NATIONAL UNIVERSITY

Second Year Syllabus
Department of Physics

Four Year B.Sc Honours Course
Effective from the Session : 2013–2014

National University
Subject: Physics
Syllabus for Four Year B. Sc Honours Course
Effective from the Session: 2013-2014

Year wise Papers and marks distribution

SECOND YEAR

Paper Code	Paper Title	Marks	Credits
222701	Electricity & Magnetism	100	4
222703	Geometrical & Physical Optics	100	4
222705	Classical Mechanics	100	4
222706	Physics Practical-II	100	4
223707	Calculus-II	100	4
223708	Math Lab (Practical)	50	2
222807	⌠ General Chemistry-II	100	4
222809	⌡ Enviromental Chemistry	50	2
	Or		
223609	⌠ Methods of Statistics	100	4
223610	⌡ Statistics Practical-II	50	2
	Total=	700	28
221109	English (Compulsory)	100	Non-Credit

Detailed Syllabus

Paper Code	222701	Marks: 100	Credits: 4	Class Hours: 60
Paper Title:	**Electricity & Magnetism**			Exam Duration: 4 Hours

1. **Electric Charge:** Electromagnetism, Electric Charge, Conductors and Insulators, Coulomb's law, Charge is Quantized, Charge is Conserved.
2. **Electric Field:** The electric field strength, Lines of force, Electric field due to – a point charge, Electric dipole, charged disc, charged sheet, charged long wire, Electric dipole and quadrupole.
3. **Gauss' Law:** Flux, Flux of an Electric Field, Gauss' law, Coulomb's law from Gauss' law in electric field. Application of Gauss' law for symmetrical objects.
4. **Electric Potential:** Electric potential and electric potential energy, Equipotential surfaces, Potential due to a point charge, a group of point charges and dipole. Calculation of field strength from potential, Insulated spherical conductor, Electrostatic generator, Electrical images.
5. **Capacitor and Dielectrics:** Use of capacitors, Capacitance, Capacitors in parallel & in series, Capacitance- its calculation for parallel-plate, cylindrical and spherical capacitors, Dielectric- an atomic view, Dielectric and Gauss's law, parallel plate capacitor with dielectric, electric vectors, Energy stored in an electric field.
6. **Current and Resistance:** Moving charges & electric current, Current and current density, Drift speed and charge carrier, Resistance, Resistivity and Conductivity, Ohm's law, Resistvity- an atomic view, Energy transfer in an electric circuit, Power in electric circuits, Semiconductors, Superconductors.
7. **Electric Circuits:** Work, Energy & electromotive force, Potential difference, Kirchhoff's laws, Current in single & multiloop circuits, Potentiometer, Wheatstone bridge, RC circuits.
8. **Magnetic Field:** Magnetic induction, Magnetic force of a current, Torque on a current loop, Moving coil galvanometer, Ammeter, Voltmeter, Hall effect, Circulating charge, Thompson's experiment.
9. **Ampere's Law and Biot-Savart Law:** Ampere's law and application such as calculation of magnetic induction near a long wire, inside a current carrying cylindrical wire, inside a solenoid, two parallel plate conductors, Bio-Savart law and its application.
10. **Electromagnetic Induction:** Faraday's laws of electromagnetic induction, Lenz's law, Induction- a quantitative study, Self and mutual inductance and calculation of self inductance, LR circuit, Energy stored in a magnetic field, Magnetisaton, B-H curve.
11. **Magnetism of Matter:** Gauss' law for magnetic fields, Magnetism ,Different magnetic material, induced magnetic field, Displacement current, Maxwell's equations.
12. **Electromagnetic Oscillations:** LC circuit, analogy to simple harmonic motion, LCR circuit, Q - Factor, Analogy to damped harmonic motion, Forced oscillations and resonance.
13. **Alternating Current:** Simple AC generator, Alternating voltage and current and their graphical representation, RMS value of current and voltage, Alternating voltage applied to resistors, capacitors and inductors. Alternating current and voltage in LR, LC and LCR circuits: series and parallel, Power dissipation in AC circuit, Power factor, AC measuring instruments, AC bridge.

14. **Thermoelectricity:** Seebeck, Peltier and Thomson effect, Relation between Seebeck, Peltier and Thomson's emf, Thermoelectric power, Thermocouple.

