPER: 401 (THEORY) Total Marks: 60
(a) MATHEMATICAL METHODS-IV: Total Marks: 40

1. ***Differential Equations***: Second order linear differential equations, series method of solutions (Frobenius), Legendre's differential equations, Legendre's polynomial, Hermite's differential

equations, Hermite's polynomial, generating function, spherical harmonics, orthogonal properties & recurrence relations. **25 Lectures**

2. ***Probability theory***: Mutually exclusive events, theorem of total probability, compound events and theorem of compound probability. Probability distributions -Gaussian distribution, mean and standard deviation. **15 Lectures**

(b) INTRODUCTON TO COMPUTER AND COMPUTER PROGRAMMING:
Total Marks: 20

1. Functional organisation of a digital computer-CPU, memory, input/output unit. Flowcharts, Algorithms, High level Computer languages, programming in one high level language (eitherFORTRAN-95 or C or C^{++}). Data types, different types of variables, important commands, I/O statements, relation and logical statements, transfer statements, string manipulation, subscripted variables, Functions and subroutines. **20 Lectures**

Suggested books:

(a)

1. Introduction to Mathematical Physics, C.Harper (Prentice Hall of India).
2. Mathematical methods for physicists, Arfken and Weber (Academic Press,
3. Harcourt India Private Ltd).
4. Mathematical Methods, M.C. Potter, J Goldberg (Prentice Hall of India).

(b)

1. Programming with C – B. Gotterfield
2. Understanding Fortran 77 – M. Boillot
3. Fundamentals of Computer – V. Rajaraman
4. Introductory methods of Numerical Analysis – S. Sastry
5. Let us C – Kenetkar

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PAPER: 402 (THEORY) Total Marks: 60
(a) WAVE OPTICS: Total Marks: 40

1 ***Interference*****:** Concept of light wave and its equation, complex representation of superposition of waves, meaning of coherence, to show that interference fringes are hyperbolic in general, condition for straight fringes, Stokes' law, interference due to Fresnel's biprism, interference by a plane parallel film, wedge shaped film, colour of thin film, Newton's rings, Michelson interferometer and its application for finding difference in wavelengths. **15 Lectures**

2 ***Diffraction*****:** Difference between Fresnel and Fraunhofer classes, half-period zones and strips, Zone plate and its lensing property, diffraction at a straight edge and at a circular aperature (with reference to microscope), Fraunhofer diffraction due to a single slit, double slit and transmission gratng, wavelength measurement by the plane transimission grating, resolving power of a grating, theory of concave grating. **15 Lectures**

3 ***Polarisation*****:** Double refraction, optic axis and $CaCO_3$ crystal, plane, circular and elliptically polarised light, Retarding plates and their uses for producing and analysing different polarised light, specific rotation of plane of polarisation and half-shade polarimeter. **10 Lectures**

(b) SPECIAL THEORY OF RELATIVITY: Total Marks: 20

1. ***Formulation of Special Theory of Relativity and Relativistic Kinematics***: The need for a new model of kinematics (relativity). Electromagnetism and null result of Michelson-Morley experiment, negation of ether concept. Postulates of special theory of

relativity. Galilean transformation (Newtonian kinematics) and Lorentz transformation. Application of Lorentz transformation,. Length contraction, time dilation and their examples and application to physical situations (viz. muon decay). Relativistic transformation of velocity. Relativistic Doppler Effect and twin paradox. **12 Lectures**

2. ***Relativistic Momentum and Energy, Space-time:*** Relativistic momentum and energy. Equivalence of mass and energy. Massless particles (i.e. photons). The geometry of space-time and space-time interval. Time-like and space-like events .Concept of four-vectors and Minkowski space. 8 **Lectures**

Suggested Books:

(a)

1. Light – K.G. Mazumdar
2. A Text book of Light- B Gosh and K G Mazumdar.
3. Geometrical and Physical optics – P.K. Chakraborty
4. Optics – A. Ghatak
5. Optics – E Hecht

(b)

1. Concept of Modern Physics-A. Beiser 2002 or later editions.
2. An introduction to Mechanics- D Klppner and R J Kolenkow 1987 or later editions.
3. The Feynan Lectures on Physics Volume- R P Leighton and M Sands 1997 or later editions.

