VTU RESEARCH APTITUDE TEST (VRAT) Syllabii
For Ph.D/M.Sc.(Engg) Programmes
VISVESVARAYA TECHNOLOGICAL UNIVERSITY,
BELAGAVI SCHEME OF VTU RESEARCH APTITUDE TEST
(VRAT) For Ph.D/M.Sc.(Engg)

For Faculty of Engineering & General Science

Common to:

Part I: **MathematicsSection**
Questions carrying one mark - 30 questions
(Objective/multiple choice, covering full syllabus)

Part II: **DisciplineOrientedSection**
Questions carrying one marks - 50 questions
(Objective/multiple choice, preferably involving numerical covering full syllabus)

Part III: **Aptitudesection**
Reading Comprehension data Sufficiency & Data Interpretation, Logical Reasoning computer awareness - 20 questions

TOTAL 100 marks
Topics of Syllabus for the Qualifying Exam for the Ph.D. Programme
Syllabus for the VRAT
For Faculty of Engineering & General Science

Part I: Mathematics Section

Questions carrying one mark (Objective/multiple choice, covering full syllabus)
- 30 questions

Common to:

SYLLABUS IN MATHEMATICS

1. Matrices: Definition, Rank of matrix Systems of m linear equations with n unknown, Eigen value and eigen vectors of a square matrix.

2. Calculus
   a) Differential Calculus: Limits and Continuity, Differentiation and its applications, Partial Derivatives. (Basic)
   b) Integral Calculus: Reduction formulae, Definite Integrals, Properties and Multiple Integrals,

3. Vector Algebra; Complex numbers: Definitions, Vector products, Properties; Amplitude & Modules of a complex number, De Moivere’s theorem and examples.

4. Applied Mathematics: Laplace Transforms (Elementary transformation), Fourier series, (Basics definition and examples.), half range Fourier series and harmonic analysis.


6. Statistics and Probability
   Measures of central tendency and dispersion curve fitting by least square methods.
   Correlation and regression analysis
   Probability: Axioms, conditional probability, probability distribution-Binomial poisson and normal distribution

TEXTBOOKS:
2. Elementary Engineering Mathematics- Dr. B.S. Grewal
3. Advanced Engineering Mathematics –Erwin Kreyszig
4. Introduction to Numerical Analysis –S.S. Sastry

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VISVESVARAYA TECHNOLOGICAL UNIVERSITY, BELAGAVI

Topics of Syllabus for the Qualifying Exam for the Ph.D. Programme
Syllabus for the VRAT

For Faculty of Engineering & General Science

Part III: Aptitude section
Questions carrying one mark - 20 questions
(Objective/multiple choice, covering full syllabus)

Common to:

Syllabus in Aptitude section

Reading Comprehension data Sufficiency & Data Interpretation, Logical Reasoning & Computer awareness
VISVESVARAYA TECHNOLOGICAL UNIVERSITY, BELAGAVI Topics of Syllabus for the Qualifying Exam for the Ph.D. Programme Syllabus for the VRAT

Part II: Discipline Oriented Section - 50 questions

Questions carrying one marks
(Objective/multiple choice, preferably involving numericals covering full syllabus)

CIVIL ENGINEERING SCIENCE

Structural Analysis
- Structural Systems
- Methods of Joints and Sections and Truss Analysis
- Strain Energy
- Arches and Cables

Fluid Mechanics
- Open Channel Flow
- Water Hammer
- Dimensional Analysis
- Impact of Jets on Vanes
- Turbines
- Centrifugal Pumps

Concrete Technology
- Fresh Concrete and Hardened Concrete
- Mix Design
- Special Concretes
- Non-destructive Testing of Concrete

Design of Concrete Structures
- Principles of Limit State Design
- Serviceability Limits
- Effective Lengths
- Design Loads
- Anchorage of Bars
- Lateral Stability of Beams

Geotech
- Index Properties of Soil
- Classification of Soils
- Soil Structures
- Compaction of Soil
- Consolidation of Soils
- Shear Strength of Soil

Transportation
- Highway Planning and Alignment
Design Principles
Pavement Materials and Construction
Wind Analysis and Site Selection for Airports

**Irrigation Engineering**
- Water Requirements of Crops
- Canals, Diversion Works,
- Gravity and Earthen Dams

**Steel Structures**
- Steel Structural Fasteners
- Tension – Compression – Flexure Members
- Connections

**Theory of Elasticity**
- Plane Stresses and Plane Strain
- Principal Stresses and Principal Strains
- Strain Displacement Relationship
- Equilibrium and Boundary Condition
- Generalised Hook’s Law

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Part II: **Discipline Oriented Section** - 50 questions

Questions carrying one mark
(Objective/multiple choice, preferably involving numericals covering full syllabus)

**Mechanical Engg. Science**
(IP/IEM/Auto/ME & Other Allied branches)

I. Prime movers (I. C. Engine)
   Classification of I. C Engines - 2 Stroke & 4 Stroke Petrol & Diesel Engines.
   Concept of Mechanical efficiency BHP & IHP Laws of 1\textsuperscript{st} & 2\textsuperscript{nd} Thermodynamics, zeroth Law, applications.

II. Refrigeration & Air-conditioning – properties – COP unit of Refrigeration,
   Refrigeration effect, Tonne Refrigeration.

III. Manufacturing Process part of a lathe, operation in a lathe, Types of Drilling Machine, operation a Drilling machine.
   Types of milling machines, operation on milling machines
   Grinding machines, bonding materials, grinding terminology. Type of grinding machine,
   Soldering,
   brazing & welding classification & types. Lubrication & bearing types.

IV Power transmission & mechtronics
   Belt drives, gear drives,
   Introduction to mechanics- open loop & closed loop control System
   Advantages & Disadvantages.

V Heat treatment of Metals-Anreding, Normalizing harding, tempering,
   carburizing, cyaniding, Nitriding
   and flame hardening, Iron, Carbon equilibrium diagram.
   Composite Materials – Types of martin materials, FRP & MMC advantages & applications.

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Part II: **Discipline Oriented Section** - 50 questions

Questions carrying one marks
(Objective/multiple choice, preferably involving numericals covering full syllabus)

**Electrical Sciences**
*(ECE/EEE/IT/TC/BM/ML and other allied branches)*

1. Fundamentals & AC Circuits Network Theorems.
2. Electrical Machines AC & DC, Transformers
3. Diode Circuits – Amplifiers, op – Amp Applications.
5. Sequential logic circuits – Flip flops & counters, shift Registers
7. Thyrestors – Choppers & Inverters.
9. Microprocessors – Architecture, operation, programming and interfacing
10. Transducers.

