

परिशिष्ट-दो  
"पाठ्यक्रम"

"प्रश्नपत्र-1"

भाग-1

छत्तीसगढ़ का सामान्य ज्ञान

1. छत्तीसगढ़ का इतिहास एवं स्वतंत्रता आंदोलन में छत्तीसगढ़ का योगदान।
2. छत्तीसगढ़ का भूगोल, जल, खनिज संसाधन, जलवायु एवं भौतिक दशायेँ।
3. छत्तीसगढ़ की साहित्य, संगीत, नृत्य, कला एवं संस्कृति।
4. छत्तीसगढ़ की जनजातियाँ, बोली, तीज एवं त्यौहार।
5. छत्तीसगढ़ की अर्थव्यवस्था, वन एवं कृषि।
6. छत्तीसगढ़ का प्रशासनिक ढांचा, स्थानीय शासन एवं पंचायती राज।
7. छत्तीसगढ़ में मानव संसाधन एवं ऊर्जा संसाधन।
8. छत्तीसगढ़ में शिक्षा, स्वास्थ्य एवं समसामयिक घटनाएं।

Part-1

General Knowledge of Chhattisgarh

1. History of Chhattisgarh and contributions of Chhattisgarh in freedom struggle.
2. Geography, water, mineral resources, climate and physical conditions.
3. Literature, music, dance, art and culture of Chhattisgarh.
4. Tribals, dialects, teej and festivals of Chhattisgarh.
5. Economy, forest and agriculture of Chhattisgarh.
6. Administrative structure of Chhattisgarh, local government and Panchayati Raj.
7. Human Resources and energy resources in Chhattisgarh.
8. Education, health and contemporary events in Chhattisgarh.

भाग-2

संबंधित विषय

(01) - ENGLISH

The paper will cover the study of English literature from Shakespeare to 1950. A first hand reading of the prescribed texts and critical ability is required to be tested.

I Literary Forms

Poetry : Lyric, Ode, Sonnet, Elegy, Satire, Epic  
Drama : Tragedy, Comedy, Farce, Melodrama,  
One Act Play, Masque

II William Shakespeare: General questions on the writer and a critical study of the following works: Hamlet, The Tempest

III A critical study of the following poets with reference of the poems shown against each of them:

Milton	:	Sonnets
Pope	:	Essay of Man
Johnson	:	The Vanity of Human Wishes
Wordsworth	:	Tintern Abbey, Immortality Ode, Milton
Keats	:	Odes
Tennyson	:	Ulysses
Browning Robert:	:	Andrea Del Sarto, Rabbi Ben Ezro
Arnold	:	Dover Beach

IV The works of the following novelists with special reference to the novels mentioned against each of them:

Dickens	:	Oliver Twist
Thomas Hardy	:	Tess of the D'urbervilles
Thackeray	:	The History of Henry Esmond
Aristotle	:	Poetics
Longinus	:	On the Sublime
Dryden	:	Essay on Dramatic Poesie
Coleridge	:	Biographia Literaria
Arnold	:	The Study of Poetry, The Function of

Eliot	:	Criticism at the present time Tradition and Individual Talent, Milton and II'Penseroso
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V(a) A critical study of the 20th century writers and their works:

E.M. Forster	:	A Passage to India
D.H. Lawrence	:	Sons and Lovers
G.B. Shaw	:	Saint Joan
W.B. Yeats	:	Byzantium, The Second Coming, A Prayer to My Daughter
T.S. Eliot	:	Gerontion, The Waste Land
W.H. Auden	:	In Memory of W.B. Yeats, The Shield of Achilles

(b) American Literature

Emerson	:	The American Scholar
Thoreau	:	Civil Disobedience
Hawthorne	:	The Scarlet Letter
S. Crane	:	The Red Badge of Courage
Eugene O'Neill	:	The Hairy Ape.

(02) - भौतिकशास्त्र

1. यांत्रिकी :- संरक्षण नियम, जड़त्वीय एवं अजड़त्वीय निर्देशतन्त्र, आपेक्षिकता का विशिष्ट सिद्धान्त, लारेंज रूपांतरण,  $E=MC^2$ , दृढ पिण्डों की गति, कोणीय संवेग, बरनौली समीकरण एवं स्टोक का नियम, प्रत्यास्थता, दण्डों एवं स्तम्भों का बंकन, ऐंठन के कारण बल युग्म, पॉइसन निष्पत्ति।
2. गणितीय भौतिक :- सदिश, प्रवणता (Gradient), अपसरण एवं कर्ल की अभिधारणा, गॉस और स्टोक के प्रमेय, आव्यूह गुणन, विभिन्न प्रकार के आव्यूह, रेखीय समीकरण निकाय, आइगन मान और आइगन फलन।
3. उष्मीय तथा सांख्यिकीय भौतिकी :- उष्मा गतिकी के विभिन्न नियम, बिन्दु फलन और मार्ग फलन की अभिधारणा, कार्नों का प्रमेय, ताप का परम मापकम, एन्ट्रॉपी, उष्मागतिक विभव, मैक्सवेल संबंध और उसके अनुप्रयोग, मैक्सवेल बौल्ड्समेन वितरण, गिब्स संयोजन की अभिधारणा, चिरसम्मत (कैनोनिकल) समुदाय, एन्ट्रॉपी की सांख्यिकीय व्याख्या, बोस आइन्स्टीन एवं फर्मी-डिरांक सांख्यिकीय।
4. तरंगे एवं दोलन :- एक विमीय तरंग का समीकरण तथा उसका हल, ठोस में प्रत्यास्थ तरंगे एवं गैस में दाब तरंगे, कला वेग और समूह वेग, मुक्त, प्रेरणित और स्थापित कम्पन, अनुनाद, विशेषता गुणांक। व्यतिकरण, न्यूटन वलय, बाईप्रिज्म, माइकल्सन व्यतिकरण मापी, विवर्तन, फ्रेनल और फ्राऊनहॉफर विवर्तन, एकल, द्वि एवं n झिरियों द्वारा विवर्तन, जोन प्लेट, वर्ण विक्षेपण क्षमता और विभेदन क्षमता, विभेदन की रैले की कसौटी, ध्रुवन, अर्धतरंग पट्टिका एवं चतुर्थांश तरंग पट्टिका, समतल ध्रुवित, वृत्तीय ध्रुवित एवं दीर्घवृत्तीय ध्रुवित प्रकाश का उत्पादन एवं विश्लेषण, स्वतः एवं उद्दीपित उत्सर्जन, लेसर का सिद्धान्त।
5. विद्युतचुम्बकीय प्रेरण, स्वप्रेरण एवं इलेक्ट्रानिक्स :- स्व एवं अन्योन्य प्रेरण, LCR परिपथ, श्रेणी एवं समान्तर परिपथ, स्वीकारक और अस्वीकारक परिपथ, मैक्सवेल समीकरण और विद्युतचुम्बकीय तरंगे, पॉइंटिंग सदिश। अन्तर्वर्ती और बहिर्वर्ती अर्धचालक, P-N सन्धि, जेनर डायोड, दृष्टीकरण एवं प्रवर्धन में डायोड एवं ट्रांजिस्टर का उपयोग, रेडियो आवृत्ति तरंगों का मॉडुलेशन एवं संसूचन, लॉजिक द्वार।
6. प्रकाशीय एवं X किरण वर्तक्रम :- परमाणु का वेक्टर मॉडल, वर्णक्रम रेखाओं की सूक्ष्म संरचना, J-J युग्मन और L-S युग्मन, सामान्य और असामान्य जीमन प्रभाव, रमन प्रभाव, रेडियोधर्मिता, नाभिकीय बंधन ऊर्जा, विखंडन और संलयन, मूल भूत कण और उनका वर्गीकरण, साईक्लोट्रॉन, अतिचालकता की प्रारंभिक

