بسم الله الرحمن الرحيم

ফাজিল স্নাতক (পাস) বিএসসি, ৩য় বর্ষ

السنة الثالثة من مرحلة الفاضل البكالوريوس في العلوم

Fazil BSc (Pass), 3rd Year

ইসলামি আরবি বিশ্ববিদ্যালয়, ঢাকা

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মোট নম্বর ও বিষয় সংখ্যা

বিষয়	বিষয়/পত্র সংখ্যা	মোট নম্বর
আবশ্যিক	১টি	১০০
ঐচ্ছিক গুচ্ছ বিষয় (২টি)	৬টি	৬০০
মোট	৭টি	৭০০

আবশ্যিক বিষয়

বিষয় কোড	বিষয়, পত্র ও পত্র শিরোনাম	নম্বর	ক্রেডিট
111001	বাংলাদেশ স্টাডিজ (Bangladesh Studies)	100	4
	মোট	100	4

৩য় বর্ষের ঐচ্ছিক বিষয়সমূহের গুচ্ছ (ফাজিল বিএসসি পাস এর জন্য)

৩য় বর্ষের গুচ্ছ-৩ এর বিষয়সমূহ থেকে ঐচ্ছিক বিষয় হিসেবে ৩ পত্রবিশিষ্ট যে কোন ১টি এবং গুচ্ছ-৪ এর বিষয়সমূহ থেকে ৩ পত্র বিশিষ্ট যে কোন ১টিসহ মোট ২টি বিষয় নির্বাচন করতে হবে। প্রতিটি পত্রের নম্বর হবে ১০০। (৩×১০০) ×২=৬০০

গুচ্ছ-৩: (ফাযিল বিএসসি পাস ৩য় বর্ষের জন্য)
[৩ পত্র বিশিষ্ট যে কোন ১টি গুচ্ছ পছন্দ করতে হবে।]

গুচ্ছ বিষয়	পত্র	পত্র কোড	পত্র শিরোনাম	নম্বর	ক্রেডিট
পদার্থ বিজ্ঞান Physics	১ম পত্র	131169	Physics, Part-I	75+25 = 100	4
	২য় পত্র	131170	Physics, Part-II	75+25 = 100	4
	৩য় পত্র	131171	Physics, Part-III	75+25 = 100	4
গণিত Mathematics	১ম পত্র	131172	Mathematics, Part-I	75+25 = 100	4
	২য় পত্র	131173	Mathematics, Part-II	75+25 = 100	4
	৩য় পত্র	131174	Mathematics, Part-III	75+25 = 100	4
প্রাণি বিজ্ঞান Zoology	১ম পত্র	131175	Zoology, Part-I	75+25 = 100	4
	২য় পত্র	131176	Zoology, Part-II	75+25 = 100	4
	৩য় পত্র	131177	Zoology, Part-III	75+25 = 100	4
বাংলা সাহিত্য Bangla Literature	১ম পত্র	131178	বাংলা কবিতা/ Bangla Poetry	100	4
	২য় পত্র	131179	বাংলা উপন্যাস ও নাটক Bangla Novel & Drama	100	4
	৩য় পত্র	131180	বাংলা ছোট গল্প ও প্রবন্ধ Bangla Short story & prose	100	4
English Literature	১ম পত্র	131181	Non-Fiction Prose & Short Story	100	4
	২য় পত্র	131182	English Poetry	100	4
	৩য় পত্র	131183	English Novel & Drama	100	4

গুচ্ছ-৪: (ফাযিল বিএসসি পাস ৩য় বর্ষের জন্য)

[৩ পত্র বিশিষ্ট যে কোন ১টি গুচ্ছ পছন্দ করতে হবে।]

গুচ্ছ বিষয়	পত্র	পত্র কোড	পত্র শিরোনাম	নম্বর	ক্রেডিট
রসায়ন বিজ্ঞান Chemistry	১ম পত্র	131184	Physical Chemistry	75+25 = 100	4
	২য় পত্র	131185	Organic Chemistry	75+25 = 100	4
	৩য় পত্র	131186	Inorganic Chemistry	75+25 = 100	4
উদ্ভিদ বিজ্ঞান Botany	১ম পত্র	131187	Biodiversity of plants	75+25 = 100	4
	২য় পত্র	131188	Life Process and Agronomy	75+25 = 100	4
	৩য় পত্র	131189	Continuity of life	75+25 = 100	4
মৃত্তিকা বিজ্ঞান Soil Science	১ম পত্র	131190	Soil Science Part-I	75+25 = 100	4
	২য় পত্র	131191	Soil Science Part-II	75+25 = 100	4
	৩য় পত্র	131192	Soil Science Part-III	75+25 = 100	4
ভূগোল ও পরিবেশ বিজ্ঞান Geography and Environment Science	১ম পত্র	131193	Geography and Environment Science-I	75+25 = 100	4
	২য় পত্র	131194	Geography and Environment Science-II	75+25 = 100	4
	৩য় পত্র	131195	Geography and Environment Science-III	75+25 = 100	4
তথ্য ও যোগাযোগ	১ম পত্র	131196	Computer Fundamental and Programming	75+25 = 100	4

গুচ্ছ বিষয়	পত্র	পত্র কোড	পত্র শিরোনাম	নম্বর	ক্রেডিট
প্রযুক্তি ICT			Language		
	২য় পত্র	**131197**	Database Management System and Information System Design	75+25 = 100	4
	৩য় পত্র	**131198**	Operating System and Multimedia	75+25 = 100	4

বিস্তারিত সিলেবাস

আবশ্যিক বিষয়:

বিষয়	পত্র কোড	পত্র শিরোনাম	নম্বর	ক্রেডিট
বাংলাদেশ স্টাডিজ	131045	বাংলাদেশ স্টাডিজ Bangladesh Studies	100	4

Distribution of Marks

Broad Question (5 out of 7) 5×16=80

Short Question (4 out of 6) 4×05=20

Total = 100

পাঠ্যবিষয়:

১. **বাংলাদেশের অভ্যুদয়** : সামাজিক, রাজনৈতিক, অর্থনৈতিক ও সাংস্কৃতিক প্রেক্ষাপট, বায়ান্নর ভাষা আন্দোলন, চুয়ান্নর যুক্তফ্রন্ট নির্বাচন ও চৌষট্টির গণতান্ত্রিক আন্দোলন, ছেষট্টির ছয় দফা আন্দোলন, আগরতলা ষড়যন্ত্র মামলা ও বঙ্গবন্ধু, ঊনসত্তরের গণঅভ্যুত্থান, সত্তরের সাধারণ নির্বাচন, ৭ ই মার্চের ভাষণ ও স্বাধীনতার ঘোষণা এবং একাত্তরের মুক্তিযুদ্ধ।

২. **বাংলাদেশের ভৌগলিক পরিচিতি** : বাংলাদেশের ভৌগলিক অবস্থান ও সীমারেখা, নদ-নদী, পাহাড়-পর্বত, সমুদ্র উপকূল, বনাঞ্চল, জলবায়ু ও বৃষ্টিপাত, বন্যা ও অন্যান্য প্রাকৃতিক দুর্যোগ, প্রাকৃতিক সম্পদ (বনজ, প্রাণীজ, মৎস ও খনিজ), জনসংখ্যা, নগর ও নগরায়ণ, পরিবেশ ও ব্যবস্থাপনা।

৩. **বাংলাদেশের ভূ-প্রকৃতি ও অধিবাসী** : ভূমি (প্রকৃতি, প্রকারভেদ ও ব্যবহার), বাঙালি, উপজাতি ও আদিবাসী এবং তাদের নৃতাত্ত্বিক ও সাংস্কৃতিক পরিচিতি।

৪. **বাংলাদেশের অর্থনীতি** : প্রধান উৎপাদন খাতসমূহ ও তাদের অর্থনৈতিক গুরুত্ব (কৃষি, শিল্প, বাণিজ্য, যোগাযোগ, ব্যাংকিং ও রাজস্ব), উৎপাদন ব্যবস্থা ও আর্থ-সামাজিক অবকাঠামো, জনসংখ্যা ও বেকার সমস্যা, জাতীয় অর্থনীতিতে নারী ও নিম্নবর্গীয়দের অবস্থান, জাতীয় অর্থনৈতিক পরিকল্পনা ও বাস্তবায়ন।

৫. **বাংলাদেশের রাজনীতি** : বাংলাদেশের সংবিধান ও তার বিবর্তন, বাহাত্তরের সংবিধানের সন্নিবেশিত জাতীয় মূলনীতি ও মৌলিক অধিকারসমূহ, সংবিধানের সংশোধনী ও অধ্যাদেশসমূহ, শাসন ও বিচারব্যবস্থা, রাজনৈতিক দল ও তাদের অনুসৃত মতবাদসমূহ।
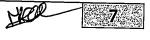
BOOKS RECOMMENDED :

১. শেখ মুজিবুর রহমান : অসমাপ্ত আত্মজীবনী

২. আমিনুর রহমান সুলতান : বাংলাদেশের অভ্যুদয় : রাজনৈতিক ও সামরিক প্রেক্ষাপট

৩. ড. মো: ইবরাহীম খলিল : স্বাধীন বাংলাদেশের অভ্যুদয়ের ইতিহাস

৪. এম, আর, আখতার মুকুল: বায়ান্নর ভাষা আন্দোলন।

৫. মেজর রাফিকুল ইসলাম : একাত্তরের মুক্তিযুদ্ধ।

৬. ড. মোহাম্মাদ হান্নান : বাংলাদেশের মুক্তিযুদ্ধের ইতিহাস।

৭. হাসান হাফিজুর রহমান (সম্পাদিত): বাংলাদেশের স্বাধীনতা যুদ্ধ দলিলপত্র

৮. মোস্তফা কামাল : বাঙালি, বাংলাদেশ ও বঙ্গবন্ধু।

৯. মো: সিরাজুল ইসলাম (সম্পাদিত) : বাংলাদেশের ইতিহাস

১০. রবিউল হোসেন: স্বাধীন বাংলাদেশের অভ্যুদয়ের ইতিহাস

১১. প্রফেসর নারায়ন চন্দ্র বসাক : বাংলাদেশের ভূপ্রকৃতি

১২. হাফিজ রশিদ খান : আদিবাসী জীবন আদিবাসী সংস্কৃতি

১৩. আব্দুল্লাহ ফারুক : বাংলাদেশের অর্থনৈতিক ইতিহাস

১৪. মোঃ শামসুল কবীর খান : বাংলাদেশের অর্থনীতি

১৫. বদরুদ্দীন উমর: বাংলাদেশের রাজনীতি

16. Haroon-ar-Rashid :Geography of Bangladesh

17. Mahabbat Khan : Bangladesh Society, politics and bureaucracy.

18. M. A. Ahad : Bnagladesh Economy

৩য় বর্ষ, গুচ্ছ-৩ এর ঐচ্ছিক বিষয়সমূহের বিস্তারিত সিলেবাস

বিষয়-১: **Physics**

বিষয়	পত্র	পত্র কোড	পত্র শিরোনাম	নম্বর	ক্রেডিট
পদার্থ বিজ্ঞান Physics	১ম পত্র	131169	Physics Part-I	75+25=100	4
	২য় পত্র	131170	Physics Part-II	75+25=100	4
	৩য় পত্র	131171	Physics Part-III	75+25=100	4

বিস্তারিত সিলেবাস

বিষয়	পত্র	পত্র কোড	পত্র শিরোনাম	নম্বর	ক্রেডিট
Physics	১ম পত্র	131169	Physics Part-I	75+25 =100	4

Marks Distribution

Written: 75

A. Mathematical Methods, Waves and Optics: 45

Broad Questions (3 out of 5) $3 \times 15 = 45$

B. Mechanics, Properties of Matter and Relativity: 30

Broad Questions (2 out of 4) $2 \times 15 = 30$

Practical: **=25**

Total: 100

Topics to be Read:

A. Mathematical Methods, Waves and Optics:

1. Vector Analysis : Transformation properties of vectors; Differentiation and integration of vectors; Line integral, volume integral andsurface integral involving vector fields; Gradient, divergence and curl of a vector field; Gauss' divergencetheorem, Stokes' theorem, Green's theorem - application to simple

problems; Orthogonal curvilinear co-ordinatesystems, unit vectors in such systems, illustration by plane, spherical and cylindrical co-ordinate systems only.

2. Matrices : Hermitian adjoint and inverse of a matrix; Hermitian, orthogonal, and unitary matrices; Eigenvalue andeigenvector (for both degenerate and non-degenerate cases); Similarity transformation; digitalization of realsymmetric matrices.

3.Ordinary Differential Equations: Solution of second order linear differential equations with constant coefficients and variable coefficients byFrobenius' method (singularity analysis not required); Solution of Legendre and Hermite equations about x=0;Legendre and Hermite polynomials - orthonormality properties.

4. Partial Differential Equations: Solution by the method of separation of variables; Laplace's equation and its solution in Cartesian, sphericalpolar (axially symmetric problems), and cylindrical polar (`infinite cylinder' problems) coordinate systems.

5. Fourier Series : Fourier expansion – statement of Dirichlet's condition, analysis of simple waveforms with Fourier series.Introduction to Fourier transforms; the Dirac-delta function and its Fourier transform; other simpleexamples. Vibration of stretched strings- plucked and struck cases.

6. Linear Harmonic Oscillator (LHO): LHO.Free and forced vibrations.Damping.Resonance.Sharpness of resonance. Acoustic, optical, andelectrical resonances: LCR circuit as an example of the resonance condition. A pair of linearly coupledharmonic oscillators --- eigenfrequencies and normal modes.

7. Waves: Plane progressive wave in 1-d and 3-d. Plane wave and spherical wave solutions. Dispersion: phase velocity and group velocity.

8. Fermat's principle: Fermat's principle and its application on plane and curved surfaces.

9. Cardinal points of an optical system: Two thin lenses separated by a distance, equivalent lens, different types of magnification, Helmholtz andLagrange's equations, paraxial approximation, introduction to matrix methods in paraxial optics – simpleapplication.

10. Wave theory of light: Huygen's principle; deduction of law of reflection and refraction.

11. Interference of Light: Condition of sustained interference by analytical treatment, Divisionamplitude and division of wave front, methods for production of interference fringes by biprismand determination of wavelength, measurement of thickness of thin films,colour of a thin film in reflected and transmitted light, Haidinger's fringe, Theory of Newton'srings. Determination of wavelength and refractive index using Newton Ring apparatus .

12. Interferrometer: Michelson's interferometer and its theory relating to the formation of circularfringe's, Determination of wavelength of a source and small difference of wave lengths in Dlines by Michelson's interferometer, standardization of a meter by Michelson's interferometer.

13. Diffraction of light: Fresnel and Fraunhofer class of diffraction, Fresnel's half period zones,zone plate its similarity with convex lens. Diffraction at straight edge, circular aperture.

14. Elements of fiber optics: Construction of optical fibers, image formation, numerical aperture,structure--step index, graded index, uses.

B. Mechanics, Properties of Matter and Relativity:

1. Mechanics of a Single Particle: Velocity and acceleration of a particle in (i) plane polar coordinates - radial and cross-radial components(ii) spherical polar and (iii) cylindrical polar co-ordinate system; Time and path integral of force; workand

energy; Conservative force and concept of potential; Dissipative forces; Conservation of linear andangular momentum.

2. Mechanics of a System of Particles: Centre of mass, centre of mass frame, centre of moving systems, Collision: elastic and inelastic collision, coefficient of restitution. Expression of velocities of two bodies after elastic and inelastic collision in laboratory frame.Elastic collision in centre of mass frame.Relationship between angle of scatterings in laboratory frame and centre of mass frame.Motion of a rigid body about a fixed axis.Angular momentum and expression of angular momentum of a system of rotating bodies.Relationship of angular momentum of a system of bodies with angular momentum in centre of mass frame.Principle of conservation of angular momentum.

3. Rotational Motion: Moment of inertia, radius of gyration; Energy and angular momentum of rotating systems of particles;Parallel and perpendicular axes theorems of moment of inertia; Calculation of moment of inertia forsimple symmetric systems; Ellipsoid of inertia and inertia tensor; Setting up of principal axes in simplesymmetric cases. Rotating frames of reference - Coriolis and centrifugal forces, simple examples.Force freemotion of rigid bodies - free spherical top and free symmetric top.

4. Gravitation: Gravitational potential and intensity, calculation of gravitational potential andintensity due to thin spherical shell, thick spherical shell, sphere, circular disc etc.Compound pendulum, measurement of 'g' by bar and Kater's pendulum.

5. Elasticity: Hooke's law, work done in strain, elongation strain, volume strain, shearing strain, Young'smodulus, Bulk modulus and rigidity modulus and their inter-relationship, Poisson's ratio,torsion in a cylinder, twisting couple, variation of strain along its length.Bending of beams and cantilevers in different cases: loaded at free end, loaded uniformly,bending moments.

6. Viscosity: Equation of continuity, Energy of a liquid in flow, Bernoulli's theorem, critical velocity, Reynold's number, Poiseuille's equation, motion in a viscous medium: Stoke's law, streamline and turbulent flow.

7. Surface tension: Surface tension as a molecular phenomenon, surface tension and surface energy. Excess pressure on curved liquid surface (spherical bubble and drop). Theory and experimental determination of surface tension of liquid by ripple method.

8. RELATIVITY : Introduction : Galilean transformation and invariance of Newton's laws of motion, non-invariance of Maxwell'sequations. Michelson-Morley experiment and explanation of the null result.

9.Special Theory of Relativity: Concept of inertial frame. Postulates of special theory; simultaneity; Lorentz transformation along one ofthe axes – length contraction, time dilatation and velocity addition theorem, Fizeau's experiment. Fourvectors. Relativistic dynamics : variation of mass with velocity; energy momentum relationship.

10.Vectors and Tensors: Covariant and contravariant vectors. Contraction. Covariant, contravariant, and mixed tensors of rank-2, transformation properties. The metric tensor (flat space-time only). Raising and lowering of indices withmetric tensors. (Consistent use of any one convention --- diag(-1,1,1,1) or diag(1,-1,-1,-1).) Example ofcommon four-vectors: position, momentum, derivative, current density, four-velocity.

Books &References:
Mathematical Physics
1. Introduction to Mathematical Physics - C. Harper (Prentice-Hall of India).
2. Mathematical Methods - M. C. Potter and J. Goldberg (Prentice-Hall of India).

