SECOND YEAR
Distribution of marks for the session 2013-2014 ; 2014-2015

Course Code	Course Title	Marks	Time In hours	Credits
PHYS-201	Mathematical Physics-II and Classical Mechanics-II (2+3) Questions	100	4	4
PHYS-202	Electricity and Magnetism (3+2) Questions	100	4	4
PHYS-203	Statistical Mechanics and Radiation (2+3) Questions	100	4	4
PHYS-204	Computer Fundamentals and Programming (5 Questions)	100	4	4
PHYS-205	Differential Equations and Applications (4 Questions)	50	3	2
PHYS-206	Mathematics-II (Differential Calculus, Integral Calculus and Special Functions) (4+4+2) Questions	100	4	4
PHYS-207	Chemistry-II (Organic Chemistry) (5 Questions)	50	3	2
PHYS-208	Physics Practical-II	150	12	6
PHYS-209	Computer Practical	50	6	2
PHYS-210	Sessional	75	-	3
PHYS-211	Viva-Voce	75	-	3
	Total	**950**		**38**

SYLLABUS

PAPER-PHYS 201: MATHEMATICAL PHYSICS-II AND CLASSICAL MECHANICS-II

(2+3) Questions x 20 **100 Marks** **4 hours** **4 Credits**

Mathematical Physics-II

1. Tensor Analysis: Coordinate Transformations, summation convention; contravariant, covariant and mixed tensors, Kronecker delta; Symmetric and skew-symmetric tensors; Fundamental operations with tensors; line element and metric tensor.

2. Complex variable: Graphical representation and polar form of complex number; roots of complex numbers; functions of complex variables, examples; analyticity and Cauchy-Riemann conditions; Cauchy's integral theorem; Taylor's series and Laurent's series; Residue and Residue theorem; Contour integration and its application to evaluation of integrals and series.

3. Partial Differential Equations: Second order constant coefficient equations, Euler's equations; separation of variables; waves equations; Heat conduction and diffusion equations; Laplace's equations.

Classical Mechanics-II

1. Two body central force problem: Equivalent one body problem, general features of central force motion; scattering in a central force field; center of mass and laboratory co-ordinates transformation of scattering problem to laboratory coordinates; Kepler's problems.

2. Hamiltonian equation of motion: Hamiltonian, Hamilton's Canonical equation of motion, physical significance of H, canonical equation from a variational principle, principle of least action.

3. Rigid bodies: Kinematics of rigid bodies, orthogonal transformations, Eulerian angles, caley-klein parameters, Infinitesimal rotation force-free motion, motion of a heavy symmetrical top.

4. Canonical transformation: Conditions for canonical transformation, infintesimal contact transformation, Poisson brackets, invariance of Poisson brackets with respect to canonical transformation, infinitesimal contact transformations interpretation in terms of Poisson brackets, Poisson brackets in Q. M., Lagrange's brackets, relation in Lagrange and Poisson brackets, Liouville's theorem.

5. Hamilton-Jacobi method: Solution of harmonic oscillator problem by Hamilton Jacobi-method, action angle variables.

6. Small oscillation: Normal coordinates, application to coupled oscillators, dissipative systems.

REFERENCES:

1. Goldstein — Classical Mechanics
2. Landau & Lifshitz — Classical Mechanics
3. Gupta & Kumar — Classical Mechanics
4. A. M. Harun-ar-Rashid — wPivqZ ejwe`¨v (Classical Mechanics in Bangla)
5. Spigel — Complex Analysis
6. Louis & Pipes — Applied Mathematics for Engineers & Physicsts
7. Arfken — Mathematical Physics
8. Rajput & Gupta — Mathematical Physics

PHYS 202: ELECTRICITY AND MAGNETISM

(3+2) Questions × 20 **100 Marks** **4 hours** **4 Credits**

Electricity

1. Electrostatics: Coulomb's law, electric field and potential due to discrete and continuous charge distributions, electric potential and potential energy, calculation of E from V; electric dipole; Gauss's law including its differential form and applications; Poisson's and Laplace's equations.