PAPER: 403 (PRACTICAL) Total Marks: 50
(One experiment should be performed in five hours)

1. To adjust and focus the given spectrometer using Schuster's method and then determine the refractive index of the material of the prism.
2. To determine the width of a single slit by observing the diffraction pattern of monochromatic light.
3. To determine the focal length of two lenses and their combination by displacement method.
4. To determine he wavelength of light emitted by a monochromatic source with the help of Newton's ring arrangement.
5. To study the variation in liquid column height with diameter of capillary tube and determine the surface tension of the liquid.
6. To determine the value of acceleration due to gravity using Katter's Pendulum.
7. To determine the magnifying power of a telescope by angular method and compare this value obtained by linear method.
8. To study the variation of optical rotation with concentration for sugar solution using polarimeter and Sodium light and hence determine the specific rotation of sugar.
9. To determine resolving power of a plane transmission grating.
10. To study the variation of absorption of light with the concentration of an organic solution using spectrophotometer (**Additional experiment for those Colleges having Star College Scheme**).

Minimum number of experiments to be completed by each student during the semester is seven.

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FIFTH SEMESTER

PAPER: 501 (THEORY) Total Marks: 60
(a) MATHEMATICAL METHODS-V: Total Marks: 30

1. Algebraic operation, Argand diagram, vector representation, complex conjugate, Euler's formula, De-Moiver's theorem. **5 Lectures**
2. Analytic function of a complex variable, Derivative of F(z) and its analyticity, contour integrals, equivalent contours, Cauchy integral theorem, differentiation under integral sign. **13 Lectures**
3. Series expansion: Taylor and Laurent series and their simple applications. Residues, Zeros, isolated singular points, evaluation of residues. Evaluation of definite intragrals. **12 Lectures**

(b) CLASSICAL MECHANICS: Total Marks: 30

1. Central force motion, two body central force motion, two body motion as a one body problem, general properties of central force motion, Energy and momentum as constants of motion in central force, Energy equation involving only the radial motion, energy diagram and nature of orbits. **8 Lectures**
2. Application of central force problem to motion under inverse square force field, solution of the equation of the path to find the nature of the orbits as hyperbolic, parabolic and elliptic. **8 Lectures**
3. Constraints, generalized co-ordinates, principle of virtual work, D' Alembert's principle and Lagrange's equations of motion, simple applications of Lagrangian formulations (i) Atwood machine (ii) simple pendulum (iii) Keplerian motion (iv) bead sliding on rotating wire.(v)compound pendulum,(vi)linear harmonic oscillator Hamilton's principle, calculus of variation, shortest distance between two points as example, Lagrange's equations from Hamilton's principle, Hamiltonian of a system, Hamilton's canonical equations of motion, applications of Hamilton's equations to simple problems like simple pendulum, Kepler's problem., Poisson brackets. **14 Lectures**

Suggested books:

(a)

1. Introduction to Mathematical Physics, C. Harper (Prentice Hall of India).
2. Mathematical methods of physicists, Arfken and Weber (Academic Press, Harcourt India Private Ltd).
3. Mathematical Methods, M.C. Potter, J Goldberg (Prentice Hall of India).

(b)

1. Classical Mechanics, S.N. Biswas (Books and Allied (P) Ltd).
2. Classical Mechanics, H. Goldstein (Narosa Publishing House).
3. An Introduction to Mechanics, Kleppner and Kolenkow (Tata McGraw- Hill).
4. Introduction to Classical Mechanics, Takwale and Puranik (Tata McGraw-Hill).
5. Classical Mechanics A modern Perspective, Barger & Olsson (McGraw Hill International).