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Part II: Discipline Oriented Section - 50 questions

Questions carrying one marks

(Objective/multiple choice, preferably involving numericals covering full syllabus)

Computer Sciences
(CSE/ISE/MCA)

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<tr>
<td>1.</td>
<td>Discrete Mathematical Structures (Set Memory Fundamentals of Logic, Relations functions)</td>
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<td>2.</td>
<td>Computer Organization (as per CSE 46 Syllabus)</td>
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<td>3.</td>
<td>Data Structures using C (Stack, recursion, Queues and lists, Trees, sorting, searching)</td>
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<td>4.</td>
<td>Operating systems (as per CS 52 Syllabus)</td>
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<td>5.</td>
<td>OOP with C++ (as per CSE 36 Syllabus)</td>
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<td>6.</td>
<td>DBMS (as per CS 53 Syllabus)</td>
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<td>7.</td>
<td>Analysis &amp; Design of Algorithms (as per CSE 43 Syllabus)</td>
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<td>8.</td>
<td>object oriented Analysis &amp; design (as per CS 72 Syllabus)</td>
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Visvesvaraya Technological University, Belagavi
Topics of Syllabus for the Qualifying Exam for the Ph.D. Programme
Draft Syllabus for the VRAT

Part II: Discipline Oriented Section

Questions carrying one mark
(Objective/multiple choice, preferably involving numericals covering full syllabus)

Textile / Silk Technology


Introduction to regenerated fibers, chemistry and physics of viscose rayon production. Production of modified viscose rayon, brief out line on production of acetate & cupramonium rayon. Manufacture of Tencel, ‘Modal’ and ‘lyocell’ fibre.

Modern developments in blowroom machineries, evaluation of blowroom performance, calculation regarding blowroom line.

Need of blending, Process modification required in blowroom for processing various blends like Polyester/cotton, Polyester/viscose, silk and its blends. Types of blending operation and blending procedure.
Various quality control studies in blowroom like alp rejection percentage, cleaning efficiency within and between lap variations.

**Carding:**

Objects of carding, detailed study of working of revolving flat card, card clothing, autolevellers, setting of different parts and effect of changing the setting on sliver quality, methods of grinding, stripping calculation of production, draft etc. in carding.

Developments in modern carding such as developments in preceding zone, speeds, efficiency etc. Developments in post carding zone.

Modern cards, their applications – tandem card, various quality control studies in carding.

**Winding:**


**Warping:**


**Sizing:**


Head stock – dry splitting comb, drag roll. After waxing, cut mark motion, beam pressing, PIV and friction clutch.

Controls in sow box – stretch and its control, moisture measurement and temperature control.


Sizing defects and remedies.
Post sizing operations – Drawing – in, leasing, knotting, automatic drawing in machine.

Chemicals and auxiliaries used for textile wet processing and their functions. Introduction to shearing and cropping. Objects of shearing and cropping.

Objects of singeing, methods of singeing by various singeing machines, precautions to be taken during singeing, latest developments in singeing.

Objects of desizing, methods of desizing, continuous desizing, desizing of cotton and other blend. latest developments in desizing.

Objects of scouring, mechanism of scouring, methods of scouring, scouring of natural cellulose fabrics, degumming of silk, scouring of wool and jute, scouring of synthetic, modifications required to scour knitted fabrics, latest developments in scouring.

Objects of Bleaching, mechanism of bleaching, methods of bleaching, bleaching of cellulose fibres, fibres, bleaching of natural protein fibres, bleaching of common manufactured fibres, bleaching of common whitening, optical whitening process for common fibres. Chemistry of optical whitening agents.

Objects of mercerization, history and developments of mercerization, physical and chemical changes in cotton due to mercerization, various factors affecting mercerization, methods of mercerization – yarns and fabrics, machines used for mercerization, slack mercerization, Hot mercerization, Faults in mercerization and their remedies, Test methods for mercerized materials. Latest developments in mercerization.

Characterization of solid state structure of textile fibres using X-rays IRS, NMR, UVS, SEM, TEM & DGC. Various Two phase models for studying two phase and one phase physical structure fibres. Description of physical structure of cotton, wool, silk, PET, Nylon and acrylic fibres.

**Moisture relations** : Concept of moisture equilibrium, moisture hysterisis, moisture regain, heat of absorption, swelling of textile fibres. Effect of moisture on various property of fibres.

Mechanical properties: Stress and strain behaviour, factors affecting tensile behaviour, structure and tensile property correlation, Elastic recovery and weaklink effect.
Stress relaxation, creep, factor affecting stress relaxation, dynamic mechanical properties and their application.

Flexural and tensional properties, Frictional properties, Amontons laws of friction, deviation of these laws in fibre friction, Bowden and Tabors theory of friction.

Optical properties, measurement of birefringence, luster. Importance of optical properties.

Electrical properties: Electrical resistance, static electricity, dielectric properties. Measurement of these properties.

Thermal properties: Thermal conductivity, specific heat, thermal conductivity and thermal expansion.

Introduction to synthetic fibres. Production of raw materials for synthetic fibres. Study of Production of PET by DMT & TPA routes. Study of Production of polyamides, nylon-6 effect of various parameters on nylon-6 Production study of semi-continuous & integrated continuous process for Production of nylon-6, Production of nylon-66.


Texturising:

Drawing:

Combing:
Objects of combing, Hook theory. Preparatory process for combing sliver lap, ribbon lap, and uni lap machines. Types of comber. Sequence of operations in rectilinear comber, straightening of hooks, parameters influencing the combing operations. Influence of feed stock on combing, influence of combing operation on quality. Noil theory. Influence of machine components and setting on combing Nipper assembly, combs, takes off material, drafting arrangements, waste
removal, transport operations in combing room. Detailed study of modern combing with reference to cylinder speed, rate of delivery, detaching mechanism, drafting system. Calculations in comber, fractionating efficiency, quality control studies in combing.

**Speed Frame:**
Objects of speed frames, operating sequence, operating regions of speedframe, drafting arrangements and systems. Spindle and flyer – design of spindle and flyer. Winding of bobbin – mechanism, package built bobbin drive, cone drive, lifter motion and builder motion, bobbin leading and flyer leading mechanism, chase length, differential gearing mechanism. Study of features of various modern speedframes. Quality control studies in speedframe, calculations pertaining to speedframe.

**Shedding:**
Different types of shed. Positive and negative tappet shedding. Heald reversing mechanism. Staggering of healds, tappet shedding and their characteristics. Different types of tappets. Merits and demerits of tappet shedding, timing, setting, early and late shedding. Study of different types of reed, reed count, healds, heald count

**Picking:**
Methods of picking, essentials of goods picking, defects in negative picking. Timing setting of picking mechanism. Different types of under picking mechanisms. Early and late picking. Shuttle checking devices, box settings, pickers, picking band, stick, check strap buffer, swell etc., Shuttle trap, weak and harsh pick.