2. Capacitors and dielectrics: Capacitors and calculation of capacitance of different types of capacitors; dielectrics; dielectric polarisation and electric displacement, three electric vectors; dielectrics and gauss's law; capacitor with dielectric; energy stored in an electric field.

3. Current electricity: Classification of electric current; current and current density; resistance, resistivity and conductively; Ohm's law and the atomic view of resistivity; electromotive force, Kirchhoff's laws; Wheatstone's bridge; potentiometer.

4. Network theorems: Superposition, reciprocity, Thevenin's, Norton's, and the maximum power transfer theorem; and their applications.

5. DC circuits: LR, RC, LC and LCR Circuits' analyses and solution of problems related to those circuits.

6. AC circuits: Usage of imaginary quantities in the analyses of the circuits having ac source; LCR circuits in series and parallel combination with ac source; series and parallel resonant circuits; Impedance and admittance; phase and power; Q of a circuit; resonance ant anti-resonance; sharpness of resonance, selectivity.

(**35 Lectures**)

Magnetism

1. Magnetic field: The magnetic flux, field and potential; magnetic moment; magnetic forces; magnetic field intensity; magnetic force on a current; torque on a current loop; magnetic dipole and its moment and potential energy.

2. **Mangetic field and interaction:** Motion of a charged particle in constant uniform electric and magnetic fields (Lorentz force); Ampere's circuital law, Biot-Savart law, and their applications; moving coil galvanometer; dead-beat and ballistic galvanometers.

3. Electromagnetic induction: Faraday's laws of electromagnetic induction; Lenz's law; self and mutual inductances; energy stored in a magnetic field; transformer, electric generators, and motors.

4. Magnetic Properties of Matter: Magnetization; Gauss' law for magnetism; magnetic permeability and susceptibility; magnetic scalar and vector potentials; magnetic hysterisis; paramagnetism, diamagnetism, and ferromagnetism.

(**25 Lectures**)

REFERENCES

1.	Hoq, Rafiquallah & Roy	Concept of Efectricity & Magnetism
2.	K. K. Tewari	Electricity and Magnetism with Electronics
3.	D. N. Vasudeva	Electricity and Magnetism
4.	Wazed Mia	Fundamentals of Electromagnetism
5.	Edminister	Electric Circuits
6.	A. M. H Rashid	we`y¨r Pz¤^KZ¡ (Electromagnetism in Bangla)

PHYS 203: STATISTICAL MECHANICS AND RADIATION

(3+2) Questions x 20 **100 Marks** **4 hours** **4 Credits**

Statistical Mechanics

1. **Introduction:** Phase space**;** density distribution in phase space; Liouville's theorem; Ensembles: microcanonical, cannonical and grand canonical ensemble; ensemble average; use of the ensembles.
2. **Statistical system:** Microstates, macrostates and thermodynamic probability; thermodynamic functions and their equilibrium conditions.
3. **Classical Statistics:** Entropy and probability; Maxwell-Boltzmann statistics and their applications; the partition functions; derivation of partition functions for ideal gas; monatomic ideal gas; the principle of equipartition of energy; specific heat capacity of a di-atomic gas; specific heat capacity of solids; statistical theory of paramagnetism.