3. Vector Analysis - M. R. Spiegel, (Schaum's Outline Series) (Tata McGraw-Hill).
4. Tatwiya Padartha Bidyar Bhumika – S. Sengupta, Asok Ghosh and D. P. Roychaudhuri (W.B.State Book Board (WBSBB)).
5. Mathematical Physics – P.K. Chattopadhyay (Wiley Eastern)

Waves and Optics

1. Waves and Oscillations - Rathin N. Chaudhury (New Age Publ.).
2. Waves- J R Crawford (Tata McGraw Hill)
3. Fundamentals of Optics - F. A. Jenkins and H. E. White (Mc Graw Hill, Kogakusha).
4. Geometrical and Physical Optics - B. S. Longhurst (Orient Longmans).
5. Optics – A. K. Ghatak (Tata Mc Graw Hill).
6. Optics – Hecht and Zajac (Addison-Wesley)

Mechanics & Properties of Matter

1. Theoretical Mechanics - M. R. Spiegel, (Schaum's Outline Series) (McGraw-Hill).
2. Mechanics - K. R. Symon (Addison-Wesley).
3. Introduction to Classical Mechanics - R. G. Takwale and P. S. Puranik (Tata McGraw-Hill).
4. Classical Mechanics – N. C. Rana and P. S. Joag (Tata McGraw-Hill).
5. Physics-I - D. Halliday and R.Risnick(Wiley India Pvt Ltd).
6. Padarther Dharma - D. P. Ray Chaudhuri (WestBengalState Book Board).
7. The Feynman Lectures on Physics – Vol I (Addison-Wesley).
8.An Introduction to Mechanics – D. Keppner and R.J. Kolenkow (Tata McGraw-Hill).
9.Mechanics – H. S. Hans and S. P. Puri (Tata McGraw-Hill).
10. Classical Mechanics – J. Goldstein (Narosa Publ. House).
11. Classical Mechanics – A. K. Roychaudhuri (O. U. P., Calcutta).

Relativity

1. Concepts of Modern Physics, Arthur Beiser, (Tata McGraw-Hill)
2. Modern Physics, K. S. Krane, (Wiley India Pvt Ltd)
3. Modern Physics, Murugeshan&Sivaprasath, (S. Chand & Company Ltd)
4. Introduction to Mechanics, Mahendra K. Verma, (Universities Press)

References:

1. Introduction to Special Relativity, R. Resnick, (Wiley India Pvt Ltd)
2. Elements of Properties of Matter, D. S. Mathur, (S. Chand & Company)
3. General Theory of Relativity, P. A. M. Dirac, (Prentice-Hall of India)

বিষয়	পত্র	পত্র কোড	পত্র শিরোনাম	নম্বর	ক্রেডিট
Physics	২য় পত্র	131170	Physics Part-II	75+25=100	4

Marks Distribution

Written: 75

A. Thermodynamics and Statistical Mechanics: 45

    Broad Questions (3 out of 5)   3×15=45

B. Electromagnetism and Basic Electonics:30

    Broad Questions (2 out of 4)   2×15=30

Practical: =25

                                      Total: 100

Topics to be Read:

A. Thermodynamics and Statistical Mechanics:

1. Kinetic Theory of Gasses: Basic assumptions of kinetic theory, Ideal gas approximation, deduction of perfect gas laws. Maxwell'sdistribution law (both in terms of velocity and energy), root mean square and most probable speeds. Finitesize of molecules : Collision probability, Distribution of free paths and mean free path from Maxwell'sdistribution. Degrees of freedom, equipartition of energy (detailed derivation not required).

2 .Real Gases: Nature of intermolecular interaction : isotherms of real gases. Van der-Waals equation of state, Otherequations of state (mention only), critical constants of a gas, law of corresponding states; VirialCoefficients, Boyle temperature.

3. Heat transfer: Thermal conductivity, diffusivity, Fourier equation for heat conduction –itssolution (steady state) for rectilinear and radial (spherical and cylindrical) flow of heat,Determination of thermal conductivity of solids by Searle's method, Forbe's method and Lee's disc method(for bad conductors).

4. Radiation: Nature of radiant heat, emissive and absorptive power, prevost's theory of heatexchange, Kirchhoff's law (simple

deduction), Black body radiation, Stefan-Boltzmann law,Planck's formula for black body radiation (elementary idea).

5. Basic Concepts of Thermodynamics: Microscopic and macroscopic points of view : thermodynamic variables of a system, State function, exactand inexact differentials.

6 . First Law of Thermodynamics: Thermal equilibrium, Zeroth law and the concept of temperature. Thermodynamic equilibrium, internalenergy, external work, quasi-static process, first law of thermodynamics and applications includingmagnetic systems, specific heats and their ratio, isothermal and adiabatic changes in perfect and realgases.

7. Second Law of Thermodynamics: Reversible and irreversible processes, indicator diagram.Carnot's cycles-efficiency, Carnot's theorem.Kelvin's scale of temperature, relation to perfect gas scale, second law of thermodynamics – differentformulations and their equivalence, Clausius inequality, entropy, change of entropy in simple reversibleand irreversible processes, entropy and disorder; equilibrium and entropy principle, principle ofdegradation of energy.

8. Thermodynamic Functions: Enthalpy, Helmholtz and Gibbs' free energies; Legendre transformations, Maxwell's relations and simpledeductions using these relations; thermodynamic equilibrium and free energies.

9. Change of State: Equilibrium between phases, triple point : Gibbs' phase rule (statement only) and simple applications.First and higher order phase transitions, Ehrenfest criterion. Clausius-Clapeyron's equation.Joule-Thomson effect.

10. Phase space: Concept of Microstates and macro states, Basic postulates - equal priori probability and ergodic hypothesis, Liouville theorem and conservation of density in phase space, Statistical ensemble - Micro-canonical, Canonical and Grand canonical ensemble and their partition functions, Relation of statistical mechanics with thermodynamics - Expressions of

different thermodynamical quantities (e.g. Free energy, pressure, average energy, entropy, Specific heat) in terms of partition function;

11. Classical statistics: Maxwell-Boltzamann distribution function, Calculation ofthermodynamical quantities for ideal gas, Maxwell-Bolzamann velocity distribution law,(Average, most probable velocity and root mean square speed and their relation; Principle of equipartition of energy.)

12. Quantum statistics: Concept of indistinguishability, Entropy of mixing and Gibb's paradox,Resolution of Gibb's paradox introducing indistinguishability;Bose-Einstein distribution function and its behaviour with temperature, Basic idea ofphenomenon Bose-Einstein condensation (Qualitative description), Calculation of variousthermodynamical quantities of photon gas (black body radiation);Fermi-Dirac distribution function and its behaviour with temperature, Basic idea of Fermisurface and fermi energy, Calculation of various thermodynamical quantities of free electrongas; Classical limits and distinguishing features of classical and quantum statistics.

B. Electromagnetism and Basic Electonics:

1. Electrostatics: Quantisation of charge and Millikan's oil-drop experiment, Coulomb's law,intensity and potential --- example of point charge, Gauss' theorem --- simple applications,potential and field due to an electric dipole, mechanical force on the surface of a charged conductor.Dielectric medium, polarization, electric displacement.

2. Capacitor: Parallel-plates and cylindrical, energy stored in parallel plate capacitor.

3. Steady Current: Network analysis --- Kirchoff's laws, Thevnin and Norton's theorem,Wheatstone bridge, potentiometer.

4. Thermoelectricity: Seebeck, Peltier, and Thomson effects, laws of thermoelectricity,thermoelectric curve --- neutral and inversion temperature, thermoelectric power.

5. Magnetic effect of current: Biot and Savart's law, Ampere's circuital law (statement only),magnetic field due to a straight conductor, circular coil, solenoid, endless solenoid, Magnetic fielddue to a small current loop --- concept of magnetic dipole, Ampere's equivalence theorem.

6. Lorentz force: Force on a moving charge in simultaneous electric and magnetic fields, force on acurrent carrying conductor in a magnetic field.

7. Magnetic materials: Intensity of magnetization, relation between **B**, **H**, and **M** --- illustration inthe case of bar magnet, magnetic susceptibility --- dia, para and ferromagnetic materials, statementof Curie's law. Hysteresis in a ferromagnetic material, hysteresis loss.

8. Electromagnetic induction: Self and mutual inductances in simple cases, energy stored ininductance.

9. Varying currents: Growth and decay of currents in L-R circuit; charging and dischargingof capacitor in C-R circuit.

10. Alternating current: Mean and r.m.s. values of current and emf with sinusoidal wave form; LR,CR and series LCR circuits, reactance, impedance, phase-angle, power dissipation in AC circuit ---power factor, vector diagram, resonance in a series LCR circuit, Q-factor, principle of idealtransformer.

11. Thermo-ionic emission: classical deduction of Richardson's equation, characteristic curve of a vacuum diode, space charge, temperature and space charge limited current, Child Langmuir law,Triode and its characteristics curves, parameters from these curves. Triode as an amplifier,graphical analysis with load line.Semiconductors : junction diode, zener diode & theirapplications.

12. Basic concepts of Transistor: PNP & NPN transistors operation, characteristicscurves of a transistor in common emitter and common base mode - current amplification factor,input & output resistance. Transistor as an amplifier (simple Mathematical treatment) in CEmode, d.c and a.c load line, graphical analysis of the amplifier.

13. Feed back in amplifiers: conditions of oscillation, Barkhausen criteria ; Working principle & description of Tunedcollector and Hartley oscillators mentioning frequency of oscillation.

14. Logic gates: Logic gates: OR, AND,NOT, NAND, NOR, XOR, their circuit realization & truth tables.Boolean algebra, de Morgan's theorem, flip-flop circuit.

Books &References:
Heat &Thermodynamics

1. Heat and thermodynamics - Zemansky and Ditman (Mc Graw Hill, Kugakusha).
2. Kinetic theory of gases - Loeb (Radha Publ. House).
3. Thermodynamics – F. Fermi (Dover)
4. Tapgatividya – AsokeGhosh (W.B.S.B.B).
5. A Treatise on Heat - Saha and Sribastava (The Indian Press Ltd).
6. GaserAnabikTattwa- Pratip Kumar Chaudhuri (W. B. S. B. B).
7.Thermal Physics – S. Garg, R. M. Bansal, C. K. Ghosh (Tata Mc Graw Hill).
8.Heat and Thermodynamics – H. P. Roy and A. B. Gupta (New Central Book Agency).

Statistical Mechanics

1. Statistical Physics, F. Mandle (ELBS).
2. Fundamentals of Statistical and Thermal Physics, F. Reif, (McGraw Hill).

Electricity & Magnetism

1. Introduction to Electrodynamics – D. J. Griffith, (Prentice Hall, India Pvt. Ltd).

2. Berkeley Series Vol II (Electricity and Magnetism) E.M. Purcell (Tata McGraw-Hill).

3. The Feynman Lectures on Physics – Vol. II (Addison – Wesley).

4. Electricity and Magnetism - J. H. Fewkes and J. Yarwood (OxfordUniv. Press, Calcutta).

5. Physics-II - D. Halliday and R.Risnick(Wiley India Pvt Ltd).

6. Classical Electrodynamics – J.D>Jackson (Wiley India)

Electronics

1. Integrated Electronics – J. Millman and C. C. Halkias (Mc Graw Hill).

2. Electronic Fundamentals and Applications – D. Chattopadhyay and P. C. Rakshit (New Age
   International)

3. Electronics Fundamentals and Applications – J. D. Ryder (PHI Pvt. Ltd).

4. Electronic Device and Circuit Theory – R. Boylestad and L. Nashelsky (Prentice – Hall).

5. Integrated Electronics – J. Millman and C. C. Halkias (Mc Graw Hill).

6. Digital Logic and Computer Design – M. Moris Mano, (PHI (Pvt.) Ltd.).

7. Electronics – R.K. Kar (Books and Allied (P) Ltd.).

8. Digital Electronics – D. Ray Chaudhuri (Platinum Publishers)

বিষয়	পত্র	পত্র কোড	পত্র শিরোনাম	নম্বর	ক্রেডিট
Physics	৩য় পত্র	131171	Physics Part-III	75+25 =100	4

Marks Distribution

Written: 75

A. Atomic Physics and Quantum Mechanics: 45

    Broad Questions (3 out of 5)   3×15=45

B. Nuclear Physics and Solid State Physics:30

    Broad Questions (2 out of 4)   2×15=30

Practical: **=25**

        Total: 100

Topics to be Read:

A. Atomic Physics and Quantum Mechanics:

1. Atomic Spectrum: Good quantum numbers, and selection rules. Stern-Gerlach experiment and spin as an intrinsic quantum number. Incompatibility of spin with classical ideas.Bohr-Sommerfeld model.Fine structure.Study of fine structure by Michelson interferometer.

2. Vector model of atom: Magnetic moment of the electron, Lande g factor.Vector model – space quantization. Zeeman effect. Explanation from vector atom model.

3. Bohr's hydrogen atom: Theory of hydrogen atom, expression of radii of electrons, expression of energies andhydrogen atom spectrum. Effect of nuclear motion on atomic spectra, reduced mass,modified Rydberg constant and wave number, Evidences in favour of Bohr' s theory,correspondence principle, fine structure of special lines and Sommerfield's relativistic atommodel.

4. Uncertainity principle: Uncertainity principle - Its deduction and application to simple problems, viz, Non-existence of electron within nucleus, Ground state energy of Hydrogen atom, Radius of Bohr orbit.

5. Molecular spectroscopy: Diatomic molecules – rotational and vibrational energy levels.Basic ideas about molecularspectra. Raman effect and its application to molecular spectroscopy (qualitative discussiononly).

6. Old quantum theory: Planck's formula of black-body radiation.Photoelectric effect.Quantization of energy levels.

7. Basic quantum mechanics: de Broglie hypothesis. Electron double-slit experiment. Compton effect, Davisson-Germer experiment,Heisenberg's uncertainty principle (statement) with illustrations. Concept of wave function as describingthe dynamical state of a single particle.Group and phase velocities, classical velocity of a particle and thegroup velocity of the wave representing the particle.Principle of superposition.Schrödinger equation.Probabilistic interpretation; equation of continuity, probability current density. Boundary conditions onthe wave function.

8. Basic postulates of quantum mechanics: Dynamical variables as linear hermitian operators and eigenvalue equations, Momentum, energy andangular momentum operators.Measurement of observables, expectation values.Commutation relationsbetween operators.Compatible observables and simultaneous measurements, Ehrenfest theorem.

B. Nuclear Physics and Solid State Physics:

1.Bulk properties of nuclei: Nuclear mass, charge, size, binding energy, spin and magnetic moment.Isobars, isotopes and isotones; mass spectrometer (Bainbridge).

2. Nuclear structure: Nature of forces between nucleons, nuclear stability and nuclear binding, the liquid drop model (descriptive) and the Bethe-Weizsacker mass formula, application to stability considerations, extremesingle particle shell model (qualitative discussion with emphasis on phenomenology with examples).

3. Unstable nuclei:

(a) Alpha decay : alpha particle spectra – velocity and energy of alpha particles. Geiger-Nuttal law.

(b) Beta decay : nature of beta ray spectra, the neutrino, energy levels and decay schemes, positron emission and electron capture, selection rules, beta absorption and range of beta particles, Kurie plot.

(c) Gamma decay : gamma ray spectra and nuclear energy levels, isomeric states. Gamma absorption in matter, photoelectric process, Compton scattering, pair production (qualitative).

4. Nuclear fission and fusion: Discovery and characteristics, fission products and energyrelease, spontaneous and induced fission, transuranic elements. Chain reaction and basic principle ofnuclear reactors. Nuclear fusion: energetics in terms of liquid drop model.

5. Crystal Geometry: Amorphous and crystalline materials, glassy forms periodic lattice,basis, translation vectors, primitive and non-primitive Crystal Axis, Unit Cell, Primitive andConventional Bravais lattice, Miller indices, symmetry, point groups and space groups.Body centered and face centered lattices, interplanner spacing. Indices of lattice planes.

6. Crystallography: Bragg's law, diffraction of X –ray, measurement of lattice parameter for cubic lattices.Theory of Laue Spots.

7. Bonding in Solids: Types of bonding in solids, covalent, Ionic bindings, energy of bonding,transition between covalent and ionic bonding, metallic bonding, Vander waal's bonding,hydrogen bond.

8. Lattice Vibrations : Linear monatomic chains, Acoustical and optical phonons, Qualitativedescription of the phonon spectrum, Brillouin Zones, Einstein and Debye theories ofspecific heat of solid T^3Law. Qualitative description of free electron theory and its

inadequacies with reference to Hall effect and specific heat of electrons in metals.

Books &References:

Atomic Physics

1. Mani H.S. and Mehta G.K. : Introduction to Modern Physics
2. Beiser A. : Perspectives of Modern Physics
3. White A.E. : Introduction to Atomic Physics
4. Barrow H., : Introduction to Molecular Physics
5. Feynmann R.P. Et al : The Feymann Lectures in Physics, B.I. Publication
6. Hertzberg G. : Atomic Spectra and Atomic Structure
7. Hertzberg G. : Molecular spectra and Molecular Structure
8. Herchiaf : Fluorescence and phosphoresceneOlon,

Quantum Mechanics

1. Quantum Mechanics – J. L. Powell and B. Crasemonn, (Oxford, Delhi).
2. Quantum Mechanics – F. Schwabl (Narosa).
3. Quantum Mechanics – A. K. Ghatak and S. Lokenathan (Macmillan, Delhi).
4. Introductory Quantum Mechanics - S. N. Ghoshal (Calcutta Book House).
5. A Textbook of Quantum Mechanics – P. M. Mathews and K. Venkatesan (Tata Mc Graw Hill).
6. Modern Quantum Mechanics – Sakurai (Persian Education)

Nuclear Physics

1. Littlefield T.A. and Thorley N. : Atomic and Nuclear Physics E.L.B.S.
2. Enge H.A. : Introduction to Nuclear Physics, Addison-Wesley
3. Meyroff : Element of Nuclear Physics
4. Kaplan : Nuclear Physics
5. Cohen : Concepts of Nuclear Physics
6. Segre : Nuclei and particles. B1n'Cham : Nuclear Physics 31

Solid State Physics

1. Introduction to SolidState Physics, C. Kittel (Wiley Eastern).
2. Elementary SolidState Physics – M. Ali Omar (Pearson Education)
4. SolidState Physics – A. J. Dekker (Mc. Millan)
4. SolidState Physics – S. O. Pillai (New Age International)
5. Elements of SolidState Physics – J. P. Srivastava (Prentice Hall)
6. An Introduction to SolidState Physics and Application – R.J. Elliot and A.F. Gibson (McMillan)
7. SolidState Physics – D.W. Snoke (Person Education)

Practical Marks: (25+25+25) 75

বিষয়	পত্র	পত্র কোড	পত্র শিরোনাম	নম্বর	ক্রেডিট
Physics	১ম পত্র	131169	Practical-1	25	1
	২য় পত্র	131170	Practical-2	25	1
	৩য় পত্র	131171	Practical-3	25	1

Distribution of Marks

i) Theory (Paper-1,2,3)   3×5=15
ii) Procedure & Data Collection (Paper-1,2,3)   3×5=15
iii) **Laboratory Note Book** (Paper-1,2,3)   3×5=15
iv) **Viva-voce** (Paper-1,2,3)   3×5=15
v) Discussions (Paper-1,2,3)   3×5=15
       Total=**75**

Laboratory Teaching Classes

One laboratory class (of 3 periods duration) per week should be devoted to teach the following topics during the three years course. These lectures should be taken in laboratory and should be of interactive type so that students also participate in the learning process. As the course on physics practical will be taught

in early months of first year, students will get sufficient time to use apparatus in practical classes.