अभिधारणा।

7. **लेग्रान्जी समीकरण**, हेमिल्टन का सिद्धांत, फर्मेट का न्यूनतम क्रिया नियम, गोलीय संनादी एवं फलन, लेजेन्ड्रे, बैसल और हरमाईट पोलीनामियल, कांची-रिमन अवस्था, कांची समाकलन प्रमेय और सूत्र।
8. **क्वान्टम यांत्रिकी** :- गतिक चरों का संकारक द्वारा निरूपण, आपरेटर का बीज गणित, श्रोडिंजर तरंग समीकरण एवं उसके अनुप्रयोग, बॉक्स में मुक्त कण, विभव प्राचीर, सरल आवर्ती दोलित एवं हाइड्रोजन परमाणु, कक्षीय कोणीय संवेग की अभिधारणा, आइंगन मान और आइंगन फलन  $L_x$ ,  $L_y$ , एवं  $L_z$ , क्रम - विनिमेय नियम।
9. **नाभिक के मूल गुण धर्म** :- द्रव - बूँद मॉडल, नाभिकीय कोश मॉडल, अभिक्रिया परिच्छेद, नाभिकीय अभिक्रियाएँ, बोर का नाभिकीय सिद्धांत, नाभिकीय विखंडन एवं इसकी द्रव बूँद मॉडल द्वारा व्याख्या। प्लाज्मा, प्लाज्मा अवस्था में संलयन अभिक्रिया, संलयन रियेक्टर, तारकीय ऊर्जा।
10. **टोस का बैंड सिद्धांत**, चालक, धातुओं का मुक्त इलेक्ट्रॉन मॉडल, ऊर्जा अवस्थाओं का घनत्व, फर्मी ऊर्जा, ऊर्जा बैंड का क्रोनिंग-पैनी माडल, हॉल प्रभाव, अनुचुम्बकत्व का लैन्जेविन सिद्धांत एवं क्यूरी वॉइस नियम।

### (02) - PHYSICS

1. **Mechanics** :- Conservation Laws, Inertial and non inertial frame of reference, Special theory of Relativity, Lorentz transformation,  $E=MC^2$ , Motion of rigid bodies, Angular momentum, Bernoulli's equation and Stoke's law, Elasticity, Bending of beams and cantilever, Couple due to twisting, Poisson's ratio.
2. **Mathematical Physics** :- Vectors, concept of Gradient, Divergence and Curl, Gauss and Stoke's theorem, Matrice Multiplication, different type of Matrices, System of equations, Eigen values and Eigen functions.
3. **Thermal and Statistical Physics** :- Different laws of thermodynamics, Concepts of point function and Path Functions, Carnot's theorem, Absolute scale of temperature, Entropy, Thermodynamic potentials, Maxwell's relation and their applications, Maxwell-Boltzmann distribution, Concepts of Gibb's Ensemble, Canonical ensemble, Statistical interpretation of entropy, Bose-Einstein and Fermi-Dirac Statistics.
4. **Waves and Oscillations** :- One dimensional wave equation and its solution, Elastic Waves in solids and pressure waves in gases, phase velocity and Group velocity, free, forced and maintained vibrations. Resonance, Quality factor, Interference, Newton's ring, Biprism, Michelson interferometer, Diffraction, Fresnel and Fraunhofer class of diffraction. Diffraction due to single, double and n slits. Zone plate, Dispersive Power and Resolving Power, Rayleigh's criterion for resolution, Polarization, Half wave plate and quarter wave plate, production and analysis of plane circularly and elliptically polarized light, spontaneous and stimulated emission, Principle of LASER.
5. **Electromagnetic Induction and Electronics** :- Self and mutual inductance, LCR circuits, series and parallel circuits, Acceptor and Rejecter circuits, Maxwell's equation and Electromagnetic waves, Poynting vector, Intrinsic and extrinsic semiconductors, P-N junction, Zener diode, Use of diodes and transistors for rectification and amplifications, modulation and detection of radio frequency Waves, Logic gates.
6. **Optical and X-ray spectra**:- Vector model of the atom, fine structure of spectral lines, J-J and L-S couplings, Normal and anomalous Zeeman effect, Raman effect, Radio activity, nuclear binding energy, fission and fusion, Elementary particles and their classification, Cyclotron, Elementary idea of super conductivity.
7. **Lagrange's Equation**, Hamilton's Principles, Fermat's principle of least action, Spherical harmonics and functions,

Legendre, Bessel and Hermite Polynomials, Cauchy's Reimann condition, Cauchy's integral theorem and formula.