4. **Quantum statistics:** Cells and Quantum states; the harmonic oscillator; the Bose-Einstein statistics; statistics of a photon gas; Black-body radiation and the Planck radiation formula.
5. **Bose-Einstein Statistics**: Energy and pressure of the gas; gas degeneracy; phonon; Bose-Einstein condensation; thermal properties of Bose-Einstein gas; liquid Helium.
6. **Fermi-Dirac Statistics**: Velocity, speed and energy distribution functions; degenerate Fermi gas, Fermi energy and low temperature limit, theory of white dwarf stars. **(35 Lectures)**

Radiation

1. **Introduction:** Properties, nature and sources of radiation; electromagnetic wave spectrum.
2. **Thermal radiation:** Concepts of black body radiation; emissive power, absorptive power, reflecting power, transmitting power; relation between emissive power and absorptive power; white body, real surface and the grey body; Radiation laws: Kirchhoff's law and its derivation, Stefan-Boltzman law and radiation pressure, Wien's law, Rayleigh Jean's law and Planck'a law.
3. **Solar radiation:** Solar, terrestrial and atmospheric radiation; structure of the sun; spectrum of the Sun; temperature of the sun; Solar parameters; Solar constant and measurement; Equilibrium temperature.
4. **Measurement of radiation**: Radiation pyrometers. **(25 Lectures)**

REFERENCES

1. Kerson Huang — Statistical Mechanics
2. A Beiser — Concept of Modern Physics
3. F. Mandol — Statistical Physics
4. Landau & Lifshitz — Statistical Physics
5. Patharia — Statistical Physics
6. Sears and Sallinger — A text book on Heat, Thermodynamics and statistical Mechanics.
7. Saha & Srivastava — A Treatise on Heat
8. Tofazzal Hossain — A Text book dfon Heat
9. Zemansky & Dittman — Heat & Thermodynamics
10. Frank Kreth — Heat Transfer
11. Donald R. Pitts — Heat Transfer

PHYS 204: COMPUTER FUNDAMENTALS AND PROGRAMMING

5 Questions x 20 **100 Marks** **4 hours** **4 Credits**

1. **Computer Arithmetic**: Number systems, conversion of numbers, Integer and Floating point representation, Data representation and Code: BCD, ASCII, GRAY, EBCDIC etc. Binary addition and subtraction with 1's and 2's complement.
2. **Basics of Digital Electronics**: Difference between analog & digital circuits, Logic gates: AND, OR, NOT, NAND, XOR, XNOR, Boolean Algebra, Combinational logic circuits, Half adder, Full adder. (Lectures)
3. **Computer Architecture and Peripherals:** Basic Organization of a computer, CPU, ALU, control unit and main memory, Generation and types of Computer; Data storage: primary and secondary memory, RAM, ROM, PROM, EPROM, EEPROM, magnetic tapes and disks, optical disks and CD-Rom; I/O devices: keyboard, mouse, joystick, scanner, OMR, Video Display Units: CRT monitor, LCD, different types of printers (9 Lectures).
4. **Computer software**: System and application software, Operating system: functions, Ideas on batch processing, real-time processing multi-programming and multi- processing, DOS, WINDOWS, LINUX etc. Application software for word processing, spreadsheet etc. Examples of Scientific Software.
5. **Computer Networks**: LAN, MAN, WAN, Different network topology, Internet and WWW, different protocols, emails.
6. **Introduction to Microprocessor**: Architecture, Fetch-execute cycle, Addressing modes, Instruction sets of Intel 8085/8086 microprocessor, Introduction to assembly language programming..
7. **Programming:** Algorithm, Flow chart, Editor, Compiler & Interpreter, Elements of Programming: constants, variables, data types, operators, expression, simple input/output programs, control statement, array, function/subroutines, files, Application in physical problems.

(60 Lectures)

REFENENCES:

1. Ralph M. Stair, Jr. — Computer in Today's world
2. Donald H. Sanders — Computers Today
3. Malvino and Brown — Digital Computer Electronics
4. Malvino and Leech — Digital Principles & Applications
5. M. N. Islam — Introduction to Computer Science
6. Byron S. Gottfried — Programming with C
7. Thomas R Hoffman — FORTRAN

PHYS 205: DIFFERENTIAL EQUATION AND APPLICATIONS

4 Questions x 12.5 **50 Marks** **3 Hours** **2 Credit**

1. Ordinary Differential Equations: Idea of differential equations and their solutions, initial value problems; First order equations: Separable, homogenous, exact and linear

equations, equations reducible to such forms, application of first order equations (growth, decay, chemical reactions etc.); Linear second order differential equations: Homogenous equations with constant coefficients, method of undetermined coefficients and variation of parameters.