Laboratory Teaching

1. Demonstration lectures on use of Vernier, Micrometer, Spherometer, Barometer, common balance ,etc.; graph plotting -2 Lab-class.

2.(i) Basic ideas of Probability & Statistics

(ii) Error analysis, significant figures, limits of accuracy of an Experiment-associated

choice ofequipments. -3 Lab-class

3. Measuring instruments (e.g. Galvanometer, Multimeter& CRO) to be used in thelaboratory −2 Lab-class.

GROUP −A

1. Determination of the value of acceleration due to gravity by using bar Pendulum.

2. Determination of moment of inertia of a metallic cylinder/rectangular bar about an axispassing through its centre of gravity.

3. To determine the modulus of rigidity of the form of a cylindrical rod by statical method.

4.Determination of young's modulus of the material of the given wire by Searle's method.

5.To determine the focal length of two given convex lenses and their combination in contact by displacement method.

6.Determination of refractive index of the given liquid with the help of plane mirror, convexlens &spherometer.

7.To determine the focal length of two given convex lenses and their combination in contact by displacement method.

8.Determination of the refractive index of the material of a prism by drawing the i-δ curve using spectrometer.

9. To calibrate a polarimeter and hence to determine the concentration of sugar solution.

10. Determination of the surface tension of water by capillary rise method.

11. Determination of the co-efficient of viscosity of water by flow through a capillary tube

12. Determination of the frequency of a tuning fork with the help of a sonometer (Either by
    using the relevant formula or by using the n-l curve).

13. To determine refractive index of water using travelling microscope.

14. To determine the boiling point of a given liquid by platinum resistance thermometer.

15. Determination of thermal conductivity of the given rod by Searle's apparatus.

16. Determination of thermal conductivity of a bad conductor of heat by Lee's and Chorlton's
method.

17. Determination of specific heat of the given liquid by the method of cooling.

18. To determine the boiling point of a given liquid by platinum resistance thermometer.

19. To determine the melting point of a solid with the help of a thermocouple.

20. To determine the wavelength of monochromatic source by Fresnel's biprism.

21. Determination of the width of a single slit by the Spectrometer with diffraction method.

22. To determine the wave length of monochromatic light by Newton's ring experiment.

GROUP –B

1. To determine the ballistic constant of a ballistic galvanometer.

2. Determination of specific resistance of the material of a given wire by meterbridge.

3. Verification of the laws of series and parallel resistance by a Post Office box.

4. Determination of E.C.E. of copper by using an ammeter and a copper voltameter.

5. Determination of EMF of a cell by potentiometer.

6. Comparison of the magnetic moments of two given bar magnets by deflectionmagnetometer.

7. Determination of the value of the given low resistance by drop of potential method with the
help of metre-bridge.

8. Determination of internal resistance of a cell with the help of potentiometer.

9. Conversion of the given galvanometer into an ammeter & its calibration using copper
voltameter.

10. Determination of resistance of a galvanometer by half - deflection method.

11. Determination of the reduction factor of a tangent galvanometer with copper voltameter
and hence to determine the value of H, the horizontal component of earth's magnetic field.

12. Convert a given galvanometer into voltmeter and calibrate it.

13. To draw the forward characteristic curves of a semiconductor diode and hence calculate the
dc resistance (r_{dc}).

14. To draw the dynamic characteristic curve of a triode for three different loads and tocalculate the voltage gain for the load and to compare it with the theoreticallycalculated value.

15. To draw input, out put and mutual characteristics curve of a transistor in CE mode and hence to calculate its h-parameters.

16. To measure the resistance, reactance and self inductance of a chocked coil in an L-Rcircuit using an A.C. Voltmeter.

17. To determine the ripple factor of a full wave rectifier with a shunt capacitor filter using a D.C. voltmeter and to study the variation of ripple factor with load.
18. Tostudu a full wave rectifier with a shunt capacitor as filter circuit and hence to determine the values of ripple factor using CRO at the differentncy loads.
19. To study the frequency response curve of a series LCR circuit and determine the resonance frequency.
20. Determination of J (mechanical equivalent of heat) by Joule's electrical calorimeter.
21. To study the variation of mutual inductance of a given pair of co-axial coils by using a ballistic galvanometer.
22. To measure the self inductance of two coils by Anderson bridge .To find the total inductance of the abovetwo coils connected in series and hence estimate the coefficient of coupling between the coils.

Books &References:

1. BSc Practical Physics, C. L. Arora, (S. Chand)
2. An Advanced Course in Practical Physics, D. Chattopadhyay and P. C. Rakshit, (NewCentral Book Agency)
3. A Text Book of Advanced Practical Physics, S. Ghosh, (New Central Book Agency)
4. ব্যবহারিক পদার্থ বিজ্ঞান- অরুনবসাক ও ছদরুদ্দিন আহমেদ চৌধুরী
5. ব্যবহারিক পদার্থ বিজ্ঞান (১ম ও ২য় খন্ড) - মফিজুল মান্নান

বিষয়-২: **Mathematics**

বিষয়	পত্র	পত্র কোড	পত্র শিরোনাম	নম্বর	ক্রেডিট
Mathematics	১ম পত্র	**131172**	Mathematics Part-I	75+25=100	4
	২য় পত্র	**131173**	Mathematics Part-II	75+25=100	4
	৩য় পত্র	**131174**	Mathematics Part-III	75+25=100	4

বিস্তারিত সিলেবাস

বিষয়	পত্র	পত্র কোড	পত্র শিরোনাম	নম্বর	ক্রেডিট
Mathematics	১ম পত্র	**131172**	Mathematics Part-I	75+25=100	4

Marks Distribution

Written: 75

A. Fundamentals of Mathematics: 45

    Broad Questions (3 out of 5)   3×15=45

B. Coordinate Geometry and Vector Analysis:30

    Broad Questions (2 out of 4)   2×15=30

Practical: **=25**

                                Total: 100

Topics to be Read:

A. Fundamentals of Mathematics:

1. **The Real Number System:** Field and order properties, Natural numbers, integers and rational numbers, Absolute value and their properties. Basic inequalities.(Including inequalities of means, powers; inequalities of Cauchy, Chebyshev, Weierstrass).

2. **The Complex Number System:** Field of Complex numbers, De Moivre's theorem and its applications.

3. **Theory of equations:** Number of roots of polynomial equation.Relations between roots and coefficients, Symmetric functions of roots, Sum of the powers of roots,

Synthetic division, Des Cartes rule of signs, Multiplicity of roots, Transformation of equations.

4. **Elementary number theory:** Divisibility, Fundamental theorem of arithmetic, Congruences (basic properties only)

5. **Summation of Series:** Summation of algebrice and trigonometric series, Arithmetieo- geometric series.

B. Coordinate Geometry and Vector Analysis:

1. **Two-dimensional Geometry:** Transformation of coodinates, Pair of straight lines (homogeneous second degree equations, general second degree equations representing pair of straight lines, angle between pair of straight lines, bisectors of angle between pair of straight lines), General equations of second degree (reduction to standard forms, identifications, properties and tracing of conics).

2. **Vector Analysis:** Vectors in plane and space. Algebra of vectors. Rectangular Components. Scatar and Vector products. Triple scalar product. Applications of vector to geometry (vector equations of straight lines and planes, areas and volunes). The gradient, divergence and curl of a vector function.

Books Recommended:
1. Schaums Outline Series- Theory and problems on set theory and related topics.
2. S. Bernard & J M Child – Higher algebra.
3. Md. Abdur Rahman – Basic Algebra
4. Fazlur Rahman & Hafizur Rahman – Fundamentals of Mathmetics.
5. H. H. Askwith – Analytic Geometry of Conic Section
6. J. A. Hummel – Vector Geometry
7. Fazlur Rahman & Hafizur Rahman – Analytic and Vector Geometry.

বিষয়	পত্র	পত্র কোড	পত্র শিরোনাম	নম্বর	ক্রেডিট
Mathematics	২য় পত্র	**131173**	Mathematics Part-II	75+25=100	4

Marks Distribution

Written: 75

A. Calculus: 45

    Broad Questions (3 out of 5)   3×15=45

B. Linear Algebra:30

    Broad Questions (2 out of 4)   2×15=30

Practical: _____ **=25**

                                      Total: 100

Topics to be Read:

A. Calculus:

1. **Differentiation:**Tangent lines and rates of change. Definition of derivative. One-sided derivatives. Rules of differentiation (proofs and applications). Successive differentiation. Leibnitz theorem (proofs and application). Related rates. Linear approximations and differentials.

2. **Applications of Differentiation:** Rolle's theorm, mean value theorem. Maximum and minimum values of functions. Concavity and points of inflection. Oplimization problems, Curvature.

3. **Function of several variables:** Limit and continuty. Partial derivatives Defferentiability. linerarization and differentials. The chain rule. Partial derivatives with constrained variables Derictional variables. Lagrange multipliers, Taylor's formula.

4. **Integration:** Antiderivatives and indefinite integrals. Techniques of integration. Definite integration using antiderivatives. Definite integration using Riemann sums. Fundamental theorems of calculus (proofs and applications). Basic properties of integration. Integration reduction.

5. **Multiple Integration:** Double integrals and iterated integrals. Double integrals over nonrectangular regions. Double integrals in polar coordinates. Area by double integral. Triple integrals and iterated integrals. Volume as a triple integrals.

6. Improper integrals. Tests of convergence and their applications. Gamma and Beta functions. Indeterminate forms, L' Hospital's rule.

B. Linear Algebra:

1. **Matrices and Determinants:** Notion of matrix. Type of matrices. Algebra of matrics. Determinant function. Properties of determinants. Minors, Cofactors, epansion and evaluation of determinants. Elementary row and colum operations and row reduced cehelon matrices. Invertible matriees Different types of matrices, Rank of matrices.

2. **System of Linear Equations:** System of linear equations (homogeneous and non-homogeneous) and their solutions. Application of matrices and determinants for solving system of linear equations. Applications of system of equations in real life problems.

3. **Vector Space:** Nation of groups and fields. Vector spaces. Subspaces. Linear combination of vectors. Linear dependence of vectors. Basis and dimension of vector spaces. Row and column space of matrix. Rank of matrices. Solution spaces of systems of linear equations.

4. **Eigenvalues and Eigenvectors:** Eigenvalues and Eigenvectors. Diagonalization. Cayley-Hamilton theorem and its application.

Book Recommended:
1. Howard Anton : *Calculus*
2. Mohammad and Bhattacharjee : *Text Book on Differential Calculus : Text Book on Integral Calculus*

3. Matin and Chakrabarty : *Differential Calculus*
4. Abu Yusuf : *Differential Calculus : Integral Calculus*
5. Fazlur Rahman & Hafizur Rahman : *Calculus-I & Calculus-II*
6. Howard Anton & Chris Rorres – *Elementary Linear Algebra with Application*
7. Seymour Lipschutz (Schaum's Outline Series) – *Linear Algebra*
8. Md. Abdur Rahman - *Linear Algebra*
9. Fazlur Rahman & Hafizur Rahman - *Linear Algebra*

বিষয়	পত্র	পত্র কোড	পত্র শিরোনাম	নম্বর	ক্রেডিট
Mathematics	৩য় পত্র	**131174**	Mathematics Part-III	75+25=100	4

Marks Distribution

Written: 75

A. Computer Programming and Numerical Analysis: 45

    Broad Questions (3 out of 5)   3×15=45

B. Ordinary Differential Equations:30

    Broad Questions (2 out of 4)   2×15=30

Practical: **=25**

                 Total: 100

Topics to be Read:

A. Computer Programming and Numerical Analysis:

1. **Computer Programming/ Algorithm and programs:** Problem analysis and development of algorithms. Program coding, execution, design, validation and refinement.
2. **Basic FORTRAN:** Data type, operations functions, assignment statement, input-output, stop and end statement.
3. **Control structure:** Logical data type, logical if and block if, do and continue, Go to statement, While statement.
4. **Input-output:** formatted input and output, File processing.
5. **Numerical Analysis/Solutions of equations of one variable:** Bisection method, Fixed point iteration, Newton-Raphson method, Error analysis for iterative method.
6. **Interpolation and polynomial approximation:** Taylor polynomials, Interpolation and Lagrange polynomial, Iterated interpolation.
7. **Numerical differentiation & integration:** Numerical differentiation with backward – difference formula, forward difference formula, Adaptive quadrature method, Trapezium method, Simpson method, Matrix algebra and system of

equations. Matrix operations, Gauss-Jordan elimination method. SOR Method. (Successive over-Relaxation method).

B. Ordinary Differential Equations

1. **Ordinary differential equations and their solutions:** Definition and formation of differential equations. Classification of differential equations. Solutions. Implicit solutions. Singular solutions. Initial value problems. Boundary value problems. Basic existence and uniqueness theorems (statement and illustration only). Direction fields. Phase line.

2. **Solution of first order Differential equations :** Separable equations. Linear equations. Exact equations. Special integrating factors. Substitutions and transformations. Homogeneous equations. Bernoulli equation. Riccati equation. First order higher degree equation-solvable for x, y and p. Clairaut's equation.

3. **Solution of higher order linear equations:** Linear differential operators. Basic theory of linear differential equations. Solution space of homogeneous linear equations. Fundamental solutions of homogeneous solutions. Reduction of orders, Homogeneous linear equations with constant coefficients. Non-homogeneous equation. Method of undetermined coefficients. Variation of parameters. Euler-Cauchy differential equation.

Books Recommended:
1. Schaum's Outline Series : Fortram 77
2. V. Rajaraman : Fortram 90/95
3. S. S. Kuo : Numerical methods & Computers
4. Burdin & J. D. Faires : Numerical Analysis
5. S. S. Shastry : Introductory Methods of Numerical Analysis
৬. হোসাইন, ভট্টাচার্য, ইলিয়াস : সাংখ্যিক বিশ্লেষণ

7. S.L. Ross- Diferential Equations.
8. Denis Gill-Introduction to Diferential Equations.
9. Frank Ayres, J R. Theory and Problems of Difrential Equations.
10. Martin Braun. An introduction to Diferential Equations and their Applications.
11. কুদ্দুস, আওয়াল, হাফিজ - Ordinary differential Equation

Practical Marks:(25+25+25)=75

বিষয়	পত্র	পত্র কোড	পত্র শিরোনাম	নম্বর	ক্রেডিট
Mathematics	১ম পত্র	131172	Practical-1/ Math Lab	25	1
	২য় পত্র	131173	Practical-2/ Math Lab	25	1
	৩য় পত্র	131174	Practical-3/ Math Lab	25	1

✓ **Problem-solving using Mathematica:** Running the package. Numerical computation. Algebraic computation. Mathematical functions. Derivatives and integrals. Limits and series. Determinents and matrices. Graphics. Standard packages. Solving problems in Algebra, Geometry, Calculus, differential equations and Computing. Problems will be selected from courses studied in the first and second years.

✓ Students are required to work on their assignments in the sessions.

✓ Evaluation:

Internal Assessment (Laboratory works) : 30 marks

Final Exam (Lab) (3 hours)   : 45 marks

Total = 75 Marks

Books Recommended:

1. Schaum's Outline Series – *Mathematica*
2. Worlfarm's Research (Student edition) – *Mathematica*

বিষয়-৩: Zoology

গুচ্ছ বিষয়	পত্র	পত্র কোড	পত্র শিরোনাম	নম্বর	ক্রেডিট
Zoology	১ম পত্র	**131175**	Zoology- Part-I	75+25 =100	4
	২য় পত্র	**131176**	Zoology- Part-II	75+25 =100	4
	৩য় পত্র	**131177**	Zoology- Part-III	75+25 =100	4

বিস্তারিত সিলেবাস

গুচ্ছ বিষয়	পত্র	পত্র কোড	পত্র শিরোনাম	নম্বর	ক্রেডিট
Zoology	১ম পত্র	**131175**	Zoology- Part-I	75+25 =100	4

Marks Distribution

Written: 75

A. Nonchordate: 45

    Broad Questions (3 out of 5)   3×15=45

B. Chordata:30

    Broad Questions (2 out of 4)   2×15=30

Practical: **=25**

                               Total: 100

Topics to be Read:

A. Nonchordate:

1. Broad classification of the following phyla up to orders with general and diagnostic characteristics of each taxonomic category with examples, particular reference to Bangladesh: Sarcomastigophora, Apicomplexa, Ciliophora, Porifera, Coelenterata, Platyhelminthes, Nematoda, Mollusca, Annelida, Onychophora, Arthropoda, Echinodermata and Hemichordata.