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PAPER: 502 (THEORY) Total Marks: 60
ATOMIC PHYSICS: Total Marks: 60

1. ***Positive rays and their analysis:*** Thomson's mass parabola method; Aston's mass spectrograph, Bainbridge mass spectrograph. **10 Lectures**
2. Rutherford's nuclear atom model, alpha scattering expt; deduction of the scattering formula. **8 Lectures**
3. ***Atomic spectra:*** Bohr's theory of hydrogen spectra; energy level diagram; Ritz combination principle; resonance, excitation, critical and ionization potentials; fine structures of the spectral lines; Sommerfeld's extension of the Bohr's theory. **12 Lectures**
4. ***Vector atom model :*** Spectra of alkali atoms; Bohr magneton; spinning electron; quantum numbers; Pauli's exclusion principle; explanation of the periodic classification of the elements; spectroscopic notations; source of radiation in external fields- normal Zeeman effect; anomalous Zeeman effect; Paschen-Back effect; Stark effect; Stern-Garlach experiment. **15 Lectures**
5. ***X-rays:*** *C*ontinuous and characteristic X-rays Mosley's law, Compton effect. **8 Lect.**
6. ***Scattering of light:*** Rayleigh scattering formula; colour of the sky; polarisation of the scattered light; Raman effect, experimental study of Raman effect, quantum theory of Raman effect, application of the effect. **7 Lectures**

Suggested Books:

1. Atomic Physics – John Yarwood
2. Concept of Modern Physics – A. Beiser
3. Atomic and Nuclear Physics – S. N. Ghosal

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PAPER: 503 (THEORY) Total Marks: 60
(a) QUANTUM MECHANICS: Total Marks: 40

1. Development of quantum mechanics in light of Black body radiation, failure of classical idea, Plank's quantum hypothesis, photoelectric effect and Compton effect. **5 Lectures**
2. Matter wave: Wave particle duality, de Broglie wave associated with moving particles-(i) non relativistic and (ii) relativistic case, verification of matter waves by (i) Davisson Germer's experiment and (ii) G.P. Thomson's electron diffraction experiment. **8 Lectures**
3. Complimentary principle of Neils Bohr, Heisenberg's Uncertainty Principle, Gamma ray microscope experiment, application of Uncertainty Principle. **7 Lectures**
4. Wave function and its probabilistic interpretation as probability amplitude; Continuity equation, probability density and probability current density J; Normalisation condition and normalised wave function; properties of well behaved wave function in quantum mechanics. Wave packets, Superposition of waves, phase velocity and group velocity and their relation. **8 Lectures**
5. Introduction to operator formalism, Dynamical variable as operator (position, momentum and Hamiltonian), Eigenvalues and eigenfunction; Expectation value, Ehrenfest's theorem. Schrodinger wave equation – (i) time dependent and (ii) time independent.. Correspondence Principle. Application of Schrodinger's wave equation –(i) one dimensional step potential (ii) one dimensional potential barrier, Reflection and transmission coefficients and tunneling effect, (iii) a particle in a one dimensional potential well of infinite depth (iv) one dimensional harmonic oscillator.(v) Theory of hydrogen atom- separation of variables, radial solution. **12 Lectures**

(b) ASTROPHYSICS: Total Marks: 20

1. ***Astrophysical Co-ordinates****:* Celestial coordinate systems, The right Ascension, Declination and Altitude-Azimuth coordinate systems. The ecliptic and annual motion of

the Sun across the sky the Signs of Zodiac. Identifications of the Constellations and bright stars. **5 Lectures**

2. ***Concept of time*:** Sidereal time and solar time; Greenwich Mean Time(GMT), standard time and local time; Julian date and its importance in astronomical observation.**5 Lectures**
3. ***Stellar Magnitude system and Distance measurement***: The Stellar magnitude system and its relation with luminosity. Apparent and absolute magnitude and their relations with distances. Trigonometric and spectroscopic parallax to determine the distances. Difference magnitude systems. **5 Lectures**
4. ***Spectral Classification and H.R. Diagram*:** Spectral classification, color index, H-D classification. The H-R Diagram. Steller evolution and the evolutionary track of a star. **5 Lectures**

Suggested Books:

(a)

1. Perspectives of Modern Physics-Beiser A. (1969)
2. Introduction to the Quantum Theory- Park D. (1974)
3. Theory and Problems of QUANTUM MECHANICS - Schaum Series
4. Introduction to the Quantum Mechanics-Griffiths D.J.
5. Classical Mechanics-N.C. Rana and P.S. Joag.

