बरकतउल्ला विश्वविद्यालय,भोपाल

Barkatullah University, Bhopal

पीएच.डी. प्रवेश परीक्षा हेतु पाठ्यक्रम

Syllabus of Ph.D. Entrance Examination
(Faculty of Science & Life Science)

Session 2012-13

प्रकाशक

कुलसचिव

बरकतउल्ला विश्वविद्यालय,भोपाल

2012–13

INDEX

1. FACULTY –SCIENCE

4. FACULTY – LIFE SCIENCE

BARKATULLAH UNIVERSITY, BHOPAL

SYLLABUS FOR Ph.D ENTRANCE TEST

SUBJECT-PHYSICS

Max. Marks : 100
Part-A
Part-B

Note : There will be 100 objective type of questions minimum passing marks will be 40. No negative marking.

PART 'A' CORE

I. Mathematical Methods of Physics

Dimensional analysis. Vector algebra and vector calculus. Linear algebra, matrices, Cayley-Hamilton Theorem. Eigenvalues and eigenvectors. Linear ordinary differential equations of first & second order, Special functions (Hermite, Bessel, Laguerre and Legendre functions). Fourier series, Fourier and Laplace transforms. Elements of complex analysis, analytic functions; Taylor & Laurent series; poles, residues and evaluation of integrals. Elementary probability theory, random variables, binomial, Poisson and normal distributions. Central limit theorem.

II. Classical Mechanics

Newton's laws. Dynamical systems, Phase space dynamics, stability analysis. Central force motions. Two body Collisions-scattering in laboratory and Centre of mass frames. Rigid body dynamicsmoment of inertia tensor. Non-inertial frames and pseudoforces. Variational principle. Generalized coordinates. Lagrangian and Hamiltonian formalism and equations of motion. Conservation laws and cyclic coordinates. Periodic motion: small oscillations, normal modes. Special theory of relativityLorentz transformations, relativistic kinematics and mass–energy equivalence.

III. Electromagnetic Theory

Electrostatics: Gauss's law and its applications, Laplace and Poisson equations, boundary value problems. Magnetostatics: Biot-Savart law, Ampere's theorem. Electromagnetic induction. Maxwell's equations in free space and linear isotropic media; boundary conditions on the fields at interfaces. Scalar and vector potentials, gauge invariance. Electromagnetic waves in free space. Dielectrics and conductors. Reflection and refraction, polarization, Fresnel's law, interference, coherence, and diffraction. Dynamics of charged particles in static and uniform electromagnetic fields.

IV. Quantum Mechanics

Wave-particle duality. Schrödinger equation (time-dependent and time-independent). Eigenvalue problems (particle in a box, harmonic oscillator, etc.). Tunneling through a barrier. Wave-function in coordinate and momentum representations. Commentators and Heisenberg uncertainty principle. Dirac notation for state vectors. Motion in a central potential: orbital angular momentum, angular momentum algebra, spin, addition of angular momenta; Hydrogen atom. Stern-Gerlach experiment. Time independent perturbation theory and applications. Variation method. Time dependent perturbation theory and Fermi's golden rule, selection rules. Identical particles, Pauli exclusion principle, spin-statistics connection.

V. Thermodynamic and Statistical Physics

Laws of thermodynamics and their consequences. Thermodynamic potentials, Maxwell relations, chemical potential, phase equilibria. Phase space, micro- and macro-states. Micro-canonical, canonical and grand-canonical ensembles and partition functions. Free energy and its connection with thermodynamic quantities. Classical and quantum statistics. Ideal Bose and Fermi gases. Principle of detailed balance. Blackbody radiation and Planck's distribution law.

VI. Electronics and Experimental Methods

Semiconductor devices (diodes, junctions, transistors, field effect devices, homo- and hetero-junction devices), device structure, device characteristics, frequency dependence and applications. Opto-electronic devices (solar cells, photo-detectors, LEDs). Operational amplifiers and their applications. Digital techniques and applications (registers, counters, comparators and similar circuits). A/D and D/A converters. Microprocessor and microcontroller basics. Data interpretation and analysis. Precision and accuracy. Error analysis, propagation of errors. Least squares fitting,

PART 'B' ADVANCED

I. Mathematical Methods of Physics

Green's function. Partial differential equations (Laplace, wave and heat equations in two and three dimensions). Elements of computational techniques: root of functions, interpolation, extrapolation, integration by trapezoid and Simpson's rule, Solution of first order differential equation using RungeKutta method. Finite difference methods. Tensors. Introductory group theory: SU(2), O(3).

II. Classical Mechanics

Dynamical systems, Phase space dynamics, stability analysis. Poisson brackets and canonical transformations. Symmetry, invariance and Noether's theorem. Hamilton-Jacobi theory.

III. Electromagnetic Theory

Dispersion relations in plasma. Lorentz invariance of Maxwell's equation. Transmission lines and wave guides. Radiation- from moving charges and dipoles and retarded potentials.

IV. Quantum Mechanics

Spin-orbit coupling, fine structure. WKB approximation. Elementary theory of scattering: phase shifts, partial waves, Born approximation.

Relativistic quantum mechanics: Klein-Gordon and Dirac equations. Semi-classical theory of radiation.

V. Thermodynamic and Statistical Physics

First-and second-order phase transitions. Diamagnetism, paramagnetic, and ferromagnetism. Ising model. Bose-Einstein condensation. Diffusion equation. Random walk and Brownian motion. Introduction to nonequilibrium processes.

VI. Electronics and Experimental Methods

Linear and nonlinear curve fitting, chi-square test. Transducers (temperature, pressure/vacuum, magnetic fields, vibration, optical, and particle detectors). Measurement and control. Signal conditioning and recovery. Impedance matching, amplification (Op-amp based, instrumentation amp, feedback), filtering and noise reduction, shielding and grounding. Fourier transforms, lock-in detector, box-car integrator, modulation techniques. High frequency devices (including generators and detectors).

VII. Atomic & Molecular Physics

Quantum states of an electron in an atom. Electron spin. Spectrum of helium and alkali atom. Relativistic corrections for energy levels of hydrogen atom, hyperfine structure and isotopic shift, width of spectrum lines, LS & JJ couplings. Zeeman, Paschen-Bach & Stark effects. Electron spin resonance. Nuclear magnetic resonance, chemical shift. Frank-Condon principle. Born-Oppenheimer approximation. Electronic, rotational, vibrational and Raman spectra of diatomic molecules, selection rules. Lasers: spontaneous and stimulated emission, Einstein A & B coefficients. Optical pumping, population inversion, rate equation. Modes of resonators and coherence length.

VIII. Condensed Matter Physics

Bravais lattices. Reciprocal lattice. Diffraction and the structure factor. Bonding of solids. Elastic properties, phonons, lattice specific heat. Free electron theory and electronic specific heat. Response and relaxation phenomena. Drude model of electrical and thermal conductivity. Hall effect and thermoelectric power. Electron motion in a periodic potential, band theory of solids: metals, insulators and semiconductors. Superconductivity: type-I and type-II superconductors. Josephson junctions. Superfluidity. Defects and dislocations. Ordered phases of matter: translational and orientational order, kinds of liquid crystalline order. Quasi crystals.

IX. Nuclear and Particle Physics

Basic nuclear properties: size, shape and charge distribution, spin and parity. Binding energy, semiempirical mass formula, liquid drop model. Nature of the nuclear force, form of nucleon-nucleon potential, charge-independence and charge-symmetry of nuclear forces. Deuteron problem. Evidence of shell structure, single-particle shell model, its validity and limitations. Rotational spectra. Elementary ideas of alpha, beta and gamma decays and their selection rules. Fission and fusion. Nuclear reactions, reaction mechanism, compound nuclei and direct reactions. Classification of fundamental forces. Elementary particles and their quantum numbers (charge, spin, parity, isospin, strangeness, etc.). Gellmann-Nishijima formula. Quark model, baryons and mesons. C, P, and T invariance. Application of symmetry arguments to particle reactions. Parity non-conservation in weak interaction. Relativistic kinematics.

BARKATULLAH UNIVERSITY, BHOPAL

SYLLABUS FOR PH.D. ENTRANCE TEST

SUBJECT CHEMISTRY

Max. Marks : 100
Part-A- 40
Part-B – 60

Note :-

The entrance test shall comprise one paper of multiple choice objective type 100 questions of one mark each covering all the papers of post Graduate course of Chemistry. There will be no negative marking. The candidate must score minimum 40% marks to qualify the Entrance exam.

Syllabus for Part-A

1. **Common elementary knowledge of computer**

   History of development of computers, mainframe, mini, micro and Super Computer Systems, General awareness of Computer Hardware i.e. CPU and other peripheral devices (input, output and auxiliary storage devices), Basic knowledge of computer systems software and programming language.

2. **Chemical sciences**

   Structure and Bonding : Concept of hybridization. Molecular orbitals and electronic configuration of homonucleare and heteronucleare diatomic molecules. Shapes of polyatomic molecules, VSEPR theory. Symmetry elements and point groups for simple molecules. Bond lengths, bond angles, bond order and bond energies. Types of Chemical Bond (weak and strong) intermolecular forces, structure of simple ionic and covalent solids, lattice energy.

Acids and Bases : Bronsted and Lewis acids and bases, pH and pKa, acid-base concept in non-aqueous media; HSAB concept. Buffer solution.

Redox Reactions : Oxidatoin numbers. Redox potential, Electrochemical series, Redox indicators.

Energetic and Dynamics of Chemical Reactions :

Law of conservation of energy. Energy and enthalpy of reactions. Entropy, free-energy, relationship between free energy change and equilibrium. Rates of chemical reactions (first-and second –order reactions). Arrhenius equation and concept of transition state. Mechanisms, including SN1 and SN2 reactions, electron transfer reactions, catalysis, Colligative properties of solutions.

Aspects of s.p.d.f. Block Elements:

General characteristics of each block. Chemical principles involved in extractions and purification of iron, copper, lead, zinc and aluminium.

Coordination chemistry: Structural aspects, isomerism, octahedral and tetrahedral crystal - field splitting of d-orbitals. CFSE, magnetism and colour of transition metal ions. Sandwich compounds, metal carbonyls and metal clusters. Rare gas compounds, nonstoichiometric oxides. Radio activity and transmutation of elements. Isotopes and their applications.

IUPAC Nomenclature of Simple Organic and Inorganic Compounds.

Concept of Chirality : Recognition of symmetry elements and chiral structures; R-S nomenclature, diastereoisomerism in acyclic and cyclic systems; E-Z isomerisms. Conformational analysis of simple cyclic (chair and boat cyclohexanes) and acyclic systems. Interconversion of Fischer, Newman and Sawhorse projections.

Common Organic Reactions and Mechanisms:

Reactive intermediates. Formation and stability of carbonium ions, carbanians, carbenes, nitrenes, radicals and arynes. Nucleophilic, electrophilic, radical substitution, addition and. elimination reactions. Familiar name reactions: Aldol, Perkin, Stobbe, Dieckmann condensations; Hofmann, Schmidt, Lossen, Curtius, Beckmann and Fries rearrangements; Reimer -Tiemann, Reformatsky and Grignard reactions. Diels -Alder reactions; Clasien rearrangements; Friedel-Crafts reactions; Wittig reactions; and Robinson annulation. Routine functional group transformations and interconversions of simple functionalities. Hydroboration,

Oppenaur oxidations; Clemmensen, Wolff- Kishner, Meerwein-Ponndorf-Verley and Birch reductions.

Spectral Techniques: Elementary principles and applications of electronic, vibrational, NMR, EPR and Mass Spectral techniques to simple structural problems, Moss Bauer.