2. Type study of the followings with their systematic position, habitats, external morphology, organ systems, such as digestion, movement, circulation, respiration, excretion,

nervous, reproduction; food and feeding habits, mode of life and development

   a.   Phylum Sarcomastigophora: Euglena, Entamoeba
   b.   Phylum Apicomplexa: *Plasmodium*
   c.   Phylum Ciliophora: *Paramecium*
   d.   Phylum Porifera: *Scypha,*
   e.   Phylum Coelenterata; *Obelia*
   f.   Phylum Ctenophora: *Hormiphora*
   g.   Phylum Platyhelminthes: *Fasciola, Taenia*
   h.   Phylum Nematoda: *Ascaris*
   i.   Phylum Rotifera: Any rotifer
   j.   Phylum Mollusca; *Pila*
   k.   Phylum Annelida: *Neanthes*
   l.   Phylum Onychophora: *Peripatus*
   m.   Phylum Arthropoda; Prawn
   n.   Phylum Phorinida: *Phoronis*
   o.   Phylum Echinodermata; *Asteropecten*
   p.   Phylum Hemichordata: *Balanoglossus*

3.   **Special study of the following**:

   a.   Protozoa: nuclear apparatus and nutrition
   b.   Porifera: canal systems
   c.   Coelenterata: polymorphism, Coral reef and reef formation
   d.   Platyhelminthes: parasitic adaptations
   e.   Annelida: segmental organs
   f.   Arthropoda: crustacean larvae
   g.   Echinodermata: larval forms

B. Chordata:

1. Broad classification of the followings up to orders with general and diagnostic characteristics of each taxonomic category with examples, particular reference to Bangladesh- Urochordata,Cephalochordata,Cyclostomata, Chondrichthyes, Osteichthyes, Amphibia, Reptilia, Aves and Mammalia

2. Type study of the followings with their systematic position, habitats, external morphology, anatomy including skeletal, digestive, circulatory, respiratory, excretory, nervous, reproductive and endocrine systems; food and feeding habits, mode of life and development
   a. Urochordata: *Ascidia*
   b. Cephalochordata: *Branchiostoma*
   c. Cyclostomata: Petromyzon
   d. Chondrichthyes: *Scoliodon*
   e. Osteichthyes: *Labeo*
   f. Amphibia: *Bufo/Rana*
   g. Reptilia: *Hemidactylus*
   h. Aves: *Columba*
   i. Mammalia: *Cavia*

3. **Special study of the following:**
   a. Poisonous and non poisonous snakes; snake venom and biting mechanism
   b. Mesozoic reptiles
   c. Migration of birds
   d. Flying mammals and marsupials
   e. Aquatic adaptations of mammals
   f. Integument and its derivatives: fish fins and scales; feathers, beak, bills and claw of birds; nails, hooves and horns of mammals; dentition, teeth and their development, types of dentition, dental formula of mammals
   g. Skeletal system: axial and appendicular skeletons of vertebrates
   h. Digestive system: modification of the alimentary canal in different chordates
   i. Circulatory system: modification of aortic arches and heart in reptiles, birds and mammals

j. Urinogenital system: excretory system; pro-, meso-, and metanephridic kidneys; reproductive system.

Books Recommended: Nonchordate

1. C. P. Hickman andL. S. Roberts. 199: Animal Diversity. Wm. C. Brown
2. J. W. Nybakken and J. McClintock. 1996: The Diversity of Invertebrates: Gulf of
3. Mexico Version. Wm. C. Brown
4. L. S. Dillon. 1976: Animal variety; An Evolutionary Account.
5. Wm. C. Brown Company Publisher Dubuque, Iowa
6. E. E. Ruppertand R. D. Barnes. 1994:Invertebrate Zoology (6" edition).Saunders College Publishing- HarcourtBrace College Publishers, New York,London
7. A. J. Marshal, W. D. William:Text Book of Zoology-Invertebrates.(Edited the edition of Text Book ofZoology, Vol. I, T. J. Parker and W. A.Haswell)
8. 6.M. Sleigh. 1989:Protozoa and other Protists. Chapman and Hall Inc., New York

Books Recommended: Chordata

9. M. Hildebrand. 1994: Analysis of Vertebrate Structure. John Wiley & Sons. Inc., New York
10. G. C. Kent and L. Miller. 1997: Comparative Anatomy of the Vertebrates. McGraw Hill
11. J. Young, 1981: Life of Vertebrates. OUP, USA
12. F. H. Pough, J. B. Heiser and W. N. McFarland. 1997:Vertebrate Life. Prentice Hall
13. K. V. Kardong. 1997: Vertebrates: Comparative Anatomy, Function, Evolution. Wm. C. Brown
14. R. M. Alexander. 1977:The Chordates.Vikas PublishingHouse Pvt. Ltd., New Delhi

15. R. Pearson and J. N. Ball. 1981:Lecture Notes on Vertebrate Zoology. Blackwell Science.
16. T. J. Parker and W. A. Haswell:A Text Book of Zoology. Vol. II. Macmillan & Co., London
17. C. K. Weichert: Anatomy of the Chordates

গুচ্ছ বিষয়	পত্র	পত্র কোড	পত্র শিরোনাম	নম্বর	ক্রেডিট
Zoology	২য় পত্র	131176	Zoology- Part-II	75+25 =100	4

Marks Distribution

Written: 75

A. Cytology & Histology, Ecology: 45

    Broad Questions (3 out of 5)   3×15=45

B. Embryology & Animal adaptation:30

    Broad Questions (2 out of 4)   2×15=30

Practical: **=25**

                                         Total: 100

Topics to be Read:

A. Cytology & Histology, Ecology:

Cytology & Histology

1. Definition of cytology and histology
2. History of cytology
3. Ultra-structures of cell; cell divisions; morphology of sperm and ovum
4. Tissue: types and functions

Ecology:

1. Definition, structure, component and function of ecosystem; Energy and its flow in Ecosystem; Biogeochemical cycles: carbon, nitrogen and carbon dioxide; Aquatic Ecosystem of a pond
2. Definition of population; population growth forms: J and S-shaped growthforms Concept of carrying capacity
3. Major biomes of the world
4. Environmental pollution: air, water, soil and noise- their sources, effects and remedial measures
5. Conservation of natural resources; concept and classification of resources; renewable and non-renewable resources and their management

6. Consequences of the loss of natural resources
7. Concept of biodiversity.

B. Embryology & Animal adaptation:
Embryology:
1. Gametogenesis- spermatogenesis and oogenesis in mammals
2. Types of eggs in animals
3. Fertilization and types of cleavage
4. Extra embryonic membranes in amniotes
5. Placentation in mammals
6. Development of Neanthes and Callus
7. Embryonic circulation and nutrition

Animal adaptation:
1. Introduction and definition.
2. Adaptive diversity in nonchordates particular reference to theirhabitats and feeding habits
3. Adaptive radiation and the distribution of organisms

Books Recommended:
1. G. B. Wilson and J. H. Morrison: Cytology. Affiliated East-West Press Pvt. Ltd., New Delhi
2. J. R. Baker. 1966: Cytological Technique. John Wiley & Sons
3. R. L. Smith. 1998: Elements of Ecology. Longman
4. M. Begon, J. L. Harper and C. R. Townsend. 1996: Ecology: Individuals, Populations and Communities. BlackwellScience
5. C. J. Krebs. 1993: Ecology- The ExperimentalAnalysis of Distribution and Abundance. Haiper Collins, New York
6. E. A. Laws. 2000: Aquatic Pollution: An Introductory Text. Wiley
7. A. Dobson. 1996: Conservation and Biodiversity. Scientific American
8. J. Turk, J. Wittes, R. Wittes and A.Turk:Ecosystems Energy, Population. W.B. Saunders Company, Philadelphia, London

9. B.Groombridge andM.D. Jenkins. 1996: Assessing Biodiversity Status and Sustainability. WCWC

10. K. J. Gaston andJ. I. Spicer. 1998: Biodiversity: An Introduction.Blackwell Science

11. M. Jeffries. 1997: Biodiversity and Conservation. Routledge

12. E. P. Odum: Fundamentals of Ecology. W. B.Saunders Com. London

3. S. F. Gilbert and A. M. Raunio (Editors). 1997:Embryology: Constructing the Organism. Sinauer

4. B. I. Balinsky: An Introduction of Embryology

5. B. H. Wilier and J. M. Oppenheimer. 1968: Foundations of Experimental Embryology. Prentice- Hall of India Pvt. Ltd., New Delhi

6. M. R. Rose and G. V. Lauder. 1996: Adaptation. Academic Press

7. R. N. Brandon. 1995: Adaptation and Environment. Princeton UP, USA

গুচ্ছ বিষয়	পত্র	পত্র কোড	পত্র শিরোনাম	নম্বর	ক্রেডিট
Zoology	৩য় পত্র	**131177**	Zoology- Part-III	75+25 =100	4

Marks Distribution

Written: 75

A. Animal Genetics: 45

    Broad Questions (3 out of 5)   3×15=45

B. Economic Zoology:30

    Broad Questions (2 out of 4)   2×15=30

Practical: **=25**

                                Total: 100

Topics to be Read:

A. Animal Genetics

1. Introduction
2. Mendel's principles of segregation and of independent assortment
3. Modification of Mendelian ratio
4. Test cross and back cross
5. Linkage and crossing over
6. Mutation and chromosomal aberrations
7. Sex linked, sex limited and sex influenced inheritance
8. Sex determination

B. Economic Zoology:

8. Apiculture: life cycle of a honey producing bee species; types of hive; honey processing
9. Sericulture: varieties of silkworm and their host plants; techniques of silkworm rearing; silkworm diseases and pests, and their control

10. Lac culture: systematic position and distribution of lac insects; life cycle of a lac insect species; collection and processing of lac

11. Integrated Pest Management (IPM): concept; components of IPM

12. Carp culture: carp culture including induced breeding of carps in ponds

13. Prawn and shrimp culture: types, techniques and management

14. Poultry farming: varieties of fowls and ducks; techniques of poultry farming; diseases of poultry and their control; economic importance of poultry

15. Economic importance of Molluscs

16. Economic importance of amphibians and reptiles in Agriculture, Fisheries and Forestry

17. Animal husbandry: concepts, farming of domestic animals-cattleand goats, diseases of domestic animals and their control, economic importance of farm animals.

Books Recommended:

1. E.W. Sinnot, L.C. Dunn and Dobzhansky: Principles of Genetics. McGraw Hill Book Co. New York

2. A. S. Islam: Fundamentals of Genetics. Vikas Publishing House Pvt. Ltd

3. R. F. Weaver and P. W. Hedrick. 1995: Basic Genetics. Wm. C. Brown Publisher, Dubuque, Iowa

4. T. A. Brown. 1997:Genetics: A Molecular Approach. Chapman and Hall

5. Dennis S. Hill. 1997: The economic importance of insects(1st edition). Chapman and Hall,London

6. D. Dent: Integrated Pest Management. Chapman & Hall, London

7. R. Wall and D. Shearer. 1997: Veterinary Entomology. Chapman and Hall
8. M. Huet. 1986: Text Book of Fish culture-Breeding and Cultivation of Fish (2ndEdition) Fishing News Books
9. V. G. Jhingran and R. S. V. Pullin. 1985: A Hatchery Manual for the Common Chinese and Indian Major Carps ADB/ICLARM
10. P. R. Boyle: Molluscs and man. Edward Arnold, London

Practical Marks:(25+25+25)=75

বিষয়	পত্র	পত্র কোড	পত্র শিরোনাম	নম্বর	ক্রেডিট
Zoology	১ম পত্র	131175	Practical	25	1
	২য় পত্র	131176	Practical	25	1
	৩য় পত্র	131177	Practical	25	1

I. Nonchordates:

1. Study of museum specimens; representative of non-chordate phyla (minimum 50 specimens to be studied)
2. Study of permanent slides: whole mount, body parts, and various cells (at least 20 slides to be studied)
   a. Whole animals- representatives of Protozoa and Arthropoda; mouth parts of Arthropoda
   b. Parasites- Nematode and Platyhelminthes
   c. Different larval forms of invertebrates
3. External morphology and dissection of various organ systems of earthworm, cockroach, prawn and Pila:
   a. Digestive system of earthworm, cockroach, prawn and *Pila*
   b. Circulatory system of earthworm and prawn
   c. Nervous system of earthworm, cockroach, prawn and *Pila*
   d. Reproductive system of earthworm and cockroach
4. Temporary mounting:
   a. Brain, ovary and nephridium of earthworm

b. Salivary gland of cockroach

c. Statocyst of prawn

d. Mouth parts of mosquito

II. Chordates:

1. Study of museum specimens: representatives of all types of chordates particular reference to Bangladesh (minimum 50 specimens to be studied)

2. Dissection: dissection of the following specimens-

   i. Lata fish- digestive system; afferent and efferent blood vessels

   ii. Frog/toad- digestive system and circulatory systems

   iii. Lizard- digestive and circulatory systems

3. Histological slides of vertebrates

4. Temporary mounting- scales and weberian ossicle of fishes; hyoid apparatus of toad; preparation of blood smear

5. Study of bones: Comparative study of the skeletons of amphibian, reptile, bird and mammal

III. Fresh water studies: identification of micro fauna in fresh watersamples

IV. Field visit to observe local invertebrate and vertebrate fauna antheir habitats, and prepare a report on the visit. Students will alsocollect specimens and submit these along with the report in the finalpractical examination to be held in the 3rd year.

Distribution of marks:

a.	Nonchordate: dissection, display, drawing & labeling	= 10
b.	Chordate: dissection, display, drawing & labeling	= 10
c.	Temporary mount:	= 05
d.	Invertebrate museum specimens	= 05
e.	e)Vertebrate museum specimens	= 05
f.	Slide whole mount, Histological slide, bones	= 05
g.	Collection of specimens	= 05
h.	Class records	= 15
i.	Viva-voce	=15

Total: 75

বিষয়-৪: বাংলা সাহিত্য/ **Bangla Literature**

গুচ্ছ বিষয়	পত্র	পত্র কোড	পত্র শিরোনাম	নম্বর	ক্রেডিট
বাংলা সাহিত্য	১ম পত্র	**131178**	বাংলা কবিতা **Bangla Poetry**	100	4
	২য় পত্র	**131179**	বাংলা উপন্যাস ও নাটক **Bangla Novel and Drama**	100	4
	৩য় পত্র	**131180**	বাংলা ছোট গল্প ও প্রবন্ধ **Bangla Short Story and Prose**	100	4

বিস্তারিত সিলেবাস

বিষয়	পত্র	পত্র কোড	পত্র শিরোনাম	নম্বর	ক্রেডিট
বাংলা সাহিত্য	১ম পত্র	**131178**	বাংলা কবিতা **Bangla Poetry**	100	4

মানবণ্টন

বড় প্রশ্ন : ৬টি প্রশ্ন থাকবে। যে কোন ৪টির উত্তর দিতে হবে	৮×২০= ৮০
ব্যাখ্যা: ৬টি ব্যাখ্যা থাকবে। যে কোন ৪টির উত্তর দিতে হবে	৮×০৫= ২০

মোট : ১০০

[বি.দ্র.: সিলেবাসের প্রত্যেক বিভাগ থেকে সমান হারে বড় প্রশ্ন ও ব্যাখ্যা নির্বাচন করে প্রশ্ন করতে হবে।]

সিলেবাসঃ নির্বাচিত কবিতা

(ক) প্রাচীন ও মধ্যযুগ :

১.	কাহ্নপা	- আলিএঁ কালিএঁ বাট রুন্ধেলা
২.	বিদ্যাপতি	- এ সখি হামারি দুঃখের নাহি ওর
৩.	চণ্ডীদাস	- মরম না জানে ধরম বাখানে
৪.	শাহ মুহম্মদ সগীর	- ইউসুফের নির্যাতন
৫.	দৌলত উজির বাহরাম খান-	লায়লী ও মজনুর প্রেম বিনিময়
৬.	কাজী দৌলত	- বারমাস্যা
৭.	আলাওল	- পদ্মাবতীর রূপ বর্ণন
৮.	আবদুল হাকিম	- যে সব বঙ্গেত জন্মি
৯.	ভারতচন্দ্র রায়	- অন্নদার ভবানন্দ ভবনে যাত্রা
১০.	লালন শাহ	- খাঁচার ভিতর অচিন পাখি

(খ) আধুনিক যুগ-১

১.	মাইকেল মধুসূদন দত্ত	- আত্মবিলাপ
২.	কায়কোবাদ	- আহ্বান
৩.	রবীন্দ্রনাথ ঠাকুর	- নিষ্ফল কামনা
৪.	কাজী নজরুল ইসলাম	- মোহররম
৫.	জীবনানন্দ দাশ	- বোধ
৬.	জসীমউদ্দীন	- কবর
৭.	বিষ্ণু দে	- ঘোড়সওয়ার
৮.	সুকান্ত ভট্টাচার্য	- ছাড়পত্র

(গ) আধুনিক যুগ-২ :

১.	সিকানদার আবু জাফর	- সংগ্রাম চলবেই
২.	ফররুখ আহমদ	- লাশ
৩.	আহসান হাবীব	- তোমাকে মৃত জেনে
৪.	শামসুর রাহমান	- বার বার ফিরে আসে
৫.	হাসান হাফিজুর রহমান	- অমর একুশে
৬.	আলাউদ্দিন আল আজাদ	- স্মৃতিস্তম্ভ
৭.	আল মাহমুদ	- সোনালী কাবিন-৫
৮.	আব্দুল মান্নান সৈয়দ	- সোনার হরিণ

সহায়ক গ্রন্থ:

১.	সৈয়দ আলী আহসান	: চর্যাপদ প্রসঙ্গ
২.	শঙ্করী প্রসাদ বসু	: মধ্যযুগের কবি ও কাব্য
৩.	আবুল আহসান চৌধুরী	: লালন শাহ
৪.	শিশির কুমার দাস	: মধুসূদনের কবি মানস
৫.	প্রমথনাথ বিশী	: রবীন্দ্র কাব্য প্রবাহ
৬.	রফিকুল ইসলাম	: কাজী নজরুল ইসলাম: জীবন ও সাহিত্য
৭.	দীপ্তি ত্রিপাঠী	: আধুনিক বাংলা কাব্য পরিচয়
৮.	তারাপদ মুখোপাধ্যায়	: আধুনিক বাংলা কাব্য
৯.	ফাতেমা কাওসার	: কায়কোবাদ: কবি ও কাব্য
১০.	সরোজ মোহন মিত্র	: সুকান্তের জীবন এবং কাব্য
১১.	ধ্রুব কুমার মুখোপাধ্যায়	: বিষ্ণু দে: জীবন ও সাহিত্য
১২.	সুনীল কুমার মুখোপাধ্যায়	: কবি ফররুখ আহমদ
১৩.	কবিতা সংগ্রহ	: প্রকাশক, ঢাকা বিশ্ববিদ্যালয়