(b)

1. Introduction to Astrophysics – H.L. Duorah & Kalpana Duorah
2. ASTRONOMY – a Self Teaching Guide – Dinah L. Moche
3. Sky Atlas-2000.0 - Wil Tirton (Cambridge, 1981)
4. University Astronomy – JM Pasachoff and ML Kutner

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PAPER: 504 (THEORY) Total Marks: 60

ELECTRONICS: Total Marks: 60

1. Volt-ampere relation of P-N junction diode (deduction not necessary), Energy band diagram of P-N diode, photo diode, LED, varactor diode and zener diode. Rectifiers- half wave and full wave with resistive load, efficiency, ripple factor, filters- series inductor, shunt capacitor, L-section and Π-section. Voltage regulation and regulated Power Supply. Clipping and clamping circuits. **8 Lectures**
2. Thevenin, Norton and Millman theorem & maximum power transfer theorem. **6 Lectures**
3. Transistor, different mode of operations and characteristics of transistor, basic transistor amplifier, load line and operating point (Q point) of transistor, Stabilization of Q point, transistor biasing circuits, two port (four terminals) device and z, y and h parameters, h parameter equivalent circuit, analysis of transistor amplifier (CE) with h parameters, current gain, voltage gain and power gain, input and output impedance, Classification of amplifiers, Class A, Class B and Class C amplifiers, cascade amplifiers, small signal RC coupled amplifier (CE) and its voltage and current gain in low, mid and high frequency, frequency response curve, Phase relation between input and output, Power amplifiers, power dissipation, Harmonic distortion, large signal Push Pull Amplifier (Class B). **14 Lectures**
4. Concept of feedback, different types of feedback, advantages of negative feedback in amplifier, Barkhousen criterion, classification of oscillators, tuned collector oscillator, Phase shift(R-C) and Wein bridge oscillator, Multivibrators. **7 Lectures**
5. Direct Coupled Amplifier, differential amplifier, introduction to IC, OPAM, characteristics of an ideal OPAM, common and differential mode, CMMR, inverting, non-inverting mode of OPAM, OPAM as scale changer, adder, subtractor, differentiator

and integrator. **6 Lectures**

6. Modulation, need of modulation, Theories of AM and FM, side-bands, power content in different parts of the modulated wave, band-width of AM and FM, modulators, amplitude modulation circuits, circuit of square law modulation and detection, SSB transmission, AM Transmitter (block diagrams), super heterodyne receiver (block diagram). Introduction to radio wave propagation, ground or surface wave, space or tropospheric wave and sky wave. Working and uses of CRO, Introductory idea of microprocessor. **12 Lectures**
7. Binary Number System, Decimal to binary conversion, Binary to decimal conversion, Binary addition and subtraction**.** OR, AND, NOT, NOR and NAND Logic gates using P-N junction diode and transistors, Boolean Algebra, De Morgan's Theorem, Sequential circuits, Latch, RS, JK, MSJK, D and T flip flops. Introduction to binary transmission ASK, FSK and PSK. **7 Lectures**

Suggested Books

1. Basic Electronics – B.L. Thereja
2. Electronics fundamentals and applications –D. Chattopadhyay and P.C. Rakshit
3. A Text Book Of Electronics –S.L. Kakani & K.C. Bhandari

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PAPER: 505 (PRACTICAL) Total Marks: 75

(One practical should be performed in the examination from the following list in six hours)