**Beat-Up:**
Theory of Beat up. Design features and working of beat up mechanism, eccentricity of sley. Factors affecting the sley eccentricity.

**Secondary Motions:**
Take up motion, - 7 wheel take up. Timing and settings, continuous take up motion. Let-off motions - positive and negative types.

**Auxiliary Motions:**

Speed and production calculation of plain looms.

**Box Motions:** 4x4 box motion, circular box motion.

**Automatic Looms:**
Cop changing, shuttle changing looms, feelers, types of feelers, shuttle eye cutters, temple eye cutters and their settings -

Chemicals and auxillaries used for textile dyeing and their functions. Chemical constitution of dyes. Effect of fibre structure on dyeing behaviour.


Properties, Selection and application of various dyes like direct dyes, basic dyes, acid dyes, sulphur dyes, Azoic dyes, Vat dyes, Sol-vat dyes, Mordant dyes, Reactive dyes, Disperse dyes, Modified basic dyes on important natural and manufactured fibres. Various after treatments given to dyed goods.

Introduction to natural dyes and their methods of application

Preparatory process for garment dyeing, speciality chemicals and dyes used for garment dyeing. Different types of dyeing practices for various types of garments, precautions to be taken for effective dyeing of garments. Quality control in garment dyeing.

Working principles of dyeing machinery for yarns, fabrics and garments. Latest developments in dyeing machinery

Brief study on eco-friendly dyeing processes.

Dyeing of blends and knitted fabrics

Introduction to colour measurement and computer colour matching.

**Ring Frame:**


**Doubling Frame:**

Open End Spinning:
Comparison of ring and O E yarns. Recent developments in O E Spinning. Setting and speeds
required to process various blends. Production calculations. Different types of rotors and opening
rollers used in open end spinning.

Dobby Looms:
Mechanical design and working principles of different types of dobbies such as negative, positive,
cam, paper, rotary, cross border dobbies, Lattice pegging methods, cyclic diagram of operation of
the dobbey mechanism.

Jacquard:
Mechanical design and operating principles of single lift single cylinder. Double lift single cylinder.
Double lift Double cylinder and cross border jacquard. Methods to increase the figuring capacity.
Piano card cutting machine. Card punching. Card lacing, casting out in jacquard. London and
Norwich harness mounting systems. Cyclogram of the jacquard shedding. Different types of tie-
ups. Review of developments in jacquards.

Shuttle-less Weaving: Study of special features of rapier, projectile, water-jet, Air-jet looms.

Study of above types of shuttle-less weaving machines with reference to: Types of weft supply
creels, Types of weft tensioning devices, Weft feed system, Types of weft insertion systems,
Different carrier breaking system, Consolidation of picking force in air jet picking systems. Weft
mixing systems, Systems of weft beat up, Types of selvedges.

Introduction to textile printing - An overview of the printing process.

Selection of dyes/pigments/auxiliaries and textile substrate to suit the end use of the printed
textile materials.
The constituents and characteristic of printing paste. Brief study of different binders, thickeners,
solvents, discharging agents and other ingredients of printing paste.

Styles of printing – Direct, discharge, resist and special styles- chemical and mechanisms used for
the above styles.

Methods of printing – Printing by Hand block, Roller, hand screen, semi-automatic screen, flat bed
and rotary screen printing methods. Developments in printing machinery.

Transfer printing – Principle, mechanisms and continuous transfer printing – Transfer printing
machinery.

The print paste preparation and preservation. Printing of natural and synthetic fibre fabrics with
various classes of dyes/pigments.

Methods of print fixation – Drying, curing by dry heat, steam fixation etc.

Finishing process: An overview - objects and methods of finishing. Classification of various finishes
– Various finishing chemicals used and their properties.
Calendering and various calendering machines used. Sanforization – principle and the process.
Resin and anti-crease finish on cotton and protein fibre fabrics. Water repellent finishes, fire
retardant and fire proof finishes.

Finishing of woollen materials, silk fabrics and blended products. Finishing of synthetic fibre fabrics
- heat setting, de-lustering, anti-static, soil release, etc.
Introduction to textile testing and quality control. Sampling techniques. Moisture relation and testing. Fiber dimensions Viz., length, fineness, maturity and strength. Their technological importance and determination by various conventional and High Volume Instruments (HVI). FQI & its importance.

Study of various systems of yarn count & its measurements by various methods & instruments.


Estimation of color fastness of dyed fabrics.

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Part II: Discipline Oriented Section

Questions carrying one marks
(Objective/multiple choice, preferably involving numericals covering full syllabus)

**Chemical Engineering**

Process Calculations and Thermodynamics: Laws of conservation of mass and energy; use of tie components; recycle, bypass and purge calculations; degree of freedom analysis.

First and Second laws of thermodynamics and their applications; equations of state and thermodynamic properties of real systems; phase equilibria; fugacity, excess properties and correlations of activity coefficients; chemical reaction equilibria.

Momentum Transfer and Mechanical Operations: Fluid statics, Newtonian and non-Newtonian fluids, Bernoulli equation, Macroscopic friction factors, energy balance, dimensional analysis, shell balances, flow through pipeline systems, flow meters, pumps and compressors, packed and fluidized beds, elementary boundary layer theory, size reduction and size separation; free and hindered settling; centrifuge and cyclones; thickening and classification, filtration, mixing and agitation; conveying of solids.

Heat Transfer: Conduction, convection and radiation, heat transfer coefficients, steady and unsteady heat conduction, boiling, condensation and evaporation; types of heat exchangers and evaporators and their design.

Mass Transfer: Fick's law, molecular diffusion in fluids, mass transfer coefficients, film, penetration and surface renewal theories; momentum, heat and mass transfer analogies; stagewise and continuous contacting and stage efficiencies; HTU & NTU concepts design and operation of equipment for distillation, absorption, leaching, liquid-liquid extraction, crystallization, drying, humidification, dehumidification and adsorption.

Chemical Reaction Engineering: Theories of reaction rates; kinetics of homogeneous reactions, interpretation of kinetic data, single and multiple reactions in ideal reactors, non-ideal reactors; residence time; non-isothermal reactors; kinetics of heterogeneous catalytic reactions; diffusion effects in catalysis.

Instrumentation and Process Control: Measurement of process variables; sensors, transducers and their dynamics, dynamics of simple systems, dynamics such as CSTRs, transfer functions and responses of simple systems, process reaction curve, controller modes (P, PI, and PID); control valves; analysis of closed loop systems including stability, frequency response (including Bode plots) and controller tuning, cascade, feed forward control.