বিষয়	পত্র	পত্র কোড	পত্র শিরোনাম	নম্বর	ক্রেডিট
বাংলা সাহিত্য	২য় পত্র	131179	বাংলা উপন্যাস ও নাটক Bangla Novel and Drama	100	4

মানবণ্টন

বড় প্রশ্ন : ৬টি প্রশ্ন থাকবে। যে কোন ৪টির উত্তর দিতে হবে   ৪×২০= ৮০

ব্যাখ্যা: ৬টি ব্যাখ্যা থাকবে। যে কোন ৪টির উত্তর দিতে হবে   ৪×০৫= ২০

<div align="right">মোট : ১০০</div>

[বি.দ্র.: সিলেবাসের প্রত্যেক বিভাগ থেকে সমান হারে বড় প্রশ্ন ও ব্যাখ্যা নির্বাচন করে প্রশ্ন করতে হবে।]

ক. নির্বাচিত উপন্যাস:

    ১.   বঙ্কিমচন্দ্র চট্টোপাধ্যায়   - কৃষ্ণকান্তের উইল

    ২.   মীর মশাররফ হোসেন   - বিষাদ সিন্ধু

    ৩.   নজিবুর রহমান   - আনোয়ারা

খ. নির্বাচিত নাটক:

    ১.   দীনবন্ধু মিত্র   -নীল দর্পন

    ২.   রবীন্দ্রনাথ ঠাকুর   - বিসর্জন

    ৩.   সিকানদার আবু জাফর   - সিরাজউদ্দৌলা

সহায়ক বই:

    ১.   অচ্যুত গোস্বামী   : বাংলা উপন্যাসের ধারা

    ২.   ক্ষেত্র গুপ্ত   : বঙ্কিমচন্দ্রের উপন্যাস: শিল্পরীতি

    ৩.   অরবিন্দ পোদ্দার   : বঙ্কিম-মানস

    ৪.   মুনীর চৌধুরী   : মীর-মানস

    ৫.   আনিসুজ্জামান   : মুসলিম-মানস ও বাংলা সাহিত্য

    ৬.   সৌমিত্র শেখর   : গদ্য শিল্পী মীর মশাররফ

    ৭.   মন্মথ মোহন বসু   : বাংলা নাটকের উৎপত্তি ও ক্রমবিকাশ

    ৮.   আশুতোষ ভট্টাচার্য   : বাংলা নাট্য সাহিত্যের ইতিহাস

    ৯.   অশোক সেন   : রবীন্দ্র নাট্য পরিক্রমা

    ১০. প্রমথনাথ বিশী   : রবীন্দ্র নাট্যপ্রবাহ

    ১১. খন্দকার সিরাজুল হক সম্পাদিত : দীনবন্ধু মিত্রের নীলদর্পণ

    ১২. সুনীল কুমার দে   : দীনবন্ধু মি

বিষয়	পত্র	পত্র কোড	পত্র শিরোনাম	নম্বর	ক্রেডিট
বাংলা সাহিত্য	৩য় পত্র	131180	বাংলা ছোট গল্প ও প্রবন্ধ Bangla Short Story and Prose	100	4

মানবণ্টন

বড় প্রশ্ন : ৬টি প্রশ্ন থাকবে। যে কোন ৪টির উত্তর দিতে হবে   ৪×২০= ৮০

ব্যাখ্যা: ৬টি ব্যাখ্যা থাকবে। যে কোন ৪টির উত্তর দিতে হবে   ৪×০৫= ২০

মোট : ১০০

[বি.দ্র.: সিলেবাসের প্রত্যেক বিভাগ থেকে সমান হারে বড় প্রশ্ন ও ব্যাখ্যা নির্বাচন করে প্রশ্ন করতে হবে।]

(ক) নির্বাচিত ছোট গল্প

১.	রবীন্দ্রনাথ ঠাকুর	- কঙ্কাল
২.	বিভূতিভূষণ বন্দোপাধ্যায়	- পুঁইমাচা
৩.	তারাশঙ্কর বন্দোপাধ্যায়	- কালাপাহাড়
৪.	আবুল মনসুর আহমদ	- হুযুর কেবলা
৫.	কাজী নজরুল ইসলাম	- শিউলিমালা
৬.	সৈয়দ মুজতবা আলী	- পাদটীকা
৭.	মানিক বন্দোপাধ্যায়	- চোর
৮.	শওকত ওসমান	- নতুন জন্ম
৯.	সুবোধ ঘোষ	-জতুগৃহ
১০.	সৈয়দ ওয়ালীউল্লাহ	- নয়নচারা
১১.	আবু ইসহাক	- জোঁক
১২.	শামসুদ্দীন আবুল কালাম	- পথ জানা নাই

(খ) নির্বাচিত প্রবন্ধ:

১.	হরপ্রদাস শাস্ত্রী	- তৈল
২.	রবীন্দ্রনাথ ঠাকুর	- সভ্যতার সংকট
৩.	প্রমথ চৌধুরী	- বঙ্গসাহিত্যের নবযুগ
৪.	কাজী আবদুল ওদুদ	- বাংলার জাগরণ
৫.	কাজী মোতাহার	- সাহিত্যের ব্যক্তিত্ব
৬.	কাজী নজরুল ইসলাম	- রাজবন্দীর জবানবন্দী
৭.	বেগম রোকেয়া	- অবরোধবাসিনী
৮.	মোহাম্মদ আকরম খাঁ	- বিদায় হজ্ব
৯.	মোতাহার হোসেন চৌধুরী	- সংস্কৃতি-কথা
১০.	আবুল ফজল	- সাহিত্যের ঐতিহ্য

১১. মুহম্মদ আবদুল হাই   - ভাষা ও সাহিত্য
১২. আহমদ শরীফ   - জীবন সমাজ ও সাহিত্য

সহায়ক গ্রন্থ:
১. শিশির কুমার দাস   : বাংলা ছোট গল্প
২. ধীরেন্দ্র দত্ত   : বাংলা ছোট গল্প: প্রসঙ্গ ও প্রকরণ
৩. চঞ্চল কুমার বোস   : বাংলা ছোট গল্পের শিল্পরূপ (১৯৪৭-১৯৯৬)
৪. আনোয়ার পাশা   : রবীন্দ্র ছোট গল্প সমীক্ষা (১-২খণ্ড)
৫. প্রমথনাথ বিশী   : রবীন্দ্র কথা সাহিত্য
৬. কৃষ্ণা বসু   : ছোট গল্পে মানিক বন্দোপাধ্যায়: শিল্পরূপ
৭. ভূমিকা অধীর দে   : আধুনিক বাংলা প্রবন্ধ সাহিত্যের ধারা
৮. সুকুমার সেন   : বাঙ্গালা সাহিত্যে গদ্য
৯. খোন্দকার সিরাজুল হক   : মুসলিম সাহিত্য সমাজ: সমাজ চিন্তা ও সাহিত্যকর্ম
১০. জীবেন্দ্র সিংহ রায়   : প্রথম চৌধুরী
১১. জহীরুল হাসান   : কাজী আব্দুল ওদুদ
১২. অরুণ কুমার মুখোপাধ্যায় : বীরবল ও বাংলা সাহিত্য
১৩. গল্প সংগ্রহ   : প্রকাশক, ঢাকা বিশ্ববিদ্যালয়
১৪. প্রবন্ধ সংগ্রহ   : প্রকাশক, ঢাকা বিশ্ববিদ্যালয়

বিষয়-৫: English Literature

গুচ্ছ বিষয়	পত্র	পত্র কোড	পত্র শিরোনাম	নম্বর	ক্রেডিট
English Literature	১ম পত্র	**131181**	Non-Fiction Prose & Short Story	100	4
	২য় পত্র	**131182**	English Poetry	100	4
	৩য় পত্র	**131183**	English Novel & Drama	100	4

বিস্তারিত সিলেবাস

বিষয়	পত্র	পত্র কোড	পত্র শিরোনাম	নম্বর	ক্রেডিট
English Literature	১ম পত্র	**131181**	Non-Fiction Prose & Short Story	100	4

Marks Distribution

A. **Non-Fiction Prose-50**

Broad Question (1out of 2)	$1 \times 20 = 20$
Short Question (2 out of 4)	$2 \times 10 = 20$
Short Notes (2 out of 4)	$2 \times 05 = 10$

B. **Short Story-50**

Broad Question (1out of 2)	$1 \times 20 = 20$
Short Question (2 out of 4)	$2 \times 10 = 20$
Short Notes (2 out of 4)	$2 \times 05 = 10$

Total: 100

Syllabus:

Non-Fiction Prose:

1. F. Bacon   : *"Of Studies, Of Great Place"*
2. V. Woolf   : *"Women and Fiction"*
3. G. Orwell   : *"Shooting an Elephant"*

Short Story

1. K. Mansfield : *"The Garden Party"*

2. O Henry   : "The Gift of Magi"
3. S. Maugham : "The Luncheon"
4. Heming Way : " A Cat in the Rain"

বিষয়	পত্র	পত্র কোড	পত্র শিরোনাম	নম্বর	ক্রেডিট
English Literature	২য় পত্র	**131182**	English Poetry	100	4

Marks Distribution

Broad Question (3 out of 5)	3× 20 = 60
Short Question (4 out of 6)	4× 05 = 20
Explanation (2 out of 4)	2× 10 = 20
	Total: 100

Syllabus:

1. W. Shakespeare : Sonnet (Shall I compare thee, My Mistress's eyes are
2. John Donne   :   "Good Morrow", "Sun Rising"
3. William Wordsworth   :   "I Wandered Lonely as a Cloud"
4. S.T. Coleridge   :   "The Rime of the Ancient Mariner"
5. George Gordon Lord Byron:"She Walks in Beauty"
6. P.B. Shelly   :   "Ode to the West Wind"
7. John Keats   :   "To Autumn"
8. Robert Brown   :   "My Last Duchess"
9. Lord Alfred Tennyson :   "Ulysses"
10. Robert Frost   :   "Stopping by Woods on a Snowy Evening"

বিষয়	পত্র	পত্র কোড	পত্র শিরোনাম	নম্বর	ক্রেডিট
English Literature	৩য় পত্র	**131183**	English Novel & Drama	100	4

Marks Distribution

A. Novel -50

Broad Question (1 out of 2)	$1 \times 20 = 20$
Short Question (2 out of 4)	$2 \times 10 = 20$
Short Notes (2 out of 4)	$2 \times 05 = 10$

B. Drama -50

Broad Question (1 out of 2)	$1 \times 20 = 20$
Short Question (2 out of 4)	$2 \times 10 = 20$
Short Notes (2 out of 4)	$2 \times 05 = 10$

Total: 100

Syllabus:

A. Novel:

1. G. Eliot　　　　　 : Silas Marner
2. E.M. Forster　　　 : A Passage to India

B. Drama:

1. Sophocles　　　　　 : *Oedipus Rex*
3. William Shakespeare　 : *The Merchant of Venice*

৩য় বর্ষ, গুচ্ছ-৪ এর ঐচ্ছিক বিষয়সমূহের বিস্তারিত সিলেবাস

বিষয়-১: Chemistry

বিষয়	পত্র	পত্র কোড	পত্র শিরোনাম	নম্বর	ক্রেডিট
Chemistry	১ম পত্র	131184	Physical Chemistry	75+25=100	4
	২য় পত্র	131185	Organic Chemistry	75+25=100	4
	৩য় পত্র	131186	Inorganic Chemistry	75+25=100	4

বিস্তারিত সিলেবাস

বিষয়	পত্র	পত্র কোড	পত্র শিরোনাম	নম্বর	ক্রেডিট
Chemistry	১ম পত্র	131184	Physical Chemistry	75+25=100	4

Marks Distribution

Written: 75

Broad Questions (5 out of 9)   5×15=75

Practical: =25

Total: 100

Topics to be read:

1. **State of aggregation of matter:** General discussion
2. **Gaseous state:** The gas laws. kinetic theory of gases, deviation form ideal behaviour. Amagat's curves.Van der Waals equation.Andrew's isotherms.lequification of gases.Joule-Thompson effect.critical phenomena. molecular weights from gas density, abnormal molecular weights, thermal dissolution.
3. **The Liquid state:** The vapour pressure of liquids, intermaolecular forces, surface tension and viscosity of

liquids, molecular structure and its relationship with surface tension, viscosity, optical rotation and dipole moment.

4. **Thermodynamics:** Work, energy and heat; first law of Thermodynamics, internal energy, enthalpy, laws of Thermochemistry. heat of reaction formation etc, heat capacities of substances. Kirchoffsequation.Reversible and irreversible process, isothermal and adiabatic processess; second law of thermodynamics, Carnot cycle, entropy, free energy, Gibb's-Helmholtz equation, Clausius-Clapyron equation.

5. **Solution properties:** Dalton's law of partial pressure, Henry's law and distribution law and their simple applications (association dissociation and solvent extraction).

6. **Colligative properties:** Raouit's laws of lowering of vapour pressure, elevation of boiling point and depression of freezing point, osmotic pressure, their experimental determination.

7. **Homogeneous equilibrium:** Law of mass ation, its enunciation and mathematical formulation of equilibrium constant and its application to chemical reactions, principle of mobile equilibrium and its application to industrial reactions.

8. **Chemical kinetics:** First and second order reactions and their simple treatment, determination of order of reaction, simple theories of reaction rate (Only outline of Arrhenius). Catalysis (elementary treatment).

Books Recommended:

1. Afinolley : *An Introduction to Physical Chemistry*
2. Daniels and Alberty : *Physical Chemistry*
3. A. R. Chowdhury : *Chemistry Fundamentals*
4. M. Haque &Y. A. Mollah : *Principles of Physical Chemistry*
5. নুরুল হক ও মহির উদ্দিন : *ভৌত রসায়ন পরিচিতি*
6. সিরাজুল ইসলাম : *প্রাথমিক ভৌত রসায়ন*
7. পাল ও চক্রবর্তী : *ভৌত রসায়ন*
8. পালিত : *ভৌত রসায়ন*

বিষয়	পত্র	পত্র কোড	পত্র শিরোনাম	নম্বর	ক্রেডিট
Chemistry	২য় পত্র	131185	Organic Chemistry	75+25=100	4

Marks Distribution

Written: 75

Broad Questions (5 out of 9)   5×15=75

Practical: _____ **=25**

Total: 100

Topics to be read:

1. **Fundamentals:** Purfiction and analysis of organic compounds, hybridization, nomenclature and structure of organic compounds.
2. **Aliphatic compounds:**
   a. **General knowledge of the following terms:** Free radicals, inductive effects, tautomerism, resonance, carbonium ions and carbanion.
   b. **Isomerism:** A general knowledge of isomerism including optical isomerism of substances containing one and two asymmetric carbon atoms and geometrical isomerism of carbon compounds.
   c. **Aliphatic compounds:** A general study, nomenclature, general methods of preparations, physical properties, reactions with special reference to functional groups and characteristic reactions and important uses of alkanes, alkynes, alkenes, alkylhalides, hydroxy compounds, ethers, amines, aldehydes, ketones, carboxylic acids and their esters halides, anhydrides and amides.
3. **Aromatic compounds:** A general study of the hybridization and structure of benxene; resonance and delocalization. isomerism in benzene substitution, preparation & reactions of benzene, aromatic halides, phenols. aldehydes, ketones, carboxylic acids, nitro, amino and diazonium compounds.

polynuclear aromatic hydrocarbons with special reference to the chemistry of naphthalene.

4. **Important reactions:** General principles and applications of some important reactions: Wurtzo-Fitting. Wlliamsonsysthesis, Malonnic and acetoacetic ester synthesis, Grignard reaction.Sandameyer reaction.Friedel-Crafts reaction.Aldol condesation, Cannizzaro reaction.Perkin reaction.

5. **Study of Carbohydrates:** With special reference to glucose, fructose, mutarotation, kiliani reaction and ruff's degradation.

Books Recommended:
1. I. L. Finar : *Organic Chemistry (Vol.I)*
2. J. Conant : *The Text Book of Organic Chemistry*
3. Ahmad & Miah : *Organic Chemistry*
4. English & Cassidy : *Principles of Organic Chemistry*
5. A. Khaleque : *Organic Chemistry*
6. মফিজুদ্দিন আহমেদ ও জব্বার মিঞা : *জৈব রসায়ন*
7. পাল ও চক্রবর্তী : *জৈব রসায়ন*
8. রবীন্দ্রনাথ ঘোষ : *জৈব রসায়ন*
9. নুরুল হক ও মহির উদ্দিন : *জৈব রসায়ন পরিচিতি*

বিষয়	পত্র	পত্র কোড	পত্র শিরোনাম	নম্বর	ক্রেডিট
Chemistry	৩য় পত্র	131186	Inorganic Chemistry	75+25=100	4

Marks Distribution

Written: 75

    Broad Questions (5 out of 9)   5×15=75

Practical: =25

Total: 100

Topics to be read:

1. **Atomic structure:** General study of the modern concept of the structure of atom. Rutherford atom model, Bohr's atom model; quantum numbers, Pauli's exclusion principle, electronic configurations of elements; elementary ideas about the wave nature of electrons; atomic orbitals.

2. **Periodic classification:** General survey of the classification of elements; periodic nature as related to the atomic structure. modern periodic table: its constition; s-block, p-block, d-block & f-block elements, change of properties of elements in periods & groups.

3. **Sizes of atoms and ions:** Atomic and ionic radii-ionization potential, electron affinity, electronegativity and their influences on the properties of molecules.

4. **Bonding:** Elementary ideas about the electronic theory of bonding, different bonds; hybridization of orbital, bond length, bond strength and bond angles, shapes of atoms.

5. **Transition metals:** General chemistry of transition elements with reference to the elements of the first transition series (3d elements).

6. **Acids and bases:** Modern views about acids and bases, theories and theirs applications and limitations. strength of acids.

7. **Group chemistry:** Brief general study of the following groups of elements in the periodic table with reference to properties and uses of elements and their important compounds with special emphasis to comparative chemistry. i) Inert gases ii) Alkali and coinage metals iii) Alkaline earth metals iv) Group-III v) Group-IV vi) Group-V vii) Group-VI viii) Group-VII. Elements.