1. To study the hydrogen spectrum by using plane transmission grating and spectrometer and hence determine the Rydberg constant.
2. To draw the characteristic curve of a photo cell and find the maximum velocity of the emitted electrons.
3. To determine the value of Planck's constant with the help of photo cell a monochromatic filter.
4. To determine the value of Stefan's constant by electrical method using an incandescent electric bulb.
5. To calibrate a spectrometer with spectral lines of known wavelength and hence determine unknown wavelength of spectral lines emitted by a given source.
6. To study the variation of refractive index of the material of a prism with known wavelengths of spectral lines of a source and hence determine the unknown wavelength of a spectral line emitted by a source.
7. To determine the wavelength of a monochromatic light emitted by given source using a biprism.
8. To determine he boiling point of the given liquid with the help of a Platinum Resistance thermometer.
9. To construct & calibrate a thermocouple and hence determine the melting point of a solid.
10. Draw a calibration curve for the variation of ionic conductivity of a solution with the pH value and then determine the ionic conductivity of a solution for a given pH value of the solution from the calibration curve. (**Additional experiment for those Colleges having Star College Scheme**).

Minimum number of experiments to be completed by each student during the semester

is seven.

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PAPER: 506 (PRACTICAL) Total Marks: 75

(One practical should be performed in the examination from the following list, in six hours)

1. To assemble and study the frequency response of an OPAMP in inverting negative feedback mode for three different feedback resistances and hence calculate upper half power point and band width. .(Using Breadboard).
2. To study the transfer characteristic of an OPAMP in negative feedback mode for different feedback loop.(Using Breadboard).
3. To verify De Morgan's theorem using IC 7400 and 7402. (Using Breadboard).
4. To study the input and output characteristics of a transistor in CB and CE configurations and determine the alpha and beta of the transistor.(Using Breadboard).
5. To measure the phase difference between the signal across R and C of an RC network using CRO and hence find the value of the resistor and frequency of the signal source. (Using Breadboard).
6. To draw the frequency response curve of RC coupled common emitter amplifier and hence determine 3dB points and band width. (Using Breadboard).
7. To trace the output wave form of a free running multivibrator for three different frequencies using CRO and hence measure the width of the output pulses and compare them ith theoretical values. (Using Breadboard).
8. To assemble (a) OR, (b) AND, (c) NOT and (d) NAND gate with resistance, diode and transistors using bread board and verify their truth table. (Using Breadboard).
9. To draw the forward bias characteristic of a semiconductor diode and the reverse bias characteristic of a Zener diode and hence determine their DC and AC resistances. Also determine the breakdown voltage of the Zener diode (Using Breadboard).
10. Using Excel package draw graph, π diagram and histogram of a given sample of data. **(Additional experiment for those Colleges having Star College Scheme).**

Minimum number of experiments to be completed by each student during the semester is seven.

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SIXTH SEMESTER

PAPER 601 (THEORY) Total marks: 60

NUCLEAR PHYSICS: Total marks: 60

1. ***Nuclear forces and Stability of Nuclei*:** Concept of packing fraction and binding energy, binding energy curve and its significance. Nucleon-nucleon forces – qualitative discussions on nuclear force. Brief outline of Yukawas meson theory, Nuclear stability, neutron proton ratio in stable nuclei, stability curve, odd-even rules of nuclear stability. **8 Lectures**
2. ***Alpha decay*:** Cause of alpha decay, basic α-decay process, range and energy of α-decay, α-decay systematics, Geiger Nuttle rules, Qualitative discussion on the theory of α-decay. **6 Lectures**
3. ***Beta-decay*:** Types of β-decays, conditions of β^+ & β^- decay and K capture, β-ray