Plant Design and Economics: Design and sizing of chemical engineering equipment such as
compressors, heat exchangers, multistage contactors; principles of process economics and cost estimation including total annualized cost, cost indexes, rate of return, payback period, discounted cash flow, optimization in Design.

Chemical Technology: Inorganic chemical industries; sulfuric acid, NaOH, fertilizers (Ammonia, Urea, SSP and TSP); natural products industries (Pulp and Paper, Sugar, Oil, and Fats); petroleum refining and petrochemicals; polymerization industries; polyethylene, polypropylene, PVC and polyester synthetic fibers.
VISVESVARAYA TECHNOLOGICAL UNIVERSITY, BELAGAVI

Topics of Syllabus for the Qualifying Exam for the Ph.D. Programme

Syllabus for the VRAT

Part II: **Discipline Oriented Section**

Questions carrying one mark

(Objective/multiple choice, preferably involving numerials covering full syllabus)

**BIO-TECHNOLOGY**

1. **BASICS OF UNIT OPERATIONS**

2. **FUNDAMENTALS OF MOMENTUM TRANSFER**
   Fluid definition, Classification, governing equations, Hydrostatic equilibrium, barometric equation, Pressure measurements, Manometric equation, Shear stress, Shear strain, Newton's law, Fluid flow, Types of flow, Laminar and turbulent flow. Continuity equation, Energy balance equation, Bernoulli's equation, Euler equation, Momentum balance, Flow through circular and non circular sections, Hagen-Poiseulles equations, Losses through pipe and fittings, Turbulent flow, and Friction factor.

3. **BASIC BIOCHEMISTRY**
   Structure and properties of mono, di, and polysaccharides, structure and properties of fatty acids, neutral fats, phospholipids, glycolipids and steroids, structure and properties of aminoacids, peptides, and proteins. Biologically important peptides. Structure and properties of purines, pyrimidines, nucleosides, nucleotides, ribonucleic acids, nucleoprotein complexes.

4. **FUNDAMENTALS OF CELL STRUCTURE AND FUNCTION**

5. **BASICS OF BIOPHYSICAL AND BIOCHEMICAL TECHNIQUES**
   Rayleigh scattering, ultra centrifugation, viscometry, crystallization, X-ray crystallography, neutron diffraction, NMR spectroscopy, electron microscopy, STM, AFM, luminescence, fluorimeter, faime, photometry, optical activity, CD, UV, IR, Laser Raman and ESR, EPR. Calorimetry, DSC, Spectrophotometry, Mass spectrometry, LC-MS, MALDI-TOF, Chromatography, Electrophoresis.

6. **FUNDAMENTALS OF THERMODYNAMICS**
7. BASIC GENETICS AND GENETIC EngINEERING
Nature of genetic material, DNA replication, Mendelian Laws of inheritance, monohybrid and
dihybrid inheritance, law of segregation and independent assortment, Gene interactions,
supplementary genes, Complementary genes, Epistasis. Identification of genetic material,
classical experiments- Hershey & Chase, Avery McLeod etc. Multiple alleles and groups antigens.
Role of genes within cells, genetic code, genetic elements that control gene expression, method of
creating recombinant DNA molecules, vectors in recombinant DNA technology, biology and salient
features of vectors, types of vectors- plasmids, cosmids, phages and viruses. Gene transfer
techniques, genetic engineering of plants and animals, structure and functions of T-DNA in the
expression of genes, Ti plasmid mediated gene transfer.

8. INTRODUCTORY BIOINFORMATICS
Databases: Sequence database, Structure database, Medical Databases. Sequence alignment and
database searches: Optional Alignment, Database similarity searching, FASTA, BLAST. Aspects of
Multiple Sequence Alignment. Phylogenetic analysis: Tree- Building Methods, Evaluating Trees
and Data. Predictive methods for Detecting Functional Sites in the DNA. Predictive methods for
secondary structure, tertiary folds from protein sequences. Plasmid mapping and primer design.

9. BIOPROCESS PRINCIPLES
Concept of mole and Molecule, Composition, of mixtures of Solids, liquids and gases. Composition
of mixtures and solutions- Percentage by weight, mole and Volume; Normality, Morality, Molality,
and ppm, pH and pK Buffer Calculations. Outline of an integrated bioprocess and the various
(upstream and downstream) unit operations involved in bioprocesses; generalized process flow
sheets. Process flow sheet and unit operations in chemical and bioprocess industries; General
material balance equation for steady and unsteady states. Basic concepts of Energy Balance.

Couples reactions and energy rise compounds, Reaction Stoichiometry, criteria of biochemical
reaction equilibrium, equilibrium constant and standard free energy change, effect of temperature,
pressure on equilibrium constants and other- factors affecting equilibrium conversion, liquid phase
reactions, heterogeneous bioreaction equilibria, phase rule for reacting systems.

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Part II: **Discipline Oriented Section**

Questions carrying one mark
(Objective/multiple choice, preferably involving numericals covering full syllabus)

**CHEMISTRY**

(Topics Studied up to the Bachelor Degree Level should be considered for setting the comprehensive questions in the subject)

1. **Periodic Properties** - Atomic radii – Ionization energy in groups and periods – Electron affinity Chemical Bonding.


Part II: Discipline Oriented Section

Questions carrying one marks
(Objective/multiple choice, preferably involving numericals covering full syllabus)

Physics

(Topics Studied up to the Bachelor Degree Level should be considered for setting the comprehensive questions in the subject)
(Topics Studied up to the Bachelor Degree Levels should be considered for setting the comprehensive questions in the subject)


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VISVESVARAYA TECHNOLOGICAL UNIVERSITY, BELAGAVI

Topics of Syllabus for the Qualifying Exam for the Ph.D. Programme
Syllabus for the VRAT

ForFacultyGeneralScience

Part II: **Discipline Oriented Section** - 50 questions

Questions carrying one marks
(Objective/multiple choice, preferably involving numericals covering full syllabus)

**MATHEMATICS**

(FOR BACKGROUND OF M.SC.(MATHS))

(Topics Studied up to the Bachelor Degree Level should be considered for setting the comprehensive questions in the subject)

1. TRIGONOMETRY
Trigonometric ratios and relations, simple problems. Complex numbers: Definition and properties, De moivre’s theorem, roots of complex numbers

2. INFINITTE SERIES

3. LINEAR ALGERBRA
Matrices and determinants, Inverse of a matrix, rank of a matrix, consistency of a system of linear equations. Eigen values and eigen vectors

4. CALCULUS
a) **DIFFERENTIAL CALCULUS**: \( n^{th} \) derivative of standard functions, polar curves, angle between polar curves. Partial differentiation, maximum and minimum for function of single and two variables. Curvature and radius of curvature, mean value theorems, Taylor’s and Maclaurin’s expansion for a function of single variable. Indeterminate forms.
b) INTEGRAL CALCULUS
   Tracing of standard curves. Beta and gamma functions. Length, Area, Volume using multiple integrals.