8. **Radio-activity:** Discovery of radioactivity, concepts of half life, and disintegration constant of radioelements, uses of radioisotopes. Typical examples and elementary idea about artificial radio-activity and nuclear reactions.

9. **Principles of analytical chemistry:** Theorical principles of qualitative and quantitative anlysis.

Books Recommended:

1. S. Z. Haider : *Introduction to Modern Inorganic Chemistry*
2. G. S. Gilreath : *Fundamental Concept of Inorganic Chemistry*
3. T. Moellar : *Inorganic Chemistry*
4. এ কে এস আহমদ : *অজৈব রসায়ন*
5. সায়েম এ লতিফ : *অজৈব রসায়ন*
6. নুরুল হক ও মহির উদ্দিন : *জৈব রসায়ন পরিচিতি*
7. রবীন্দ্রনাথ ঘোষ : *অজৈব রসায়ন*

Practical Marks:(25+25+25)=75

বিষয়	পত্র	পত্র কোড	পত্র শিরোনাম	নম্বর	ক্রেডিট
Chemistry	১ম পত্র	131184	Practical	25	1
	২য় পত্র	131185	Practical	25	1
	৩য় পত্র	131186	Practical	25	1

Marks distribution:

1. Inorganic qualitative analysis   30 Marks
2. Organic qualitative analysis/Inorganic quantitative 15 Marks
3. Lab note book   15 Marks
4. Viva-voce   15 Marks

Total = 75 Marks

Experiments:

A. **Inorganic Qualitative Analysis:** Qualitative analysis of mixture of inorgnic compounds containing three radicals, two basic and one acid (including interfering radicals by classical or semi-micro methods.

B. **Inorganic quantitative Analysis:**
   i) Acidimetry and Alkalimetry: Preparation of N/10 HCl, H_2SO_4 and CH_3, COOH solutions and their standardisation.
   ii) Determination of Na_2CO_3 content in washing soda.
   iii) Determination of mixture of carbonate and causticsoda
   iv) Oxidation-reduction titration's involving.
      a) Preparation and standardization of N/10 $KMnO_4$ sodium oxalate solution.
      b) Determination of ferrous iron using standard $KMnO_4$solution.
      c) Determination of Ca in $CaCO_3$ by standard $KMnO_4$solution.
      d) Preparation of standard N/10 $K_2Cr_2O_7$ solution and determination of ferrous iron by using internal indicators.

    e) Determination of Cu iodometrically.

C. Physical Chemistry:

1. Determination of molecular weight by
   a) Vapour density method
   b) Depression of freezing point or elevation of boiling point.
2. Thermochemical measurements; heat of meutralization and heat of solution calorimetrically.
3. Rate of inversion of sucrose to be followed by a polarimeter.
4. Experiment involving distribution law: Determination of partition co-efficient, molecular association and equilibrium constant.
5. Measurements of electrolytic conductance and two typical conductometric titrations of strong acid-strong base and weak acid-strong base.
6. Determination of solubility of a solid at various temperatures and calculation of its heat of solution.

D. Organic qualitative analysis:

analysis of organic compounds, such as amine (primary, secondary and tertiary), aldehydes, ketones, carboxylic acids, phenols and itrocompounds (containing only one functional group).

The analysis should include the following:

  i) Elemental analysis (N.S. and halogen).
  ii) Solubility tests with the following solvents.
    a) Water
    b) 5% Solution of sodium bicarbonate, sodium hydroxide and hydrochloric acid
    c) Concentraled sulphuric acid
  iii) Functional group analysis

Book Recommended:

1. A. I. Vogel : A. Text Book of Quantitive Inorganic Analysis
2. A. I. Vogel : A. Text Book of Qualitative Inorganic Analysis
3. Jabbar & Haque: Practical Chemistry
4. Shriner & Fuson: Systematic Identification of Organic compounds
5. নরুল হক ও মহির উদ্দিন: ব্যবহারিক রসায়ন
6. হাজারী, গুপ্ত ও দে. : স্নাতক জৈব রসায়ন

বিষয়-২: **Botany**

বিষয়	পত্র	পত্র কোড	পত্র শিরোনাম	নম্বর	ক্রেডিট
Botany	১ম পত্র	131187	Biodiversity of plants	75+25 =100	4
	২য় পত্র	131188	Life Process and Agronomy	75+25 =100	4
	৩য় পত্র	131189	Continuity of life	75+25 =100	4

বিস্তারিত সিলেবাস

বিষয়	পত্র	পত্র কোড	পত্র শিরোনাম	নম্বর	ক্রেডিট
Botany	১ম পত্র	131187	Biodiversity of plants	75+25 =100	4

Marks Distribution

Written: 75

Broad Questions (5 out of 9)   5×15=75

Practical: **=25**

Total: 100

Topics to be read:

A. Microbiology:

i.   Introduction, Characteristics and reproduction of Prions, Viroids, Rickettsia and Mycoplasma.

ii. Viruses: Definition, biological nature, physical and chemical structure, multiplication, transmission and economic importance.

iii. Bacteria: Introduction, Classification, Structure, Multiplication and economic importance.

B. Phycology:

i.   Habit and habitats, classification, general structures, reproduction and economic importance of Algae.

ii. Salient feature of Cyanophyceae, Chlorophyceae, Phaeophyceae and Rhodophyceae.

iii. Life histories of *Anabaena, Oedogonium and Vaucheria.*

C. Mycology:

i. Introduction, general Characteristics, classification, structure and economic importance of Fungi.

ii. Life histories of *Saccharomyces, Penicillium, Puccinia and Agaricus.*

iii. Lichens: Habit and habitats, classification, structure and importance.

D. Higher Cryptogams:

Bryophyta:

i. Introduction, salient features of Hepaticopsida, Anthoceropsida and Bryopsida with examples.

ii. Life history of *Marchantia, Pelia, Anthoceros and Sphagnum.*

Pteridophyta:

i. Introduction, salient features of Psilopsida, Lycopsida, Sphanopsida and Pteropsida with examples.

ii. Life histories of *Lycopodium, Selaginella and Pteris.*

E. Gymnosperms:

i. Introduction, general characteristics, modern classification and economic importance.

ii. Life stories of *Cysas and Gnetum.*

F. Angiosperms:

i. Morphology, of flowers, types of inflorescence and fruits.

ii. Definition, scope, units of Classification, nomenclature, preparation of harbarium sheets; Artificial (Linnaeus), natural (Benthum and Hooker) and phylogenetic. (Engler and Prantle) systems of classification, merits and demerits of these systems.

iii. Magnoliopsida (Dicot): Nymphaeaceae, Rutaceae and Cucurbitaceae.

iv. Liliopsida (Monocot): Amaryllidaceae and Aracaceae

G. Plant Pathology:

i. Introduction, Scope and importance of plant diseases.

ii. Classification of plant diseases.

iii. Casual organisms, symptoms, etiology and control measures of the following plant diseases:

a) Brown spot of rice, b) Late light of potato, c) Stem rust of wheat, d) Stem rot of jute, e) Tikka disease of ground nut.

H. Biodiversity and Conservation:

i. Definition and elements of biodiversity; causes and loses of biodiversity; rare, vulnerable, threatened and endangered species of Bangladesh.

ii. Definition and types of conservation, principles of conservation, advantages and disadvantages of in situ and ex-situ conservation; conservation in botanic gardens and seed banks; role and activity of IUCN, WWF, and CITES.

বিষয়	পত্র	পত্র কোড	পত্র শিরোনাম	নম্বর	ক্রেডিট
Botany	২য় পত্র	**131188**	Life Process and Agronomy	75+25 =100	4

Marks Distribution

Written: 75

    Broad Questions (5 out of 9)   5×15=75

Practical: **=25**

                                          Total: 100

Topics to be read:

A. Ecology:

i.   Definition and scope of ecology, climatic, topographic and biotic factors.

ii. Salient features of hydrophytes, xerophytes and halophytes.

iii. Plant succession: Causes and types, hydrosere, xerosere.

iv. Structure and function of ecosystems (Sundarban Forest and Pond Ecosystem).

v.   Food chain, food web and ecological pyramids.

vi. Phyhtogeographical regions of Bangladesh.

B. Environmental Science:

i.   Definition and components of the environment.

ii. Pollution: Air, water and sound pollution, causes and effects of pollution on plants and animals and their remedies.

iii. Green house effects: Sources and effects of green house gases, ozone layer depletions.

iv. Population growth and its impact on nature.

C. Plant Physiology:

i.   Absorption of water: Mechanism of absorption of water and nutrients by roots and ascent of sap.

ii. Essential mineral elements: Essentials elements, deficiency symptoms in plants.

iii. Photosynthesis: Pigment systems, photophosphorylation and the fixation of CO_2 through C_3 and C_4 pathways, factors affecting the rate of photosynthesis.

iv. Respiration: Mechanism of aerobic and anaerobic respiration and fermentation, respiratory quotient, factors affecting respiration.

v. Plant growth regulators: Classification with examples, application of plant growth regulators.

vi. Physiology of flowering: Photoperiodism and vernalization.

vii. Dormancy of seeds: Nature, causes and removal of seed dormancy, viability of seeds.

D. Phytochemistry:

i. Nitrogen metabolism: Nitrogen fixation and Nitrogen cycle.

ii. Carbohydrates: Classification, common carbohydrates found in plants.

iii. Amino acids: Classification, structure and synthesis of amino acids.

iv. Vitamins: Definition, origin, types and deficiency diseases caused by Vitamin-A, B, B_2 and C.

v. Enzymes: Definition, nomenclature, classification with examples, mechanism of action.

E. Embryology:

i. Introduction, sporogenesis and gametogenesis, fertilization.

ii. Development of embryo and endosperm in dicot plant, seed and fruit formation.

F. Economic botany:

i. Scientific and local names, parts used and importance of 10 plants of each of the following group: food grains, pulses, medicines, rubber, oil, spices and timber yielding plants.

ii. Tea and rubber: Cultivation and processing.

G. Palaeobotany:

i. Definition and scope of Palaeobotany.

ii. Types of fossils and fossilization processes.

iii. Geological era; appearance and extinctions of the life forms in different geological periods.

H. Agronomy and Horticulture:

i. Definition and scope of Agronomy and Horticulture, classification of field crops.

ii. Seeds: Characteristics of a good seed, procurement, quality of seeds, seed treatment.

iii. Fertilizers: Definition, classification of fertilizers, composition, dosage, application time and procedure.

iv. Crop rotation: Significance, common weeds and their control.

v. Preparation of seed bed, sowing and seeding growth, pre-and post-transplanting care.

vi. Cultivation of Tomato, Mango and Rose.

বিষয়	পত্র	পত্র কোড	পত্র শিরোনাম	নম্বর	ক্রেডিট
Botany	৩য় পত্র	131189	Continuity of life	75+25 =100	4

Marks Distribution

Written: 75

    Broad Questions (5 out of 9)   5×15=75

Practical: **=25**

        Total: 100

Topics to be read:

Anatomy:

i. Origin and differentiation of apical meristem, tissues and tissue systems.

ii. Distribution of mechanical tissues, normal secondary growth in dicot stem and dicot root and root-stem transition.

Cytology:

i. Introduction, definition and scope of Cytology, concept of prokaryotic and eukaryotic cell.

ii. Ultra structure of eukaryotic cell; detailed structure and function of cell organelles (Chloroplast, mitochondria, ribosome, endoplasmic reticulum and nucleus).

iii. Physical and chemical structure of chromosome.

iv. Meiotic cell division and its significance.

Genetics:

i. Mendelism, exceptions of Mendel's laws

ii. Linkage and crossing over, Liked genes and recombination of linked gene.

iii. Biochemical structure of DNA and RNA; replication of DNA

iv. Mutation: Definition, types of mutation and mutagens, detection of mutation in Drosophila by CIB method.

v. Polyploids and their economic importance plant breeding and evolution.

D. Plant Breeding:

i.   Introduction: Definition, scope and objectives of plant Breeding.

ii. Hybridization: Objectives and techniques of artificial hybridization.

iii. Breeding techniques in self pollinated crops: Methods, merits and demerits of pure line selection and pedigree method.

E. Evolution:

Theories of evolution, Darwins theory, Lamarck's theory and mutation theory of evolution.

F. Biotechnology:

i.   Definition, scope, importance and achievements of biotechnology.

ii. Plant tissue culture: Direct and indirect methods of in vitro culture, culture medium, production of disease free plants and commercial aspects of tissue culture.

iii. Biogas Technology: Production methods and uses.

iv. Biofiertilizers: Definition, production methods and uses.

G. Biostatistics:

i.   Definition and scope of biostatistics, idea of continuous and discontinuous variables, concept of population and sample.

ii. Parameters of measures of central tendency (mean, mode, medium) and dispersion (range, variance, standard deviation and co-efficient of variation).

Practical Marks:(25+25+25)=75

বিষয়	পত্র	পত্র কোড	পত্র শিরোনাম	নম্বর	ক্রেডিট
Botany	১ম পত্র	131187	Practical	25	1
	২য় পত্র	131188	Practical	25	1
	৩য় পত্র	131189	Practical	25	1

1. Morphological and microscopic examination of Bacteria, Algae, and Fungi included in the syllabus.
2. Morphological and microscopic examination of Bryophytes, Pteridophytes and Gymnosperms included in the syllabus.
3. Anatomy of root, stem (primary and secondary) with single staining technique.
4. T.S. of Anther and Ovary.
5. Morphological and anatomical adaptations of plants in different ecological conditions.
6. Preparation of lactophenol and cotton blue. Working out of the plant diseases included in the syllabus.
7. Working out of locally available angiosperms and members of the angiospermic families included in the syllabus. Technique of preparation of herbarium sheets.
8. Setting up of the psychological experiment on osmosis, photosynthesis and respiration in order to know the working principles and expected results.
9. Determination of emasculation and crossing technique.
10. Study of plant population by quadrate method.
11. i) Identification: fertilizers, seeds, vegetables and fruits.
    ii) Museum specimens and permanent slides.
    iii) Botanical names of available local plants.
    iv) Economic products included in the syllabus.
    v) Plants of morphological and ecological interest.

12. Excursion shall be performed in order to study and collect plants from natural habitats, records of field trips should be maintained properly.
13. Practical notebook should be maintained properly and regularly signed by course teacher.
14. Practical class records duly signed by course teacher and herbarium sheets as well as other collections have to be submitted on the day of practical examination.
15. Viva-Voce will be held during the practical examination.

Marks distribution:

01.	Bacteria/Algae/ Fungi/ Plant Pathology	10
02.	Bryophytes/ Pteridophytes/ Gymnosperms	10
03.	Taxonomy	08
04.	Anatomy (secondary growth of dicot stem and root)	07
05.	Cytology/ Plant Breeding/ Physiological experiments	05
06.	Ecological adaptations (two specimens)	03
07.	i) Identification: (5specimens)	05
	ii) Botanical names of 2 angiosperms	02
08.	Collections	05
09.	Practical Note Book and Excursion Report	10
10.	Viva-Voce	10

Total: 75

Books Recommended:

Microbiology:

1. Brock, T.D., W.S. David and T.M. Michael :1984. Biology of Microorganisms. Prentice-Hall Engle Wood, Cliffs, New Jersey.
২. ইসলাম, এম. রফিকুল, মিহির লাল সাহা এবং এম. এ. বাসার : ২০০৪. অনুজীব বিজ্ঞান, হাসান বুক হাউজ, ঢাকা।

Phycology:

1. Bold, H.C. and M.J. Wynne   : 1978. Introduction to the Algae, Prentice Hall, India.
2. Fritsch, F.E. : 1946. The Structure and Repreduction in Algae. Vol. I, Cambridge Univ. Press, London.
৩. খান. এ. এ.: ২০০০. মাইক্রোবায়োলজি, দোলন চাপা, কাজী প্রকাশনী, ঢাকা।

Mycology:

1. Alexopoulos, C.J., C.W. Mims and M. Blackwell : 1996. Introductory Mycology (4th ed.), Wiley, Eastern Ltd. Calcutta, India.
২. খান. এ. এ.: ২০০০. মাইক্রোবায়োলজি, দোলন চাপা, কাজী প্রকাশনী, ঢাকা।

Gymnosperms:

1. Arnold, C. R. : 1977. An Introduction to Palaeobotany. Tata McGraw Hill Pub.
   House, New Delhi.
2. Biswas, C. and B. M. Johri: 1997. The Gymnosperms. Norasa Pub. House, New Delhi.

Plant Pathology:

1. Agrios, G.N.   : 1997. Plant Pathology (4th ed.) Academic Press, London.
2. Singh, R.S.   : 1978. Plant Diseases. Oxford & IBH Pub. Co., New   Delhi.

Angiosperms:

1. Davis, P. H and
   V.H. Heywood : 1963. Principles of Angiosperm Taxonomy. Oliver Boyd,   Edinburgh and London.
2. Hooker, J.D.   : 1887-1897. Flora of British India, Vols. 1-7.
৩. হাসান, এম.এ. এবং এম. কে. আলম   : ১৯৯৭.উদ্ভিদ শ্রেণী বিন্যাস তত্ত্ব (৩য় সংস্করণ), হাসান বুক হাউজ, ঢাকা।

Plant Anatomy and Embryology:

1. Cutter, E.G   : 1969. Plant Anatomy. Part I & II. Edward Arnold Pub., UK.
2. Eames, A.J. and L.H. MacDaniels : 1947. An Introduction to Plant Anatomy. McGraw Hill Pub. Co., New York.

Economic Botany:
1. Albert, F. H. : 1972. Economic Botany. Tata McGraw Hill Pub. Co. Ltd., New Delhi.
2. Cotton, C.M.: 1990. Ethnobotany– Principles & Application.
৩. হাসান, এম. এ.: ১৯৯৬. বাংলাদেশের ভেষজ উদ্ভিদ, আশরাফিয়া বই ঘর,বাংলাবাজার, ঢাকা।
৪. আহমেদ, সামসুদ্দিন: ১৯৯৬. বাংলাদেশের লোকজ বনৌষধি, হাসান বুক হাউজ, বাংলা বাজার, ঢাকা।

Plant Ecology & Environmental Science:
1. Bannister, P. : 1976. Introduction of Physiological Plant Ecology. Black well Scientific Publications.
2. Kershaw, K.A. : 1973. Quantitative and dynamic Plant Ecology, Edward Arnold Ltd.
3. Shukla and P.S. Chandel : 1991. Plant Ecology and Soil Science, S.Chand & Co., India.