spectrum, Pauli's neutrino hypothesis. **5 Lectures**

4. ***Gamma-rays:*** γ-rays and their origin. Interaction of γ-particle with matter. **2 Lectures**
5. ***Nuclear models*****:** Evidence in favour of liquid properties of nuclei, Liquid drop model, Bethe-Weisackar's mass formula. Applications of mass formula – estimation of fission energy, prediction of most stable member of an isobaric family. Shell model (Basic concepts only). **8 Lectures**
6. ***Nuclear Reactions*****:** Types of nuclear reactions, conserved quantities of nuclear reaction, energies of nuclear reaction – Q-value & its experimental determination. Exoergic & endoergic reactions. Cross-section of nuclear reaction and its unit. Nuclear fission and chain reaction, critical size, controlled chain reaction and basic principle of nuclear reactor. Nuclear fusion reaction – basic concepts of fusion reactions, fusion barrier, fusion and thermonuclear reactions (PP chains only). **15 Lectures**
7. ***Accelerators*****:** Necessity of charge particle acceleration – construction and working principle of linear accelerator. Construction and working principle of a cyclotron. **5 Lectures**
8. ***Detectors*****:** Principles of detection of charge particles. Construction and working principle of gas filled detectors. Ionization chamber – its construction & working principle. **5 Lectures**
9. ***Cosmic rays*****:** Origin of cosmic rays, primary & secondary cosmic rays and their composition. The East West effect. Latitude, longitude & altitude effect, Extensive Air Shower (EAS). **6 Lectures**

Suggested Books:

1. The Atomic Nucleus - R. D. Evans
2. Concept of Modern Physics -y A. Beiser
3. Nuclear Physics -S. N. Ghosal
4. Introductory Nuclear Physics - K. S. Krane
5. Nuclear physics - I. Kaplan
6. Atomic & Nuclear Physics - A. B. Gupta & D. Ghosh
7. Atomic & Nuclear Physics

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PAPER: 602 (THEORY) Total marks: 60

(a) MATHEMATICAL METHODS: Total marks: 15

Introduction to tensor, transformation of coordinates, contravariant and covariant tensor, tensorial character of physical quantities, symmetric and antisymmetric tensors, kronecker delta. Rules for combination of tensors- addition, subtraction, outer multiplication, contractions and inner multiplications. **15 Lectures**

(b) SOLID STATE PHYSICS: Total Marks: 45

1. The idea of amorphous and crystalline solids, The crystal lattice and translation vectors, unit cell, types of crystal lattice, Miller indices, diffraction of X-rays, use of Bragg's law to the determination of lattice constants. **10 Lectures**
2. The different types of crystal bonding: ionic, covalent, metallic, Van der Waal and hydrogen bondings, cohesive energy of ionic crystal, Madelung constant. **5 Lectures**
3. Free electron theory of metals, Boltzmann's equation of state, electronic specific heat, electrical and thermal conductivity of metals, Wiedemann-Franz law.(Quantum Mecanical treatment to be used).Bloch theorem in one dimension, Kronig-Penny

model of energy bands of solids, distinction among metal, insulator and semiconductor, intrinsic and extrinsic semiconductors (qualitative discussion only). **15 Lectures**

4. Introductory concept of superconductivity, Meissner effect, types I and type II superconductors. **5 Lectures**
5. Magnetic properties of solids: Magnetization, magnetic intensity, magnetic susceptibility, permeability, hysteresis, B-H curve and energy loss in hysteresis, different classes of magnetic material, magnetic moment, Bohr magneton, Larmor precession, Classical theory of paramagnetism(Langevin's theory and Curie law), Weiss theory(Quantum Mecanical treatment to be used), relation between para and ferromagnetism, Ferromagnetic domain. **10 Lectures**

Suggested Books

(a)

1. Introduction to Mathematical Physics, C. Harper (Prentice Hall of India).
2. Mathematical methods of physicists, Arfken and Weber (Academic Press, Harcourt India Private Ltd)
3. Mathematical Methods, M.C. Potter, J Goldberg (Prentice Hall of India).