5. DIFFERENTIAL EQUATIONS
   Solutions of first order and first degree differential equations,

6. APPLIED MATHEMATICS
   a) Laplace Transforms, Fourier Series & Fourier Transforms
   b) NUMERICAL METHODS
       Solutions of algebraic and transcendental equations, finite differences and related problems, numerical differentiation and numerical integration, Numerical solution of ordinary and partial differential equations, application to Engineering problems.
   c) STATISTICS AND PROBABILITY
       Correlation and regression, analysis of variance.
       Probability: Axioms, Including Bayes theorem, conditional probability, probability distribution-Binomial poisson, normal, geometric and exponential distribution.

TEXTBOOKS:

2. Elementary Engineering Mathematics- Dr. B.S. Grewal
3. Advanced Engineering Mathematics –Erwin Kreyszig
4. Introduction to Numerical Analysis –S.S. Sastry

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Business Administration

Module 1

Module 2
Organization behaviour: nature: Learning, Personality: definition-traits-determinants. Perception; Meaning, factors influencing perception, perception and decision making.

Module 3
Marketing Management: Meaning-importance – Marketing management process- Marketing mix.

Module 4
Human Resource Management: definition, nature, scope-managerial and operative functions of HRM. Objections of HRM.

Module 5
Financial Management: Definition, scope, functions, objectives, Time value of money.

Latest Management concepts in all the above modules.
VISVESVARAYA TECHNOLOGICAL UNIVERSITY, BELAGAVI
SCHEME OF VRAT
For Ph.D/M.Sc.(Engg)

**Business Administration**

**Part I: Verbal Ability, Numerical Analysis Quantitative ability**
Questions carrying one mark - 30 questions

**Part II: Discipline Oriented Section**
Questions carrying one marks - 50 questions
(Objective/multiple choice)

**Part III: Aptitude section**

| Reading Comprehension data Sufficiency & Data Interpretation, Logical Reasoning computer awareness | - 20 questions |

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Part II: Discipline Oriented Section - 50 questions

Questions carrying one mark
(Objective/multiple choice, preferably involving numericals covering full syllabus)

Polymer Science and Technology

Fundamentals of polymer science - definition to polymer/macromolecules, copolymer, blends, composites, fibres, etc. Classification of polymers, functionality of monomers. Explain the terms crystallinity, amorphous, tacticity, stereoregularity, Tg/Tm, configuration/conformation.

Chemistry and Mechanism of Polymerization:

Methods of Polymerization - Bulk, solution, suspension, emulsion, solid phase, gas phase polymerizations

Molecular weight and size: The concept of molecular weights (number average, weight average, viscosity average and z average molecular weight - definitions and mathematical expressions), molecular weight distribution (MWD) & its importance and polydispersity.

Polymer properties – approach and the concept of chemical structure of polymers

Polymer testing/characterization – density, bulk density, UTM, stress-strain curves (types), definition for tensile modulus, impact strength, thermal methods-DSC and TGA (basics), melt viscosity (MFI)

Chemistry, properties and uses of some polymers – Types of polyethylene (LDPE & HDPE), nylons, PP, PS, PAN, PMMA, PET, PC, NR, SBR, epoxies

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VRAT Syllabus for PhD
(Architecture)

SYLLABUS

City Planning: Historical development of city planning, principles of city planning, new towns, survey methods, site planning and planning regulations and building bye laws.

Housing : Concept of shelter, housing design and policies, role of government agencies, finance and management.

Landscape Design: Principles of landscape design, landscape elements, materials, planning design.

Visual and Urban Design: Principles of visual composition, proportion, scale, rhythm, symmetry, asymmetry and balance of form and color, sense of place and space, division of space, focal point, vista, visual survey.

Illustory of Architecture: Indian - Indus valley, Vedic, Buddhist, Indo-Aryan, Dravidian and mughal periods; European - Egyptian, Greek, Roman, Medieval, and Renaissance periods.

Development of Contemporary Architecture: Development and impact on society since industrial revolution, influence of modern art on architecture, works of national and international architects, post modernism in architecture.

Planning Theory: Planning process, comprehensive planning, land use and density in residential and non-residential areas, central place theory, rank-size rule, settlement pattern, land utilization, and district level planning.

Techniques of planning: Application of remote sensing techniques in urban and regional planning, planning surveys, methods of preparation of urban and regional development plans, structure plans, strategy plans, etc.; and site planning principles and design.

ECOLOGY AND ENVIRONMENTAL IMPACT ASSESSMENT

- Ecosystems – types and symbiotic relationship, Energy flow
- Environmental Impact Assessment – Objectives, Types, Limitations
- Public Participation, Environmental Management Plan (EMP)

ENVIRONMENTAL CHEMISTRY AND MICROBIOLOGY

- Equilibrium and Colloidal Chemistry
- Organic Chemistry and Analytical Chemistry
- Bacteria, Algae and Fungi
- Virology
- Bacterial Metabolism and Metabolic Pathways

WATER TREATMENT AND DISTRIBUTION

- Water Quality Guidelines and Drinking Water Standards
- Aeration, Sedimentation, Coagulation and Flocculation
- Filtration, Adsorption, Softening
- Rural Water Supply
- Water Distribution Network – types, advantages
- Design Equations and their Applications

WASTEWATER COLLECTION, TREATMENT & DISPOSAL

- Objectives, Wastewater categories and Characteristics
- Preliminary Treatment Units
- Primary Treatment Units
- Secondary treatment – Aerobic, Anaerobic, Suspended and Attached Growth Systems
- Kinetics and Biokinetic Coefficients
- Batch and Continuous Reactor Systems
- Wastewater Collection System - Types, Design Principles
- Stabilization Ponds
- Industrial Wastewater Treatment
- Rural Sanitation Systems
SOLID WASTE ENGINEERING AND MANAGEMENT
- Sources, Generation rates, Quantification and Characterization
- Collection, transportation, treatment and disposal
- Leachate and Gases Control in Sanitary Landfills
- Composting, Incineration and Pyrolysis

ATMOSPHERIC & NOISE POLLUTION CONTROL
- Major Air Pollution Sources, Meteorology
- Air Pollutants and their Impact on Environment, Human and Property
- Air Pollution Standards, Air pollution Control – SPM and Gaseous
- Gaussian Dispersion Model and its Application
- Stability Classes, types of Plumes and Behaviour
- Atmospheric Inversion – causes and effects on pollutants dispersion
- Noise – sources, effects, measurement and control