Cytology:
1. Dupraw E. J.: 1970. DNA and Chromosomes, Holt, Rinehart and Winston, New York.
2. Gupta, M.L. and M.L. Jangir : 1998. Cell Biology: Fundamentals and Applications, Agro Botnika, New Delhi.
5. জামান, এম. এ.: ১৯৭৫. কোষবিদ্যা, বাংলা একাডেমী, ঢাকা।
6. সুহিত গুহ: ১৯৭৮. সাইটোলজি, পশ্চিম বঙ্গ রাজ্য পুস্তক পর্ষদ।

Plant Physiology:
1. Goodwin, T.W. and E. I. Mereer: 1983. Introduction to Plant Biochemistry (2nd ed.). Pergamon Press.
2. Hess, D. : 1975. Plant Physiology. Springer International Student Edition.
৩. কর্মকার : ২০০০. উদ্ভিদ শরীর বিজ্ঞান, হাসান বুক হাউজ, ঢাকা।

Phytochemistry:
1. Goodwin, T. W. and E. I. Mereer : 1983. Introduction to Plant Biochemistry (2nd ed.). Pergamon Press.

2. Jain, J.L: 1983. Fundamentals of Biochemistry (2nd ed.). S. Chand and Co. Ltd. New Delhi.

Genetics:

1. Benjamin Lewin: 2000. Gene 2000. Oxford University Press and Cell Press.
2. Gordner, E. J. : 1960. Principles of Genetics. John Wiley and Sons, Inc. New York, London.
3. ইসলাম , এ. এস. : ১৯৮৪. বংশগতি বিদ্যার মূল কথা, বাংলা একাডেমী, ঢাকা ।
8. আখতারুজ্জামান : বংশগতি বিদ্যা, বাংলা একাডেমী, ঢাকা ।

Plant Breeding:

1. Allard, R.W. : 1999. Principles of Plant Breeding. (3rd ed.). John Wiley & Sons. Inc., New York.
২. ভূইয়া, এম. এস. রশীদ: ১৯৯২. উদ্ভিদ প্রজনন, বাংলা একাডেমী, ঢাকা ।

বিষয়-৩: **Soil Science**

বিষয়	পত্র	পত্র কোড	পত্র শিরোনাম	নম্বর	ক্রেডিট
Soil Science	১ম পত্র	131190	Soil Science Part-I	75+25 = 100	4
	২য় পত্র	131191	Soil Science Part-II	75+25 = 100	4
	৩য় পত্র	131192	Soil Science Part-III	75+25 = 100	4

বিস্তারিত সিলেবাস

বিষয়	পত্র	পত্র কোড	পত্র শিরোনাম	নম্বর	ক্রেডিট
Soil Science	১ম পত্র	131190	Soil Science Part-I	75+25=100	4

Marks Distribution

Written: 75

A. Pedology and Soil Physics: 45

Broad Questions (3 out of 5)   3×15=45

B. Soil Microbiology and Plant Biochemistry:30

Broad Questions (2 out of 4)   2×15=30

Practical: **=25**

Total: 100

Topics to be read:

A. Pedology and Soil Physics:

1. Soil science as an independent discipline, historical development of soil science, branches of soil science and their relationship with other branhces of science; Concept of soil.

2. Soil forming materials - Rocks, Minerals- Primary and secondary; Weathering- physical and biogeochemical; Soil

profile- horizons, layers, pedon and polypedons; Master horizons in soil.

3. Zonality concept of soils, Study of the orders and suborders of Soil Taxonomy with special reference to Bangladesh.

4. Definition of soil physics, soil physical properties; soil - a three phase disperse system, description of the three phases; Mass-Volume relations of soil constituents. Soil texture- definition, primary particles, Particle size analysis and expression of results. Assumptions and limitations of Stoke's law. Determination of textural class of a soil. Soil density.

5. Soil structure- definition, classification and agricultural significance.

6. Soil consistence- Atterberg's constants and their practical significance.

7. Soil water- classification and determination. Soil moisture constants.

8. Composition of soil air, gas transport through soil, renewal of soil air and importance of soil air.

9. Soil temperature and Soil colour.

B. Soil Microbiology and Plant Biochemistry

1. Soil Organisms- Flora and fauna. Soil as a habitdat for flora and fauna, significance of organisms in soil environment. Position of microorganism in the living world.

2. Soil flora- Actinomycetes, Bacteria, Algae and Funig- their structure, and simple classification. Growth and reproduction of bacteria. Environmental requirements of microorganisms. Biological nitrogen fixation (BNF) and their importance in agriculture, Elementary idea about nitrogen cycle.

3. Carbohydrate- definition, classification & synthesis in plants.

4. Respiration- aerobic and anaerobic respiration with its importance.

5. Enzyme- definition, classification and enzyme activity in soil. Factors affecting enzyme activity in soil.
6. Nucleic acids- Composition, Classification and functions.

Books Recommended:

1. The Nature and properties of soils- Brady andWeil, 13thed.
2. Introductory Soil science- DilipKumar Das- 6thed.
৩. আধুনিক মৃত্তিকা বিজ্ঞান- দেলোয়ার হোসেন হাওলাদার ও মোঃ হুমায়ুন কবির ২০১৪ ।
৪. অনুজীববিজ্ঞান- মো: রফিকুলইসলাম
5. Fundamentals of Biochemistry- Dr. J.L Jain, S.Jain&N.Jain.

বিষয়	পত্র	পত্র কোড	পত্র শিরোনাম	নম্বর	ক্রেডিট
Soil Science	২য় পত্র	**131191**	Soil Science Part-II	75+25 = 100	4

Marks Distribution

Written: 75

A. Soil Chemistry and Soil Pollution: 45

    Broad Questions (3 out of 5)   3×15=45

B. Soil Fertility and Fertilizers:30

    Broad Questions (2 out of 4)   2×15=30

Practical: **=25**

                                      Total: 100

Topics to be read:

A. Soil Chemistry and Soil Pollution:

1. Concept and scope of soil chemistry.
2. Soil organicmatter- composition, characteristics and functions in soil.
3. Humus- originand importance.
4. Clay minerals- structure, classification and importance.

5. Ion exchange properties of soil - origin of ion exchange Properties, CEC of soil, importance of ion exchange in agriculture.Concept of soil pH and soil solution,importance of pH on soil porperties and plant growth.
6. Plant nutrient- soil as a medium for plant growth, nutritional requirements of plants.
7. Essential plant nutrients- Criteria of essentiality, classification, source, function & deficiency sypmtoms of nutrient (specially N.P.K.S&Zn). Basic concepts of mechanisms of nutrient uptakein plants.
8. Soil pollution- concept and types of soilpollution.
9. Uses and impact of pesticides - fungicides on soil and water ecosystem.Adverse effects of heavy metals on plant growth.Control of soil pollution.

B. Soil Fertility and Fertilizers:

1. Concepts of soil fertility & soil productivity. Factors affecting plant growth and development. Maintenance of soil fertility.Nutrient interactions- antagonistic- synergistic activity.
2. Preparation and application of Compost Green manure and Farm yard manure.
3. Fertility status of the soils of Bangladesh.
4. Fertilizer materials- source and manufacture of major fertilizer materials.Time and methods of fertilizer application.Single, compound and mixed fertilizer.Nutrient contents and chemical formulaeof major chemical fertilizer's. Fate of added nutrient in soil, residual effects of fertilizers, fertilizer law, balanced fertilization. Fertilizer grade &fertilizer ratio.

Books Recommended:

1. The Nature and properties of soils - Brady and weil-2012
2. আধুনিকমৃত্তিকাবিজ্ঞান- দেলোয়ার হোসেনহাওলাদার ও মোঃহুমায়ুনকবির ২০১৪
3. Environmental soil science-Tan
4. Introductory soil science- DilipKumar Das-6thed 2010
5. Soil Fertility and Fertilizer- Tisdale & Nelson-2009
6. Soils and Soil Fertility- L.M Thompson & F.R. Troch
7. Soil Fertility Management for SutstainableAgricutlture- R. Prasad.
৪. আধুনিক মৃত্তিকা বিজ্ঞান- দেলোয়ার হোসেন হাওলাদার ও মোঃ হুমায়ুন কবির ২০১৪

বিষয়	পত্র	পত্র কোড	পত্র শিরোনাম	নম্বর	ক্রেডিট
Soil Science	৩য় পত্র	131192	Soil Science Part-III	75+25 = 100	4

Marks Distribution

Written: 75

A. Soil Management and Soil Conservation: 45

Broad Questions (3 out of 5)   3×15=45

B. Soil Survey and Crops of Bangladesh:30

Broad Questions (2 out of 4)   2×15=30

Practical: **=25**

Total: 100

Topics to be read:

A. Soil Management and Soil Conservation:

1. Objectives and Principles of Soil Management – Preparation and application of Compost, Green manure and FarmYerd manure, Main components of Soilmanagement – Tillage, irrigation, quality of water in irrigation, application of organic matter, fertilizer and pesticide.

2. Formation, properties and management of Problematic Soils – Saline Soils, Acid sulphate soils, Waterlogged soils, Organic soils and Hilly soils.

3. Soil as a basic and irreplaceable resource, Population versus resource base of the world.

4. Soil degradation: types and processes of soil degradation, factors affecting soil degradation.

5. Soil erosion– classification and harmful effects of soil erosion.Factors affecting water and wind erosion.Principles of soil conservation practices in the field.

6. Sustainable Land Use– definition and sustainable land use system.

B. Soil Survey and Crops of Bangladesh:

1. Soil survey- Definition and importance of soil survey.Agricultural and non-agricultural uses of soil survey.Types of soil survey- Techniques of Exploratory, Reconnaissance and Detailed soil survey. Soil survey work plan & soil survey report. Base materials used in soil survey.

2. Cropping pattern, corprotation and cropping intensity. Classification of crops.

3. Agronomy of different crops of Bangladesh: Origin, improved varieties, Climate, Soil requirements, Cultural practices. Fertilization, harvesting and storing Rice, Wheat, Jute, cotton, Potato and Pulse.

Books Recommended:

1. Soil Conservation and Sustainable Land Use – T.H. Khan.
2. Problem Soilsof Bangladesh - BARI
3. Manual of Soil and Water Conservation Practices – Gurumel Singh.
4. আধুনিক মৃত্তিকা বিজ্ঞান- দেলোয়ার হোসেন হাওলাদার ও মোঃ হুমায়ুন কবির- ২০১৪
5. Soils: their survey and taxonomic classification of soil- SRDI- 2013
6. কৃষি প্রযুক্তি হাতবই- BARI-2012
7. আধুনিক মৃত্তিকা বিজ্ঞান- দেলোয়ার হোসেন হাওলাদার ও মোঃ হুমায়ুন কবির- ২০১৪

Practical Marks:(25+25+25)=75

বিষয়	পত্র	পত্র কোড	পত্র শিরোনাম	নম্বর	ক্রেডিট
Soil Science	১ম পত্র	131190	**Practical**	25	1
	২য় পত্র	131191	**Practical**	25	1
	৩য় পত্র	131192	**Practical**	25	1

Marks distribution:

Written Examination =   30

Laboratory Book=   30

Viva-Voce=   15

Total: 75

1. Precautions to be taken in the laboratory.
2. Collection, preparation and storage of soil sample.
3. Determination soil moisture by gravimetric method.
4. Determination of soil Bulk density and Particle density.
5. Preparation of standard solution of $K_2Cr_2O_7$, Oxalicacid, NaOH and $FeSO_4$.
6. Determination of organic carbon present in soil by wet oxidation method.
7. Determination of soil pH and Free carbonates.
8. Determination Glucose of a supplied sample.
9. Determination of total and Available nitrogen in soil.
10. Preparation of culture media for Microorganisms.
11. Gram staining and spore staining.

Books Recommended:

A Hand book on Analysis of SOIL, PLANT and WATER - S.M. ImamulHuq and MdDidarulAlam.

বিষয়-৪: **Geography and Environment Science**

বিষয়	পত্র	পত্র কোড	পত্র শিরোনাম	নম্বর	ক্রেডিট
Geography and Environment Science	১ম পত্র	**131193**	Geography and Environment Science-I	75+25 = 100	4
	২য় পত্র	**131194**	Geography and Environment Science-II	75+25 = 100	4
	৩য় পত্র	**131195**	Geography and Environment Science-III	75+25 = 100	4

বিস্তারিত সিলেবাস

বিষয়	পত্র	পত্র কোড	পত্র শিরোনাম	নম্বর	ক্রেডিট
Geography and Environment Science	১ম পত্র	**131193**	Geography and Environment Science-I	75+25 = 100	4

Marks Distribution

Written: 75

A. Physical Geography & Environment: 45

    Broad Questions (3 out of 5)   3×15=45

B. Economic Geography:30

    Broad Questions (2 out of 4)   2×15=30

Practical: **=25**

                                   Total: 100

Topics to be read:

A. Physical Geography & Environment:

* Physical Environment:

    1. Elements and Components of Physical Environment

    2. Global Cycles and Systems of the Earth's Environment

    3. The Sources of Energy for the Earth's Environment

    4. Major Energy Systems of Earth and Interrelation in Environmental systems

5. Scope and contents of Physical Geography and Environment

* **Geomorphology:**
    1. Size and Shape of the Earth
    2. Materials of the Earth's Crust, Rocks and Minerals
    3. Earthquakes and features produced in the Earth's Surface
    4. Volcanoes: Types and Features in the Earth surface

* **Climatology:**
    1. Composition of the atmosphere
    2. Elements and Factors of Weather and Climate
    3. Insolation and Temperature, Horizontal and Vertical Distribution of Temperature
    4. Atmospheric Pressure and Wind System
    5. Humidity, Condensation and Precipitation: Formation of Clouds, Fogs, Dews, Frosts, Snows and Hails, Types and Distribution of Rainfall

B. Economic Geography:

* **Introduction to Economic Geography**
    a) Definition, Concept, Scope and Objective of Economic Geography
    b) Relation between Geography and Economics
    c) Classification of Economic Activities

* **Economic Geography of Production**

Primary Activities
    a) Gathering, Hunting, Lumbering, Fishing, Mining and Nomadic Herding/Livestock Ranching
    b) Agriculture: General characteristics of various agricultural systems and case studies of selected commodities such as Rice, Wheat, Cotton, Jute, Sugarcane, Rubber and Tea

Secondary Activities
    a) Development and Distribution of Power and Energy Resources of the World

b) Manufacturing; Characteristics; Physical and Socio-economic Factors for growth of Industries

c) Major Industrial and Manufacturing regions of the world

d) Case Studies of some Industrial Complexes: Iron and Steel Industry, Apparel Industry, Textile Industry, Dairying and Mixed Farming Industries

Tertiary Activities

a) Transportation and Trade: Regional and International Pattem

b) Trade and its effect on the economy of the region

4. Quaternary Activities: Professional, Administrative Services and Entertainment

Books Recommended:

1. Strahler A. H. and Strahler A. N. 1992: Modern Physical Geography, 4thedition, Wiley: Singapore.
2. Blijj H. J. de and Muller P. O. 1996: Physical Geography of the Global Environment, Wiley: New York.
3. Singh Savindra, 2007: Climatology, PrayagpustakBhawan: Allahabad, India.
4. Singh Savindra, 2003: Physical Geography, PrayagpustakBhawan: Allahabad, India.
5. Coe, N., Kelly, P. and Yeung, HWC, 2012. Economic Geography: A Contemporary Introduction, 2nd edition, Wiley-Blackwell: Singapore.
6. Wood, A. and Roberts, SM, 2011. Economic Geography-Places, Networks, and Flow. Routledge: New York.
7. Alexander, JW, 1988: Economic Geography, Prentice-Hall, New Delhi.

বিষয়	পত্র	পত্র কোড	পত্র শিরোনাম	নম্বর	ক্রেডিট
Geography and Environment Science	২য় পত্র	**131194**	Geography and Environment Science-II	75+25 = 100	4

Marks Distribution

Written: 75

A. Population and Cultural Geography: 45

Broad Questions (3 out of 5)   3×15=45

B. Geography of Bangladesh:30

Broad Questions (2 out of 4)   2×15=30

Practical: **=25**

Total: 100

Topics to be read:

A. Population and Cultural Geography:

1. **Introduction to Population Geography:** Definition and concept, development of Population Geography, Population and Demography

2. **Sources of population data:**
   i) Population census
   ii) Sample survey
   iii) Registration

3. **Population Distribution:**
   i) Population Density
   ii) Factors Affecting Population Distribution/Determinants

4. **Population Composition**
   i) Biological: Size, Age, Sex
   ii) Social: Marital Status, Language, Religion, Education

5. **Introduction to Cultural Geography:**
   Definition, Scope and Methods

B. Geography of Bangladesh:

1. **Location and Boundary;** Administrative divisions and geographic regions

2. **The Natural Environment**
    2.1 Geological Structure & Physiography
    2.2 Climate and Soil
    2.3 River Systems

3. **Population**
    3.1 Size, Growth, Age and Sex Structure
    3.2 Density and distribution
    3.3 Population characteristics, Problems

4. **Hazards and disasters:** Floods, cyclones, droughts, and river bank erosion.

Books Recommended:

1. Jones,HR 1990. Population Geography, Guilford Press.
2. Clarke, JI.1978: Population Geography, London: Oxford Series
3. Zilensky, W I 984: A Prologue to Population Geography. U.K.
4. Bogue, D.J..1978: Principles of Demography. NY.
5. বাকী, আ হ ম, ২০০৬। সাংস্কৃতিক ভূগোল, বঙ্গ প্রকাশনীঃ ঢাকা।
6. Rashid, H. 1995: *Geography of Bangladesh, UPL, Dhaka.*
7. Rahman, A. Atiq. et al.: *Environment and Development in Bangladesh Vol: 1-2, UPL, Dhaka.*
8. Islam, N and Choudhury S. I. 1992 *Bangladesh Bhougolic Shomikhaya, Department of Geography, University of Dhaka*
9. হাসান , এম. ও অন্যান্য ঃ বাংলাদেশ প্রাকৃতিক ভূগোল ও পরিবেশ, বাংলা একাডেমী, ঢাকা।
10. ঈমাম, বি. ঃ বাংলাদেশের খনিজ সম্পদ, বাংলা একাডেমী, ঢাকা।
11. চৌধুরী, সিরাজুল ইসলাম, ১৯৯৫ ঃ অর্থনৈতিক ভূগোল: বিশ্ব ও বাংলাদেশ, ঢাকা বিশ্ববিদ্যালয়, ঢাকা।

বিষয়	পত্র	পত্র কোড	পত্র শিরোনাম	নম্বর	ক্রেডিট
Geography and Environment Science	৩য় পত্র	131195	Geography and Environment Science-III	75+25 = 100	4

Marks Distribution

Written: 75

A. Regional Geography of South Asia(Excl.BD): 45

    Broad Questions (3 out of 5)   3×15=45

B. Geography of Human Settlements:30

    Broad Questions (2 out of 4)   2×15=30

Practical: **=25**

        Total: 100

Topics to be read:

A. Regional Geography of South Asia(Excl.BD):

1. Introduction to South Asia

    1.1 Geographical Location

    1.2 Member Countries: National Boundaries, Socio-economic Database

2. Physical Environment of South Asia

    2.1 Physiography

    2.2 Climate

    2.3 Drainage Systems

    2.4 Vegetation

    2.5 Mineral and Energy Resources

3. Cultural Environment of South Asia

    3.1 Population: Growth, Distribution and Characteristics

    3.2 Economic:

    a) Major Crops (Rice, Wheat, Cotton, Sugarcane and Tea) Productions and Distributions

    b) Major Industry (Iron and steel, Textile power and Energy) Production and Distributions

c) Transportation: Roads, Railways, Waterways and Airways.

d) Trade and Commerce: Internal and External Trade

B. Geography of Human Settlements:

1. Definition, Scope, types and approaches of the study of human Settlement

2. Rural Settlement:

a) Rural Settlements: Types, Forms and Characteristics

b) Rural Periodic Markets: Origin, Growth, Characteristics and their role in Development

3. Urban Settlements:

a) Definition, Scope, classification (types) of Urban Settlement.

4. Origin and History of Urban Centers:

a) Factors of Urban Growth

b) Urbanization process

Books Recommended:

1. Abbasi, BushraAfza, 1991 : *Geography of South Asia, Sang-e-Meel Publication, Lahore*

2. Davis, K. 1951 : *The Population of India & Pakistan, University Press, London*

3. Spate O.H.K & A.T.A. Learmonth. 1967 : *India, Pakistan and Ceylon, The Regions, Methuen & Co., London*

৪. রউফ , কাআ ও বিল্লাহ, মো ২০০৬ ঃ *দক্ষিণ এশিয়া, সুজনেষু প্রকাশনী, ঢাকা* ।

5. Carter, Harold, 2000 The Study of Urban Geography, London: Edward Arnold.

6. Singh, R.L. (et.al.),1998 Geographic Dimensions of Rural Settlements

7. Daniel, P.1990 The Geography of Settlement

৮. বাকী, আবদুল, ২০০২ *পৌরবসতি ঃ কাঠামো, জনগোষ্ঠী ও পরিকল্পনা প্রসঙ্গ, সুবর্ণ প্রকাশ, ঢাকা* ।

৯. ইলাহী, ম. ও রুমী, সৈ.র.আ. ২০০৫ *নগর ভূগোল-সাম্প্রতিকধারা, ঢাকা: সুজনেষু প্রকাশনী* ।

১০. ইসলাম, এন. ও বাকী, আবদুল, ১৯৯৬ (সম্পাদিত) নগরায়ন বাংলাদেশ, আরবান ষ্টাডিজ প্রোগ্রাম, নগর গবেষণা কেন্দ্র, ঢাকা ।

Practical Marks:(25+25+25)=75

বিষয়	পত্র	পত্র কোড	পত্র শিরোনাম	নম্বর	ক্রেডিট
Geography and Environment	১ম পত্র	131193	Practical	25	1
	২য় পত্র	131194	Practical	25	1
	৩য় পত্র	131195	Practical	25	1

Section A: Maps and Element of Maps   Marks- 25
Marks distribution:

Written Examination   = 15

 Laboratory Book   = 05

 Viva-Voce   = 05

1. Scales: Simple, Diagonal and Comparative
2. Drawing of Contours and Profiles
3. Cartographic Representation of Geographical Data: Dot, Shade and Isopleth methods
4. Introduction to use of Geographic Information Systems (GIS), Remote Sensing (RS), Geographic positioning system (GPS)

Section B: Elementary Surveying: Marks- 25
Marks distribution:

Written Examination (Fieldwork & Drafting Map) = 15

 Laboratory Book   =05

 Viva-Voice   =05

1. Principles of Surveying
2. Definition of Surveying: Types of Surveying: Geodetic, Plane
3. Methods of Surveying: **Chain and Tape Surveying:** Equipments, Recording of field data, open and closed Traverse surveying, Drawing procedure, Advantage and disadvantages.

Plane Table Surveying: Equipments Drawing procedure, Advantage and disadvantages.

Section C. Map Projection Marks- 25
Marks distribution:
Written Examination = 15
Laboratory Book = 05
Viva-Voice = 05

1. Definition and Classification of Projections.
2. Construction of the following Projections.
    2.1 Cylindrical Projection: Simple Cylindrical and Cylindrical Equal Area projection
    2.2 Simple Conical Projection with One Standard Parallel
    2.3 Zenithal Equal Area projections (polar case)
   3. Identification, Use, Merits & Demerits of Projections.

Books Recommended:
1. Singh R.L, 1994 : *Elements of Practical Geography, India.*
2. Singh, Gopal, 2005 *Practical Geography, India*
3. Aziz &Shahjahan : *Surveying, Dhaka.*
৪. রউফ, কা. আ. ২০০৬ ঃ *ফলিত ও ব্যবহারিক ভূগোল, সুজনেষু প্রকাশনী, ঢাকা ।*
৫. ইলাহী, ম. ২০০৪ ঃ *পরিসংখ্যান ভূগোল, বাংলা একাডেমী, ঢাকা ।*

বিষয়-৬: তথ্য ও যোগাযোগ প্রযুক্তি /ICT

বিষয়	পত্র	পত্র কোড	পত্র শিরোনাম	নম্বর	ক্রেডিট
তথ্য ও যোগাযোগ প্রযুক্তি	১ম পত্র	131196	Computer Fundamental and Programming Language	100	4
	২য় পত্র	131197	Database Management System and Information System Design	100	4
	৩য় পত্র	131198	Operating System and Multimedia	100	4

বিস্তারিত সিলেবাস

বিষয়	পত্র	পত্র কোড	পত্র শিরোনাম	নম্বর	ক্রেডিট
তথ্য ও যোগাযোগ প্রযুক্তি	১ম পত্র	131196	Computer Fundamental and Programming Language	75+25=100	4

Marks Distribution

Written Exam:Broad Questions (5 out of 9)   5×15=75
Practical Exam   =25
                                    Total: 100

Topics to be Read:

1. **Computer fundamentals:** Computer basics, components of a computer system, importance, limitations,classifications, generations and history of computers.

2. **Microcomputer system:** Microcomputer basics, pc and pc clones, organizations of microcomputer, bus architecture, motherboard and its components, adapter boards.

3. **Input and output devices:** I/o operations and interfaces, keyboard, pointing devices, scanners, monitor, printer, plotters, speakers.

4. **Microprocessors:**Functions,organizationand classifications of microprocessors, arithmetic logic unit, control unit, risc, cisc, special processors.

5. **Memory & storage devices:** Classification, general properties, memory hierarchies, rom, ram, cache memory, secondary memory: hard disk, optical disk, flash memory.

6. **Computer software:** Software, classification of software, commercial software, freeware, advantages of package programs, popular package programs, programming languages, high level languages.

7. **System software and operating system:**System software, bios, language translators, text editor, os: characteristics, types, linux, unix, ms dos, windows, utility programs.

8. **Database concepts:**Basic concepts, database structures, database management system, benefits and limitations of dbms.

9. **Computer networks and the internet:**Introduction to computer network, network terminologies, lan topology, transmission media, wan, bandwidth, evolution of the internet, internet services, internet address, electronic mail, the world wide web, introduction to some protocols.

10. **It applications:**Concepts and applications of it, multimedia hardware and software, ecommerce,

11. **Security:**Computer and network security, malwares, antivirus.

12. **Computer and society:**Impact of computer and internet on society.

13. **Computer programming:**Introduction, problem solving techniques, algorithm specification and development. Programming style, debugging and testing, documentation. Program design methodologies, structured and modular program design.

14. **Programming language in c:**Introduction to c, programming file structure: purpose of .h and .c files, simple makefile, constant, variable and data types, operator and expression, type conversion, decision making: branching and looping, arrays and strings, user defined functions, structures and union, bit field and bit-wise operations, pointer, file management in c, command line arguments, dynamic memory allocation and linked list, preprocessor, managing input/output operation.

সহায়ক গ্রন্থাবলী (Reference Books):

১. ড. মোহাম্মাদ লুৎফর রহমান : আধুনিক কম্পিউটার বিজ্ঞান
২. ইঞ্জিনিয়ার কামাল হোসেন : ইন্টারনেট, ই-মেইল ও সোস্যাল নেট
৩. কামরুল হায়াদার : কম্পিউটার কোষ
৪. ইঞ্জিনিয়ার কামাল হোসেন : কম্পিউটার হার্ডওয়্যার
৫. মালিন সরকার : মাইক্রোসফট এক্সেল
৬. মাহবুবুর রহমান : এম.এস অফিস প্যাকেজ
৭. মোস্তফা জব্বার : তথ্য ও যোগাযোগ প্রযুক্তি
8. David Evans : Introduction to Computing
9. Joan Lambert : Microsoft Office 2016 Step by Step
10. EZ-REF Courseware : Microsoft Office 2007 Training Manual
11. P.K Sinha : Computer Fundamentals
12. Donaid H. Sanders : Computer Essentials for Business
13. Goel : Computer Fundamentals
14. Rajaraman V and Adabala N : Fundamentals of Computers
15. Reema Thareja : Computer Fundamentals and Programming in C
16. Sahni Horowitz : Fundamentals of Computer Algorithms

বিষয়	পত্র	পত্র কোড	পত্র শিরোনাম	নম্বর	ক্রেডিট
তথ্য ও যোগাযোগ প্রযুক্তি	২য় পত্র	**131197**	Database Management System and Information System Design	75+25=100	4

Marks Distribution

Written Exam:Broad Questions (5 out of 9)   5×15=75

Practical Exam   =25

Total: 100

Topics to be Read:

1. **Introduction:** General overview and purpose of DBMS, advantages, applications, common features and overall structure of database.

2. **Data modeling:** Relational model: structure of relational model, key constraints, referential integrity constraints, general constraints, relational algebra – fundamental, additional and extended operations, aggregate functions, outer joins and database modification using <u>RA. ER</u> model: entity and relationship sets, constraints – key, mapping cardinality and participation constraints, strong and weak entity sets, E-R diagram, class hierarchies, aggregation, conceptual database design with the ER model, converting ER to relational model, Object-relational data model: complex data types, structured types and inheritance, implementing O-R features.

3. **Relational database design:** Features of good relational design, functional dependency theory - basic concept, uses, closure of a set of fds, closure of attribute sets, canonical cover, algorithms for fds, decomposition using fds & its desirable properties, atomic domains and first normal form, BCNF and 3NF, multivalued dependencies and fourth normal

form, decomposition algorithms for different normal forms, database design process.

4. **Database application development:** Database Management Systems (DBMS s), SQL: data definition and data manipulation languages, integrity constraints, basic queries, nested and complex queries, modification of the database, Views: definition, update on views, cursors, Extending DBMS functionality: stored procedures, assertions and triggers, embedded and dynamic SQL, DBMS administration: DBA, users, privileges, security, performance, ODBC, JDBC, Web/Database architectures.

5. **DBMS implementation technology:** Storage and file structure: different storage types, file and record organization, data dictionary storage, Indexing and hashing: basic concepts, ordered indices, B+-tree index files, B-tree index files, static & dynamic hashing, comparison of ordered indexing & hashing.

6. **Query processing:** Overview, measures of query costs, selection operation, sorting, join operation, other operations, evaluation of expressions. Query optimization: Introduction, transformation of relational expressions, evaluation plan.

7. **Transaction processing:** Transactions: concepts, ACID properties, transaction states, concurrent schedules, serializability - conflict and view serializability, recoverability, Concurrency control: lock-based concurrency control, two-phase locking, problems with locking, locking and starvation, deadlock – prevention, detection and recovery.

8. **Introduction to modern database systems:** Object-relational databases, deductive databases, spatial databases, temporal databases, multimedia databases, mobile databases and advanced relational databases.

9. **Information System Design:** Introduction to general systems theory, Players in the Systems Game, Information Systems Building Blocks. Information Systems Development, Project Management. Systems Analysis, Requirements Discovery, Deliverables, Data Modeling and Analysis, Process Modeling, Feasibility Analysis and System Proposal, Systems Design, Applications Architecture and Modeling, Database Design, Output Design and Prototyping, Input Design and Prototyping, User Interface Design, Systems Construction and Implementation, Systems Operations and Support, Object-Oriented Analysis and Modeling, Object-Oriented Design and Modeling.

সহায়ক গ্রন্থাবলী (Reference Books):

1. C.J. Date: An Introduction to Database Systems
2. C.J. Date: SQL and Relational Theory: How to Write Accurate SQL Code
3. Hector Garcia-Molina, Jeff Ullman, and Jennifer Widom: Database Systems: The Complete Book
4. Raghu Ramakrishnan and Johannes Gehrke : Database Management Systems
5. Carlos Coronel and Steven Morris : Database Systems: Design, Implementation, and Management
6. Hans van der Heijden : Designing Management Information Systems
7. James Senn: ANALYSIS and DESIGN OF INFORMATION SYSTEMS

বিষয়	পত্র	পত্র কোড	পত্র শিরোনাম	নম্বর	ক্রেডিট
তথ্য ও যোগাযোগ প্রযুক্তি	৩য় পত্র	131198	Operating System and Multimedia	75+25=100	4

Marks Distribution

Written Exam:Broad Questions (5 out of 9)   5×15=75

Practical Exam   =25

Total: 100

Topics to be Read:

1. **Introduction:** Operating system overview, structure and components of an operating system.
2. **System calls:** Class of system calls and description.
3. **MIPS R3000 processor:** Overview and programming model, Exceptions, MIPS system call, system161.
4. **Process and threads:** Process and thread model, process and thread creation and termination, user and kernel level thread, scheduling, scheduling algorithms, dispatcher, context switch, real time scheduling, OS/161 switch.
5. **Concurrency and synchronization:** IPC and inter-thread communication, critical region, critical section problems and solutions.
6. **Resource management:** Introduction to deadlock, ostrich algorithm, deadlock detection and recovery, deadlock avoidance, deadlock prevention, starvation.
7. **File management:** File Naming and structure, file access and attributes, system calls, file organization: OS and user perspective view of file, memory mapped file, file directories organization,
8. **Case study:** UNIX file access permissions and rights.

9. **File System Implementation:** Implementing file, allocation strategy, method of allocation, directory implementation, UNIX i-node, block management, quota.

10. **UNIX file management:** Berkeley fast file system (FFS) Ext2fs, Ext3fs, superblocks, partition, Ext2fs and Ext3fs Directories, supporting multiple filesystem, OS/161 VFS, UNIX buffer cache, filesystem consistency.

11. **Memory management:** Basic memory management, fixed and dynamic partition, virtual memory, segmentation, paging and swapping, MMU.

12. **Virtual memory management:** Paging, page table structure, page replacement, TLB, R3000 TLB and address space, R3000 TLB handling, exception vector, demand paging and segmentation, thrashing and performance.

13. **I/O management:** I/O Devices, I/O Bus architecture and controller, interrupts, DMA, programmed I/O, Evolution of I/O functions, I/O software layer, Device drivers, Device independent I/O software, buffering.

14. **Disk I/O management:** Structure, performance, low-level disk formating, Disk arm scheduling algorithm, error handling, stable storage.

15. **Security:** Threats, data security, intruders, data loss, user authentication, password security and salt, one way function, authentication using physical object, software threats, Trojan Horses, spoofing, trap doors, viruses, anti-virus approach and technique, snadbox implementation, security policy and mechanism, protection mechanism, protection domain, Access Matrix, access control list, capabilities.

16. **RAID:** RAID 0-5, HP auto RAID.

17. **Multiprocessor system:** UMA MP, NUMA, SMP- structure and programming model, synchronization, scheduling.

18. **Multimedia:** Introduction, Design Concepts, Preproduction and Presentation Graphics: Presentation Graphics Design, Preproduction, Typefaces and Graphics. Desktop Publishing, Production Planning and Design, User Interface Design, Hypermedia Authoring Concepts, Multimedia Sound, File Compression, Video Production, Digital Video, Animation, HTML & Web-Based Multimedia, Designing Web-based Multimedia, Producing Multimedia, Content & Legal Considerations for Multimedia, Content & Legal Considerations for Multimedia, Multimedia Distribution, Networking Multimedia.

সহায়ক গ্রন্থাবলী (Reference Books):

1. Avi Silberschatz and Peter Galvin : Operating System Concepts
2. William Stallings : Operating Systems: Internals and Design Principles
3. Gary J Nutt : Operating Systems: A Modern Perspective
4. Maurice J Bach : Design of the UNIX Operating System
5. Mukesh Singhal and Niranjan Shivaratri : Advanced Concepts in Operating Systems
6. Ralf Steinmetz and Klara Nahrstedt : Multimedia Systems
7. J D Gibson : Multimedia Communications: Directions and Innovations
8. A Puri and T Chen : Multimedia Systems, Standards, and Networks
9. Bakmaz Bojkovic RAO : Wireless Multimedia Communication Systems
10. Borko Furht : Handbook of Multimedia Computing

Practical Marks:(25+25+25)=75

বিষয়	পত্র	পত্র কোড	পত্র শিরোনাম	নম্বর	ক্রেডিট
Computer Science	১ম পত্র	131196	Practical	25	1
	২য় পত্র	131197	Practical	25	1
	৩য় পত্র	131198	Practical	25	1

1) Programming Language Lab: Based on Computer Fundamental and Programming Language Theory Course.
2) Data Structure and Algorithms Lab: Based on Data Structure and Algorithms Theory Course.
3) Database Management System Lab: Based on Database Management System and Information System Design Theory Course
4) Data Communication and Networking Lab: Based on Data Communication and Networking Lab.