8. **Quantum Mechanics**:- Representation of dynamic variables by operators, Operators Algebra, Schrodinger wave equation and its application, Free particle in a box, Potential barrier, Simple harmonic oscillator and Hydrogen atom, Concept of orbital angular momentum. Eigen values and Eigen function  $L_x$ ,  $L_y$ , and  $L_z$ , Commutative rules.
9. **Basic Properties of nucleus**:- Liquid drop model, nuclear shell model, reaction cross section, nuclear reaction, Bohr's nucleus theory. Nuclear fission and its explanation by liquid drop model, Plasma, fusion reaction in Plasma, fusion reactor, stellar energy.
10. **Band theory of solids**, conductors, free electron model of metal, density of states, fermi energy, Kronig-Penny Model for energy bands. Hall effect. Langevin's theory of paramagnetism and Curie Weiss Law.

### (03) - राजनीतिशास्त्र

1. प्राचीन भारतीय राजनैतिक विचार के प्रमुख लक्षण, मनु और कौटिल्य, प्राचीन यूनानी विचारधारा की विशेषताएँ प्लेटो, अरस्तू, मध्यकालीन राजनैतिक विचार की सामान्य विशेषताएँ, संत थामस एक्विनास, मार्सिलियो ऑफ पेडुआ, मैकियावेली, हॉब्स, लॉक, मॉन्टेस्क्यू रूसो, बेन्थम, जे.एस.मिल, टी.एच. ग्रीन, हीगेल, मार्क्स, लेनिन और माओ-त्से-तुंग, लास्की।
2. राजनीति विज्ञान का स्वरूप और क्षेत्र:- स्वतंत्र विषय के रूप में राजनीति विज्ञान का विकास राजनीति एक विशिष्ट मानव व्यवहार के रूप में परम्परागत बनाम समसामयिक उपागम, व्यवहारवाद व्यवस्था और सिद्धान्त और अन्य आधुनिक उपागम उत्तर व्यवहारवादी राजनीतिक विश्लेषण, राजनीतिक विश्लेषण का मार्क्सवादी उपागम।
3. आधुनिक राज्य की उत्पत्ति और स्वरूप: संप्रभुता, संप्रभुता का अद्वैतवादी और बहुल सत्तावादी विचार, शक्ति, सत्ता, वैधता, राष्ट्र राज्य प्रणाली।
4. राजनैतिक बाध्यताएँ - प्रतिरोध, क्रांति, अधिकार, स्वतंत्रता, समानता, न्याय।
5. लोकतंत्र का सिद्धान्त।
6. राजनीतिक विचारधाराएँ - आदर्शवाद, व्यक्तिवाद, समाजवाद (लोकतांत्रिक और फैंबियन) उदारवाद, फासीवाद, मार्क्सवादी।
7. तुलनात्मक राजनीति के अध्ययन के उपागम: पारंपरिक और संरचनात्मक-प्रकार्यात्मक उपागम, राजनीतिक समाजीकरण, राजनीतिक सम्प्रेषण और राजनीतिक विकास की अवधारणा।
8. दल व्यवस्था और राजनीतिक प्रक्रिया - दल व्यवस्था, दबाव समूह, प्रतिनिधित्व और निर्वाचन व्यवस्थापिका, कार्यपालिका, न्यायपालिका, नौकरशाही।
9. भारतीय शासन व राजनीति:
  - (क) आधुनिक भारत में राष्ट्रवाद एवं उप निवेशवाद राजा राममोहन राय, दादाभाई नौराजी, गोखले, तिलक, श्री अरविंद, भीमराव अंबेडकर, एम.एन. रॉय गांधी और नेहरू।
  - (ख) गठन : भारतीय संविधान सभा का गठन - प्रस्तावना मौलिक अधिकार और निर्देशक सिद्धान्त, संघ सरकार, राष्ट्रपति, प्रधानमंत्री, मंत्रिमण्डल, संसद और संसदीय प्रक्रिया उच्चतम न्यायालय और न्यायिक सक्रियतावाद, न्यायिक समीक्षा, भारतीय संघवाद, केन्द्र-राज्य संबंध, राज्य सरकार-राज्यपाल की भूमिका, पंचायती राज।
  - (ग) कृत्यकारी - भारतीय राजनीति में वर्ग, जाति, क्षेत्रवाद, भाषावाद और संप्रदायवाद की राजनीति, धर्मनिरपेक्षता और राष्ट्रीय एकीकरण की समस्याएँ, राजनैतिक श्रेष्ठिधर्म, परिवर्तनकारी घटक, राजनैतिक दल और राजनैतिक सहभागिता, आयोजना

और विकासात्मक प्रशासन, सामाजिक आर्थिक परिवर्तन और भारतीय लोकतंत्र पर उसका प्रभाव, संविधान संशोधन।

10. भारत की विदेश नीति  
(अ) निर्धारक तत्व और विशेषताएँ, पंचशील।  
(ब) भारत का उसके पड़ोसियों से संबंध – पाकिस्तान, चीन, बांग्लादेश, नेपाल, श्रीलंका और अफगानिस्तान।  
(स) भारत का उच्च सत्ताओं से संबंध – संयुक्त राज्य अमेरिका, सोवियत संघ/रूस से संबंध।  
(द) भारत और अन्य संगठन – संयुक्त राष्ट्र संघ, राष्ट्रमण्डल, सार्क, अफ्रो-एशियाई एकता, गुटनिरपेक्ष आन्दोलन।  
(इ) दृष्टिकोण :- भारतीय दृष्टिकोण, अरब-इजरायल संघर्ष, कांगो, कोरिया, निकारागुआ में अमेरिकी हस्तक्षेप।  
(फ) नीतियाँ :- अन्तर्राष्ट्रीय शांति व सुरक्षा, निरस्त्रीकरण, मानव अधिकार, पर्यावरणीय मुद्दे, उत्तर दक्षिण संवाद, दक्षिण-दक्षिण संवाद, परमाणविक नीति, वैश्वीकरण।  
(ज) गुटनिरपेक्षता का मूल्यांकन एवं प्रासंगिकता।