(b)

1. Introduction to Solids by L.V. Azarof
2. Introduction to Solid State Physics by C.Kittel
3. Solid State Physics by A J Dekker
4. Solid State Physics by S O Pillai

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PAPER: 603 (THEORY) Total Marks: 60

(a) MODERN OPTICS: Total Marks: 40

1. ***Optics of crystals:*** Wollaston prism, Rochon prism, Jones calculus, Interference of polarized light: interference due to crystal plates in plane polarised light, Babinet compensator. Principle of liquid crystal display. **8 Lectures**
2. ***Lasers:*** Characteristics of laser light, absorption Spontaneous emission, Stimulated emission, Einstein coefficients, Population inversion and light amplification, Essential components of the laser, Ruby and He-Ne laser (principles only). Elementary idea about non-linear optics: Second Harmonic Generation. **10 Lectures**
3. ***Holography:*** Formation of a hologram, Reconstruction of the hologram (mathematical aspect). **6 Lectures**
4. ***Optical Fibers:*** Types of fibers; propagation of a ray through step index fiber: numerical aperture, multipath dispersion; propagation through graded index fiber. Basic idea about communication through an optical fiber cable (Block diagram). **10 Lectures**
5. ***Optical components & Spectrographs:*** Ramsden and Huygen's eyepieces, oil immersion objective, Prism spectrograph (Glass and quartz), Grating spectrograph. **6 Lectures**

(b) ELECTROMAGNETIC THEORY: Total Marks: 20

1. Electromagnetic field equation in integral and differential form, displacement current, Maxwell's equations, Energy Conservation Law-Poynting theorem and Poyntingvector. **6 Lectures**
2. Electromagnetic wave equation, velocity of electromagnetic wave, Monochromatic plane wave equation in free space and conducting medium. Reflection and Refraction of plane electromagnetic wave for normal and oblique incidence, Snell's law, reflection and transmission co-efficient, Fresnel's equations, Polarisation of

electromagnetic wave, linear, circular and elliptical polarization, Brewster's law. **14 Lectures**

Suggested books:

(a)

1. Optics -A Ghatak.
2. Optical Communication System-J. Gower.
3. Laser and Non linear optics – B.B. Laud
4. Optoelectronics and fiber optic communication – C.K. Sarkar and D.C. Sarkar

(b)

1. Electrodynamics by Griffith
2. Electricity and Magnetism by Laud

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PAPER: 604 (THEORY) Total Marks: 60

(a) STATISTICAL MECHANICS: Total Marks: 30

1. Statistical system, and its coordinates, specification of a state in statistical mechanics, Macrostate and microstate, phase space, ensemble, Boltzmann entropy relation, ergodic hypothesis, postulate of equal a priori probability, density of phase points in phase space, Liouville' theorem. **8 Lectures**
2. Symmetry of wavefunction, restriction regarding the number of particles in given state, different types of statistics- Maxwell-Boltzmann(MB), Bose-Einstein(BE) and Fermi-Dirac(FD) Statistics, Most probable distribution relation in MB, BE and FD statistics and their comparison. Degeneracy Factor, Density of state. **7 Lectures**
3. Application of MB statistics to derive Maxwell distribution law (velocity, energy, momentum and frequency). **5 Lectures**
4. Fermi energy and Fermi temperature, Fermi distribution function, Application of FD statistics to discuss electronic specific heat. **5 Lectures**
5. Application of BE statistics to explain BE condensation and to derive Black body radiation formula. **5 Lectures**

(b) COMPUTER APPLICATIONS: Total marks: 30

1. Programming exercise (either FORTRAN-95 or C or C^{++}): simple mathematical series generation and summation, sorting of numbers largest of n numbers, sorting a list ascending/descending order, solution of quadratic equation, solution of simultaneous linear equation, least square graph fitting (straight line and quadratic curve) of given data, iterative methods, implementation of Runge-Kutta 4^{th} order method of solving differential equation and Simpson's rule for integration. **30 Lectures**

Suggested Books:

(a)

1. Statistical Mechanics- B.K Agrawal and M. Eisner
2. Statistical Mechanics- R.K.Pathria

(b)