Books Recommended:
1. Halliday, D, Resnick, R. and Krane K.S. — Physics
2. Halliday, D, Resnick, R. and Walker, J. — Fundamentals of Physics
3. Tewari, K.K. — Electricity and Magnetism
4. Young, A.P. and Friemen — University Physics
5. Huq. M.S., Rafiqullah, A.K. & Roy, A.K — Concept of Electricity and Magnetism
6. Islam A.K.M.A, Islam M.N. and Islam, S — তড়িৎ চুম্বক তত্ত্ব ও আধুনিক পদার্থবিজ্ঞান
7. Moksed Ali S. M. — তড়িৎবিদ্যা ও চুম্বকত্ব

Paper Code	222703	Marks: 100	Credits: 4	Class Hours: 60
Paper Title:		**Geometrical & Physical Optics**		Exam Duration: 4 Hours

1. **Geometrical Optics:** Spherical aberration, Chromatic aberration, Astigmatism, Ray matrices and its applications. Reflection and refraction, Total internal reflection, Two types of images, Plane mirrors, Spherical mirrors, Images from spherical mirrors, Spherical refracting surfaces, Thin lenses, Power of lenses, Microscope, Telescope, Eye and its mechanism.
2. **Coherence:** First order coherence, Spatial and Temporal coherence, Higher order coherence.
3. **Interference of waves:** Principle of superposition, Phase velocity and group velocity, Huygen's principle, Young's experiment, Fresnel biprism, Division of wavefront and amplitude, Michelson's interferometer, shapes and positions of fringes, Newton's ring and its experiment, Multiple beam fringes with a plane parallel plate, Fabry-Perot interferometer.
4. **Diffraction:** Diffraction, Fraunhofer and Fresnel diffraction, Single, double and multiple slit diffraction, Diffraction grating, spectrometer, Resolving power, Fraunhofer diffraction at a circular aperture, Fresnel half period zone, Fresnel diffraction at a straight edge.
5. **Polarisation:** Definition, Plane, Circular and Elliptical polarization, Malu's law, Brewster's law, Optical activity, Double refraction, Optic axis, half-wave and quarter-wave plate, Nicol prism, Polarimeter.
6. **Dispersion and scattering:** Dispersion, Cauchy and Selemeier formula, Scattering, Rayleigh scattering, Thomson's Scattering.

Books Recommended:

1. Eugene Hecht and Alfred Zajac : Optics
2. Rossi, B. : Optics
3. Guenther. R.D. : Modern Optics
4. Born, M, and Wolf : Principles of Optics

5. Brijlal : Optics
6. Moksed Ali S. M. : Geometrical and Physical Optics

Paper Code	222705	Marks: 100	Credits: 4	Class Hours: 60
Paper Title:		**Classical Mechanics**		Exam Duration: 4 Hours

1. **Review of Elementary Principles**: Equations of motion, Conservation laws of a system of particles, Constraints, Generalised co-ordinates, Generalised force, D'Alembert's principle and Lagrange's equations.
2. **Lagrangian Formulation**: Variational method, Euler-Lagrange equations of motion, Hamilton's principle, Lagrange's equation from Hamilton's principle, Applications of Lagrange's equation.
3. **Two-body Central Force Problem**: Two-body central force problem-reduction to equivalent one-body problem, Kepler's laws of planetary motion, Centre of mass and laboratory co-ordinates, Transformation of scattering problem from laboratory co-ordinates to centre of mass co-ordinates.
4. **Dynamics of Rigid Body Motion**: Kinematics and dynamics of rigid bodies, Independent co-ordinates, orthogonal transformation, Euler's angles, Euler's equation of motion for solving rigid body problems, symmetric top.
5. **Hamiltonian Mechanics**: Legendre transformations and the Hamilton's equations of motion, Derivation of Hamilton's equations from variational principle, Principle of least action and its application.
6. **Canonical Transformation**: Equations of canonical transformation, Legendre transformations, Integral invariant of Poincare, Lagrange and Poisson Brackets.
7. **Small Oscillations**: Formulation of the problem, Study of small oscillations using generalized co-ordinates, Normal co-ordinates, Normal modes, Forced vibrations.