WATER RESOURCES ENGINEERING AND APPLIED HYDRAULICS
- World water resources, Indian water resources, Karnataka’s water resources
- Estimation of Precipitation, Hydrograph Theory
- Flow Measurements – different methods
- Storm runoff Estimation and Design Principles of Storm Sewers
- Water Hammer Analysis
- Confined and Unconfined Aquifers
- Artificial Recharge, Ground Water Pollution

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VISVESVARAYA TECHNOLOGICAL UNIVERSITY, BELGAUM
Topics of Syllabus for the Qualifying Exam for the Ph.D. Programme
Syllabus for Geology

Part II: Discipline Oriented Section - 50 questions

Questions carrying one mark
(Objective/multiple choice, preferably involving numericals covering full syllabus)

Physical Geology-
The dynamics of Earth- Outer zones, crust and inner zones of the Earth, continents and ocean floor
Weathering and Erosion. Volcano ’s, Rivers, Wind, Coastal scenery and work of sea.
Earthquake , Plate tectonics, Orogenic belts, Geosynclines.

Mineralogy and Crystallography-
Physical properties of Minerals, origin and occurrences of Minerals.
Crystal - Forms of crystals, symmetry elements, and crystal systems,
Optical properties of Minerals.
Study of Minerals-Oxide group, Carbonate group, Feldspar group, Mica group, Silicate group and ore
minerals for their properties, uses and occurrences.

Petrology
Igneous rocks – Textures, structures and classification
Sedimentary rocks – Characters, textures, structures and classification
Metamorphic rocks – Agents of metamorphism, Textures, structures kinds of metamorphism Study
of rocks for their properties, uses and occurrences – Granite, Basalt, Dolerite, Gabbro, Pegmatite,
Sandstone, Conglomerate, Shale, Limestone, Gneiss, Marble, Phyllite, Slate and Schists.

Structural Geology
Mechanical principles
Attitude of beds
Folds – Parts and nomenclature
Joints – Geometric and genetic classification
Faults – Identification in field, parts and classification
Unconformities – Recognition of unconformities and types of unconformities

Stratigraphy and Paleontology
Principles of stratigraphy
Stratigraphic units
Physical divisions of India
Fossils, Important use of fossils
Standard geological time scale
Paleo botany, - Introduction, Plants classification. Evolution of plants and their geological distribution,
invertebrate paleontology classification.

Hydro Geology
Ground water, occurrences and vertical distribution
Aquifer, kinds and types
Ground water prospecting
Ground water quality
Ground water pollution

Remote sensing and GIS
Applications, concepts, elements, electromagnetic radiation, electromagnetic spectrum, Passive and
active remote sensing, EMR interaction with atmosphere and earth materials, satellites, parameters
of sensors
GIS – applications, components of GIS, Maps, projections.
Reference:
A Text Book of Geology by- P K Mukerjee
Holmes Principals of Geology by-Arthur Holmes. Structural Geology by- M P Billings
Ground Water by- D K Todd
Ground Water by- H M Raghunath
Basics of Remote Sencing & GIS by-Dr S Kumar
Petrology by-Tyrrel
VISVESVARAYA TECHNOLOGICAL UNIVERSITY, BELGAUM

Topics of Syllabus for the Qualifying Exam for the Ph.D. Programme Syllabus for the VRAT- for Nanotechnology

Introduction to nanoscience and nanotechnology: History, background scope and interdisciplinary nature of nanoscience and nanotechnology, scientific revolutions, nanosized effects surface to volume ratio, crystal structure, atomic structure, molecules and phases, energy bands- insulators, semiconductors and conductors, Nanoscale-molecular and atomic size, quantum effects.

Nanomaterials synthesis: Synthesis and nanofabrication, Bottom-Up and Top-Down approach with examples. Chemical precipitation methods, sol-gel method, chemical reduction, Sonochemical synthesis, Hydrothermal, solvothermal, solution combustion process.

Physical Methods- Ball milling, Physical Vapour deposition (PVD), Chemical Vapor deposition (CVD), Sputter deposition, electric arc deposition, Lithography techniques.

Biological methods- Synthesis using micro organisms and bacteria, Synthesis using plant extract, use of proteins and DNA templates.

MATERIAL CHARACTERIZATION TECHNIQUES

Compositional and structural Characterization techniques: X-ray Photoelectron Spectroscopy (XPS), Energy Dispersive X-ray analysis (EDAX), Principles and applications of X-ray diffraction; electron diffraction, Surface characterization Techniques- High resolution microscopy; Scanning electron microscopy (SEM), Transmission electron microscopy (TEM), Atomic force microscopy (AFM), scanning tunneling microscopy (STM).

Spectroscopic techniques: Fourier Transform infrared (FTIR) spectroscopy, Raman spectroscopy techniques: micro Raman and laser Raman.

Nanobiotechnology and Medical application

Introduction, Biological building blocks- size of building blocks and nanostructures, Peptide nanowires and protein nanoparticles, DNA double nanowires, Nanomaterials in drug delivery and therapy, Nanomedicine, Targeted gold nanoparticles for imaging and therapy

Nanoelectronics

Introduction, Electronic structure of Nanocrystals, Tuning the Band gap of Nanoscale semiconductors, Excitons, Quantum dot, Single electron devices, Nanostructured ferromagnetism, Effect of bulk nanostructuring of magnetic properties, Dynamics of nanomagnets, Nanocarbon ferromagnets, Giant and colossal magnetoresistance, Introduction of spintronics, Spintronics devices and applications.

Carbon based Nanostructures

Carbon Nanotubes (CNT), Graphene, Fullerenes, history and types, Carbon clusters, Single wall tubes, Multiwall tubes, Macroscopic Nanotube materials, Physical properties (Mechanical Properties, Thermal Properties, Electronic Properties, magnetic and superconducting properties), Applications of Carbon Nanotubes.
NANOCOMPOSITES - DESIGN AND SYNTHESIS

Introduction to Nanocomposites. Composite material, Mechanical properties of Nano composite material: stress - strain relationship, toughness, strength, plasticity.

Synthesis methods for various nanocomposite materials: mechanical alloying, thermal spray synthesis etc. Nano composites for hard coatings; DLC coatings; Thin film nanocomposites; Modeling of nanocomposites.