1. Programming with C – B. Gotterfield
2. Understanding FORTRAN 77 – M. Boillot
3. Fundamentals of Computer – V. Rajaraman
4. Introductory methods of Numerical Analysis – S. Sastry
5. Let us C – Kenetkar

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PAPER: 605 (PRACTICAL) Total Marks: 75

(One practical should be performed in the examination from the following list, in six hours)

1. To study variation of potential drop with frequency across the inductor, capacitor and non-inductive resistor of a series LCR circuit for an ac signal and hence find the resonant frequency. Compare it with theoretical value.
2. To determine the Q- factor of a series resonance circuit containing L C and R for three different values of R.
3. To determine the value of `J' (the mechanical equivalent of heat) by Callender and Bern's method.
4. To determine the value of self-induction of a coil with the help of Anderson's Bridge.
5. To determine the constant of a ballistic galvanometer by using a capacitor charged to a known potential difference.
6. To study the ripple factor of a half-wave and full-wave rectifier using semiconductor diode and L and Π section filter.(Using Breadboard).
7. To measure the phase difference between he sgnal accros R and C of an R-C network using CRO and hence find the value of the resistor and frequency of the signal.
8. To determine the temperature coefficient of the material of a given wire.
9. To study the detection of the cosmic ray on the earth surface using G.M. counter. (**Additional experiment for those Colleges having Star College Scheme**).

Minimum number of experiments to be completed by each student during the semester is six.

PAPER: 606 (PROJECT AND COMPUTER PROGRAMMING) Total Marks: 75

(a) PROJECT: Total Marks: 40
(Experimental project work of any relevant topic within the syllabus of Physics, to be guided by a teacher and to be submitted along with a report)

(b) COMPUTER PROGRAMMING: Total Marks: 35

(One practical should be performed in the examination from the following list, in five hours)

1. To determine (a) mean, (b)standard deviation and (c)standard error of the given experimental data.
2. To analyse the supplied experimental data between two variables using least square straight line fitting programme.
3. To rearrange the supplied numerical data in ascending/descending order and find the largest/smallest number in a given list of numbers.
4. To solve for the two unknown variables in the given pair of simultaneous equations.
5. To find roots (real and distinct, real and repeated and imaginary) of a quadratic equation.

6. To generate Fibonacci numbers up to 200 and also to check whether the given number is a prime number.
7. To make a scientific presentation of procedure, data analysis and result of any one experiment from Paper-605 using power point.
8. Calculation of mean, mode, median, co-relation, regression, analysis of variance, χ-square of given data using Excel or SPSS. (Sample size should be large. It may be collected from internet). (**Additional experiment for those Colleges having Star College Scheme).**

Minimum number of experiments to be completed by each student during the semester is five.

Undergraduate Course Syllabus Under semester system

Physics General/Subsidiary

1. The undergraduate General/Subsidiary Course in Physics under the Gauhati University is a three year six semester Course. There are six university examinations during the course, the 1st semester, 2nd semester, 3rd semester, 4th semester, 5th semester and 6th semester held each at the end of every six months.
2. A student who wants to study Physics as General/Subsidiary Course subject should have also Mathematics as one of the Subsidiary Course subject.
3. A student pursuing a General/Subsidiary Course in Physics has to study two other subjects of General/Subsidiary Course (out of these two one should be Mathematics) during the first four semesters along with compulsory subjects English (during 1st and 2nd semester) and Environmental studies (during 2nd and 3rd semester). During last two semesters of the course a student has to study any one of the General/Subsidiary Course subjects studied during the first four semesters along with General/Subsidiary Course of Physics. The structure of detailed syllabus and total number of papers in each semester is given below.

Structure for General/Subsidiary Course under semester system:

Year	Sem	Subjects	**Total Marks (Physics)**	Total Marks (Electives)	**Total Credits (Physics)**	Total Credits (Electives)	Grand Total Credit(C)
1st	1st	**Physics**	**75**		**6**		
		Elective		75		6	
		Elective		75		6	
		English		50		4	
	2nd	**Physics**	**75**		**6**		