SYLLABUS FOR PART-B

Chemistry of Non-transition Elements : General discussion on the properties of the nontransition elements; special features of individual elements; synthesis, properties and structure of their halides and oxides, polymorphism of carbon, phosphorus and sulphur. Synthesis, properties and structure of boranes, carboranes, borazines, silicates carbides, silicones, phosphazenes, sulphur -nitrogen compounds: peroxo compounds of boron, carbon and sulphur; oxy acids of nitrogen, phosphorus, sulphur and halogens, interhalogens, pseudohali and noble gas compounds.

Chemistry of Transition Elements: Coordination chemistry of transition metal ions; Stability constants of complexes and their determination; stabilization of unusual oxidation states. Stereochemistry of coordination compounds. Ligandfield theory, splitting of d-orbitals in low-symmetry environments. Jahn- Teller effect; interpretation of electronic spectra including charge tranfer spectra; spectrochemical series, nephelauxetic series Magnetism: Dia-, para-, ferro- and antiferromagnetism, quenching of orbital angular moment, spin orbit coupling, inorganic reaction mechanisms; substitution reactions, trans effect and electron transfer reactions, photochemical reaction of chromium and ruthenium complexes. Fluxional molecules iso-and heteropolyacids; metal clusters. Spin crossover in coordination compounds.

Organometallic Chemistry of Transition Elements: Synthesis, structure and bonding, organometallic reagents in organic synthesis and in homogeneous catalytic reactions (hydrogenation, hydroformaylation, isomerisation and polymerization); pi-acid metal complexes, activation of small molecules by coordination.

Topics in Analytical Chemistry: Adsorption partition, exclusion electrochromatography, Solvent extraction and ion exchange methods. Application of atomic and molecular absorption and emission spectroscopy in quantitative analysis Light scattering techniques including nephelometry and Raman spectroscopy.

Electronalytical techniques: voltammetry, cyclicvoltammetry, polarography, amperometry, coulometry and conductometry ion-elective electrodes. Annodic stripping voltammetry; TGA, DTA, DSC.

Bioinorganic Chemistry: Metal ions in Biology, Molecular mechanism of ion transport across membranes; ionophores. Photosynthesis, PSL, PSH; nitrogen fixation, oxygen uptake proteins, cytochromes and ferrodoxins.

Solids: Dislocation in solids, Schottky and Frenkel defects, Electrical properties: Insulators and semiconductors superconductors; band theory of solids, Solid-state reactions.

Quantum Chemistry: Plank's quantum theory, wave-particle duality. Uncertainty Principle, operators and commutation relations: postulates of quantum mechanics and Schrodinger equation: free particle, particle in a box, degeneracy, harmonic oscillator, rigid rotator and the hydrogen atom. Angular momentum, including spin; coupling of angular momenta including spin-orbit coupling.

The variation method and perturbation theory: Application to the helium atom; antisymmetry and Exclusion Principle, Slater wave functions. Terms symbols and spectroscopic states.

Born-Oppenheimer approximation. Hydrogen molecule ion. LCAO-MO and VB treatments of the hydrogen molecule; electron density, forces and their role in chemical bonding. Hybridization and valence MOs of H_2O, NH_3 and CH_4. Huckel pi-electron theory and its applications to ethylene, butadiene and benzene. Idea of self-consistent field.

Fast Reaction: Luminescence and Energy transfer processes. Study of kinetics by flow techniques, relaxation methods, flash photolysis technique.

Macromolecules: Number-average and weight average molecular weights; Determination of molecular weights. Kinetics of polymerization. Stereochemistry and mechanism of polymerization.

Aromaticity : Huckle's rule and concept of aromaticity (n) annulenes and heteroannulenes, fullerenes (C60)

Stereochemistry and conformational Analysis: Asymmetric synthesis: enantio and diastereo selective synthesis, Cram's rule and Prelog generalization. Effects of conformation on reactivity in acyclic compounds and cyclohexanes. Stereochemistry of Biphenyls, allenes and spiranes.

Selective Organic Name Reactions: Favorskii reaction; Stork enamine reaction; Michael addition, Mannich Reaction; Sharpless asymmetric epoxidation; Ene reaction, Barton reaction, Shapiro reaction, Baeyer-Villiger reaction.

Mechanisms of Organic Reactions: Labelling and Kinetic isotope effects, Hammett equation, (sigma-rho) relationship, non-classical carbonium ions, neighbouring group participation.

Pericyclie Reactions: Selection rules and stereochemistry of electrocyclic reactions, cycloaddition and sigmatropic shifts, Sommelet, Hauser, Cope and Claisen rearrangements.

Heterocyclic Chemistry: Synthesis and reactivity of furan, thiophene, pyrrole, pyridine, quinoline, isoquinoline and indole; Skraup synthesis, Fischer indole synthesis.

Reagents in Organic Synthesis: Use of the following reagents in organic synthesis and functional group transformations; Complex metal hydrides, lithium dimethylcuprate, lithium disopropylamide (LDA) dicyclohexylcarbodimide. I,3-Dithiane (reactivity umpolung), trimethylsilyl iodide, tri-n butyl tin hydride,

Woodward and prevost hydroxylation, osmium tetroxide, DDQ, selenium dioxide, Wilkinson's catalyst, Baker yeast.

Thermodynamics: First law of thermodynamics, relation between Cp and Cv; enthalpies of physical and chemical changes; temperature dependence of enthalpies. Second law of thermodynamics, entropy, Gibbs-Helmoholtz equation. Third law of thermodynamics and calculation of entropy.

Chemical Equilibrium: Free energy and entropy of mixing, partial molar quantities, Gibs-Duhem equation. Equilibrium constant, temperature-dependence of equilibrium constant, phase diagram of one-and two-component systems, phase rule.

Ideal and Non-ideal solutions: Excess functions, activities, concept of hydration number: activities in electrolytic solutions; mean ionic activity coefficient; Debye-Huckel treatment of dilute electrolyte solutions.

Electrochemistry: Electrochemical cell reactions, Nearnst equation, Electrode Kinetics, electrical double layer, electode/electrolyte interface, Batteries, primary & secondary Fuel Cells, corrosion and corrosion prevention.

Surface Phenomenon: Surface tension, adsorption on solids, electrical phenomenan at interfaces, including electrokinetic, micelles and reverse micelles: solubilization, micro-emulsions. Application of photoelectron spectroscopy. ESCA and Auger spectroscopy to the study of surfaces.

Statistical Thermodynamics: Thermodynamic probability and entropy; Maxwell-Boltzmann, Bose-Einstein and Fermi-Direc statistics. Partition function: rotational, translational, vibrational and electronic partition functions for diatomic molecules; calculations of thermodynamic function and equilibrium constants.

Non-equilibrium Thermodynamics: Postulates and methodologies, linear laws, Gibbs equation, Onsager reciprocal theory.

Reaction Kinetics: Methods of determining rate laws; Mechanisms of photochemical, chain and oscillatory reactions. Collision theory of reaction rates; steric factor, treatment of unimolecular reactions. Theory of absolute reaction rates, comparison of results with Eyring and Arrhenius equations. Ionic reactions: salt effect. Homogeneous catalysis and Michaelis-Menten kinetics; heterogeneous catalysis.

Photochemistry : Cis-trans Isomerisation, Paterno-Buchi reaction, Norrish Type I and II reactions photoreaction of Ketones, di-pomethane rearrangement, photochemistry of arenas.

Drug Design : Prodrugs, Hard & Soft drugs, Structure-Activity relationship (SAR), Bioisosterism, Theories of drug activity, QSAR-Development of QSAR, Drug Receptor interactions, Physio-Chemical parameters.

Barkatullah University , Bhopal (M.P.)
Syllabus for Ph.D.M.Phil. Entrance Test 2012
Subject – Mathematics

Maximum Marks : 100
Minimum Marks : 40

Note : There will be 100 objective type of questions Minimum Passing Marks will be 40. No negative marking.

UNIT – 1

Analysis: Elementary set theory, finite, countable and uncountable sets, Real number system as a complete ordered field, Archimedean property, supremum, infimum.

Sequences and series, convergence, limsup, liminf.

Bolzano Weierstrass theorem, Heine Borel theorem.

Continuity, uniform continuity, differentiability, mean value theorem.

Sequences and series of functions, uniform convergence.

Riemann sums and Riemann integral, Improper Integrals.

Monotonic functions, types of discontinuity, functions of bounded variation, Lebesgue measure, Lebesgue integral.

Functions of several variables, directional derivative, partial derivative, derivative as a linear transformation, inverse and implicit function theorems.

Metric spaces, compactness, connectedness. Normed linear Spaces. Spaces of continuous functions as examples.

Linear Algebra: Vector spaces, subspaces, linear dependence, basis, dimension, algebra of linear transformations.

Algebra of matrices, rank and determinant of matrices, linear equations.

Eigenvalues and eigenvectors, Cayley-Hamilton theorem.

Matrix representation of linear transformations. Change of basis, canonical forms, diagonal forms, triangular forms, Jordan forms.

Inner product spaces, orthonormal basis.

Quadratic forms, reduction and classification of quadratic forms

UNIT – 2

Complex Analysis: Algebra of complex numbers, the complex plane, polynomials, power series, transcendental functions such as exponential, trigonometric and hyperbolic functions. Analytic functions, Cauchy-Riemann equations.

Contour integral, Cauchy's theorem, Cauchy's integral formula, Liouville's theorem, Maximum modulus principle, Schwarz lemma, Open mapping theorem.

Taylor series, Laurent series, calculus of residues.

Conformal mappings, Mobius transformations.

Algebra: Permutations, combinations, pigeon-hole principle, inclusion-exclusion principle, derangements.

Fundamental theorem of arithmetic, divisibility in Z, congruences, Chinese Remainder Theorem, Euler's Ø- function, primitive roots.

Groups, subgroups, normal subgroups, quotient groups, homomorphisms, cyclic groups, permutation groups, Cayley's theorem, class equations, Sylow theorems.

Rings, ideals, prime and maximal ideals, quotient rings, unique factorization domain, principal ideal domain, Euclidean domain.

Polynomial rings and irreducibility criteria.

Fields, finite fields, field extensions, Galois Theory.

Topology: basis, dense sets, subspace and product topology, separation axioms, connectedness and compactness.

UNIT – 3

Ordinary Differential Equations (ODEs):

Existence and uniqueness of solutions of initial value problems for first order ordinary differential equations, singular solutions of first order ODEs, system of first order ODEs.

General theory of homogenous and non-homogeneous linear ODEs, variation of parameters, Sturm-Liouville boundary value problem, Green's function.

Partial Differential Equations (PDEs):

Lagrange and Charpit methods for solving first order PDEs, Cauchy problem for first order PDEs. Classification of second order PDEs, General solution of higher order PDEs with constant coefficients, Method of separation of variables for Laplace, Heat and Wave equations.

Numerical Analysis :

Numerical solutions of algebraic equations, Method of iteration and Newton-Raphson method, Rate of convergence, Solution of systems of linear algebraic equations using Gauss elimination and Gauss-Seidel methods, Finite differences, Lagrange, Hermite and spline interpolation, Numerical differentiation and integration, Numerical solutions of ODEs using Picard, Euler, modified Euler and Runge-Kutta methods.

Calculus of Variations:

Variation of a functional, Euler-Lagrange equation, Necessary and sufficient conditions for extrema. Variational methods for boundary value problems in ordinary and partial differential equations.

Linear Integral Equations:

Linear integral equation of the first and second kind of Fredholm and Volterra type, Solutions with separable kernels. Characteristic numbers and eigenfunctions, resolvent kernel.