Books Recommended:
1. Goldstein, H. : Classical Mechanics
2. Harun-ar-Rashid, A.M. : Classical Mechanics (in Bangla)
3. French, A.P. : Special Relativity

Paper Code	222706	Marks: 100	Credits: 4	Practical Class Hours: 60
Paper Title:		**Physics Practical-II**		Exam Duration: 6 Hours

To perform two experiments (one from each group) each of three hours duration.

i)	Experiments (3 hours each)	2 x 40 =	80
ii)	Laboratory note book		10
iii)	Table Viva-voce		10
		Total marks=	100

Marks for each experiment shall be distributed as follows:
a) Theory   5
b) Data collection and tabulation   15
c) Calculation, graphs and result   15
d) Discussions   5
                Total marks   =   40

Group – A
(One Experiment of 3 hrs. duration to be performed)
1. Determination of logarithmic decrement of a Ballistic galvanometer and C.D.R.
2. Determination of self inductance of a coil by Rayliegh's method.
3. Mutual inductance for varying distance between two coils.
4. Determination of absolute capacitance of a condenser using a ballastic galvanometer.
5. Determination of platinum resistance thermometer co-efficients.
6. To investigate the voltage current relationship for a simple inductive circuit and hence to determine the inductance.
7. To investigate the voltage current relationship for an a.c. capacitor circuit and hence to determine the capacitance.
8. To study the variation of capacitive and inductive reactances with frequency.
9. Calibration curve of a thermocouple and determination of the melting point of wax.

Group – B
(One experiment of 3 hrs. duration to be performed)
1. Determination of wavelenght of light by Newton's rings.
2. Determination of wavelenght using a bi-prism.
3. Specific rotation of plane of Polarisation in sugar solution by polarimeter.
4. Determination of refractive index of prism material by spectrometer.
5. Determination of wavelenght of spectral lines from gas discharge tube by diffraction grating.
6. Calibration of a spectrometer and determination of a unknown wave length.
7. Determination of Cauchy's constants.
8. To determine the refractive index of the material of a prism and a given liquid by total internal reflection using a spectrometer.
9. To determine the thickness (or refractive index) of a very thin transparent plate.

Books Recommended:
1. Ahmed, G.U. and Uddin, M.S. : PracticalPhysics
2. Din, K. and Matin, M.A. : AdvancedPractical Physics
৩. Chawdhury, S.A. and Bashak, A.K. : ব্যবহারিক পদার্থবিদ্যা

Paper Code	223707	Marks: 100	Credits: 4	Class Hours: 60
Paper Title:		Calculus- II		Exam Duration: 4 Hours

1. Vector valued functions of a single variable: Limits. Derivatives and integrals. Tangent lines to graphs of such functions. Arc length from vector viewpoint. Arc length parametrization .

2. Curvature of space curves: Definition. Curves of zero curvature. Curves of constant non-zero curvature. Cartesian equations and parametric equations. Radius of curvature. Centre of curvature.

3. Functions of several variables: Limits and continuity. Partial derivatives. Differentiability, linearization and differentials. The chain rule. Partial derivatives with constrained variables. Directional derivatives, gradient vectors and tangent planes. Extreme values and saddle points of functions of several variables. Lagrange multipliers. Taylor's formula.

4. Multiple Integration: Double integrals and iterated integrals. Double integrals over

nonrectangular regions. Double integrals in polar coordinates. Area by double integrals. Triple integrals and iterated integrals. Volume as a triple integral. Triple integral in cylindrical and spherical coordinates. General multiple integrals. Jacobians.

5. **Topics in Vector Calculus:** Scalar and vector fields, Gradient, divergence and curl, and their properties. Line integrals, Independence of paths. Green's theorem. Surface integrals. Stokes' theorem. The divergence theorem.

Recommended :

1. Howard Anton-*Calculus 5/E (and forward edition)*

Paper Code	223708	Marks: 50	Credits: 2	Class Hours: 30
Paper Title:	Math Lab (Practical)			Exam Duration: 2.5 Hours

Getting started. Problem solving using Mathematica /Maple (Problems will be selected from Papers studied in the first and second years of their studies).
Students are required to work on their assignments in MMT 201 in the lab sessions.