Text Books and References


5. Introduction to Solid State Physics, C. Kittel, Wiley Eastern

6. Fundamentals of Nanoelectronics by George W. Hanson (Pearson Education,New delhi)


10. A practical approach to X-Ray diffraction analysis by C.Suryanarayana

11. Electron Microscopy and analysis by P.J. Goodhew and F.J. Humphreys

12. Scanning electron microscopy and x-ray microanalysis by J.I. Goldstein

13. Characterization of nanostructured materials by Z.L. Wang

14. Modern Raman Spectroscopy: A practical approach by E. Smith and G.Dent

15. Principles of Instrumental analysis by D.A. Skoog, F.J. Hollen and T.A. Niemann

VISVESVARAYA TECHNOLOGICAL UNIVERSITY, BELAGAVI

SCHEME OF VRAT

For Ph.D/M.Sc.(Engg)

For Faculty of Engineering & General Science

Common to:

Part I: Mathematics Section
Questions carrying one mark
(Objective/multiple choice, covering full syllabus) - 30 questions
VISVESVARAYA TECHNOLOGICAL UNIVERSITY, BELAGAVI

Topics of Syllabus for the Qualifying Exam for the Ph.D. Programme
Syllabus for the VRAT

Common to:
Civil Engineering Science / Mechanical Engineering Science’ / Electrical Engineering Science / Computer Sciences / Textile / Silk Engineering / Chemical Engineering / Polymer Science / Bio-Tech/ Architecture / Physics / Chemistry / Mathematics/Computer Application/Geology/Nanotechnology /Physical Education/Library Science and MBA

- 20 questions

Part III: **Aptitude section**
Reading Comprehension data Sufficiency & Data Interpretation, Logical Reasoning computer awareness
Business Administration

Part I: Verbal Ability, Numerical Analysis Quantitative ability

Questions carrying one mark - 30 questions
Part II: Discipline Oriented Section - 50 questions

Questions carrying one mark

(Objective/multiple choice, preferably involving numericals covering full syllabus)

Physical Geology-
The dynamics of Earth- Outer zones, crust and inner zones of the Earth, continents and ocean floor Weathering and Erosion. Volcano ‘s, Rivers, Wind, Coastal scenery and work of sea. Earthquake, Plate tectonics, Orogenic belts, Geosynclines.

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Physical properties of Minerals, origin and occurrences of Minerals. Crystal - Forms of crystals, symmetry elements, and crystal systems, Optical properties of Minerals. Study of Minerals-Oxide group, Carbonate group, Feldspar group, Mica group, Silicate group and ore minerals for their properties, uses and occurrences.

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Igneous rocks – Textures, structures and classification
Sedimentary rocks – Characters, textures, structures and classification
Metamorphic rocks – Agents of metamorphism, Textures, structures kinds of metamorphism Study of rocks for their properties, uses and occurrences – Granite, Basalt, Dolerite, Gabbro, Pegmatite, Sandstone, Conglomerate, Shale, Limestone, Gneiss, Marble, Phyllite, Slate and Schists.

Structural Geology
Mechanical principles
Attitude of beds
Folds – Parts and nomenclature
Joints – Geometric and genetic classification
Faults – Identification in field, parts and classification
Unconformities – Recognition of unconformities and types of unconformities

Stratigraphy and Paleontology
Principles of stratigraphy
Stratigraphic units
Physical divisions of India
Fossils, Important use of fossils
Standard geological time scale

Hydro Geology
Ground water, occurrences and vertical distribution
Aquifer, kinds and types
Ground water prospecting
Ground water quality
Ground water pollution

Remote sensing and GIS
Applications, concepts, elements, electromagnetic radiation, electromagnetic spectrum, Passive and active remote sensing, EMR interaction with atmosphere and earth materials, satellites, parameters of sensors
GIS – applications, components of GIS, Maps, projections.
Reference-
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Ground Water by- H M Raghunath
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Introduction to nanoscience and nanotechnology: History, background scope and interdisciplinary nature of nanoscience and nanotechnology, scientific revolutions, nanosized effects surface to volume ratio, crystal structure, atomic structure, molecules and phases, energy bands- insulators, semiconductors and conductors, Nanoscale-molecular and atomic size, quantum effects.

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Introduction, Biological building blocks- size of building blocks and nanostructures, Peptide nanowires and protein nanoparticles, DNA double nanowires, Nanomaterials in drug delivery and therapy, Nanomedicine, Targeted gold nanoparticles for imaging and therapy
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Text Books and References

2. Introduction to Nanotechnology, Charlees P. poole jr. and frank J. Owens, wiley inter science.
5. Introduction to Solid State Physics, C. Kittel, Wiley Eastern
6. Fundamentals of Nanoelectronics by George W. Hanson (Pearson Education, New delhi)
7. Nanotechnology and Nano Electronics – Materials, devices and measurement Techniques by WR. Fahrner – Springer


10. A practical approach to X-Ray diffraction analysis by C. Suryanarayana

11. Electron Microscopy and analysis by P.J. Goodhew and F.J. Humphreys

12. Scanning electron microscopy and x-ray microanalysis by J.I. Goldstein

13. Characterization of nanostructured materials by Z.L. Wang

14. Modern Raman Spectroscopy: A practical approach by E. Smith and G. Dent

15. Principles of Instrumental analysis by D.A. Skoog, F.J. Hollen and T.A. Niemann

VISVESVARAYA TECHNOLOGICAL UNIVERSITY, BELGAUM
SCHEME OF UNIVERSITY LEVEL RESEARCH APTITUDE TEST (VRAT)
For Ph.D/M.Sc.(Engg)
For Library Science

Part I: Unit: 1 to Unit 10
Questions carrying one mark
(Objective/multiple choice, covering full syllabus)
- 80 questions

Part II: Aptitude section
Reading Comprehension data Sufficiency & Data Interpretation, Logical Reasoning computer awareness
- 20 questions

TOTAL 100 marks

LIBRARY SCIENCE

Unit-1
Library and society, information society, Library philosophy, data, information & knowledge, Communication models, five laws of library science, professional organisations and associations.