Classical Mechanics:

Generalized coordinates, Lagrange's equations, Hamilton's canonical equations, Hamilton's principle and principle of least action, Two-dimensional motion of rigid bodies, Euler's dynamical equations for the motion of a rigid body about an axis, theory of small oscillations.

Barkatullah University , Bhopal (M.P.)

Syllabus for Entrance Test
For Admission to Ph.D. Course in
Statistics

Max. Marks : 100
Min. Makrs : 40

Note : There will be 100 objective type of questions Minimum Passing Marks will be 40. No negative marking.

UNIT I : Probability Theory, Standard discrete and Continuous distributions. Sampling distributions. Standard errors and asymptotic distributions, distribution of order statistics and range Simple, Partial and Multiple Correlation Coefficients and related tests, Simple and multiple linear regression.

UNIT II : Methods of estimation. Properties of estimators. Confidence intervals, Testing of hypotheses. Tests of Significance: Small and Large sample tests. Analysis of discrete data and chi-square test of goodness of fit. Simple nonparametric tests for one and two sample problems.

UNIT III : Gauss-Markov models, Analysis of variance and covariance. Fixed, random and mixed effects models. Designs of Experiments Three basic designs, Factorial Experiments. Incomplete Block Designs, BIBD.

UNIT IV : Sampling - Simple Random Sampling , Stratified Random Sampling , Systematic Sampling. Statistical Quality Control- Process Control & Product Control. Control Charts and acceptance sampling.

UNIT V : Linear Programming – Graphical & Analytical methods for solving LPP. Duality and related theorems. Assignment & Transportation Problems .

Vital Statistics – Fertility & Mortality Rates ,Life Table and it's construction.

Note : (i) Each unit will be of EQUAL weight .

(ii) Questions will be of **' MCQ'** type .

BARKATULLAH UNIVERSITY, BHOPAL
SYLLABUS OF Ph.D. ENTRANCE EXAM 2012
Ph.D. IN EARTH SCIENCE/ GEOLOGY

Maximum Marks: 100
Minimum Marks : 40

Note : There will be 100 objective type of questions Minimum Passing Marks will be 40. No negative marking.

All questions would be of the multiple choice type. The question paper will be divided into two parts :

Part-A This will have question of B.Sc. Level (As per syllabus taught in Indian Universities) from the areas of Physical Geology, Structural Geology, Stratigraphy, Palaeontology, Mineralogy, and Petrology.

Part-B This part of the questions paper will have questions of M.Sc. Level (As per syllabus taught in Indian Universities) from Geomorphology, Geodynamics, Structural Geology, Stratigraphy, Environmental Geology, Mineral exploration, Ore Geology Indian Mineral deposits, Mineral economics, Engineering geology, hydrogeology and G.I.S.

BARKATULLAH UNIVERSITY, BHOPAL
Syllabus for Ph D Entrance Exam 2012
Subject – Computer Science

Max. Marks : 100
Min. Marks : 40

Note : There will be 100 objective type of questions. Minimum Passing Marks will be 40. No negative marking.

Discrete Structures :-

Sets, Relations, Functions, Pigeonhole Principle, Inclusion-Exclusion Principle, Equivalence and Partial Orderings, Elementary Counting Techniques, Probability, Measure (s) for information and Mutual information.

Computability : Models of computation-Finite Automata, Pushdown Automata, Non – determinism and NFA, DPDA and PDAs and Languages accepted by these structures, Grammars, Languages, Non – computability and Examples of non – computable problems.

Graph : Definition, walks, paths, trails, connected graphs, regular and bipartite graphs, cycles and circuits, Tree and rooted tree, Spanning trees, Eccentricity of a vertex radius and diameter of a graph, Central Graphs, Centres of a tree, Hamiltonian and Eulerian graphs, Planar graphs.

Groups : Finite fields and Error correcting / detecting codes.

Computer Arithmetic :

Propositional (Boolean) Logic, Predicate Logic, Well – foraied – formulae (WFF), Satisfiability and Tautology.

Logic Families : TTL, ECL and C – MOS gates, Boolean algebra and Minimization of Boolean functions, Flip – flops – types, race condition and comparison, Design of combinational and sequential circuits.

Representation of Integers : Octal, Hex, Decimal, and Binary. 2's complement and 1's complement arithmetic. Floating point representation.

Programming in C and C++ :

Programming in C : Elements of C – Tokens, identifiers, data types in C. Control structures in C. Sequence, selection and iteration(s). Structured data types in C-arrays, struct, union, string, and pointers.

O – O Programming Concepts : Class, object, instantiation. Inheritance, polymorphism and overloading.

C++ Programming : Elements of C++ – Tokens, identifiers, Variables and constants, Datatypes, Operators, Control statements, Functions parameter passing, Class and objects, Constructors and destructors, Overloading, Inheritance, Templates, Exception handling.

Relational Database Design and SQL :

E-R diagrams and their transformation to relational design, normalization – INF, 2NF, 3NF, BCNF and 4NF. Limitations of 4NF and BCNF.

SQL : Data Definition Language (DDL), Data Manipulation Language (DML), Data Control Language (DCL) commands. Database objects like-Views, indexes, sequences, synonyms, data dictionary.

Data and File structures :

Data, Information, Definition of data structure. Arrays, stacks, queues, linked lists, trees, graphs, priority queues and heaps.

File Structures : Fields, records and files. Sequential, direct, index-sequential and relative files. Hashing, inverted lists and multi – lists. B trees and B+ trees.

Computer Networks :

Network fundamentals : Local Area Networks (LAN), Metropolitan Area Networks (MAN), Wide Area Networks (WAN), Wireless Networks, Inter Networks.

Reference Models : The OSI model. TCP / IP model.

Data Communication : Channel capacity. Transmission media-twisted pair, coaxial cables, fibre – optic cables, wireless transmission-radio, microwave, infrared and millimeter waves, Lightwave transmission. Thelephones-local loop, trunks, multiplexing, switching, narrowband ISDN, broadband ISDN, ATM, High speed LANS, Cellular %Radio, Communication satellites-geosynchronous and low-orbit.

Internetworking : Switch / Hub, Bridge, Router, Gateways, Concatenated virtual circuits, Tunnelling, Fragmentation, Firewalls.

Routing : Virtual circuits and datagrams. Routing algorithms. Conjestion control.

Network Security : Cryptography-public key, secret key. Domain Name System (DNS) – Electronic Mail and Worldwide Web (WWW). The DNS, Resource Records, Name servers, E-mail-architecture and Serves.

System Software and Compilers :

Assembly language fundamentals (8085 based assembly language programming). Assemblers-2-pass and single-pass. Macros and macroprocessors.

Loading, linking, relocation, program relocatability. Linkage editing.

Text editors. Programming Environments. Debuggers and program generators.

Compilation and Interpretation. Bootstrap compilers. Phases of compilation process. Lexical analysis. Lex package on Unix system.

Context free grammars. Parsing and parse trees. Representation of parse (derivation) trees as rightmost and leftmost derivations. Bottom up parsers-shift-reduce, operator precedence, and LR. YACC package on Unix system.

Topdown parsers-left recursion and its removal. Recursive descent parser. Predictive parser. Intermediate codes-Quadruples, Triples. Intermediate code generation, Code generation. Code optimization.

Operating Systems (with Case Study of Unix) :

Main functions of operating systems. Multi Programming, multiprocessing, and multitasking.

Memory Management : Virtual memory, paging, fragmentation.

Concurrent Processing : Mutual exclusion. Critical regions, lock and unlock.

Scheduling : CPU scheduling, I / O scheduling, Resource scheduling. Deadlock and scheduling algorithms. Banker's algorithm for deadlock handling.

UNIX :

The Unix System : File system, process management, bourne shell, shell variables, command line programming.

Filters and Commands : Pr, head, tail, cut, paste, sort, uniq, tr, join, etc., grep, egrep, fgrep, etc., sed, awk, etc.

System Calls (like) : Creat, open, close, read, write, iseek, link, unlink, stat, fstat, umask, chmod, exec, fork, wait, system

Software Engineering :

System Development Life Cycle (SDLC) : Steps, Water fall model, Prototypes, Spiral model.

Software Metrics : Software Project Management.

Software Design : System design, detailed design, function oriented design, object oriented design, user interface design. Design level metrics.

Coding and Testing : Testing level metrics. Software quality and reliability. Clean room approach, software reengineering.

Current Trends and Technologies :

The topics of current interest in Computer Science and Computer Applications shall be covered. The experts shall use their judgement from time to time to include the

topics of popular interest, which are expected to be known for an application development software professional, currently, they include :

Digital Libraries and Data Warehousing : Concepts, Types of Digital documents, Issues behind document Infrastructure, Corporate Data Warehouses.

Data Warehousing : Data Warehouse environment, architecture of a data warehouse methodology, analysis, design, construction and administration.

Data Mining : Extracting models and patterns from large databases, data mining techniques, classification, regression, clustering, summarization, dependency modelling, link analysis, sequencing analysis, mining scientific and business data.

Simple Applications (in windows) : Scrolling, splitting views, docking toolbars, status bars, common dialogs.

Advanced Windows Programming : Multiple document interface (MDT) multi threading, object linking and Enbel, Active X control, Active T emplel library (ALT)

Combinational Circuit Design, Sequential Circuit Design, Hardwired and Micro Programmed processor design, Instruction formats, Addressing modes, Memory types and organisation, Interfacing peripheral devices, Interrupts.

Microprocessor architecture, Instruction set and Programming (8085, P – III / P – IV), Microprocessor applications.

Database Concepts, ER diagrams, Data Models, Design of Relational Database, Normalisation, SQL and QBE, Query Processing and Optimisation, Centralised and Distributed Database, Security, Concurrency and Recovery in Centralised and Distributed Database Systems, Object Oriented Database Management Systems (Concepts, Composite objects, Integration with RDBMS applications), ORACLE.

Display systems, Input devices, 2D Geometry, Graphic operations, 3D Graphics, Animation, Graphic standard, Applications.

Concepts, Storage Devices, Input Tools, Authoring Tools, Application, Files.

Programming language concepts, paradigms and models.

Data : Data types, Operators, Expressions, Assignment, Flow of Control.

Control structures, I / O statements, User – defined and built – in functions, Parameter passing.

Principles, classes, inheritance, class hierarchies, polymorphism, dynamic binding, reference semantics and their implementation.

Principles, functions, lists, types and polymorphisms, higher order functions, lazy evaluation, equations and pattern matching.

Principles, horn clauses and their execution, logical variables, relations, data structures, controlling the search order, program development in prolog, implementation of prolog, example programs in prolog.

Principles of parallelism, coroutines, communication and execution, Parallel Virtual Machine (PVM) and Message Passing Interface (MPI) routines and calls. Parallel programs in PVM paradigm as well as MPI paradigm for simple problems like matrix multiplication.

Preconditions, post-conditions, axiomatic approach for semantics, correctness, denotational semantics.

Analog and Digital transmission, Asynchronous and Synchronous transmission, Transmission media, Multiplexing and Concentration, Switching techniques, Polling.

Topologies, Networking Devices, OSI Reference Model, Protocols for :

Data link layer

Network layer

Transport layer, TCP / IP protocols, Networks security, Network administration.

Definition, Simple and Composite structures, Arrays, Lists, Stacks queues, Priority queues, Binary trees, B – trees, Graphs.

Sorting and Searching Algorithms, Analysis of Algorithms, Interpolation and Binary Search, Asymptotic notations-big ohm, omega and theta, Average case analysis of simple programs like finding of a maximum of n elements, Recursion and its systematic removal, Quicksort – Non – recursive implementation with minimal stack storage.