Paper Code	222807	Marks: 100	Credits: 4	Class Hours: 60
Paper Title:	General Chemistry–II			Exam Duration: 4 Hours

1. **Nonmetals:** General properties of nonmetals, ortho and para hydrogen molecules, allotropy of carbon, catenation, halogens and their basic properties, chemistry of noble gases.
2. **Metals:** Metallic bond, electron sea theory of metallic bond, characteristics of metals, band theory of conductivity, conductors, semiconductors and insulators, transition metals and inner transition metals colour and magnetism in transition metal chemistry.
3. **Energy changes in chemical Reactions:** System and surroundings, open system and closed system, thermodynamics, state functions, the first law of thermodynamics, the concept of internal energy and enthalpy, measurement of enthalpy changes, enthalpy of formation, Hess's law, lattice enthalpy, Born-Haber cycle, second law of thermodynamics, entropy and free energy.
4. **Rates of chemical Reactions:** Reaction rate, rate constant, rate law, order of reactions, first order reaction, half life, order and molecularity, effect of temperature on the rate of reaction, collision theory and reaction rates, activation energy, Arrhenius equation.
5. **Electrochemistry:** Redox reactions, electrolytic and galvanic cells, cell notation, standard reduction potentials, emf of cells, the effect of concentration of cell emf, batteries, corrosion.
6. **Catalysis:** Catalyst, homogeneous catalysis, enzyme catalysis, auto catalysis.
7. **Solids:** Properties of solids, crystalline and amorphous solids, distinction between

crystalline and amorphous solids, isomorphism, polymorphism and allotropy, crystal lattice unit cell crystal systems Bragg's law.

8. **Coordination Chemistry:** Coordination compounds, ligands, coordination number, nomenclature, structures of complex compounds, Werner's primary and secondary valency concept, sidwick's electronic concept, valence bond theory, stability of coordination compounds.

9. **Aromatic Compounds:** Aromaticity aromaticity of benzene, Electrophillic aromatic substitution reactions with reference to nitration halogention, sulphonation and alkylation. Heterocyclic compounds: Pyrrole, furan, thiophene, pyridine.

10. **Organic reactions:** Brief study on Electrophilic addition, Nucleophilic addition, Elimination reaction, condensation reaction, oxidation, and reduction reactions and organic compounds. Mechanism and application of the following reactions, Friedel Craft reaction, Clemmenson reduction, Wolf Krishner reduction, Perkin reaction, Claisen reaction, Cannizzaro reaction and Aldol condensation.

11. **Carbohydrates:** Definition, classification, structure and reactions of monosacchanides. Polysaccharide-cellulose and strach.

12. **Amino Acids:** Structures classification, synthesis physical and chemical properties of amino acids.

13. **Polymer Chemistry:** Polymers homopolymer, heteropolymer, low density and high density polymer, copolymers, studies of some polymers- polyvinylchloride, nylon 66, silk and wool.

Books Recommended:

General Chemistry , D.D. Ebbing Houghton Miffin Co.

Chemistry – The Moleceular Nature of Matter and Change, M. silberberg, WCB/ Mc Graw-Hill. Introduction to Modern Inorganic Chemistry, S.Z. Haider, Friends International.

Selected Topics on Advanced Inorganic Chemistry, S. Z. Haider, Students' publication

Modern Inorganic Chemistry, R.D. Madan, S. Chand & company Ltd.

Selected Topics in Inorganic Chemistry, W.U. Malik, G. D. Tuli and R.D. Madan, S. Chand & Company Ltd.

Organic Chemistry by T Morison and RN bayed

Fundamental of organic Chemistry by salomans

Organic Chemistry Vot I& II IL fair

Basic Inorganic Chemistry, F.A. Cotton,G. Wilkinson, and P. L. Gaus, John willey & Sons. Principles of physical chemistry, M. M. Huque and M. A. Nawab, students' publications.

Paper Code	222809	Marks: 50	Credits: 2	Class Hours: 30
Paper Title:	**Environmental Chemistry**			Exam Duration: 2.5 Hours

1. **Environment:** Introduction components of environment, factors affecting environment, environmental management, environment and health, environmental chemistry, segments of environment – atmosphere hydrosphere, lithosphere and biosphere, structure of atmosphere.