2. Series solution of second order differential equations: Linear second order differential equations with variable coefficients, power series solution about an ordinary point, regular singular point and the method of Frobenius.

3. Legendre's Differential equation and Legendre Polynomials : Solution of Legendre's differential equation, Rodrigue's formula for the Legendre polynomials, Legendre's functions of second kind,The generating function for $P_n(x)$, Legendre coefficient,the orthogonality of $P_n(x)$, integrals for $P_n(x)$, Recurrence formula for $P_n(x)$.

4. Bessel's Differential equation: Series solution of Bessel's differential equation, Generating function for $J_n(x)$, integrals for $J_o(x)$ and $J_n(x)$, Recurrence formula for $J_n(x)$, Orthogonal properties of Bessel's functions. Bessel's function of second kind (Newman function), The modified Bessel's function.

PHYS 206: MATHEMATICS-II (DIFFERENTIAL CUALCULUS, INTEGRAL CALCULUS AND SPECCIAL FUNCTIONS)

(4+4+2)Questions x 10 **100 Marks** **4 hours** **4 Credits**

Differential Calculus

Function of real variable; Domain and ranges, Graphs of functions, limits and continuity; Differential of functions; successive differentiation; partial differentiation, statement of Rolle's theorem and Mean value theorem, Expansion in power series, Taylor's theorem, Indeterminate forms. Maxima and Minima; Tangents, normals pedal equation of plane curves, curvature of plane curves, Asymptote. (25 Lectures)

Integral Calculus

Indefinite integrals, Definition of definite Integral as the limit of sum, Definite integrals, elementary reduction formulae, Formulae for length of plane curves, plane areas and areas of surfaces of revolutions, volumes of solids of revolutions. (25 Lectures)

Special Functions

Beta and gamma function: Definition of beta and gamma functions; their properties, Evaluation of integrals using gamma functions. Hermite polynomials; Laguerre polynomials. (10 Lectures)

REFERENCES

1. J. Edwards — Calculus for Beginners
2. J. Edwards — Differential Calculus
3. J. Edwards — Integral Calculus
4. Das & Mukherjee — Integral and Differential Calculus
5. Mohammad & Bhattacherjee — Text Book on Differential and Integral Calculus
6. M.A. Jabbar — Text Book on integral Calculus
7. Granville — Calculus
8. M.A. Jabbar — Differential Calculus
9. Moqbul Hossain — cÖ‡f` I †hvRbx Kjb (Calculus in Bangla)

PHYS 207: CHEMISTRY-II (ORGANIC CHEMISTRY)

5 Questions x 10 **50 Marks** **3 hours** **2 Credits**

Organic Chemistry

1. Hybridization in organic compounds, Empirical and molecular formulae.

2. A general study of paraffins, olefins, acetylene, aldehydes. ketones, amines, alkalihalides, alcohol

3. General principles and application of organic reactions: Wurtz-Fittig, Manonic and acetoacetic, Friedel-Crafts reaction, Perkin's reactions, Aldol condensation, Benzoin condensation and Hoffman degradation. **(25 Lectures)**

REFERENCES

1. S.Z. Haider — Introduction to Modern Inorganic Chemistry
2. R.D. Madan — Modern Inorganic Chemistry
3. Cofton & Wilkinson — Basic Inorganic Chemistry
4. S.K.S. Hazari — mœvZK A‰Re imvqb (Inorganic Chem. in Bangla)
5. S. U. Ahmed & Latif Hossain — mœvZK A‰Re imvqb (Inorganic Chem. in Bangla)
6. A.K. S. Ahmed — A‰Re imvqb (Inorganic Chem. in Bangla)

PHYS 208: PHYSICS PRACTICAL-II

150 Marks **12 hours** **6 Credits**

Each student is to perform **one experiment of 6 hours** duration and **Two experiments of each 3 hours** duration.

Marks distribution:

(i) Class performance including lab. notebook	= 30
(ii) One experiment of 6 hours duration	= 60
(iii) Two experiments each of 3 hours duration (2x30)	= 60
Total	**= 150**

Marks distribution for the 6 hours experiment:

(i) Theory		= 10
(ii) Procedure+ Data collection	(10+14)	= 24
(iii) Calculation + Result		= 10
(iv) Discussion		= 06
(v) Experimental Viva		= 10
Total		**= 60**

Marks distribution for each of the 3 hours experiment:

(i) Theory		= 05
(ii) Procedure + Data collection	(5+7)	= 12
(iii) Calculation + Result		= 05
(iv) Discussion		= 03
(v) Experimental Viva		= 05
Total		= 30

LIST OF EXPERIMENTS

6 HOURS EXPERIMENTS

1. Determination of Logarithmic decrement of a Ballistic galvanometer & C.D.R.
2. Determination of Mutual inductance for varying distances between the coils.
3. Determination of capacitance of capacitors.
4. Calibration of an electromagnet: I-B curve.
5. Determination of temperature coefficients of a platinum resistance thermometer wire.
6. Determination of B-H curve of iron in the form of anchor-ring.
7. Determination of neutral temperature for a given thermocouple.
8. Comparison of electrostatic and electromagnetic units of capacitance.
9. Verification of the laws of combination of resistances.
10. Determination of the velocity of e. m. waves by Lecher wire.
11. Determination of Self inductance by Anderson's method.
12. Calibration of a voltmeter.
13. Calibration of an ammeter.

3 HOURS EXPERIMENTS

1. Determination of end corrections of a metre bridge wire and to find the specific resistances.
2. Determination of Galvanometer resistance by Half deflection method.
3. Determination of Galvanometer resistance by Kelvin's method.
4. Determination of Low resistance by Direct method.
5. Determination of low resistance by method of projection.
6. Determination of figure of merit of a galvanometer.
7. Determination of Self-inductance by Rayleigh's method.
8. Determination of high resistance.
9. To investigate the voltage current relationship for a simple inductive circuit and hence to determine the inductance of a coil.
10. To investigate the voltage current relationship for an a.c. capacitor circuit and hence to determine the capacitance.
11. To study the variation of capacitive and inductive resistances with frequency.

PHYS 209: COMPUTER PRACTICAL

50 Marks **6 Hours** **2 Credit**

Each student is to perform **two experiments each of three hours duration** in practical examination.

Marks distribution:

(i) Class performance including lab. Notebook	= 10
(ii) Two experiments each of 3 hours duration (2x20)	= 40
Total	**= 50**

Marks distribution of each experiment:

(i) Theory	= 3
(ii) Procedure + Data collection	= 8
(iii) Calculation / Result	= 2
(iv) Discussion	= 2
(v) Experimental Viva	= 5
Total	**= 20**

LIST OF EXPERIMENTS

1. Verification and design of AND, OR, NOT and XOR gates using NAND gates.
2. To convert a Boolean expression into logic gates circuit and assemble it using logic gate ICs.
3. To design a combinational logic circuit for a specified truth table.

4. Design of half adder and full adder.
5. Assembly language programming with 8085: addition and subtraction of numbers, multiplication by repeated addition.
6. Programming with C/ C++/ Fortran/Java and solving common problems like (i) solution of a quadratic equation (ii) Finding the highest and lowest from a set of numbers (iii) finding factorials (iv) generating different series like Fibonicci, a list of primes etc. (v) testing whether a given integer is prime.
7. Generating graph from computer using common software like MS Excel,

MATLAB, Microcalc, Harvard Graphics, Homer etc.