Design of Algorithms (Divide and Conquer, Greedy method, Dynamic programming, Back tracking, Branch and Bound). Lower bound theory. Non – deterministic algorithm – Non – deterministic programming constructs. Simple non-deterministic programs. NP – hard and NP – complete problems.

Object, messages, classes, encapsulation, inheritance, polymorphism, aggregation, abstract classes, generalization as extension and restriction. Object oriented design. Multiple inheritance, metadata.

HTML, DHTML, XML, Scripting, Java, Servelets, Applets.

Software development models, Requirement analysis and specifications, Software design, Programming techniques and tools, Software validation and quality assurance techniques, Software maintenance and advanced concepts, Software management.

Introduction, Memory management, Support for concurrent process, Scheduling, System deadlock, Multiprogramming system, I/O management, Distributed operating systems, Study of Unix and Windows NT.

Neural Networks : Perceptron model, Linear separability and XOR problem. Two and three layered neural nets. Back Propagation – Convergence, Hopfield nets, Neural net learning, Applications.

Fuzzy Systems : Definition of a Fuzzy set, Fuzzy relations, Fuzzy functions, Fuzzy measures, Fuzzy reasoning, Applications of Fuzzy systems.

BARKATULLAH UNIVERSITY, BHOPAL
Ph.D. Entrance Test

SUBJECT : ELECTRONICS

Max. Marks : 100
Min. Marks : 40

Note : There will be 100 objective type of questions. Minimum Passing Marks will be 40. No negative marking.

1. Circuit and Network Analysis

Network Equations: Kirch0ff's Laws, Source Transformations, Loop Variable Analysis, Node Variable Analysis, First-Order Differential Equations, Time constants. Initial conditions in Networks, Initial condition in elements, Procedure for Evaluating initial conditions, Initial State of a Network.

Second-Order Equation, Higher order Equation : Laplace Transformation, Transforms of other signal waveforms: The Ramp and impulse function waveform synthesis.

Impedance functions and Network Theorems Transform impedance and transform circuits, series and Parallel combination of elements superposition and Reciprocity. Theven in Theorem and Norton's Theorem.

Sinusoidal steady-state Analysis: The Sinusoidal steady state. The sinusoid and e+_jwt Phasors and Phsors Diagrams, Frequency Response Plots: Power transfer and insertion and complex Power, Problems in optimizing power transfer, Insertion loss Tellegnins' Theorem.

2. Integrated Circuit and Interfacing System

Number systems and Code, Decimal, hcx, Octal, ASCII, their Inter conversion, Binary Addition, substraction, Multiplication and Division, Binary coded decimal number, Gray Code, Gates: Inverters, OR Gate AND Gate, Boolean Algebra, NOR Gate. Demorgan's theorem, NAND Gate, Exlusive Or Gate, EX NOR Gate. Application of gates in additional and subtraction, Half adder, Full adder.

TTL circuits, Digital Integrated circuits, TTL characteristics, TTL overview, AND-OR-INVERT gate, Multiplexer, Demultiplexer, Boolean Functions and Truth Table, form for Boolean functions, Karnough Map method, Flip flop, Registers and Counters, D-Flip flop, J.K. Flip Flop, JK Master slave flip flop, Ripple counters, synchronous counters, Ring Counters

Basic D/A converter (R-2R, binary weight type), A/D Converter (Counter ramp and successive approximation), Interfacing seven segment Display, digital clocks, Digital frequency meter, digital Multimeter, Sample hold circuits, (Basic concepts and working)

3. Operational Amplifiers

Differential and cascade Amplifiers; Differential Amplifiers circuit configurations, Introduction to operational Amplifiers block diagram representation of typical OP-AMP Analysis of Typical Op-AMP Equivalent circuits, Interpretation of data sheets and characteristics of Op-AMPs with Negative feedback, Voltage series feedback: Amplifier, Voltage-shunt feedback. Amplifiers, Practical Op-AMP.

Application of Op-Amp, Active filters First Order Active Filters, second order filters, Linear Power Supplies : Rectifier circuits Regulations, voltage References, Op-AMP regulators, Theory of oscillation, Relaxation Oscillators, Bootstrap Oscillators, Other LM566C Voltage controlled oscillator, The LM 555 Timer controller, LM565 Phase Locked loop.

4. Operating System

Overview of the Operating system: Evolution of operating system classification of operating system, Batch O.S. multiprogramming. Time sharing, real time, combination, distributed O.S. File Management: File concepts, file types, type based system.

Process Management: Process view, structure, process state, process control block, multiprogramming. Levels of schedulers and scheduling

algorithms, evaluation of various scheduling algorithms, multiple processor scheduling process synchronization mechanism.

Memory Management: Memory management scheme, Contiguous allocation, Portioning, Segmentation,

Device Management: Techniques for device management, dedicated devices, shared devices, virtual devices, I/O traffic controller, I/O Scheduler, Deadlocks and security & protection: Definition, characteristics, necessary conditions, resources, allocation graph, methods for handling deadlocks, deadlock prevention, deadlock avoidance deadlock detection and recovery, Security Policies and Mechanisms. Authentication, protection and access control, worms and viruses.

5. Sensors and transducers

Wheatstone bridge for sensor based measurements, Instrumentation amplifier, Sensors and transducers, Terminologies, active and passive transducers, Displacement transducers, Digital transducers and level measurement.

Measurement of strain gauges and materials, Gauging techniques, Strains gauge circuits, Measurement of pressures, Diagrams and elastic elements. Force balance transducers, Solid state devices. Thins film pressure transducers, Piezoelectric pressure transducers. Pressure multiplexes.

Measurement of temperature, Temperature sensors and calibration, Load cell, Digital force transducers, Phototubes, Photodiodes and phototransistors, Photovoltaic sensors.

6. Digital System and Microprocessors

Signal processing lements, DAC : Weightier resistor network R-2R ladder network, ADC, Simultaneous, Counter Type, Successive approximation, Single and dual slop ADC, sample and hold circuits.

Memories: Memory concepts, Core memory, Semiconductor memory, Bipolar RAM, MOS memories dynamic RAM, ROMs Programmable logic array, Architecture of 8085 , Buses, Registers, Arithmetic logic unit, Assembly and higher level languages. Micro and Macro instruction. Stack and subroutine.

Interfacing Dip switches, LED, seven segment display to 8085. General purpose programmable peripheral IC 8255 Interfacing ADC & ACS.

7. Electronic Instrumentation

Concepts of Measurement, Basis characteristics of measuring devices, calibrations, Generalised measurement, Zero, First and second order system definition, Wave form generators, Signal processing circuits, Lock in amplifiers.

Power supplies, Digital multimeter, Digital frequency meter, Digital phase meter, Power meter.

Cathode ray oscilloscopes, basic principles, CRT features single and dual beam CRO, Storage CRO. Recorders, Strip chart, XY and magnetic Digital Data Recording.

Representation (Block diagram, Signal flow, Transfer function) of control system. SCR, DIAC, TRIAC & GTO, PID controller.

8. Process control instrumentation

Introduction & Mathematical models of physical system. Transfer function; block Diagram Algebra, Signal Flow Graphs.

Feedback characteristics of control systems: Feedback and Non-feedback systems, Reduction of parameter Variations by Use of Feedback, control over System Dynamic by Use of Feedback, Time Response of First-Order System, Time Response of Second- Order System, Steady-state Errors and Error Constants,

The concept of stability, Necessary conditions for stability, Hurzitz Stability Criterian, Routh Stability Criterian, Relative Stability Analysis, More on the Routh Stability Criterian.

The Root Locus Concept, Construction Root Loci, Root Contours, System correlation between time and frequency response,

9. Data communication and network

Analog and Digital transmission : Pulse modulation, Code modulation, PCM codes, Delta Modulation PCM, Adaptive Delta modulation, Pulse Code Modulation Digital Multiplexing, Time-Division carrier system. Frequency Division multiplexing, Microwave System, Microwave Repeaters.

Satellite multiple-satellite system Link Models, satellite system Parameters, Satellite System link equations. FDM satellite systems, Frequency Hopping, Data Communication Circuits, Data; Communication Codes, Error Control, ISO Protocol Hiterarchy, Local Area Network.

10. Automated Instruments

General purpose programmable phripheral IC's 8253, Interrupts simple example of using EL, DI, SIM, RIM, Direct memory access 8051 Microcontroller Architecture, Instruction, Programming 8051, microcontroller pindiag, Architecture, Instruction Set, programming (8096-16 bit Microcontroller) and its Architecture.

11. Industrial Electronics

Power semiconductors: Diodes Thyristor, Gate turn off Asymmetric Thryristor, Trace Power MOSFET. Smart Power Devices.

Rectifying Circuit: Single Phase half wave, Bi-phase half wave, Three phase half wave, single phase Bridge, Three Phase Bridge rectifiers, Regulation Power Factor, Transform rating.

Converters: Naturally commutated converters, Converter operation, Voltage source and Current source inverter, Inverter performance, Cyclo converter.

Switched mode power supplied, Series-resonant power supplies, Uninterrupted Power Supplied (UPS), Welding power supplied, Thyristor circuit breakers.

12. Computer networking:

What is a network need for network, Application of network, Network Terminology: Client, Server, Cable, Links, Connectivity, Protocol, Backbone, Internet working, Types of network; LAN, WAN, MAN, Network topologies: Ring, Star, Bus, Tree, Mesh, The OSI Reference Model.

Transmission Media, Wireless Transmissinon, Narrowband, Broadband ISDN, ATM, Cellular Radio, Communication Satellites.

Data Link Layer: Data Link layer design issues, Error detection and correction.

Network layer: Network layer design issues, Routing algorithms, Internet working, The internet transport Protocols (TCP and UDP), The World Wide Web and Multimedia.

BARKATULLAH UNIVERSITY, BHOPAL
Syllabus for Ph D Entrance Exam 2012
Subject – Botany

Max. Marks : 100
Min. Marks : 40

Note : There will be 100 objective type of questions. Minimum Passing Marks will be 40. No negative marking.

Unit-1 Biology and diversity of virus, Bacteria, Fungi, Algae, Bryophyta, Pteridophyta

1) General account, classification, ultra structure, nutrition, Reproduction and Economic importance of Virus, Archaebacteria, Eubacteria, Cynobacteria, Mycoplasma, Actinomycetes, Rickettsiae, Chlamydiae
2) General Characteristics, Classification, Ultra structure, Reproduction and Economic Importance of fungi. Fungi in Medicine, Food, Antibiotics, Vitamins, steroids, Fermentation, Industries, Mycorrhiza, Biocontrol agent, Fungal disease in plant & Humans
3) General characteristics, .Diversified habitat, Classification, Thallus organization, Ultra structure, Nutrition, pigmentation, Flagella Reproduction and Economic Importance of Algae.
4) General characteristics, Distribution, Classification, Morphological Structure, Reproduction, Life history Ecological & Economical importance of Bryophytes
5) General Characteristics, Classification, Internal & External Morphology, Reproduction,& life history of Pteridophytes.

Unit–II Biology and Diversity of Phanerogames

1) General Characteristics, Classification, Evolution, Distribution, Complexity of gametophyte(Reproduction) Economic Importance of Living and fossil Gymnosperms
2) Origin and Evolution of Angiosperms, Plant Identification, Angiosperms Taxonomy-Aims, Fundamental component (Alpha, Beta & Gama) Principle and rules of Nomenclature, modern trends in Taxonomy, Taxonomic Tools, Herbarium, Flora, Botanical Garden, Classification of Angiosperms, Primitive angiosperms.

3) Flower development, Morphology of Stamens and Carpel & their Evolution, Diagnostic characteristic, Economic Importance and members of families of dicot and monocot.

4) Apical and floral meristems, SAM,RAM, Root & Shoot growth & Differentiation Tissues, Secondary growth (normal and abnormal),Leaf growth and differentiation, Secretary ducts and laticifers, lateral roots, root hairs, root microbe interaction.

5) Vegetative and sexual Reproduction, Microsporogenesis, Development of male gametophytes, Megasporogenesis, Development of female gametophytes, Pollination, Self incompatibility, Double fertilization, Embryogenesis, types of endosperms & their development, Polyembryoni, apomixes, Fruit & Seed development and dispersal.

Unit –III Molecular Biology

1) Structural organization of Prokaryotic & eukaryotic plant cell, Structure and function of cell wall, cytoskeleton, Plasma membrane and cell organelles,

2) Chromosome structure and their special types, karyotypes analysis & evolution, structural and numerical changes in chromosomes, cell division, & cell cycle

3) Genetics of prokaryotes and eukaryotes, Cytoplasmic & gene interaction, Male sterility, Molecular marker.

4) Conformation of nucleic acid (A,B,Z, DNA, RNA)DNA replication, repair and damage, recombination. Mutation, conformation of Protein.(Ramchendran plot), secondary, tertiary, and quaternary structure of protein & protein synthesis, Transposable elements

5) Control of gene expression at transcriptional & translation level, Immune system and cancer.

UNIT-IV Plantphysiology, Biochemistry Biotechnology, Tissueculture

1) Plant water relation,Absorption, Transpiration of water and food, Cell signaling, Principles of thermodynamics, Signal transduction receptors, pathway.
2) Enzyme, Nitrogen metabolism, Photosynthesis, Respiration, Carbohydrate, Lipid & Protein.
3) Plant Growth Regulators and Elicitors, Flowering process (floral induction, Development, Photoperiodism Phytochrome, Cryptochrom, Photomorphogenetic receptors, vernalization.) & Stress Physiology.
4) Principle and scope of Biotechnology, Intellectual property rights, Recombinant DNA technology, Genomic and cDNA library , PCR, DNA finger printing, Genetic engineering of plants, Transgenic, Genetic manipulation of microbes, Molecular markers, Role of Biotechnology in Industries, medicine and Agriculture.
5) General Introduction & scope of plant cell and tissue culture techniques of tissue culture, Organogenesis and advanced embryogenesis, Somatic hybridization Application of plant tissue culture, Secondary metabolites, Cryo preservation and germplasm storage.

UNIT–V Environmental Biology and economic Botany

1) Principle & scope of environmental Biology, Earth Man & Environment, Physicochemical and Biological factors, Wetlands & Waste land conservation, Natural resources and Sustainable development,
2) Ecosystem Component, Energy flow, Food chain and food web, Succession, Ecological adaptation, Community.
3) Biodiversity and its conservation, Field bank and Gene bank, Seed bank, In vitro depositories, National parks, Sanctuaries, Botanical garden, Biosphere reserves, Hot spots, Endemism, Endangered and Threatened species.
4) Geological hazards –landslides, floods, Earth quake, Volcanism, Avalanche, Natural and Anthropogenic source of pollution and their management , Climate change and Global warming, Environmental laws and Education.
5) Utilization of resource from forest, grass land and aquatic habitats, food forage and fodder, timber, non wood forest products, Ethnobotany scope, importance

BARKATULLAH UNIVERSITY, BHOPAL
Syllabus for Ph D Entrance Exam 2012
Subject – Zoology

Max. Marks : 100
Min. Marks : 40

Note : There will be 100 objective type of questions. Minimum Passing Marks will be 40. No negative marking.

UNIT	TOPICS
I	1. Classification of chordates and non-chordates
	2. Trends in Biosystematics: Chemotaxonomy, Cytotaxonomy and Molecular taxonomy
	3. Taxonomic categories, Biodiversity and Biodiversity Indices
	4. Phylogenetic and Biological concept of species
	5. Populations and their characters, demography, growth and regulation
II	1. Histological and cytological techniques
	2. Separation techniques, Immunological techniques, Electrophoresis
	3. General principles and application: Spectrophotometer, Ultracentrifuge, Cryotechniques, flame photometers, Microscopy
	4. Biomaterials and Nano particle: Their structural and functional Genomics
	5. Membrane channel pumps (transport mechanism)
	6. Cell: Cell signaling, adhesion and communication
III	1. Comparative anatomy of vertebrates: Heart, Aortic Arches, Urinogenital system
	2. Morphometry, Physico - chemical parameter of water bodies
	3. Bio-indicators
	4. Causes of pollution of aquatic resources, their management and conservation. Method of water quality monitoring: BOD, COD
	5. Fish culture, fresh water, Prawn culture, Economic interface and by products of fishes
	6. Sexual cycle, fecundity, parental care
IV	1. Kinds of Environmental Pollution
	2. Toxicology, Toxicity, Testing principles, Toxicants

	3. Neural and Hormonal control of animal behavior
	4. Gametogenesis: Spermatogenesis, Oogenesis
	5. Totipotency and Pleuripotency
	6. Haemopoietic stem cell, blood cell formation
V	1. Digestive and Metabolism, Respiratory and Circulatory mechanism
	2. Reproductive mechanism, chemical and nervous co-ordination mechanism. Excretory and osmoregulatory mechanism
	3. Thermodynamics and its application to biological systems, Homeostasis and Environmental limiting factors
	4. Environmental impact assessment and sustainable development
	5. Adaptation Levels: Various adaptation viz. Migration, Aquatic (Deep sea and Hill stream adaptation), Volent adaptation, Desert adaptation
	6. Sericulture, Insect pest management, strategies and tools. Common pests of Cotton, Sugarcane, Paddy, stored grains, citrus fruits, mangoes and household.

BOOKS FOR REFERENCE:

1. Alcock, J. Animal Behavior: An evolutionary Approach. Sinauer Assoc. Sunderland, Massachusetts, USA.
2. Berril B. I. and Karp. G. Development Biology. Mcgraw Hill, New York
3. Watson Gilman Witkowski Zoller Recombinant DNA Scientific American Books: Karp Gerald Cell Biology
4. Odum: Ecology
5. L. Veera Kumari: Bio-Instrumentation
6. Dallela and Sharma: Animal Taxonomy. Ramnath Publication
7. Hochachka: Biochemical Adaptation. Princeton University, New Jersey.

BARKATULLAH UNIVERSITY, BHOPAL
Syllabus for M.Phil./Ph.D. Entrance Exam 2012
Subject – Zoology

Max. Marks : 100
Min. Marks : 40

(Only UTD)

Note : There will be 100 objective type of questions. Minimum Passing Marks will be 40. No negative marking.

Cell and its Structural organization and function of intracellular organelles: Cell membrane/wall, nucleus, mitochondria, Golgi bodies, lysosomes, endoplasmic reticulum, peroxisomes, plastids, vacuoles, chloroplast, structure & function of cytoskeleton and its role in motility.

Cell division and cell cycle; Mitosis and meiosis, their regulation, steps in cell cycle and control of cell cycle.

Biomolecules: Structure, functions, properties and their significance (protein, Carbohydrates, Lipids, Nucleic Acids and Vitamins).

Mendelian principles: Dominance, segregation, independent assortment, deviation from Mendelian inheritance and genetic variation.

Concept of gene and Genetic engineering, Alleles, multiple alleles, pseudo
alleles, Cloning and Transgenics.

Principles and methods of Taxonomy: Concepts of species and hierarchical taxa, biological nomenclature, classical and quantitative methods of taxonomy of plants, animals and microorganisms.

Level of structural organization: Unicellular, colonial and multicellular forms; levels of organization of tissues, organs and systems, comparative anatomy.

Emergence of evolutionary thought: Lamarckism; Darwin-Concepts of variation, adaptation, struggle, fitness and natural selection; Mendelism; spontaneity of mutation and evolutionary synthesis.

Statistical methods: measures of central tendency and dispersal; probability distributions (Bionomial, Poisson and normal), sampling distribution; difference between parametric and non-parametric statistics; confidence interval; errors; levels of significance; regression and correlation; t-test, analysis of variance; X2 test basic introduction to Multivariate statistics etc.

Biodiversity: Concepts, management and conservation issues and their solutions.

Ecology: Physical conditions of environment: temperature, light & water, Biogeochemical cycles; Ecosystem, concept, structure and function, Food chain and food web: Energy flow; Succession.

Fisheries Biology

Brief account of major fisheries in India and Madhya Pradesh. Freshwater and Marine fisheries.

Fisheries and Industry: Fish processing, methods of processing, fish related industries and fish product export related industries.

Fisheries Biotechnology: Fish preservation, its effects on nutritional and culinary characteristics, fish preservation and related problems and remedies.

Fish breeding and mass production: Induced breeding and transgenic breeding. Fish farming and culture.

Fisheries management and fisheries related marketing strategies.

BATKATULLAH UNIVERSITY, BHOPAL-462026

DEPARTMENT OF ENVIRONMENTAL SCIENCES & LIMNOLOGY

SUBJECT - ENVIRONMENTAL SCIENCES

DOCTORAL ENTRANCE TEST (DET)

NOTE 1: The entrance test shall comprise of one multiple choice objective type paper having one hundred questions of one mark each (covering all the basic papers of the concerned Post Graduate course and has also been adopted form UGC NET Syllabus) of three hours duration to assess the fundamental knowledge of the candidate. There will be no negative marking. The candidates must score minimum 40% marks (35% for SC/ST/Physically handicapped) to qualify the Entrance Test.
NOTE 2: At least 10 objective questions from each unit.

DURATION: 3 hrs **MAXIMUM MARKS:** 100

UNIT I. BASIC PRINCIPLES OF ENVIRONMENTAL SCIENCES

Definition, Principles and scope of environmental science, Man and environment, ecosystem, pathways in ecosystem. Physico-Chemical and Biological factors in the environment. Geographical classification and Zones. Structure and composition of Atmosphere, Hydrosphere, Lithosphere and Biosphere. Natural resources and its conservation and sustainable development

UNIT II. FUNDAMENTALS OF ENVIRONMENTAL CHEMISTRY

Stochiometry, Solubility product, solubility of gases in water, the carbonate system, Unsaturated and saturated hydrocarbons, radio nuclides. Chemical compositions of Air: Classification of elements, chemical speciation, Particles, Ions and radicals in atmosphere, chemical processes for formation of inorganic and organic particulate matter, thermo chemical and photochemical reaction in atmosphere Oxygen and Ozone chemistry, chemistry of air pollutants, photochemical smog

Water Chemistry: Chemistry of water, Concept of DO, BOD, COD, Sedimentation coagulation, Filtration, Redox potential.

Soil Chemistry: Inorganic and organic components of soil, Nitrogen pathways and NPK in soils.

Toxic Chemicals in the environment-Air, Water: Pesticides in water, Biochemical aspects of Arsenic, Cadmium, Led Mercury, Carbon monoxide, Ozone and PAN pesticides, insecticides, MIC, carcinogens in the air.

UNIT III. ECOLOGICAL CONCEPTS

Definition, Principles and scope of ecology, Human ecology and Human settlement, evolution, origin of life and speciation. Ecosystem: Structure and functions, Abiotic and biotic components, energy flows, food chains, Food, web, Ecological pyramids, types and diversity. Ecological succession, population, Community ecology and Parasitism, Preypredator relationships. Common flora and fauna in India.

Aquatic: Phytoplankton, Zooplankton and Macrophytes. Terrestrial: forest, Endangered and Threatened Species.

Biodiversity and its conservation: Definition, Hotspots of biodiversity, Strategies for biodiversity conservation, National Sanctuaries, Gene pool.

Micro flora of Atmosphere: Air Sampling techniques, Identification of aeroallergens, Air-borne disease and allergies.

Environmental Biotechnology: Fermentation Technology, Sericulture Technology, Biofertilizer Technology.

UNIT IV. ENVIRONMENTAL GEOSCIENCES

The Earth system and Biosphere: Conservation of matter in various Geosphere, Lithosphere, Hydrosphere, Atmosphere and Biosphere, Energy budget of the earth, earth's environment, and seasons. Ecosystems flow of energy and matter, coexistent in communities-Food webs, Earth's major ecosystems-terrestrial and aquatic, General relationship between landscape, biomes and climate, Climate of India, Indian Monsoon, El nino, Droughts, Tropical cyclones and Western Disturbances

Geological hazards : Earth's process, Concept of residences and rate of natural cycles, Catastrophic geological hazard, Study of floods, Landslide, Earthquakes, Volcanism and Avalanche, Prediction and perception of the hazards and adjustment to hazardous activities.

Mineral Resources and environment: Global Water Balance, Ice sheets and fluctuating of sea levels, Origin and composition of seawater, hydrological cycle, factor influencing the surface water, Types of Water, Resources of Ocean, Oceans pollution by toxic wastes, Human use of surface water and ground water, Ground water pollution.

Principles of remote sensing and its application of environmental science, Application of GIS in environmental management.

UNIT V. ENERGY RESOURCES

Sun as source of energy, Solar radiation and it's spectral characteristics, Fossils fuels-classification, compositions, Physico-chemical chrematistics and energy content of coal, Petroleum and natural gas, Principles of generation of hydroelectric power, Thermal energy

conversion, Wind energy, Hydro-energy, Geothermal energy, Solar collector, Photovoltaic, Solar pond, nuclear energy-Fission and fusion, magneto hydrodynamic power, Bio-energy from biomass and biogas, Anaerobic digestion, Energy use pattern in different parts of the World.

Environmental implication of energy uses, CO_2 emissions, Global warming, Air and Thermal pollution, Radioactive waste and radioactivity form nuclear reactors, Impacts of large scale exploitation of Solar.

UNIT VI. POLLUTION

AIR: Natural and anthropogenic source of pollution, Primary and Secondary pollutants , Transport and diffusion of pollutants, gas laws governing the behavior of pollutants in the atmosphere, Methods of monitoring and control of air pollution SO_2, NOx, CO, SPM, Effects of pollutant on Climate, human beings, plants and animals, Acid rain, Air Quality standards.

Water: Types, Sources and consequences of water pollution, Physio-chemical and Bacteriological sampling and analysis of water quality, Standards, Sewage waste water treatment and recycling .Water quality standards.

Soil: Physico-chemical and Bacteriological sampling as analysis of soil quality, Soil pollution control, Industrial waste effluents, and heavy metals. Their interaction with soil components, Soil microorganism and their functions, Degradation of different insecticides, fungicides and weedcides in soil, Different kind of Synthetic fertilizer (NP& K) and their interaction with different component of soil.

Noise: Sources of noise pollution Measurements of noise and indices, effect of metrological parameters on noise propagation, Noise exposure levels and Standards. Noise control and battement measures. Impact of noise on human health.

Marine: Sources of Marine pollution and control, Criteria employed for disposal of pollutants in marine system-coast management. Radioactive and thermal Pollution.

UNIT VII. ENVIRONMENTAL IMPACT ASSESSMENT

Introduction to environmental impact assessment and environmental Management Plan. EIA guidelines 1994. Notification of Government of India, Impact Assessment Methodologies, generalized approach to impact analysis, Procedure for reviewing environmental impact analysis and statement. Guidelines for Environmental Audit, Introduction to environmental Planning.

Base line information and prediction (land, water, atmosphere, energy etc) restoration and rehabitation technologies. Land use policy for India, Urban planning for India, Rural

planning and Land use pattern. Concept and strategies of sustainable development, Cost-Benefit analysis. Environmental priorities in India and Sustainable development.

UNIT VIII. ENVIRONMENTAL WASTE MANAGEMENT

Sources and generation of solid waste, their characteristics, chemical composition and classification. Different method of disposal and management of solid waste (Hospital Waste and Hazardous waste) recycling of waste material. Waste minimization technologies.

Hazardous Waste Management and Handling Rule-1989, Resource Management, Disasters Management and Risk analysis.

Environment protection-issues and problems, International and national efforts for environment protection. Provision of constitution of India regarding Environment (Article 48A and 58A).

Environmental Policy resolution, Legislation, Public Policy Strategies in pollution control, Wildlife Protection Act amended-1991, Forest conservation act-1980, Indian Forest Act (Revised)-1982, Air (Prevention and control of Pollution) Act-1981 as amended by Amendment Act 1987 and rule 1982, Motor vehicle Act, 19888, The water (Prevention and control Pollution) Act, 1974 as amended up to 1988 and rules 1975, The environmental (Protection) Act, 1986 and Rules 1986.

Scheme of labeling of environment friendly product (Eco mark), Public liability Insurance Act, 1991 and Rules 1991.

UNIT IX. BIO-STATISTICS

Basic elements and tool of Statistical analysis, Probability, assembling, measurement and distribution of attributes, Distribution-Normal t and x, Poisson and Binomial Arithmetic, Geometric and Harmonic means, Matrices, Simultaneous linear equation tests of hypothesis and significance.

Introduction to environmental system analysis, Approaches to development of model, Liner simple and multiple regression model, validation and forecasting, Model of population growth and interaction, Lotka-Voterra model, Leslie's matrix model, point source stream pollution model, box model Gaussian plume model.

UNIT X. ENVIRONMENTAL AWARENESS

Environmental education and Awareness, Environmental ethics Global imperatives, Global environmental problems-Ozone depletion, Global warming and climatic change, Current environmental issues in India.

Context: Narmada Dam, Tehri Dam, Almethi Dam. Soil erosion, Soil formation and reclamation of Usra, Alkaline and Saline Soil, Waste lands and their reclamation, Desertification and its control.

Vehicular pollution and urban air quality, Depletion of Natural Resources, Biodiversity conservation and Agenda-21, Waste disposal, Recycling and power generation, Fly ash utilization. Water crises-conservation of water, Environmental Hazards, Eutrophication and restoration of Indian Lakes, Rain water harvesting, Wetlands conservation, Epidemiological issues (i.e. Goitre, Fluorosis and Arsenic).

Barkatullah University Bhopal-462026
Syllabus for Ph.D. Entrance Test
Subject - Microbiology

Note 1: The Entrance test shall comprise of ten objective or short definitions like questions will be asked from each unit, in all 100 Marks of questions will be asked which have to be answered in Three hours to access the fundamental knowledge of the candidates. There will be no negative marking. The merit list shall be prepared according to percentage of score and minimum qualifying score shall be of 40% marks to qualify the entrance Test.

Note : Three will be 100 objective type of questions minimum passing marks will be 40. No negative marking.

Duration- 3 hrs. **Marks- 100**

Unit-I

1. Morphology and ultra structure of bacteria: cell wall of eubacteria and archaebacteria.
2. Cell membrane: structure, composition and properties.
3. Antigenic properties, structure and function of capsule flagella cilia and Pilli.
4. Cultivation of bacteria: aerobic and anaerobic.
5. Bacterial growth: growth kinetic-growth rate and generation time; synchronous and continuous culture.

Unit-II

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1. General morphology and ultra structure of viruses: capsids – helical symmetry, icosahedral symmetry and complex symmetry. Viral genomes and its types Antigenic drift and Antigenic shift in Viruses
2. Viral related agents: viroids and prions.
3. Cultivation of viruses in embryonated eggs, experimental animals and cell culture: primary and secondary cell cultures, suspension cell cultures and monolayer cell cultures.
4. Serological methods: Haemagglutination, haemagglutination inhibition, complement fixation, IFA, ELISA, RIA.Purification of viruses.

Unit-III

1. General features classification & nomenclature of fungi. History of Mycology, occurrence, nutrition and growth of fungi.
2. Structure reproduction vegetative, asexual and sexual structure of fungi, Ecology of soil fungi (fungistasis, fungicidal, antagonism, symbiosis, synergismetc).
3. Mycosis, Keratinophylic and Dermatophylic fungi its Culture Cultivation and characterization.

Unit-IV

1. General characteristics immunity, occurrence, classification reproduction of protozoa.
2. protozoan diseases: Malaria, Amoebiasis, Toxoplasmsis, Leishmaniasis, Trypanosomiasis, Balantidium coli: their causative agents, sources, transmission, Laboratory diagnosis, prevention & control

Unit-V

1. Immune response: Innate immune mechanism, Defence barriors, Adaptive or Acquired Immunity, Anatomical organization of immune system:
2. Primary and Secondary lymphoid organs, Cells of immune system: Mononuclear cells and granulocytes, Antigen presenting cells(APC),T and B Cells and their subsets, NK cells and Dendritic cells.
3. Vaccine, its types and function.

BARKATULLAH UNIVERSITY, BHOPAL
SYLLABUS FOR Ph.D ENTRANCE TEST
SUBJECT-BIOTECHNOLOGY

Time : 3 hrs.
Max. Marks : 100

Note : There will be 100 objective type of questions minimum passing marks will be 40. No negative marking.

Theories of origin of life, water, concept of pH, buffer, cell Biology-General Structure and Function of Cell and Cell organelles, types of cells, cell theory, membrane transports, cell signaling, motility and shape, cell aging, methods of cell biology.

Biochemistry-Fundamentals of Biochemistry, Structure and function of macro molecules-amino acids and nucleic acids, enzymes as biocatalysts, important metabolic pathways (glycolysis, calvin cycle,TCA, HMP, etc.). Biological oxidation and its coupling to ATP synthesis, vitamins, co-enzymes and co-factors.

Structure, function & diversity of microorganisms, scope of microbiology, prokaryotic and eukaryotic microorganisms, microbial nutrition , sterilization and pure culture techniques, polyphasic and numerical taxonomy. Antibiotics- mode of action and mechanism of drug resistance.

Types of immune response. Major histocompatability system, complement system, molecular mechanisms of antibody diversity, cytokinin and hypersensitivity , autoimmunity and vaccines, co genetical and acquired immuo deficiencies, detection of moleculas using RIA, ELSA, western blot, immuno precipitation, flow cytometry FISG, GISH, hybridoma technology.

DNA structure and replication in prokaryotes and eukaryotes, DNA damage and repair, types of mutation, RNA structure and synthesis, protein synthesis and targeting, regulation of gene expression in prokaryotes and eukaryotes , gene silencing by sense, antisense, RNAi technology.

Recombinant DNA Technology. Molecular tools of genetic engineering, techniques in genetic engineering, gene cloning and gene libraries, and applied aspects of genetic engineering. Large scale expression analysis-microarray based techniques, nucleic

acid, protein sequence database, data mining methods for sequence analysis, web based tools for sequence searches, motif analysis and presentation.

Bio-process technology- microbial stress, screening of and improvement of microbial growth and growth media. Bioreactor, Downstream processing.

Plant tissue culture, Biopesticides and integrated pest management. Animal cell culture, techniques of cell culture, embryo technology, transgenic crops and animal, molecular pharming, Bioethics and Biosafety, IPR, waste water, solid waste management, Bioremediation and detoxification of hazardous chemicals, Biodiversity and its conservation.

Introduction to biostatistics, sampling methods, sample analysis,, basic test- t-test, chi-square test ANOUA, Tukeys HSD part hoc, regression, and coreletion.

SYLLABUS

FOR

M. Phil BIOSCIENCE

(As Per UGC Norms)

DEPARTMENT OF BIOSCIENCE

UTD

BARKATULLAH UNIVERSITY

BHOPAL-462026

M. Phil ENTRANCE TEST FOR BIOSCIENCE DEPARTMENT

The entrance test shall comprise of one multiple choice objective type paper having one hundred questions of one mark each covering all the basic papers of the concerned Post Graduate course of three hours duration to assess the fundamental knowledge of the candidate. The question paper should be prepared by a panel of examiners recommended by the Examination Committee of the concerned subject. There will be no negative marking. A merit list of the entrance test shall be prepared by the committee on the percentile basis and notified accordingly by the Registrar after approval of the Kulpati.

Provided that the merit list shall be applicable for the respective academic year only.

SYLLABUS FOR M.Phil (Bioscience), Barkatullah University, Bhopal

			Max. Marks
(i) Three theory papers on:			
	Paper-I	Research Methodology Quantitative methods and Computer Applications	100
	Paper-II	Biochemistry and Biotechnology	100
	Paper-III	Elective paper-1: Endocrinology Or, Ecology	100
(ii)	Seminar (two)		100
(iii)	Dissertation		100
(iv)	Viva-voce Examination		100
		Total	**600**

SYLLABUS FOR BIOSCIENCE M. Phil ENTRANCE TEST

DEPARTMENT OF BIOSCIENCE

BATKATULLAH UNIVERSITY

BHOPAL-462026

NOTE 1: The entrance test shall comprise of one multiple choice objective type paper having one hundred questions of one mark each covering all the basic papers of the concerned Post Graduate course of three hours duration to assess the fundamental knowledge of the candidate. There will be no negative marking.

NOTE 2: At least 10 objective questions from each unit.

DURATION: 3 hrs **MAXIMUM MARKS:** 100

1. ***ANIMAL PHYSIOLOGY:-*** Digestive system, respiration, circulatory system, muscle contraction, nerve impulse transmission, endocrine system, reproductive system, excretory system, cellular communication.

2. ***CYTOLOGY AND GENETICS:-*** Cellular organization, Mendelian principles, linkage and crossing over, structure of DNA, type of DNA, mutations, genetic code, protein synthesis.

3. ***PLANT PHYSIOLOGY:-*** Growth hormones, photoperiodism, phytochrome, photosynthesis, N-metabolism in plants, S-metabolism in plants, respiration and energy metabolism, totipotency.

4. ***BIOCHEMISTRY:-*** Carbohydrates, lipids, amino acids, proteins, nucleic acids, biosynthesis of proteins, enzymes, basic idea of immunology, antigen and antibody.

5. ***BIOLOGICAL TECHNIQUES:-*** Microscopy, centrifugation, electrophoresis, spectrophotometry, autoradiography, Southern, Northern and Western Blotting, ELISA.

6. ***ECOLOGY:-*** Ecosystem , biosphere, Biogeochemical cycles, community population, pollution ecology, causes and sources, Industrial pollution, Radioactive pollution, autecology, synecology.

7. ***GENETIC ENGINEERING:-*** Cloning methods, plasmids, methods of gene transfer in plant transformation, genetic engineering of mammalian cells, biotechnology of domestic animals.

8. ***ENDOCRINOLOGY:-*** Functions of hormones, pituitary gland, thyroid gland, adrenal gland, biosynthesis , chemical structure, transport and functions of hormones. Techniques in endocrinology, general theories of hormone action.

9. ***FISHERIES:-*** Fish physiology, fish genetics, induced breeding, mono sex culture, HCG, fish diseases, aquatic toxicity, storage and cycles of gonadal maturation.

10. ***MICROBIOLOGY:-*** history and importance of microbiology, microbial growth, microbial pathogenicity, microbial diseases of humans, microorganisms and geochemical cycles, autotrophic eukaryotes, prokaryotes and immune system.

SYLLABUS

FOR

Ph. D BIOSCIENCE

(As Per UGC Norms)

DEPARTMENT OF BIOSCIENCE

UTD

BARKATULLAH UNIVERSITY

BHOPAL-462026

SYLLABUS FOR BIOSCIENCE DOCTORAL ENTRANCE TEST (DET)

DEPARTMENT OF BIOSCIENCE
BATKATULLAH UNIVERSITY
BHOPAL-462026

NOTE 1: The entrance test shall comprise of one multiple choice objective type paper having one hundred questions of one mark each covering all the basic papers of the concerned Post Graduate course of three hours duration to assess the fundamental knowledge of the candidate. There will be no negative marking. The candidates must score minimum 40% marks (35% for SC/ST/Physically handicapped) to qualify the Entrance Test.
NOTE 2: At least 10 objective questions from each unit.

DURATION: 3 hrs **MAXIMUM MARKS:** 100

1. ***ANIMAL PHYSIOLOGY:-*** Digestive system, respiration, circulatory system, muscle contraction, nerve impulse transmission, endocrine system, reproductive system, excretory system, cellular communication.
2. ***CYTOLOGY AND GENETICS:-*** Cellular organization, Mendelian principles, linkage and crossing over, structure of DNA, type of DNA, mutations, genetic code, protein synthesis.
3. ***PLANT PHYSIOLOGY:-*** Growth hormones, photoperiodism, phytochrome, photosynthesis, N-metabolism in plants, S-metabolism in plants, respiration and energy metabolism, totipotency.
4. ***BIOCHEMISTRY:-*** Carbohydrates, lipids, amino acids, proteins, nucleic acids, biosynthesis of proteins, enzymes, basic idea of immunology, antigen and antibody.
5. ***BIOLOGICAL TECHNIQUES:-*** Microscopy, centrifugation, electrophoresis, spectrophotometry, autoradiography, Southern, Northern and Western Blotting, ELISA.
6. ***ECOLOGY:-*** Ecosystem , biosphere, Biogeochemical cycles, community population, pollution ecology, causes and sources, Industrial pollution, Radioactive pollution, autecology, synecology.
7. ***GENETIC ENGINEERING:-*** Cloning methods, plasmids, methods of gene transfer in plant transformation, genetic engineering of mammalian cells, biotechnology of domestic animals.
8. ***ENDOCRINOLOGY:-*** Functions of hormones, pituitary gland, thyroid gland, adrenal gland, biosynthesis , chemical structure, transport and functions of hormones. Techniques in endocrinology, general theories of hormone action.
9. ***FISHERIES:-*** Fish physiology, fish genetics, induced breeding, mono sex culture, HCG, fish diseases, aquatic toxicity, storage and cycles of gonadal maturation.
10. ***MICROBIOLOGY:-*** history and importance of microbiology, microbial growth, microbial pathogenicity, microbial diseases of humans, microorganisms and geochemical cycles, autotrophic eukaryotes, prokaryotes and immune system.

BARKATULLAH UNIVERSITY, BHOPAL
SYLLABUS FOR ENTRANCE TEST FOR PH.D.
SUBJECT : GENETICS

Max. Marks : 100

Note : There will be 100 objective type of questions Minimum Passing Marks will be 40. No negative marking.

1. General Genetics

Cellular reproduction (cell division): The cell cycle, mitosis, amitosis and meiosis. Nondisjunction and its consequences. Genetic significance of mitosis and meiosis.

Principles of mendelian inheritance: a). Terminology: Gene, allele, locus, genome, genotype, phenotype, homozygote, heterozygote, hemizygote. b). Segregation: Mendel's experiments; monohybrid cross, test cross, back cross, reciprocal cross. c). Independent assortment: Mendel's experiments; dihybrid crosses, genotypes of dihybrid crosses. Correspondence between mendelian factors and chromosomes, chromosome theory of inheritance. Segregation and assortment in haploid organisms. Incomplete dominance, over dominance, codominance, multiple alleles and polygenic inheritance.

Gene interaction: Epistasis, additivity, interaction between more than two gene pairs, Modifiers, complementary gene action, pleiotropism, lethality, segregation distortion. Crossing over and linkage, chromosome mapping, use of genetic maps, cross over suppression, tetrad analysis in *Neurospora*.

Sex-determination and sex- linked inheritance, sex- influenced, sex-limited traits, and sex-reversal. Extra chromosomal inheritance.

Properties and evolution of genetic material flow of genetic information. Organisation of viral and bacterial genomes. Eukaryotic genomes: c-value paradox; repetitive DNA; modern concept of gene; gene families; non- coding genes.

2. Principles of Biochemistry

pH, acids, bases and buffers, The Henderson-Hasselbalch equation, titration and buffers, physiological buffers (bicarbonate buffer, protein/ amino acids and buffer system). Principles

of energetics: enthalpy (*H*), entropy (*S*) and free energy (*G*), high and low energy phosphate compounds, oxidation- reduction reaction, activation energy. Types of bonds.

Structure and properties of carbohydrates: triose, tetrose, pentose and hexose sugars; disaccharides, polysaccharides, glycoprotein. Structure and properties of lipids and biomembranes: fatty acids, acylglycerole, phospho-glycerides, sphingolipids, terpenes, steroids, lipid digestion, lipoprotein, biological membranes.

Structure of amino acids. Structure and properties of polypeptides and proteins: A). Peptide bonds, proteolysis, amino acids composition of polypeptides. B). Structure of polypeptide/proteins: Primary structure: determination of primary structure (Edman reaction, alternative method by sequencing the DNA coding for the polypeptide). Secondary structure: α-helix, β-pleated sheet, the random coil and triple helix. Tertiary structure: fibrous and globular proteins. Quaternary structure C). Oxygen carrying proteins: role of haemoglobin and myogloin in oxygen transport, oxygen dissociation curves of haemoglobin.

Enzymes: Classification and mode of action-nomenclature and types; enzyme kinetics; reaction order (zero-order, first-order and second –order reactions); Michaelis-Menten equation; enzyme inhibitors; regulation of enzyme activity (common mechanisms: photolytic activation, control proteins to inhibit or stimulate enzymes, reversible covalent modification, allosteric control). Vitamins and coenzymes: Water-soluble vitamins and coenzymes (vitamins B and vitamin C) Fat soluble vitamins-vitamins not acting as coenzymes: vitamin A, D, E and K. Hormones viz. peptide hormones, steroid hormones. Plant growth regulators viz. auxins, cytokinins, gibberellins, abscessic acid, ethylene.

Nucleic acids: structure of purines and pyrimidines, nucleotides, nucleosides, Watson and Crick model, forms of DNA, RNA, types of RNA. Biological importance of DNA, RNA.

3. Analytical Techniques

Chromatography: principles and applications. Adsorption, partition and ion exchange chromatography. Gel filtration, affinity and HPLC, GLC, GC and FPLC.

Moving boundary, zonal and isoelectric focusing techniques of electrophoresis Paper, agarose gel, 2D Gel and SDS- PAGE.

Sedimentation and velocity, preparative and analytical ultracentrifugation techniques. Differential and density centrifugation, subcellular fractionation.

Radioactivity: disintegration of radionuclides, half life of radioactive compounds, measurement of radioactivity. Scintillation counting, isotopic tracer techniques, autoradiography. Use of isotopes: in vivo and in vitro labeling, radio diagnosis. Spectrophotometry and colorometry: principles, types and applications, Beer-Lambart law, extinction coefficient. Principle and applications of atomic absorption spectrophotometry.

Principles of optical rotatory dispersion and dichroism, X-ray diffraction, X-ray crystallography. Principle and applications of NMR. Microscopy principle and applications: simple, compound, florescent, electron, scanning and transmission microscope. Fixation and staining.

4. Biostatistics and Computer Applications

Fundamental of biostatistics, sample and sampling, collection of data and their representation, measures of central tendency, measures of dispersion. Normal, binomial and Poisson distributions.

Probability, laws of probability. Need of statistical testing, degree of freedom, level of significance.

Tests of significance: applications of 't'-test and *chi* square test. Correlation and regression, coefficient of correlation and its significance, relationship between correlation and regression.

Measure of biodiversity, metroglyph and index score method. Analysis of variance. Principle of field experimentation, Randomized block design, Latin square design, split plot design and stript plot design.

Introduction to computer and their applications. Concepts of operating system, software and database management system. Computer networks and internet (ftp, http, www). Introduction to neural networks.

5. Cell and Molecular Biology

The cell theory, structure and function of pro-and eukaryotic cells Structure and function of cellular organelles (viz. mitochondria, chloroplast, golgi bodies, endoplasmic reticulum, lysosome, plastids) Genetic organisation of nucleus, mitochondria and choloroplast. Structure and function of nuclear membrane and nucleolus. Cytoskeleton and cell motility.

Transcription in prokaryotes and eukaryotes. Replication in bacterial and eukaryotic chromosomes. Genetic code, central dogma, wobble hypothesis. Translation: general mechanism; role of rRNA in translation.

Regulation of gene expression: inducible and repressible system; positive and negative regulation; enhancers and promoters; transcription factors-types, DNA binding motifs. Models of gene regulation in prokaryotes and eukaryotes. Post transcriptional regulation: alternative splicing; transport and targeting of RNA; post- transcriptional gene silencing. Mechanism of steroids hormone and stress induced gene expressions.

Gene mapping in bacteria: transformation, conjugation, transduction, sexduction. Recombination, deletion and complementation mapping in T4 phage (rII locus). Homologous recombination: models and molecular mechanism. Gene conversion: molecular mechanisms Transposons and mechanism of transposition.

Endogenous and exogenous origin of DNA damage. Types of DNA damage. DNA repair pathways. Mutations; classification, mutagens, molecular mechanism of mutations. Detection of mutations, application of mutagenesis for human welfare.

6. Cytogenetics

The architecture of prokaryotic and eukaryotic chromosomes, nucleosome model. The DNA packaging in chromatin. Metaphase chromosome, classification based on centromeric position, centromeric index, arm ratio. Polytene chromosome, lampbush chromosome, B-chromosome.

Variation in chromosome number; euploidy, aneuploidy. Variation in the arrangement of chromosome segments; translocation, inversion. Variation in the number of chromosomal segments; deletion, dupication. Variation in chromosomal morphology; isochromosome, bridge-break-fusion cycle, ring chromosome, Robertsonian translocation (centric fusion). Role of chromosomal alterations in speciation and evolution.

Euchromatin and heterochromatin; distribution and fuction Fundamentals of chromosome preparations: role of colchicine and hypotonic treatment, major chromatin stains. Chromosomal banding techniques: NOR (nucleolar organising region), C-banding, G-banding, Q-banding, FISH (fluorescent *in situ* hybridisation) Introduction to chromosome painting.

Methods of chromosome manipulation in animal and plants; induction of polyploidy. Gynogenesis and androgenesis. Sex chromosomes in plants and animals: male heterogamety, female heterogamety, multiple sex chromosomes. Cytotaxonomy and karyotype concept.

Chromosome as a functioning organelle. Dosage compensation, Lyon's hypothesis. Chromosome constancy and dynamism

7. Plant Improvement and Seed Technology

Nature and objectives of plant breeding, concept of ideotype. Germplasm collection and conservation, centers of diversity. Plant introduction, pure line theory, techniques of hybridization and consequences of hybridization. Origin of cultivated plants viz. wheat, cotton, brassica, tobacco, triticale.

Breeding methods for self pollinated crops: pure line selection, mass selection, pedigree method, bulk population breeding, back crocs method, concept of multiline variety. Breeding methods for cross pollinated plants: mass selection, recurrent selection, synthetic and hybrid varieties. Incompatibility and male sterility. General features of heterosis and inbreeding depression, theories of heterosis. Use of molecular markes in plant breeding.

Cell and tissue culture, differentiation and morphogenesis. Protoplast fusion and somatic hybridization. Induction of mutations in cell cultures, somaclonal variation, *In-vitro* propogation, application of tissue culture in crop improvement, use of anther culture and haploids in plant breeding.

Mutation breeding: induction and selection of mutations in autogamans, allogamons and vegetatively propagated plants. Breeding for disease resistance, genetics of resistance including gene for gene hypothesis. Germplasm conservation by plant tissue culture techniques. Production of secondary metabolites in cell cultures.

Seed industry in India, general principles of seed production, nucleus and breeder's seed. Seed certification and seed legislation. Seed processing and seed testing. Intellectual property rights and related issues with reference to plant breeding.

8. Population and Evolutionary Genetics

Concept of evolution and theories of organic evolution with an emphasis on Darwinism. Hardy-Weinberg's law of genetic equilibrium, destabilizing factor viz. natural selection, mutation, genetic drift, migration, meiotic drive.

Quantifying genetic variability: genetic structure of natural populations, phenotypic variation, factors affecting genetic human disease frequency. Inbreeding coefficient, its estimation. Estimation of gene frequencies, distribution of rare genes.

Analysis of quantitative traits, quantitative traits and natural selection. Estimation of heritability, genotype-environment interactions. Molecular analysis of quantitative traits, phenotypic plasticity.

Genetics of speciation: phylogenetic and biological concept of species, patterns and mechanisms of reproductive isolation, models of speciation (allopatric, sympatric, parapatric). Molecular evolution, gene evolution, evolution of gene families, assessment of molecular variation.

Population genetics and ecology: metapopulation, extinction of small populations, loss of genetic variabilities, conservation of genetic resources. Origin and evolution of economically important microbes and animals.

9. Human and Clinical Genetics

Methods of studying human genetics: pedigree construction, population and twin studies. Distribution patterns of traits in human families in accordance with mendelian principle: autosomal dominant traits, autosomal recessive traits, sex-linked and sex-influenced (or sex-limited) traits. Significance of Mendel's law of segregation and independent assortment in studying human genetics (inheritance of allelic and non- allelic genes); inheritance of blood groups. Demonstration of linkage and association of traits in human. Genomic imprinting syndromes, Mitochondrial syndromes.

The concept of penetrance and expressivity. Genetic cotrol of haemoglobin synthesis; genetic basis of hereditary persistance of foetal haemoglobin; haemoglobin disorders with special reference to sickle cell anaemia. Garrodian inborn errors of metabolism: PKU, albinism, alkaptonuria, analysis of mutations in biochemical pathways. Polymorphism and genetic markers; clinical importance of polymorphism. Ethnic factors in genetic diseases; ethnic distribution of important genetic diseases.

The human chromosomes; normal chromosome constitution, sex-chromosomes, origin of barr body, mosaicism Abnormalities of chromosome numbers; Turner syndrome, Klinefelter syndrome, XYY male, Down's syndrome. Abnormalities of chromosome structures; *Cri du chat* syndrome Genetic predisposition to sporadic cancer, tumor progression: angiogenesis and metastasis. Chromosomal aberrations in neoplasm, tumor specific markers.

Biology of twining; types and biology of twins: dizygotic, monozygotic, determination of zygosity of twins (brief description): foetal membrane method; DNA finger printing; genetic markers; similarity method; mailed questionnaire method of psychologists. Variation in twining frequencies; Weinberg's differential rule for statistical estimation of monozygotic and dizygotic twin pairs. Application of twin research; co-twin control method. The genetic and environment components of congenital defects; cleft palate, harelip, clubfoot, anencephaly, polydactyly, congenital heart malformations. Principle and strategies in identifying disease genes.

Mapping of human chromosome. Introduction to the human genome project; beginning, aims and controversy. Benefits of genome sequencing of human; benefits of studying non-human organism (functional genomics in model organisms). Identification of new genes; DNA microarray analysis (genomic technique). Eugenics: theoretical and practical considerations.

10. Developmental and Behavioural Genetics

Early development; fertilization, types of cleavage, gastrulation. Development of vertebrate nervous system: formation of neural tube, tissue architecture of the central nervous system (CNS). Genetics of pattern formation with reference to drosophila; maternal genes, formation of body axes, segmentation genes, homeotic gene function on imaginal disc development.

Programmed rearrangements in genes: chromatin diminution, endoreplication cycle, gene amplification. Embryonic stem cells and their applications.

Nature-nurture and behavior. Genetic experiments to investigate animal behavior: selection studies, inbred strain studies. Identifying genes for behaviour and induced mutations. Genetics of human behavior: twin and adoption study designs, interpreting heritability, linkage and association studies. Environmental influence- shared and non- shared environment.

Neurogenetics: study designs; genetic and environmental manipulations, circadian rhythms, learning and memory. Cognitive disabilities: mental retardation, learning disorders, communication disorder, dementia.

Psychopathology: schizophrenia, mood disorders, anxiety disorders, disorders of childhood. Personality and personality disorders: antisocial personality, criminal behavior.

11. Immunology

Types of immunity, innate, acquired active, passive, self vs non-self discrimination. Physiology of immune system: lymphoid tissue, differentiation of lymphocyte, lymphocytes sub-population in man and mouse. Antigen types Antibodies: structure, distribution and functions, isotypic, allotypic, idiotypic variants. Antigen antibody reactions, RIA, ELISA.

Humoral immunity and cell mediated immunity, B and T cell and their antigens. Signaling pathways and receptor molecules in B and T cell activation. Immunological specificity and memory, cell mediated cytotoxicity. APC cells, phagocytic cells, macrophages activation, dendric cells, natural killer cells, lymphokinesis.

Structure and functions of class I and II MHC molecule. Genetic rearrangement of immunoglobulin gene. MHC antigen in transplantation and HLA tissue typing Effecter mechanisms in immunity.

The complement system: definition, significance and mode of activation, classical and alternative pathway. Biological functions of C proteins. Cell mediated effecter response. Infection and Immunity, vaccine and vaccination.

Immunological tolerance, suppressor, hypersensitivity. Autoimmunity, Immunodeficiency, AIDS, HIV, hepatitis, muscular dystrophy, arthritis. Monoclonal antibodies as biomedical tool. Genetic disorder of haemopoetic systems: overview of blood cell types, sickle cell anemia, thalassemia and haemophelia. Immune response during tuberculosis and malaria.

12. Biotechnology and Bioinformatics

Microbes as the tools in Biotechnology: identification and classification of microbes. Methods for isolation and culture techniques, microbial growth and its kinetics. Fermentation

technology: primary and secondary metabolism, continuous and batch type culture techniques, types and design of fermenters. Fermentation process: brewing, production of antibiotics (penicillin) and other organic compounds, single cell protein. Role of microbes in food and dairy products, food preservation.

Techniques used in recombinant DNA technology, Cloning vectors, cloning in bacteria and eukaryotes. Construction and screening of genomic & cDNA library. Application of recombinant DNA technology in medicine and agriculture, GMO. Application of gene cloning in synthesis of drug and enzymes (insulin, interferons).

Restriction mapping. Southern blotting, northern and western blotting techniques, RFLP, RAPD, SSR, 16sRNA. DNA sequencing techniques Preparation of radiolablled and synthetic probes. Gene amplification, DNA chip technology and microarray.

Introductory bioinformatics, scope, applications and challenges of bioinformatics, useful bioinformatics websites. Introduction to genetic algorithms Retrieval of biological data (entrez, srs and dbget/linkdb) Database searches: FASTA and BLAST, sequence filters, iterative database searches and psi-BLAST).

Sequence alignment methods and applications of gene and protein families. Methods and applications of phylogenetic trees (phylip etc.) Whole genome analysis, comparative genomics, paralogs and orthologs, second generation sequence analysis. Structure prediction and 2D analysis of protein. Introduction to drug designing, primer designing.