2. **Pollution and Pollutants:** Pollution, environmental pollution, pollutant, classification of pollutants, types of pollution PCBS and their sources and hazards, Detection & estimation of PCBS. Biomultification.

3. **Air Pollution:** Introduction air quality, major sources of air pollution, gaseous pollutants, acid rain-how acid rain is formed, adverse effects of acid rain, greenhouse effect- how the greenhouse effect is produced, consequences of greenhouse effect and global warming EL Nino phenomenon and its effect, ozone depletion, mechanism of ozone depletion, effects of ozone depletion.
4. **Water Pollution:** Introduction, classification of water pollutants, physical, chemical and biological characteristics of wastewater, industrial wastewater treatment, municipal water treatment, water quality parameters and standards, measurements of important parameters such as PH, DO, BOD, COD and temperature for water quality assessments.
5. **Soil Pollution:** Composition of soil, importance of soil to the biosphere, sources of soil pollution, effects of soil pollution- synthetic fertilizer and pesticides, effects of industrial effluents, effects of urban wastes, control of soil pollution.
6. **Heavy metals in the Environment:** trace metals, light metals and heavy metals, deadly heavy metals, sources of heavy metals, biochemical effects, toxicity, toxicology, control and treatment of mercury, chromium, arsenic and lead.

Books Recommended:
1. Environmental Chemistry, B.K. Sharma, Goel Publishing House.
2. Environmental Chemistry, AK. De New Age International Publishers.
3. Environmental Chemistry, S.E. Manahan, CRC Press.
4. A Textbook of Environmental Chemistry
   and Pollution Control, S.S. Bara S. Chand &
   Company Ltd.

Paper Code	223609	Marks:100	Credits: 4	Class Hours: 60
Paper Title:	Methods of Statistics			Exam Duration: 4 Hours

1. **Simpling Distribution:** Concept of sampling Distribution of Statistics and its standared error, χ^2 , t and F statistics and their distributions, properties and uses of these distributions.
2. **Design of Experiment:** Principles of experimental design and analysis of variance, Meaning of experiments and randomization, Replication and local control, Basic designs: CRD, RBD and LSD, Analysis of these designs, Estimation of parameters, Missing plot estimation and analysis, Factorial experiment, 2_2 , 2_3 factorial experiments, Analysis and interpretation of these designs.
3. **Survey Methods:** Concept of population, Sample, Sampling, Types of sampling, Principles of random sampling, Census and surveys, Advantages and limitations of sample survey over census, Sampling frame. Sampling and non-sampling errors, Detailed study of simple random sampling, Stratified random sampling, Systematic sampling and cluster sampling, Concept of quota sampling, Multistage sampling.
4. **Test of Hypothesis:** Concept of test of hypothesis, Logic behind tests of hypothesis, Neyman Pearson's approach of testing hypothesis, Preliminaries of tests: Hypothesis, Null and alternative hypotheses, Simple and composite hypotheses, Concept of test of significance, Procedures of testing a hypothesis, Test errors, Level of significance, One-tailed and two-failed tests, P-value. Concept of test statistics: Normal, χ^2 t and F statistics.
5. Testing the significance of a single mean, Single variance, Single proportion, Difference

of two means and two proportions, Ratio of two variances and their confidence intervals, Confidence intervals concerning simple correlation coefficient and regression coefficient for single and double sample, Paired t-test, Testing the homogeneity of several population means, Variance and proportions, Test of goodness of fit.

Books Recommended :

1. David F.N.   :   Probability theory for statistical Methods
2. Levy H, and Roth L   :   Elements of Probability
3. Mostafa M.G.   :   Methods of Statistics
4. Islam M.N.   :   Introduction to Statistics and probability.
5. Kapoor; Saxena   :   Mathematical Statistics
6. Ali A.   :   Theory of statistics Vol. I
7. Mood, Graybill and Boes :   Introduction to the Theory of Statistics 3_{rd} Ed.
8. Hogg,R.V.and Craig,A.T. :   An introduction to Mathematical Statistics.
4. Federer   :   Experimental Design; Theory and Applications.
5. Mallick S .A.   :   Parikkaneer Design.
6. Bhuiyan M.R.   :   Fundamentals of Experimental Design.
7. Anderson, R.L. and
   Bancroft. T.A.   :   Statistical Theory in Research
8. Mood and Graybill   :   Introduction to the Theory of Statistics
9. Weather Burn C.E.   :   A First Paper in Mathematical Statistics
10. Cochran G.W.   :   Sampling Techniques

Paper Code	223610	Marks: 50	Credits: 2	Class Hours: 30
Paper Title:		**Statistics Practical –II** **(Introduction to Statistics +Methods of Statistics)**		Exam Duration: 2.5 Hours

1. **Introduction to Statistics:** Condensation and tabulation of data, Graphical representation of data, Frequency table, Measures of location, Dispersion, Moments, Skewness and Kurtosis, Measures of correlation coefficient, Rank correlation, Fitting of simple regression lines, Fitting of Binomial, Normal and Poisson distributions, Finding trend values and seasonal variation from time series data by different methods, Calculation of index numbers and test of index number, Use of Newton's forward and backward formula, Solution of numerical integration.

2. **Methods of Statistics:** Analysis of basic designs, Missing plot estimation and analysis of these designs, Measures of relative efficiency, Analysis of factorial designs, Drawing of SRS, Estimation of mean and properties with standard error in SRS, Drawing of stratified random samples and estimation of mean and variance of population from samples of stratified random samples, Cluster samples, Systematic samples and determination of relative efficiency.

3. **Test of Hypothesis:** Common tests of significance of Mean, Variance, Proportion, Correlation coefficient and Regression coefficient, Fitting of theoretical distributions and testing of goodness of fit, tests of large samples, Tests of homogeneity, Construction of

confidence intervals.

Paper Code	221109	Marks: 100	Non-Credit	Class Hours: 60
Paper Title:		**English (Compulsory)**		Exam Duration: 4 Hours

Aims and objectives of this Paper:

To develop students' English language skills, to enable them to benefit personally and professionally. The four skills — listening, speaking, reading and writing will be integrated to encourage better language use.

1. **Reading and understanding**   5×4=20

   Students will be expected to read passages that they might come across in their everyday life, such as newspapers, magazines, general books etc. Simple stories will also be included to give students a familiarity with different uses of the language.

   [N.B. : 5 Questions are to be answered. Each question will carry 4 marks. There may be division in each question]

   a) Understanding different purposes and types of readings
   b) Guessing word-meaning in context.
   c) Understanding long sentences
   d) Recognizing main ideas and supporting ideas.
   e) Answering comprehension questions.
   f) Writing summaries.

2. **Writing**
                                                                                   40
   a) Writing correct sentences, completing sentences and combining sentences.
                                                                                   5
   b) Situational writing : Posters, notices, slogans, memos, advertisements etc.
                                                                                   4
   c) Paragraph writing : Structure of a paragraph; topic sentences; developing ideas; writing a conclusion; types of paragraphs (narrative, descriptive, expository, persuasive); techniques of paragraph development (such as listing, cause and effect, comparison and contrast).   8

                                          Or,

   d) Newspaper writing : Reports, press releases dialogues etc.
   e) Writing resumés.   **Or,**   8
   f) Writing letters : Formal and informal letters, letters to the editor, request letters, job applications, complaint letters etc.
   g) Essay : Generating ideas; outlining; writing a thesis sentence; writing the essay: writing introductions, developing ideas, writing conclusions; revising and editing.   15

3. **Grammar**   25
   a)   Word order of sentences.
   b) Framing questions.
   c) Tenses, articles, subject-verb agreement, noun-pronoun agreement, verbs, phrasal verbs, conditionals, prepositions and prepositional phrases, infinitives, participles, gerunds. (Knowledge of grammar will be tested through contextualised passages).
   d) Punctuation.

4. **Developing vocabulary** : Using the dictionary, suffixes, prefixes, synonyms, antonyms, changing word forms (from verb to noun etc.) and using them in sentences.   10

5. **Translation from Bengali to English**.   1×5=5

6. **Speaking skills** : Speaking skills should be integrated with writing and reading in classroom activities.

   The English sound system; pronunciation skills; the IPA system; problem sounds, vowels, consonants and dipthongs; lexical and syntactic stress.
   (Writing dialogue and practising it orally students can develop their speaking skill. Dialogue writing can be an item in writing test.)