Unit-2
Types of libraries, library classification and cataloguing, trends in library classification and cataloguing, metadata formats,

Unit-3
Library information sources and services, documentary and non documentary, library standards, library extension activities, electronic resources and services, Institutional repositories, internet resources and web technology, web designing tools,

Unit-4
Introduction to Information technology, computer hardware and software, data representation and file organisation, programming languages, computerisation of libraries, library automation software’s, Database management systems, computer networks & library networks

Unit-5
Management of library and information science, planning of library and information centers, financial management in libraries, HRM in libraries, scientific management, TQm in libraries, knowledge management, library security measures,

Unit-6
Information systems and services, national and international information systems, IRS, abstracting and indexing, types of indexing systems, search techniques,

Unit-7
Basics of Research methodology, types of research, research design, hypothesis, research methods, tools and techniques, statistical techniques and softwares, analysis and interpretation, report writing. Citation formats

Unit-8
Digital libraries and information management, digital technologies and digital library initiatives, digital resource management, institutional repositories, digital library software’s-open source and commercial, digital preservation and archiving

Unit-9
Scientometrics, citation analysis, bibliometric laws, growth of literature, webometrics, scientometric tools and techniques

Unit-10
Content management and its softwares, knowledge management, information literacy, electronic resource management, web technology and semantic web, marketing of library information products and services,
VISVESVARAYA TECHNOLOGICAL UNIVERSITY, BELGAUM  
SCHEME OF UNIVERSITY LEVEL RESEARCH APTITUDE TEST (VRAT)  
For Ph.D/M.Sc.(Engg)  
FOR PHYSICAL EDUCATION

Part I:  
Questions carrying one mark  
(Objective/multiple choice, covering full syllabus)  
- 80 questions

Part II : Aptitude section  
Reading Comprehension data Sufficiency & Data Interpretation, Logical Reasoning computer awareness  
- 20 questions

TOTAL 100 marks

Sports Medicine

Unit: I  
a) Concepts and content of sports medicine  
b) Duties of athletic trainer. c) Role of Sports physician

Unit: II  
a) Concept of Doping:  
i) Doping classes: Stimulant, Narcotic analgesic, Anabolic Steroids, Beta Blockers, Diuretics.  
ii) Doping methods: Blood Doping, Pharmacological, chemical and physical manipulation.  
iii) Classes of drugs subject to certain restriction, Alcohol, Marijuana, Local anesthetics, Cortico steroids  
b) Smoking and its bad effects.

Unit: III  
Therapeutic modalities:  
Hydrotherapy: Treatment and rehabilitation in the following  
Electro therapy: Conditions  
Heat therapy: Sprain, Strain, low lack problem and Remedial exerciser

Unit: IV  
A) Specific sports injuries of shoulder Elbow, wrist and fingers, Abdomen, thigh, knee, ankle and foot.  
B) Nutrition:  
a) Preparation of diet for various games and sports- Body weight and caloric need of sports and games.  
b) Caloric value of different food items  
c) Body height and weight index.
Books for Reference:

1) Leonard Lorson - Foundations of Muscular activity
2) Williams J.G.P. - Sports medicine
3) Alok Ghosh - Handbook of sports medicine and Physical fitness.
4) Park J.E. - Preventive and social medicine
5) Eriksson B.O and - Sports medicine, Health and Others Medication.
6) Berger R.A. - Applied Exercise Physiology
7) Sundararajan G.S - Sports medicine
8) Herbert A De vries - Physiology of Exercises
9) Khanna G.C. & Exercise physiology and Sports
10) Clarke D.H. - Exercise Physiology
11) Pacharui S.K. - Sports medicine
12) Dr. Sharma N.P. - Handbook of sports medicine
13. Shaver L.G. - Essentials of exercise physiology
14. Appenzellar Otto - Sports medicine-fitaess-Training
15. Dr. Pande P.K. - Outline of sports medicine
16. Dr. Pande P.K. - Know How sports medicine
17. Roy 85 Irwin - Sports medicine.

Sports Physiology

Unit: I

Structure and function of Muscle:
Classification of muscles, structure of muscle tissues, Various theories of muscular contraction: Hypertrophy of muscle in relation to physical activity.

Unit: II

Neuromuscular Physiology:
Neuro Motor units, Neuro muscular junction, Bioelectric potential, Muscle tone, posture and equilibrium.

Unit: III

Bio-Energetics:
Fuel for muscular work and energy for muscular contraction, Aerobic and Anaerobic system, Inter relationship of Aerobic and anaerobic system with special reference to different activities, Anaerobic Threshold training.

Unit: IV

Physiological Changes due to exercise and training:
Books for Reference:


Sports Psychology

Units I
B) History, development & importance of Sports psychology
C) Future of psychology in physical educational & Sports

Units II
Personality: Definitions, Dimensions of personality.
C) Physique-mind and intellect, emotional stability social stability.
D) Factors affecting the development of personality. -Traits of sportsman through sports participation.
E) Assessment of sports personality.

Units III
Principles in sports psychology: Psychology and sports performance
a) Principles and application.
b) Coaching, Decisions and Research in sports psychology.

Units IV
Intelligence
Intelligence of sports performance, Motivation
Definition: Motives, Drive, Need.
Organic motives-Emergency motives-objectives motives.
Learning
Theories of Learning
1) Association Theories of Learning.
2) Cognitive Theories of Learning
3) Cybernetic Theories of Learning

Books for Reference:

I. Psychology in sports- by Richard in suinn, Published by- Surjeet publications T.K. Kolhapur Road, Kamala Nagar, Delhi:
2. Psychology in P.E and Sports by Dr. M.L. Kamalesh Published by Metropolitan Book Co. Pvt. Ltd. 1 Netaji Subhash Marg New Delhi.

Sports Nutrition

Unit I
Introduction to Sports Nutrition
Importance & Scope of Sports Nutrition
Concept of Sports Nutrition.
Trends in Sports Nutrition

Unit II
Content of Nutrition
Proportion of carbohydrates, fat & protein
Principles of Sports Nutrition
Recommendation for fat & protein
Water, exercise & dehydration
Unit III

Diet prescription & ergogenic aids
Sports supplement
Nutrition according to Body composition & for special population
Pre meal, exercise & energy expenditure

Unit IV

Proportion of diet content.
Sports supplement.
Intake & energy expenditure.

Books for Reference:


Sports Training

Unit 1

Introduction and Trends in Sports Training
Meaning, Definition, Scope of Sports Training
Aim and Characteristics of Sports Training
Trends in Sports Training
Talent Identification

Unit 2

Training Methods
Principles of Sports Training,
Load, Adaptation, Recovery
Sports Fitness Training Methods
Periodization

Unit 3

Training Program
Long Term and Short Term Training Plans
Technique, Skill, and Psychological Training
Design Training Program
Evaluation of Training Program

Books for Reference:


**Sports Biomechanics**

Unit 1

Introduction and Trends in Biomechanics
Meaning, Definition, Scope of Biomechanics
Importance of Biomechanics
Trends in Biomechanics

Unit 2

Analysis of Techniques and Training
Analysis of fundamental Skills and Sports Skills
Video Film Analysis - Cinematography and Videography
Tools of Biomechanical Analysis - Electrography and Dynamography - LED’s and Electromagnetic Markers - Force transducers and Pressure Sensors

Unit 3

Skill Analysis
Athletics – Field Event
Athletics – Track Events
Athletics – Jumping Events

Unit 4

Skill Analysis of Various Sports events: Cricket, Foot ball, Basket ball, hockey, Archery, Badminton

Books for Reference: