



UTTARANCHAL UNIVERSITY

(Established vide Uttaranchal University Act, 2012)

(Uttarakhand Act No. 11 of 2013)

Arcadia Grant, P.O. Chandanwari, Premnagar, Dehradun, Uttarakhand

SYLLABUS FOR PH.D. ENTRANCE EXAM

SYLLABUS FOR ENTRANCE EXAMINATION FOR Ph.D.

Research Aptitude/ Research Methodology (Common to all)

General aptitude:

1. **General Science:** General understanding of science including matters of everyday observation and experience.
2. **Current events:** Knowledge of significant national and international events.
3. **General mental ability and reasoning:** Reasoning and analytical abilities.
4. **Environmental awareness:** Pollution and its impacts, climate change, sustainable development
5. **Basic Computer Skills:** Basic computer awareness and its uses. Role and use of computers in research.
6. **Interactive English:** Grammar, vocabulary, sentence completion, usage, synonyms, antonyms, one word substitute, idioms/phrases, error detection and comprehension.
7. **Information and Communication Technology (ICT):** Terminology and abbreviations used in ICT, applications of ICT in academics and research.

Research aptitude:

1. Meaning, nature, significance and types of research. synopsis, hypothesis, data collection, literature survey, sampling, interviewing, questionnaire, data processing, interpretation, report writing, bibliography, Article, research paper, seminar, conference, symposium, workshop etc.
2. Role of governing bodies/research organizations like UGC, CSIR, ICAR, ICSSR, ICPR, ISRO, DRDO etc. in research and development.
3. Basic Statistics for Research- Basic of Stats with Mean, Median, Mode, Standard Deviation & Variance. Their applications in research.

Basic concept of Permutation, Combination & Probability.

Discipline/ Subject course syllabus

BIOTECHNOLOGY

Biomolecules (Carbohydrates, proteins, lipids, enzymes), metabolic pathways, Enzyme kinetics and inhibition, immobilized enzymes. Cellular & Molecular Biology- Membrane structure and function; Cell theory; Structural organization and function of intracellular organelles; Cell division and Cell cycle and cancer biology; Structure and types of DNA, RNA; DNA replication, repair, transcription, translation, gene regulation. Immunology: Innate and acquired, Structure & function of antibody, MHC, antigen-antibody interactions. Autoimmunity; vaccines, hypersensitivity. Genetic engineering, gene cloning, transgenic organisms, molecular markers, vectors, methods of gene transfer, molecular farming, Gene therapy. Concepts of genetics. Bacteria, Fungi, viruses, laboratory identification of microbes, sterilization techniques, culture media and types, transformation, conjugation, transduction Host-Pathogen interactions, antibiotics. Fermentation Technology - Basic fermentor (types), downstream processing; Isolation; screening and maintenance of industrially important microbe, scaling up of cell culture, industrial biotechnology products. Electrophoresis, centrifugation, microscopy, biosensors, chromatography, Mass spectrophotometry, PCR, DNA fingerprinting. Bioinformatics- Databases, sequence alignment, search engines, BLAST, FASTA, Phylogenetic analysis. Cell and tissue culture (plant and animal) - Media, different types / methods of culture, applications, cell lines, secondary metabolites, Concept of Intellectual property rights. Environmental biotechnology, Bioremediation, Bioleaching, biopesticides. waste management.

SYLLABUS FOR PH.D. ENTRANCE EXAM- CHEMISTRY

Chemical periodicity, Structure and bonding including shapes of molecules (VSEPR Theory). Main group elements and their compounds: Allotropy, industrial importance of the compounds. Transition elements and coordination compounds: spectral and magnetic properties. Inner transition elements: spectral and magnetic properties, redox chemistry, analytical applications. Organometallic compounds & applications, bonding and structure, and reactivity. Bioinorganic chemistry: photosystems, porphyrins, metalloenzymes, nitrogen fixation, metal complexes in medicine. Electron spectroscopy and microscopic techniques.

Basic principles of quantum mechanics: Chemical applications of group theory rules. Molecular spectroscopy: Rotational and vibrational spectra of diatomic molecules; electronic spectra; IR and Raman activities – selection rules; Chemical thermodynamics: Kinetics and their applications; elementary; phase equilibria solutions. Nernst equation, redox systems, electrochemical cells; collision and transition state theories of rate constants; unimolecular reactions; enzyme kinetics; salt effects; homogeneous catalysis; photochemical reactions. Colloids and surfaces.

IUPAC nomenclature of organic molecules including Regio- and stereoisomers. Organic reaction mechanisms involving addition, elimination and substitution reactions with electrophilic, nucleophilic or radical species. Common named reactions and rearrangements – applications in organic synthesis. Functional group interconversion including oxidations and reductions; common catalysts and reagents (organic, inorganic, organometallic and enzymatic). Principles and applications of photochemical reactions in organic chemistry. Structure determination of organic compounds by IR, UV-Vis, ^1H & ^{13}C NMR and Mass spectroscopic techniques. Principles of qualitative and quantitative analysis; acid-base, oxidation reduction and precipitation reactions; use of indicators; nuclear reactions & applications of isotopes.

SYLLABUS FOR PH.D. ENTRANCE EXAM-COMPUTER SCIENCE & ENGINEERING

C Programming and Data structure: Programming in C. Recursion. Arrays, stacks, queues, linked lists, trees, binary search trees, binary heaps, graphs

Operating Systems: Process and memory management, Concurrent processing, Scheduling, Multiprocessor Operating Systems and related Thread Handlings

Software Engineering: Models, Process and Project Metrics, Analysis Concepts and Principles, Measures, Metric Indicators, Software Quality Assurance, Software Prototyping.

DBMS: DBMS design, Distributed Databases, Client/Server Architecture, ODBMS and RDBMS, Data Warehousing and Data Mining

Network and Information Security; Concept of layering, Flow and error control techniques, Switching, IPv4/IPv6, Routing and routing algorithms, Basics of network and information security, Introduction to intelligent networking, Performance analysis of networks

Theory of Computation: Models of computation, Automata Languages accepted by models, Grammars, Languages, Non-computability and Examples of non-computable problems, Turing machine, Compiler design

SYLLABUS FOR PH.D. ENTRANCE EXAM- CIVIL ENGINEERING

Section 1: Environmental Engineering

Water and Waste Water: Quality standards, basic unit processes and operations for water treatment. Drinking water standards, water requirements, basic unit operations and unit processes for surface water treatment, distribution of water. Sewage and sewerage treatment, quantity and characteristics of wastewater. Primary, secondary and tertiary treatment of wastewater, effluent discharge standards. Domestic wastewater treatment, quantity of characteristics of domestic wastewater, primary and secondary treatment. Unit operations and unit processes of domestic wastewater, sludge disposal.

Air Pollution: Types of pollutants, their sources and impacts, air pollution meteorology, air pollution control, air quality standards and limits.

Municipal Solid Wastes: Characteristics, generation, collection and transportation of solid wastes, engineered systems for solid waste management (reuse/ recycle energy recovery, treatment and disposal).

Noise Pollution: Impacts of noise, permissible limits of noise pollution, measurement of noise and control of noise pollution.

Section 2: Transportation Engineering

Transportation Infrastructure: Highway alignment and engineering surveys; Geometric design of Highways - cross-sectional elements, sight distances, horizontal and vertical alignments; Geometric design of railway track; Airport runway length, taxiway and exit taxiway design.

Highway Pavements: Highway materials - desirable properties and quality control tests; Design of bituminous paving mixes; Design factors for flexible and rigid pavements; Design of flexible pavement using IRC: 37-2012; Design of rigid pavements using IRC: 58-2011; Distresses in concrete pavements.

Traffic Engineering: Traffic studies on flow, speed, travel time - delay and O-D study, PCU, peak hour factor, parking study, accident study and analysis, statistical analysis of traffic data; Microscopic and macroscopic parameters of traffic flow, fundamental relationships; Control devices, signal design by Webster's method; Types of intersections and channelization; Highway capacity and level of service of rural highways and urban roads.

Section 3: Geomatics Engineering

Principles of surveying; Errors and their adjustment; Maps - scale, coordinate system; Distance and angle measurement - Levelling and trigonometric levelling; Traversing and triangulation survey; Total station; Horizontal and vertical curves.

Remote sensing and GIS: Principles and fundamentals of Image Processing; Geographical Information Systems-Fundamentals and Advances, Surveying-Advances and GNSS, Photogrammetry -principles and applications Geographical Positioning system (GPS)

Section 4: Structural Engineering

Structural Mechanics : Analysis of Flexure, Torsion, Shear, Compression and Tension - Analysis of Structures-Force and Stiffness methods - Concrete making materials and Technology- Design of Concrete , Steel Structures- Plastic analysis and design-Prestressed Concrete- simple and continuous beams- Structural Dynamics- Analysis of Free and Forced vibrations-Damping-Seismic design- Modal analysis-Finite Element method - Theory of Elasticity-Analysis of Stress and Strain.

Construction Materials and Management: Construction Materials: Structural steel - composition, material properties and behaviour ; Concrete - constituents, mix design, short-term and long-term properties; Bricks and mortar; Timber; Bitumen.

Section 5: Geotechnical Engineering

Soil Mechanics: Origin of soils, soil structure and fabric; Three-phase system and phase relationships, index properties; Unified and Indian standard soil classification system; Permeability - one dimensional flow, Darcy's law; Seepage through soils - two-dimensional flow, flow nets, uplift pressure, piping; Principle of effective stress, capillarity, seepage force and quicksand condition; Compaction in laboratory and field conditions; One- dimensional consolidation, time rate of consolidation; Mohr's circle, stress paths, effective and total shear strength parameters, characteristics of clays and sand.

Foundation Engineering: Sub-surface investigations - scope, drilling bore holes, sampling, plate load test, standard penetration and cone penetration tests; Earth pressure theories - Rankine and Coulomb; Stability of slopes - finite and infinite slopes, method of slices and Bishop's method; Stress distribution in soils - Boussinesq's and Westergaard's theories, pressure bulbs; Shallow foundations - Terzaghi's and Meyerhoff's bearing capacity theories, effect of water table; Combined footing and raft foundation; Contact pressure; Settlement analysis in sands and clays; Deep foundations - types of piles, dynamic and static formulae, load capacity of piles in sands and clays, pile load test, negative skin friction.

Section 6: Water Resources Engineering

Fluid Mechanics: Properties of fluids, fluid statics; Continuity, momentum, energy and corresponding equations; Potential flow, applications of momentum and energy equations; Laminar and turbulent flow; Flow in pipes, pipe networks; Concept of boundary layer and its growth.

Hydraulics: Forces on immersed bodies; Flow measurement in channels and pipes; Dimensional analysis and hydraulic similitude; Kinematics of flow, velocity triangles; Basics of hydraulic machines, specific speed of pumps and turbines; Channel Hydraulics - Energy-depth relationships, specific energy, critical flow, slope profile, hydraulic jump, uniform flow and gradually varied flow.

Hydrology: Hydrologic cycle, precipitation, evaporation, evapo-transpiration, watershed, infiltration, unit hydrographs, hydrograph analysis, flood estimation and routing, reservoir capacity, reservoir and channel routing, surface run-off models, ground water hydrology - steady state well hydraulics and aquifers; Application of Darcy's law.

Irrigation: Duty, delta, estimation of evapo-transpiration; Crop water requirements; Design of lined and unlined canals, head works, gravity dams and spillways; Design of weirs on permeable

foundation; Types of irrigation systems, irrigation methods; Water logging and drainage; Canal regulatory works, cross-drainage structures, outlets and escapes.

Section 7: Construction Technology and Management

Project Planning & Management-Network Scheduling-PERT, CPM Construction Techniques-RC & PSC, Modular construction practice-Construction Economics & Finance-Depreciation, Project appraisal Quantitative Methods in Construction Management-Linear and Dynamic programming Construction Methods& Equipment-Equipment for Earth moving, Material transport, Pile driving, dewatering-Contract Management & Arbitration- types of contracts, disputes-Construction Materials-Concrete, polymers, Sealants.

SYLLABUS FOR PH.D. ENTRANCE EXAM- ENGLISH

- Drama
- Poetry
- Fiction, Short Story
- Non-Fictional Prose
- Language: Basic concepts, English in use.
- Indian Writing in English
- Literary Criticism
- Literary Theory
- Research Methods and Materials in English

**SYLLABUS FOR PH.D. ENTRANCE EXAM- FOOD SCIENCE &
NUTRITION**

ADVANCE FOOD SCIENCE NUTRITION

Food groups – balanced diet, food pyramid, RDA, BMI, BMR, macro and micro nutrition, Meal Planning, nutraceuticals, Functional foods, Prebiotics, Probiotic. Food microbes, Food toxicology. Major food constituents, their physicochemical properties. Principle of Food Science, Role of water in food. Carbohydrates, proteins and lipids: classification, physical, chemical, nutritional, and functional properties Structural correlations; auto-oxidation of lipids and rancidity Introduction Food science and nutrition,

Diet therapy, fevers, Allergy, Obesity, underweight, lung diseases, GI tract diseases. Nutritional intervention-national nutrition policies and programmes. Food and nutrition security. Quality evaluation of foods- objectives and subjective, Quality attributes; Classification of quality attributes. Food guidelines and safety measurement.

Food processing and preservation Basic concept and technology, Food Adulteration, Health hazards of food adulterants, Food additives, Food Laws and standards.

SYLLABUS FOR PH.D. ENTRANCE EXAM- FOOD TECHNOLOGY

Chemistry of Carbohydrates, Proteins, Lipids, Pigments, Food flavours, Enzymatic and non-enzymatic browning; amino acids and fatty acids classifications, Water soluble and fat soluble vitamins, Role of minerals in nutrition, Antinutrients in food, General Characteristics of microorganisms, Microbial growth in food: Intrinsic and extrinsic factors, Microbial Food spoilage, Food borne illness, food fermentation. Food Products Technology: Processing principles: Canning, chilling, freezing, dehydration, control of water activity, CA and MA storage, fermentation, hurdle technology, addition of preservatives and food additives, Food packaging, food laws; Grain products processing: Milling of rice, wheat, and maize, parboiling of paddy, cereal based products bread, biscuits, extruded products and breakfast cereals, Solvent extraction, refining and hydrogenation of oil; ripening of fruits, Fruits, vegetables and plantation products processing: jam, jelly, marmalade, squash, candies, and pickles, tea, coffee, chocolate and essential oils from spices; Milk and milk products processing: Pasteurized and sterilized milk, cream, butter, ghee, ice-cream, cheese and milk powder; Animal products processing: Drying and canning of fish, post mortem changes, tenderization and freezing of meat, egg powder. Basic food engineering - Heat transfer: Heat transfer by conduction, convection, radiation, boiling and condensation, sterilization, evaporation of liquid foods, drying methods, spray and freeze-drying, freezing and crystallization; Mass transfer operations. Novel Thermal Techniques, dielectric heating, Microwave processing, Infrared heating, ohmic heating, pulse electric field, Properties and functions of various nutraceuticals – functional food ingredients – probiotic, prebiotic and symbiotic and their functional role. Antioxidants, nutraceuticals and functional foods. Analytical Instruments: Ultra violet spectroscopy; infrared absorption spectroscopy; near-infrared absorption spectroscopy; mass spectroscopy; nuclear magnetic resonance spectroscopy. , Biotechnology and food safety.

SYLLABUS FOR PH.D. ENTRANCE EXAM (LAW)

I. Jurisprudence

1. Nature and Sources of Law
2. Schools of Jurisprudence
3. Concept of Rights and Duties
4. Legal Personality
5. Concept of Property, Ownership and Possession

II. Constitutional Law

1. Preamble
2. Fundamental Rights and Duties
3. Directive Principles of State Policy
4. Judiciary

III. Administrative Law

1. Nature , Scope and Importance of Administrative Law
2. Principle of Natural Justice
3. Judicial Review of Administrative Actions

IV. Law of Crimes

1. General Principles of Criminal Liability – Actus reus and mens rea, individual and group liability and constructive liability

2. General Exceptions
3. Theories and Kinds of punishments
4. Compensation to the victims of crime

V. Law of Torts

1. Nature and Definition of Torts
2. General Principles of Tortious liability
3. General defenses
4. Strict and absolute liability

VI. Public International Law

1. Definition, Nature and Basis of International Law
2. Sources of International Law

VII. Family Law-I

1. Sources and schools
2. Marriage and Dissolution of Marriage

VIII. Environment and Human Rights Law

1. Meaning and Concept of Environment and Environmental Pollution
2. Concept and Development of Human Rights

IX. Intellectual Property Rights

1. Concept and Meaning of Intellectual Property
2. Theories of Intellectual Property

X. Comparative Public Law and System of Governance

1. Comparative Law – Relevance, Methodology, Problems and Concerns
2. Rule of Law – Formal and Substantive versions

**SYLLABUS FOR PH.D. ENTRANCE EXAM – MECHANICAL
ENGINEERING**

Engineering Mathematics

Linear Algebra: Matrix algebra, systems of linear equations, eigenvalues and eigenvectors.

Calculus: Functions of single variable, limit, continuity and differentiability, mean value theorems, indeterminate forms; evaluation of definite and improper integrals; double and triple integrals; partial derivatives, total derivative, Taylor series (in one and two variables), maxima and minima, Fourier series; gradient, divergence and curl, vector identities, directional derivatives, line, surface and volume integrals, applications of Gauss, Stokes and Green's theorems.

Differential equations: First order equations (linear and nonlinear); higher order linear differential equations with constant coefficients; Euler-Cauchy equation; initial and boundary value problems; Laplace transforms; solutions of heat, wave and Laplace's equations.

Complex variables: Analytic functions; Cauchy-Riemann equations; Cauchy's integral theorem and integral formula; Taylor and Laurent series.

Probability and Statistics: Definitions of probability, sampling theorems, conditional probability; mean, median, mode and standard deviation; random variables, binomial, Poisson and normal distributions.

Numerical Methods: Numerical solutions of linear and non-linear algebraic equations; integration by trapezoidal and Simpson's rules; single and multi-step methods for differential equations.

Applied Mechanics and Design

Engineering Mechanics: Free-body diagrams and equilibrium; trusses and frames; virtual work; kinematics and dynamics of particles and of rigid bodies in plane motion; impulse and momentum (linear and angular) and energy formulations, collisions.

Mechanics of Materials: Stress and strain, elastic constants, Poisson's ratio; Mohr's circle for plane stress and plane strain; thin cylinders; shear force and bending moment diagrams; bending and shear stresses; deflection of beams; torsion of circular shafts; Euler's theory of columns; energy methods; thermal stresses; strain gauges and rosettes; testing of materials with universal testing machine; testing of hardness and impact strength.

Theory of Machines: Displacement, velocity and acceleration analysis of plane mechanisms; dynamic analysis of linkages; cams; gears and gear trains; flywheels and governors; balancing of reciprocating and rotating masses; gyroscope.

Vibrations: Free and forced vibration of single degree of freedom systems, effect of damping; vibration isolation; resonance; critical speeds of shafts.

Machine Design: Design for static and dynamic loading; failure theories; fatigue strength and the S-N diagram; principles of the design of machine elements such as bolted, riveted and welded joints; shafts, gears, rolling and sliding contact bearings, brakes and clutches, springs.

Fluid Mechanics and Thermal Sciences

Fluid Mechanics: Fluid properties; fluid statics, manometry, buoyancy, forces on submerged bodies, stability of floating bodies; control-volume analysis of mass, momentum and energy; fluid acceleration; differential equations of continuity and momentum; Bernoulli's equation; dimensional analysis; viscous flow of incompressible fluids, boundary layer, elementary turbulent flow, flow through pipes, head losses in pipes, bends and fittings.

Heat-Transfer: Modes of heat transfer; one dimensional heat conduction, resistance concept and electrical analogy, heat transfer through fins; unsteady heat conduction, lumped parameter system, Heisler's charts; thermal boundary layer, dimensionless parameters in free and forced convective heat transfer, heat transfer correlations for flow over flat plates and through pipes, effect of turbulence; heat exchanger performance, LMTD and NTU methods; radiative heat transfer, Stefan-Boltzmann law, Wien's displacement law, black and grey surfaces, view factors, radiation network analysis.

Thermodynamics: Thermodynamic systems and processes; properties of pure substances, behaviour of ideal and real gases; zeroth and first laws of thermodynamics, calculation of work

and heat in various processes; second law of thermodynamics; thermodynamic property charts and tables, availability and irreversibility; thermodynamic relations.

Applications: *Power Engineering:* Air and gas compressors; vapour and gas power cycles, concepts of regeneration and reheat. *I.C. Engines:* Air-standard Otto, Diesel and dual cycles. *Refrigeration and air-conditioning:* Vapour and gas refrigeration and heat pump cycles; properties of moist air, psychrometric chart, basic psychrometric processes. *Turbomachinery:* Impulse and reaction principles, velocity diagrams, Pelton-wheel, Francis and Kaplan turbines.

Materials, Manufacturing and Industrial Engineering

Engineering Materials: Structure and properties of engineering materials, phase diagrams, heat treatment, stress-strain diagrams for engineering materials.

Casting, Forming and Joining Processes: Different types of castings, design of patterns, moulds and cores; solidification and cooling; riser and gating design. Plastic deformation and yield criteria; fundamentals of hot and cold working processes; load estimation for bulk (forging, rolling, extrusion, drawing) and sheet (shearing, deep drawing, bending) metal forming processes; principles of powder metallurgy. Principles of welding, brazing, soldering and adhesive bonding.

Machining and Machine Tool Operations: Mechanics of machining; basic machine tools; single and multi-point cutting tools, tool geometry and materials, tool life and wear; economics of machining; principles of non-traditional machining processes; principles of work holding, design of jigs and fixtures.

Metrology and Inspection: Limits, fits and tolerances; linear and angular measurements; comparators; gauge design; interferometry; form and finish measurement; alignment and testing methods; tolerance analysis in manufacturing and assembly.

Computer Integrated Manufacturing: Basic concepts of CAD/CAM and their integration tools.

Production Planning and Control: Forecasting models, aggregate production planning, scheduling, materials requirement planning.

Inventory Control: Deterministic models; safety stock inventory control systems.

Operations Research: Linear programming, simplex method, transportation, assignment, network flow models, simple queuing models, PERT and CPM.

SYLLABUS FOR PH.D. ENTRANCE EXAM- MATHEMATICS

Real numbers system, sequence and series of functions, convergence and uniform convergence. Gauss theorem, Green's theorem, Stoke's theorem. Analytic functions, Cauchy-Riemann equations, Cauchy's theorems, singularities. Groups, Cayley's theorem, Sylow's theorem, Rings, Euclidean domains, unique factorization domains. Algebra of matrices, rank of a matrix, Eigen value and vectors. Vector spaces, basis and dimension, linear transformations, dual space, annihilators and inner product spaces. First order ODE and PDE, Existence and uniqueness of solution $\frac{dy}{dx} = f(x, y)$. Classification of second order PDE, wave, heat and Laplace equation. Linear integral equation of Fredholm and Volterra type, Variation of calculus, Euler-Lagrange equation. Numerical solutions of algebraic equations, numerical solution of systems of linear algebraic equations, finite differences, interpolation, numerical differentiation and integration, numerical solutions of ODEs. LPP, simplex method dual of LPP, assignment Problem, transportation problem, queuing theory.

**SYLLABUS FOR PH.D. ENTRANCE EXAM - COMPUTER
APPLICATIONS/COMPUTER SCIENCE**

- 1) Fundamental of Computer Science
- 2) Data Science
- 3) Theory of Computation
- 4) Cloud Computing
- 5) Recent Trends in Computer Science

SYLLABUS FOR PH.D. ENTRANCE EXAM – MANAGEMENT

- 1) General Management
- 2) Marketing
- 3) Human Resource Management
- 4) Finance
- 5) International Business

SYLLABUS FOR Ph.D. ENTRANCE EXAMINATION- PHYSICS

1. **Mathematical Methods of Physics:** Vector calculus. Matrices and their properties, linear ordinary differential equations of first & second order, Special functions. Fourier series, Fourier and Laplace transforms. Complex analysis, Elementary probability theory, binomial, Poisson and normal distributions.
2. **Classical Mechanics:** Dynamical systems, Phase space dynamics, stability analysis. Central force motions, Variational principle, Lagrangian and Hamiltonian formalism Small oscillations, Poisson brackets and canonical transformations. Special theory of relativity.
3. **Electromagnetic Theory:** Electrostatics, Laplace and Poisson equations, Magnetostatics: Biot-Savart law, Electromagnetic induction. Maxwell's equations in free space. Electromagnetic waves in free space. Reflection and refraction, polarization, Fresnel's law, interference, coherence, and diffraction.

4. **Quantum Mechanics:** One dimensional Schrödinger equation. Commutators and Heisenberg uncertainty principle. Motion in a central potential: orbital angular momentum, angular momentum algebra, spin, addition of angular momentum; Hydrogen atom. Time-dependent and independent perturbation theory and applications. Variational method, identical particles.
5. **Thermodynamic and Statistical Physics:** Laws of thermodynamics. Maxwell relations, Phase space, micro- and macro-states. Micro-canonical, canonical and grand-canonical ensembles and partition functions. Classical and quantum statistics, Ideal Bose and Fermi gases. Blackbody radiation and Planck's distribution law.
6. **Atomic & Molecular Physics:** Quantum states of an electron in an atom. Electron spin, Spectrum of helium and alkali atom. LS & JJ couplings. Zeeman, Paschen-Bach & Stark effects. Electronic rotational, vibrational and Raman spectra of diatomic molecules, selection rules. Lasers.
7. **Condensed Matter Physics:** Bravais lattices. Reciprocal lattice. Diffraction and the structure factor. Bonding of solids. Free electron theory and electronic specific heat. Band theory of solids Superconductivity:
8. **Nuclear and Particle Physics:** Basic nuclear properties, Binding energy, semi-empirical mass formula, liquid drop model. Classification of fundamental forces. Elementary particles and their quantum numbers. Quark model, baryons and mesons.
9. **Electronics and Experimental Methods:** Semiconductor, device structure, device characteristics, frequency dependence and applications. Opto-electronic devices Operational amplifiers and their applications. Digital techniques and applications.

SYLLABUS FOR Ph.D. ENTRANCE EXAMINATION- MASS COMMUNICATION

UNIT-I INTRODUCTION TO COMMUNICATION

Communication process of communication Fundamentals of Communication – Definition, Nature, Scope, Types and Functions. Communication Models and Theories. Fundamentals of Journalism – Definition, Nature, Scope and Functions

UNIT II- PRINT MEDIA AND MEDIA LAWS ETHICS

Qualifications, Duties and Responsibilities of Journalists. Principles and Practices of Editing and Designing. Basics of News – Concept, Elements, News Sources, Structure of News, Principles of News Writing Feature Writing. Specialized Reporting. Salient Features of Indian Constitution – Preamble,

Directive Principles of State Policy, Fundamental Rights and Duties. Freedom of Speech and Expression in India. Major Media Laws of India .Press Council of India and Press Commissions. Media Ethics and Code of Conduct for Media Professionals. Press and Book Registration Act, Right to Information Act, Official secret Act, Working journalist act, Journalistic Ethics

UNIT III- ADVERTISING AND PUBLIC RELATIONS

Fundamentals of Advertising Types, Functions and Significance. Fundamentals of Public Relations – Concept, Nature, Scope, Types, Functions and Significance. Advertising Agency – Structure, Advertising and gender issue, laws related to indecent portrayal of women, Resources, Functions and Significance. Public Relations Management – Types of Publics and Art of Management of Different Public Relations (Investor Relations, Employee Relations, Supplier Relations, Distributor Relations, Customer Relations, Media Relations, Government Relations, Community Relations etc. Corporate Communication – Role of Communication in Corporate Houses, Corporate Communication Principles and Practices, DAGMAR and AIDA, PR tools and techniques, PR campaign and design

UNIT IV- COMMUNICATION RESEARCH

Fundamentals of Communication Research. Defining Research Problem, Review of Literature, Research Design, Primary Data Collection, content analysis, Statistical Analysis, Results and Discussion, Testing of Hypothesis, Sampling etc. Types of Media Research –Quantitative and Qualitative. Data Collection and Analysis Procedures, Principles and Techniques of Writing Research paper

UNIT V- ELECTRONIC MEDIA AND NEW MEDIA PRODUCTION

History of Radio and Television, Writing for Electronic Media – Principles and Techniques. Production for Radio and Television. Production of Multi-Media Contents. Types of New Media – Computer, Internet, E-mail, Mobile Phone, Video Streaming, Video Conferencing etc..Web Designing – Concept, Nature, Scope, Web Language, Presentation, Multi-Media Production d) Cyber Laws and Ethics

SYLLABUS FOR Ph.D. ENTRANCE EXAMINATION- ECONOMICS

Microeconomic Analysis:Introduction to Microeconomics, Cardinal and Ordinal Utility Analysis, Theory of Production and Costs; Pricing and output under different forms of market structure; Theory of Rent, Interest and Wages

Macroeconomic Analysis: Concepts of GDP and National Income, Classical Theory of Income and employment, Consumption, Investment, Multiplier

Money and Banking: Concepts of Money in a Modern Economy, Monetary Aggregates, Quantity Theory of Money, Money Supply and Credit Creation

Statistical Analysis: Frequency Distribution, Graphical Representation of Data, Techniques of Data Collection, Sampling Techniques, Correlation, Regression

Indian Economy: Indian Economy: Basic features, Agriculture: Land Reforms and Green Revolution; New agricultural policy; New industrial policy; Balance of Payment

SYLLABUS FOR Ph.D. ENTRANCE EXAMINATION- AGRICULTURE

Section A: Research Methodology

Classification, tabulation and graphical representation of data. Theory of probability. Basic principles of designs- randomization, replication and local control, Uniformity trials, size and shape of plots and blocks; Analysis of variance. Completely randomized design, randomized block design and Latin square design, Factorial experiments. Analysis of covariance and missing plot techniques in randomized block and Latin square designs; Transformations, crossover

designs, balanced incomplete block design, resolvable designs and their applications ~ concepts, randomisation procedure, analysis and interpretation of results. Large sample tests, testing of hypothesis based on exact sampling distributions ~ chi square, t and F; Confidence interval estimation and point estimation of parameters of binomial, Poisson and Normal distribution; Correlation and regression analysis, Nonparametric tests.

Section B: General Agriculture

Unit I

Crop growth analysis in relation to environment agro-ecological zones of India. Quantitative agro-biological principles and inverse yield nitrogen law. Crop response and production functions; concept of soil plant relations; yield and environmental stress. Integrated farming systems, organic farming, and concept of conservation farming including modern concept of tillage, dry farming, concept of balance nutrition, integrated nutrient management; precision agriculture. Farming system - integrated farming system, alternate farming system - meaning and scope - recycling and crop residue management - natural farming - concept and components. Cropping system. Definition, concept, significance and dimensions of dryland farming in Indian agriculture, characteristics and classification of dryland. Sustainability concepts in cropping and farming systems. Year-round fodder production and management, preservation and utilization of forage and pasture crops.

Unit II

Soil fertility and productivity – factors affecting; features of good soil management; problems of supply and availability of nutrients; relation between nutrient supply and crop growth. Criteria of essentiality of nutrients; Essential plant nutrients – their function, nutrient deficiency symptoms; transformation and dynamics of major plant nutrients, chemistry of waterlogged soil. Preparation and use of farmyard manure, compost, green manures, vermicompost, bio fertilizers and other organic concentrates their composition, availability and crop responses; recycling of organic wastes and residue management. Commercial fertilizers; composition, relative fertilizer value and cost; crop response to different nutrients, residual effects and fertilizer use efficiency, fertilizer mixtures and grades; agronomic, chemical and physiological methods of increasing fertilizers use efficiency; nutrient interactions. Time and methods of manures and fertilizers application; foliar application and its concept; relative performance of organic and inorganic manures; economics of fertilizer use; integrated nutrient management; use of vermicompost and residue wastes in crop.

Unit III

Horticulture-Its definition & branches, importance and scope future prospects of horticulture in Uttarakhand; horticultural and botanical classification; climate and soil for horticultural crops. Plant

propagation-methods and propagating structures; principles of orchard establishment; Principles and methods of training and pruning, juvenility and flower bud differentiation. Unfruitfulness; pollination, pollinizers and pollinators; fertilization and parthenocarpy; kitchen gardening; garden types and parts. Lawn making; medicinal and aromatic plants; species and condiments; use of plant bio-regulators in horticulture. Irrigation & fertilizers application-method and quantity. Production Technology of different vegetables. Production technology of important cut flowers like rose, gerbera, carnation, liliium. Package of practices for loose flowers like marigold and jasmine under open conditions. Greenhouse equipment, materials of construction for traditional and low cost green houses. Irrigation systems used in greenhouses, typical applications, passive solar greenhouse, hot air greenhouse heating systems, greenhouse drying.

Unit IV

Mendelian principles of heredity, Cell division – mitosis, meiosis, Probability and Chi-square. Dominance relationships, gene interaction. Multiple alleles, pleiotropism and pseudoalleles, Sex determination and sex linkage, sex limited and sex influenced traits. Linkage and its estimation, crossing over mechanisms, chromosome mapping. Structural changes in chromosome, Mutation, classification, Methods of inducing mutation. Cytoplasmic inheritance. Genetic disorders, Nature, structure & replication of genetic material. Protein synthesis, Transcription and translational mechanism of genetic material, Gene concept: Gene structure, function and regulation, Lac and Trp operons. Domestication, Acclimatization, introduction; Centre of origin/diversity, component of Genetic variation; Heritability and genetic advance; Genetic basis and breeding methods in self- pollinated crops-mass and pure line selection, hybridization techniques and handling of segregating population; Multiline concept. Genetic basis and methods of breeding cross pollinated crops, modes of selection; Heterosis and inbreeding depression, development of inbred lines and hybrids, composite and synthetic varieties. Biotechnology tools-DNA markers and marker assisted selection.

Unit V

Introduction, plant diseases, scope and objectives of Plant Pathology. History of Plant Pathology, Terms and concepts in Plant Pathology. Pathogenesis, Diseases: classification of plant diseases, symptoms due to biotic and abiotic causes. Important plant pathogenic organisms, different groups: fungi, bacteria, viruses, viroids, algae, phanerogamic parasites and nematodes. Fungi: general characters, somatic structures, fungal tissues, reproduction (asexual and sexual). Nomenclature, Binomial system of nomenclature, rules of nomenclature, classification of fungi. Bacteria: general morphological characters. Basic methods of classification and reproduction. Viruses: nature, multiplication and transmission. Basic principles of plant disease management and disease management strategies.

**SYLLABUS FOR Ph.D. ENTRANCE EXAMINATION- ELECTRONICS AND
COMMUNICATION ENGINEERING**

Circuit Analysis:

Structure and operation, various configurations, input & output characteristics, BJT as an amplifier, DC analysis of various biasing circuits, stability, Graphical analysis of CE amplifier, h-parameter model (low frequency) of BJT. Circuit Design and Analysis using PSPICE – Schematics, attributes and types of analysis in PSPICE, use of PROBE. Design and analysis of current sources, current mirrors, and active loads, Applications and design of integrated circuits – Bipolar OPAMP circuits, CMOS OPAMP circuits, Active filters, Oscillators, Schmitt trigger circuit, Non-sinusoidal oscillators and timing circuits Design and analysis of Signal conditioning circuits, Instrumentation amplifier, switched capacitor filters, Current to voltage, voltage to current, voltage to frequency, frequency to voltage converters Design and analysis of Phase Locked loop and its application circuits.

Digital Electronics:

Number system , Boolean algebra , K Map , Design Procedure, adders, Subtractors , code conversion, Multiplexers/ Demultiplexers, encoder/decoders, decimal adders & amplitude comparators, Flip-Flops and their conversions, analysis and synthesis of synchronous sequential circuit, excitation table, state table & diagram. Design of synchronous counters, shift registers and their applications. MOS as a switching element concept of transfer characteristics, Input characteristics and output characteristics of logic gates, TTL, Tri-state logic, open collector output, NMOS, CMOS. Sequential memories, Random Access memories, Read-only memories.

Embedded System Design:

Design of Embedded systems, Microcontroller architectures, microcontroller based system design, case studies. Interfacing Memory and I/O devices, synchronous and asynchronous transfer, interrupts, DMA, Serial data transfer, GPIB, RS-232C, I2C, CAN bus protocols. RFID, Smart cards, PDA's, Zip drives. Development and troubleshooting tools, single board microcomputer kits, simulators, In Circuit Emulators, IDE, Logic analyzer. Introduction to Operating Systems, Process Management & Inter Process Communication, semaphores, conditional critical regions, event queues, deadlock, processor management, scheduling algorithms, queuing system model, Memory management, I/O subsystem, File System Organization, POSIX Thread Programming Real-time.

Communication Systems:

Digital communication principles, FDM, TDM and WDM systems, PCM, delta modulation, transmission coding, code compression, Companding, CODECs, error detection and correction codes, cyclic codes, convolution codes, data security, encryption/decryption algorithms. MODEMs, Shift Keying Techniques, Spread Spectrum modulation, FDMA, TDMA and CDMA. Telephone communication, switching networks, analog and digital exchanges, speech digitization and transmission, traffic engineering, numbering and charging plan, facsimile, WLL,

radio paging and other telecommunication services, Mobile communication systems, cellular concepts, UMTS, frequency reuse, roaming, SMS, GSM, GPRS, CDMA and EDGE, GPS.

Data Communication Networks:

Data communication networks and services, application and layered architecture, OSI model, IEEE 802.3 and IEEE 802.11, Network topologies, LAN and MAC, Data link control, Bridging, switching, addressing, Transmission systems, circuit switching networks, routing, signaling and traffic management Packet switching networks, Internetworking – Repeaters, bridges, routers and gateways. Introduction to Routing protocols TCP/IP and Internetworking, TCP/IP protocol suite TCP/IP Sockets Client-Server, computing, Name Service, Application protocols over TCP/IP, IPV6, network architectures and protocols, Web server, SMTP server, DNS server, network security, ATM Networks, ISDN, BISDN, VoIP, VoDSL, VPN, MPLS-VPN, Metro-E network, VOIP. High speed LANs – Fast and Gigabit Ethernet, FDDI. Wireless LANs. Bluetooth, Wi-Fi WLAN, WAP and Mobile computing.

Artificial Neural Networks:

Basic neuron models: McCulloch-Pitts model, nearest neighbor model, radial basis function model, etc., Neural network models: multilayer perceptron, nearest neighbor based multilayer perceptron, associative memory; radial basis function based multilayer perceptron, etc. Learning algorithms: the back propagation algorithm, self-organization learning, winner-take-all competitive learning, evolutionary learning, etc. Applications: character recognition, signal restoration, etc.

Image Processing:

Image acquisition, Image representations, Image digitalization, Sampling, Quantization, Histograms, Image Quality, Noise in Images, Basic operations on images, Image Enhancement, Pixel intensity transformations, Histogram equalization and matching, noise removal, Edge sharpening, Spatial Filtering, Convolution, Image smoothing.

Internet of Things:

Introduction to IOT, Understanding IoT fundamentals , Arduino Simulation Environment, Arduino Uno Architecture, Sensor & Actuators with Arduino, Overview of Sensors working, IoT Protocols. Cloud Platforms for IOT.