### (03) - POLITICAL SCIENCE

- Main features of Ancient Indian political thought, Manu and Kautilya; Characteristics of ancient Greek Thought - Plato, Aristotle, General features of Medieval Political Thought - St. Thomas Aquinas, Marsiglio of Padua, Machiavelli, Hobbes, Locke, Montesquieu, Rousseau, Bentham, J.S. Mill, T.H. Green, Hegel, Marx, Lenin and Mao-Tse-Tung, Laski
  - Nature and scope of Political Science: Growth of Political Science as an independent discipline. Politics as a specific human behavior, Traditional Vs. Contemporary approaches to the study. Behaviouralism Systems Theory and other recent approaches, Post-behaviouralism, political analysis: Marxist approach to political analysis.
  - The emergence and nature of the Modern State Sovereignty, The Monistic and Pluralistic thought of Sovereignty: Power, Authority and Legitimacy, Nation-States System.
  - Political Obligation-Resistance, Revolutions, Rights, Liberty, Equality, Justice.
  - Theory of Democracy;
  - Political Ideologies – Idealism, Individualism, Socialism, (Democratic and Fabian) Liberalism, Fascism and Marxism.
  - Comparative Politics- Traditional and Structural Functional approach, concept of Political Socialisation, Political communication, Political Development.
  - Party System and Political Procedure – party system, Pressure Groups, Representation and Election, Executive, Legislature, Judiciary, Bureaucracy.
  - Indian Govt. and Politics  
(a) Nationalism and Colonialism in Modern India, Raja Ram Mohan Roy, Dadabhai Naoroji, Gokhale, Tilak, Sri Aurobindo, B.R. Ambedkar, M.N. Roy, Gandhi, Nehru.  
(b) Constitution of India – formation, Preamble, Fundamental Rights and Directive Principles of State Policy; Union Government-President, Parliament, Prime Minister and Cabinet; Parliament and Parliamentary Procedure; Supreme Court and Judicial Review and Judicial Activism; Indian Federalism, Centre-State Relations, Role of Governor, Panchayati Raj.  
(c) The Functioning – Role of Class, Caste, Language, Region and Communalism in Indian Politics, Secularism, National Integration, Political Elites, Changing Composition, Political Parties and Political Participation, Planning and Developmental Administration, Socio-Economic changes and their impact on Indian Democracy. Constitutional Amendment.
10. Indian Foreign Policy.

- Determinating Elements, Characteristics, Panchsheel.
- Relations with Neighbours ; Pakistan, China, Bangla Desh, Nepal, Sri Lanka & Afghanistan.
- Relations with Super Powers ; USA, USSR/Russia.
- India and other Organisations- United Nations Organisation, Commonwealth, SAARC, Afro-Asian Solidarity, non-alignment movement
- Attitudes-Indian Attitudes on Arab-Israel Conflict, Congo, Korea, US intervention in Nicaragua.
- Policies – International Peace and Security, Disarmament, Human Rights, Environmental issues, North-South Dialogue, South-South Dialogue, Nuclear Policy, Globalisation.
- Estimation of Non-alignment and Relevance

### (04) - हिन्दी

प्राचीनकाल से लेकर आज तक के हिन्दी साहित्य के इतिहास का सामान्य ज्ञान अपेक्षित होगा। हिन्दी साहित्य के इतिहास के किसी भी काल खण्ड और रचना प्रवृत्ति पर प्रश्न पूछे जा सकेंगे। पाठ्य – सामग्री से व्याख्या के अतिरिक्त कवियों/लेखकों के रचनात्मक अनुदान पर आलोचनात्मक प्रश्न पूछे जा सकेंगे।

- निम्नलिखित प्राचीन कवियों की कविताएँ :-**  
कबीर-कबीर ग्रंथावली, नागरी प्रचारिणी सभा, सं.-श्याम सुंदर दास, प्रथम 100 साखियों, सूरदास-भ्रमर गीत सार सम्पादक- आचार्य रामचन्द्र शुक्ल, प्रथम पचास पद, तुलसी दास-विनय पत्रिका, (गीता प्रेस गोरखपुर), प्रथम पचास पद, घनानंद कवित्त (सं. – विश्वनाथ प्रसाद मिश्र) प्रथम पचास कवित्त।
- निम्नलिखित आधुनिक कवियों की कविताएँ:-**  
जयशंकर प्रसाद – कामायनी (श्रद्धा सर्ग), सूर्यकान्त त्रिपाठी निराला-राम की शक्ति पूजा, बादल राग, कुकुरमुत्ता। सुमित्रानंदन पंत – परिवर्तन, नौकाविहार, संध्या के बाद, ताज। सच्चिदानंद हीरानंद वात्स्यायन अज्ञेय – नदी के द्वीप, यह द्वीप अकेला, कलगी बाजरे की, हरी घास पर क्षण भर, अंत: सलिला। मुक्तिबोध-भूल-गलती, ब्रम्हराक्षस, अंधेरे में।
- निम्नलिखित उपन्यास:-**  
प्रेमचंद – गोदान, फणीश्वरनाथ रेणु – मैला आँचल, भीष्म साहनी – तमस।
- निम्नलिखित नाटक:-**  
जयशंकर प्रसाद – स्कंदगुप्त, धर्मवीर भारती – अंधायुग, मोहन राकेश – आधे-अधूरे।
- निम्नलिखित निबंध:-**  
सरदार पूर्ण सिंह – मजदूरी और प्रेम, पं. रामचन्द्र शुक्ल-श्रद्धा-भक्ति, कविता क्या है? डॉ. हजारी प्रसाद द्विवेदी – अशोक के फूल।
- भारतीय व पाश्चात्य काव्य-सिद्धांत:-**  
रस संप्रदाय, अलंकार संप्रदाय, वक्रोक्ति संप्रदाय, अनुकरण सिद्धांत, विरेचन सिद्धांत, अभिव्यंजनावाद।
- आधुनिक हिन्दी कविता के प्रमुख वाद:-**  
छायावाद, प्रगतिवाद, प्रयोगवाद
- भाषा विज्ञान:-**  
भाषा परिवर्तन के कारण, ध्वनि परिवर्तन के कारण व दिशाएँ, अर्थ परिवर्तन के कारण व दिशाएँ, हिन्दी भाषा का विकास। देवनागरी लिपि की विशेषताएँ, हिन्दी शब्द समूह।

### (05) - संस्कृत

- काव्य ग्रंथ :- वैदिक साहित्य का इतिहास :-**  
संहिता – ऋग्वेद, यजुर्वेद, सामवेद एवं अथर्ववेद का सामान्य परिचय। ब्राह्मण, आरण्यक एवं उपनिषद् ग्रंथों का संक्षिप्त परिचय। वेदांगसाहित्य का सामान्य ज्ञान। ऋग्वेद संहिता के सूक्त-अग्नि-1.1, उषस् - 1.18, विष्णु-1.154, इन्द्र - 2.12, रुद्र - 2.33, वरुण -

- 7.86, मंडूक-7.103, अक्षसूक्त - 10.34, पुरुष सूक्त - 10.90, नासदीय सूक्त - 10.129 ।
2. **लौकिक संस्कृत साहित्य का इतिहास :-**  
रामायण, महाभारत, पुराण, महाकाव्य, गद्यकाव्य, चम्पू साहित्य, कथासाहित्य, नाटक, गीतिकाव्य, ऐतिहासिक महाकाव्य ।
3. **व्याकरण :-**  
सन्धि, कारक एवं समास
4. **काव्यग्रंथ :-**  
अभिज्ञान शाकुन्तलम् (सम्पूर्ण) - कालिदास प्रणीतम् ।  
किरातार्जुनीयम् (प्रथमसर्ग) - भारविकृतम् ।  
शिशुपालवधम् (प्रथमसर्ग) - माघकृतम् ।  
कादम्बरी (शुकनासोपदेशः) - बाणभट्टकृतम् ।  
स्वप्नवासवदत्तम् - भासकृतम् ।
5. **काव्यशास्त्र :-**  
काव्य प्रयोजन, काव्य हेतु, काव्यलक्षण, काव्य - भेद ।  
अलंकार - अनुप्रास, यमक, रूपक, उपमा, उत्प्रेक्षा, विभावना, विशेषोक्ति, अर्थान्तरन्यास, निदर्शना तथा अपह्नुति ।
6. **संस्कृत से हिन्दी/अंग्रेजी में अनुवाद ।**

### (06) - MICROBIOLOGY

- I. **General Micro biology -**  
Microbiology, Microscopic measurements, Types of microbes, phase contrast, dark field and fluorescence. Sterilization techniques, preparation of Culture media, culture techniques. Microbial growth measurements, Types of dye staining.
- II. **Bacteriology -**  
Morphology and ultra structure of bacteria, nomenclature of bacteria, Classification of bacteria
- III. **Virology -**  
Brief outline on discovery of viruses. nomenclature and classification of viruses, Viral genome, viral related agents, (Virions & Prions) Bacteriophages structure and organization Plant Viruses - classification nomenclature and effect of viruses on Plants, Prevention of crop loss due to virus infection Animal Viruses- Classification and nomenclature of animal and human viruses.
- IV. **Mycology and Physiology -**  
Mycology - Micro fungi, general feature of fungi, classification of fungi general life cycle of fungi, fungi and ecosystem. Phycology - Micro algae, General feature, Classification and general life cycle of algae, Algae & ecosystem.
- V. **General Biochemistry-**  
Biochemistry of bacteria, animal and plant cell, Specialized components of microorganisms and their structure and function. Enzymes- their classification and kinetics. Structural features and chemistry of micro molecules. Bioenergetics and strategy of metabolism.
- VI. **Molecular Biology:-**  
Nucleic acid as genetic information carriers, Structural feature of DNA and its relation to function, DNA - replication, DNA repair system. Structural feature of RNA and its relation to function. Regulation of gene expression, maturation and processing of RNA. Protein Synthesis
- VII. **Microbial Genetics-**  
Gene as a Unit of mutation and recombination. Gene transfer mechanism, plasmids.  
Microbial genetics and design of vaccines.
- VIII. **Microbial physiology and development-**  
Basic concept of bioenergetics. Brief account of photosynthetic and accessory pigments.  
Respiration metabolism. Assimilation of nitrogen. Microbial development, sporulation and morphogenesis.
- IX. **Environmental Micro biology -**

- Aero biology  
Aquatic micro biology  
Soil micro biology  
Waste treatment  
Positive and negative roles of microbes in environment.
- X. **Microbial diversity-**  
Diversity of Microbial world, extremophiles, Basic ecological principle and microbes
- XI. **Food Microbiology -**  
Food as substrate for microorganisms.  
Contamination and spoilage of food materials.  
Food borne infections and intoxications.  
Food fermentation.  
Food produced by microbes.
- XII. **Medical Micro biology -**  
Early discovery of Pathogenic microorganisms;  
Classification and general properties of bacteria and viruses;  
Anti microbial therapy;
- XIII. **Microbial technology -**  
Biotechnology and microbiology;  
Fermentation technology;  
Industrial production of citric acid, enzymes, ethanol, acetic acid, antibiotics and steroids;  
Bio-fertilizer, Bio-pesticides, Mushroom Production, Biopolymers, Bioremediation;  
Scale-up, instrumentation control, physical and chemical environment sensors, downstream process;
- XIV. **Immunology -**  
Immune system and immunity;  
Antigens and antibodies;  
Antigens- antibodies Reactions;  
Tumor immunology;  
Hyper sensitivity reactions;  
Immunity to infections;
- XV. **Biostatistics -**  
Introduction- definition of statistics and importance in microbiology, Mean, Median and Mode, Standard deviation, Standard error, Histogram, Tabulation, Normal distribution, Binomial distribution and Poisson distribution, Chi- square test and T-test.
- XVI. **Bioinformatics & Biophysics -**  
Over view of bioinformatics, genomics & genome project, phylo-genetics and bioinformatics protein analysis, Scope and methods of biophysics, methods in biophysical analysis.
- XVII. **Computer in Microbiology-**  
Computer Basics, Operating systems, windows and Unix, Hardware, Software, Disk Operating System, Multimedia, Network Concepts, C-programming, HTML & XML
- XVIII. **Recombinant DNA Technology -**  
Core Techniques and essential enzymes used in RDNA technology, Cloning Vectors, Specialized cloning strategies, PCR methods and application, DNA Sequencing methods.

### (07) - HOME SCIENCE

- Food Science  
Food Group  
Food Preparation  
Food Preservation  
Food Science & Food Analysis  
Food Processing
- Nutrition Science  
Fundamentals of nutrition  
Nutritional Biochemistry  
Food microbiology  
Public nutrition
- Food and Nutrition  
Food Science and Quality Control  
Macro and Micro Nutrients

Human Nutritional Requirements Assessment of Nutritional Status	Advanced child study methods and assessment Women's Studies, Family Welfare Programme- Recent Approaches
Institutional Management Management of Hospitality Institutes – Hospital/Hotel/ Restaurant/Cafe and Outdoor catering Management of Social Institutes – family as Institute, child care and Geriatric institutes, Panchayats Management of Educational Institutes – Preschool, primary & Secondary Schools, (College and Universities) Higher Educational Institutes. Management of Special Institutes for physically and socially challenged Challenges and Problems faced by Institutions.	Children with special needs and children at risk( child labour, street children, child abuse, chronically sick); Intervention programme Socialisation in various family contexts across different cultures
Clothing Principle of clothing-Socio – Psychological aspects of clothing, selection of fabrics, clothing and family clothing Clothing construction – basic principle of drafting, flat pattern and draping methods Textile Design – principles and concepts Fashion Design – fashion cycles, business and merchandizing Care and maintenance of textile materials and garments ; Laundru agents-methods and equipments	Non-formal Education and Extension Education History and Development of Home Science in Formal/Non-formal and Extension Education Theory and Practices of proramme/curriculum planning and development Management and Administration of Formal/ Non formal and Extension Education Monitoring, Supervision and Evaluation of Formal,Non-formal and Extension Education Vocationalisation of Home Sciences in India Theories and Principles of Guidance and Counselling in Formal/ Non-formal/ Extension
Textiles General properties and fine structure of all textile fibers Processing and manufacture of all natural and man-made fibers Definition and classification of yaens: identification of yarns and its use in various fabrics Fabric construction, definition and types of woven, non-woven, knitted and other construction techniques Testing of fibers, yarns and fabric; Importance of quality control and research institutes	Developmental and Educational Communication Concept and classification of communication Traditional Methods and Materials of communication-selection/ preparation/ use Modern Methods and Materials of communication- selection/ preparation/ use Strategies for developmental communication Classroom communications in Home Science trends Communication for publicity and public relations Change and challenges in communication in contemporary society
Clothing and Textiles Textile chemistry- Fibers and dyes Dyeing, printing and finishing of fibers yarns and fabrics Textile and Apparel Industry – Fundamental of Business, specifications, quality control agencies and marketing Historic and Traditional Textile of world with emphasis on India	Home Science Extension Education Curriculum Development for formal education in Home Sciences General and special methods of teaching Home Science Media and Materials for promoting Home Science in Formal/ Non-formal/ Adult/ Extension Education Non-formal and Adult Education in Home Science Extension Education in Home Science Women in Changing India and plans for their development Self-employment and Entrepreneurship through Home Science Programme of Extension in Home Science Measurement and Evaluation including monitoring and supervision for Formal/ Non-formal/ Education/ Extension Education
Family Resource Management Concept of Home Management Management of Human Resources: Classification of Resources; Basic Characteristics of Resources. Decision making in family: Steps in decision making; Methods of resolving conflicts; Work simplification; Importance of work simplification in home; Mudels classes of change; Simple pen and pencil technique in work simplification Housing, Interior Design, Principles of Interior design, various colours and colour schemes Household equipment- Selection and Care Family resources- management of Resouces like time energy and money; Basic characteristics of Resources; Efficient methods of utilization of Resources Family life cycle-Demands upon resources like time, energy and money Concept of Egronomics-its importance and application in home Consumer Education- Laws protecting consumer; Role of consumer society in protecting consumer; kinds of adulteration; Identification of adulteration	Methods of Research Trends in Research in Home Science Research Designs Types of Rsearch Sampling Techniques Selection and Preparation of Tools for data collection Type of variables and their selection Data collection and classification/ coding Analysis of data through parametric non-parametric statistics Report writing-presentation of data, interpretation and discussion
Human Development Child Development-Principles and Stages Life Span Development- Theories of Human Development and Behaviour Child rearing, Socialisation practices and Dynamics Early Childhood Care and Education- Emerging Trends Development problems and disabilities during childhood and adolescence, guidance and counseling	

**(08) - वाणिज्य**

1. वाणिज्य का अर्थ एवं क्षेत्र, व्यावसायिक एवं आद्यौगिक संगठन की परिभाषा, संगठन, प्रबंध एवं प्रशासन में भेद, व्यावसायिक संगठन के विभिन्न प्रारूपों के विभेदात्मक लक्षण, सार्वजनिक उपक्रमों के रूप।
2. औद्योगिक संगठनों का विकास, औद्योगिक संगठन के सिद्धांत एवं प्रबंध। औद्योगिक इकाइयों का पैमाना, अनुकूलन आकार का सिद्धांत, स्थानीयकरण का सिद्धांत, वैज्ञानिक प्रबंध एवं विवेकीकरण,

- उत्पादकता—अर्थ एवं प्रभावित करने वाले घटक, भारत में उत्पादकता आंदोलन, पूंजी निर्गमन पर नियंत्रण।
3. प्रबंध की प्रकृति एवं महत्व, प्रबंध की आधुनिक अवधारण, प्रबंध के कार्य उद्देश्यों के आधार पर, अपवाद के आधार पर प्रबंध, कार्यालयीन प्रबंध, क्षेत्र सिद्धांत एवं प्रणालियाँ और नैतिक कार्य, कार्यालयीन अभिलेखों की व्यवस्थापना और व्यवहार, कार्यालयीन उपकरण एवं मशीनें।
  4. कम्पनी सचिव— कार्य नियुक्ति, वैधानिक स्थिति और योग्यताएँ, प्रस्ताव और सभाएँ, कम्पनी सचिव के अधिकार, कर्तव्य एवं दायित्व, सूचना का प्रारूप, एजेण्डा तथा सूक्ष्म एवं प्रस्ताव, कम्पनी द्वारा पत्र व्यवहार।
  5. वैध अनुबन्ध के आवश्यक तत्व, निक्षेप, गारण्टी (प्रत्याभूति) और हानि रक्षा, एकाधिकार प्रतिबन्धात्मक व्यापार व्यवहार अधिनियम के प्रमुख प्रावधान, उपभोक्ता चेतना।
  6. सांख्यिकी प्रबंधकीय युक्ति के रूप में सांख्यिकी, सांख्यिकी—सर्वेक्षण का आयोजन, सांख्यिकी—समकों का संग्रहण, केन्द्रीय प्रवृत्तियों के माप, अपकरण, विषमता, सूचकांक, कालपरिचय का सह—संबंध गुणांक।
  7. आयकर महत्वपूर्ण परिभाषाएँ, निवास स्थान और कर दायित्व, वेतन तथा मकान सम्पत्ति से आय की गणना, व्यक्तियों और फर्मों पर कर की गणना।
  8. लागत लेखांकन— लागत के तत्व एवं लागतों के निर्धारण की विधियाँ, लागत पत्र की रचना और टेकालेखे, सीमान्त लागत एवं सम विच्छेद बिन्दु, परिचालन लागत।
  9. लेखांकन—द्वि प्रविष्टि प्रणाली के सिद्धांत, समायोजन सहित अंतिम खाते, साझेदारी प्रवेश एवं समापन, अंशों का निर्गमन एवं हरण।
  10. अंकेक्षण—परिभाषा, क्षेत्र एवं महत्व, रोकड़ पुस्तक का अंकेक्षण, सम्पत्तियों एवं दायित्वों का सत्यापन, अंकेक्षक के अधिकार, कर्तव्य एवं दायित्व, एक शिक्षण संस्था का अंकेक्षण।

### (08) - COMMERCE

1. Meaning and scope of commerce, definition of Business and industrial organization, distinction between organization, management and administration, distinctive features of different forms of Business organisation, forms of public enterprises.
2. Evolution of industrial organization, principles and management of industrial organization, scale of industrial units, Theory of optimum size. theories of localisation, scientific management and rationalization productivity, meaning and factors affecting productivity, Productivity movement in India : Control of Capital issue.
3. Nature and importance of management, modern concept of management, management functions, management by objectives and management by exception, office management, scope and principle, systems and routines handling of office records, office equipments Machines.
4. Company Secretary Functions, Appointment legal position and qualifications, resolution and meetings, rights, duties and liabilities of a Company Secretary, drafting of notice. Agenda, Minutes, Resolutions, company correspondence.
5. Essentials of a valid contract, bailment, Guarantee and indemnity. Main provision of M.R.T.P., consumers consciousness.
6. Statistics :- Statistics as a managerial tool, conduct of investigation, collection of statistical data, Measures of Central tendency dispersion; Skew-ness, Index numbers; Karl Pearson's Coefficient of Correlation.
7. Income Tax:-Important definitions, residence and tax liability, computation of income under the heads salary; income from house property, computation of tax on individual and firms.

8. Cost Accounting :- Elements of cost and methods of allocating on cost; Preparation of Cost Sheet and contract accounts; Marginal Costing and Break Even Point, Operating Cost.
9. Accountancy :- Principles of Double Entry System; Final account with adjustment; Partnership-Admission and Dissolution; issue and forfeiture of shares.
10. Auditing :- Definition, Scope and importance, Audit of Cash Book. Verification of Assets and liabilities. Rights, Duties and liabilities of auditor, Audit of an educational institution.

### (09) - रसायनशास्त्र

#### भौतिक रसायन

##### उष्मागतिकी:

उष्मागतिकी का प्रथम नियम,  $C_p$  तथा  $C_v$  के मध्य संबंध, भौतिक व रासायनिक परिवर्तनों की एन्थेल्पी, एन्थेल्पी की तापीय निर्भरता, ऊष्मागतिकी का द्वितीय नियम, एण्ट्रॉपी, गिब्स तथा हेल्मोल्ड्स के फलन, एण्ट्रॉपी तथा गिब्स फलन का निर्धारण, ऊष्मागतिकी का तृतीय नियम, मैक्सवेल संबंध, गिब्स फलन की ताप दाब पर निर्भरता, गिब्स—हेल्मोल्ड्स समीकरण।

##### रासायनिक साम्य:

मिश्रण की मुक्त ऊर्जा तथा एण्ट्रॉपी, आंशिक मोलर गुण, गिब्स ड्यूहेम समीकरण, साम्य नियतांक, साम्य नियतांक की तापीय निर्भरता, प्रावस्था आरेख, प्रावस्था नियम, आदर्श विलयन तथा अणुसंख्य गुणधर्म, वितरण गुणांक, सक्रियता, जलयोजन संख्या की धारणा, विद्युत अपघटनी विलयनों की सक्रियताएँ, औसत आयनिक सक्रियता—गुणांक, प्रबल विद्युत उपघट्यों की डिबाई—हकल व्याख्या, विद्युतवाहक बल (EMF) मापन के अनुप्रयोग, विभिन्न प्रकार के सांद्रण सेल।

##### पृष्ठ घटना:

पृष्ठ तनाव, ठोसों पर अधिशोषण, अतः तले (Interface) पर विद्युतीय घटना, पृष्ठों के अध्ययन की विधियाँ का प्रारंभिक ज्ञान (उदाहरण प्रकाश—इलेक्ट्रॉनिक, स्पेक्ट्रोस्कोपी), मिसेल व विलयनीकरण।

##### अभिक्रिया बल गतिकी:

रासायनिक अभिक्रियाओं की दर, दर समीकरण (Rate equation) निर्धारित करने की विधियाँ, आरहीनियस समीकरण, अभिक्रिया दर का संघट्ट सिद्धांत (Collision Theory), स्टेरिक कारक (Steric factor), एक—आण्विक अभिक्रियाओं के सिद्धांत, परम—अभिक्रिया (Absolute Reaction) दर सिद्धांत, संघट्ट सिद्धांत एवं परम—अभिक्रिया (Absolute Reaction) दर सिद्धांत की तुलना, द्विआण्विक अभिक्रियाएँ, लवण—प्रभाव, समांगी उत्प्रेरण, एन्जाइम बल गतिकी।

##### प्रकाश रसायन:

द्विपरमाणु प्रकाश रसायनिक अभिक्रियाएँ, प्रकाश भौतिकी तथा प्रकाश रासायनिक क्रियाएँ, श्रृंखला अभिक्रियाएँ, प्रकाश रासायनिक अभिक्रिया की बल गतिकी, वृहदाणुओं (Macromolecules) के संख्या औसत तथा औसत भार, अणुभार का निर्धारण, बहुलीकरण की बलगतिकी, बहुलीकरण का त्रिविम रसायन तथा क्रियाविधि,

##### ठोस अवस्था:

ब्रेग का समीकरण, ब्रैविस जालक, मिलर सूचकांक तथा तलों का अंकन, एकल घनाकार सेल के आयामों का निर्धारण तथा एकल सेल में परमाणु और अणुओं की संख्या का निर्धारण, आयनिक क्रिस्टलों की जालक ऊर्जाएँ, मेडलंग नियतांक, बॉर्न—हैबर चक्र, शॉटकी तथा फेन्केल त्रुटियाँ, स्थान—भ्रंश, ठोसों के विद्युतीय गुण, विद्युतरोधी तथा अर्धचालक।

##### नाभिकीय रसायन:

रेडियो सक्रिय क्षय (radio active decay) तथा साम्य, नाभिकीय अभिक्रियाएँ, Q-मान, नाभिकीय अनुप्रस्थ परिच्छेद (Nuclear Cross

Section), नाभिकीय अभिक्रियाओं के प्रकार, नाभिकीय रूपान्तरण के रासायनिक प्रभाव, विखण्डन (fission) तथा संलयन (fusion) उत्पाद, रेडियो सक्रिय ट्रेसर तकनीक, सक्रियण विश्लेषण, मोसबायर स्पेक्ट्रोस्कोपी – सिद्धांत तथा रासायनिक अनुप्रयोग, गणन तकनीकी।  
**आण्विक स्पेक्ट्रोस्कोपी:**

द्विपरमाण्विक अणुओं की घूर्णन तथा कम्पन स्पेक्ट्रोस्कोपी का सैद्धांतिक अध्ययन, स्पेक्ट्रोस्कोपी चयन नियमों के लिए समूह-सिद्धांत के अनुप्रयोग, इलेक्ट्रॉन अनुचुम्बकीय अनुनाद तथा नाभिकीय चुम्बकीय अनुनाद (NMR) स्पेक्ट्रोस्कोपी के सिद्धांत, परमाणुओं तथा अणुओं के इलेक्ट्रॉनिक स्पेक्ट्रा, परमाणवीय अवशोषण स्पेक्ट्रोस्कोपी के अनुप्रयोग,

**विश्लेषण की भौतिक-रासायनिक विधियाँ:**

रासायनिक विश्लेषणों में – वितरण तथा अधिशोषण क्रोमेटोग्राफी, विलायक निष्कर्षण, आयन-विनिमय अवकलनीय उष्मीय विश्लेषण तथा उष्मीय भारात्मक विश्लेषण (TGA), पोलेरोग्राफी तथा चक्रीय वोल्तामिति, औसत, मानक विचलन, त्रुटियों के प्रकार, प्रोपागेशन त्रुटियाँ (Propagation Errors), न्यूनतम वर्गात्मक विश्लेषण (Least Square Analysis), यथार्थता व परिशुद्धता (Accuracy and Precision)।

### अकार्बनिक रसायन

**संरचना तथा आबंधन:**

परमाण्विक कक्षक, परमाणुओं का इलेक्ट्रॉनिक विन्यास (ऑफबाऊ सिद्धांत व L-S युग्मन), तत्वों के आवर्ती गुण: आयनिक-त्रिज्या, आयनन-विभव, इलेक्ट्रॉन-बन्धुता, विद्युत ऋणात्मकता, संकरण की संकल्पना, द्विपरमाण्विक अणुओं का इलेक्ट्रॉनिक विन्यास, बहुपरमाण्विक अणुओं के आकार, बन्ध दैर्घ्य, बन्धकोण, बन्ध कोटि तथा बन्ध ऊर्जाएं, अनुनाद, रासायनिक बंध के प्रकार (हाइड्रोजन बन्ध सम्मिलित), अंतर-आण्विक बल।

**अणु तथा परमाणुओं की इलेक्ट्रॉनिक संरचना:**

श्रोडिन्जर का समीकरण (SE) तथा क्वाण्टम यांत्रिकी की अभिधारणाएं, SE के प्रारंभिक अनुप्रयोग (यथा: बॉक्स में कण, आवर्ती-दोलक, घूर्णक तथा हाइड्रोजन परमाणु), भिन्नता प्रमये (variation theorems), क्षोभ सिद्धांत (perturbation theory) (हीलियम परमाणु पर अनुप्रयोग), इलेक्ट्रॉनिक विन्यास तथा युग्मन योजना, LCAO, आण्विक कक्षक तथा संयोजकता-आबंध सिद्धांत द्वारा  $H_2$  तथा  $H_2^+$  की व्याख्या।

**अ-संक्रमण तत्वों का रसायन:**

s, p, d, तथा f वर्ग के तत्व प्रत्येक वर्ग के तत्वों का सामान्य लक्षण, सामान्य धातुओं के निष्कर्षण एवं शोधन के रासायनिक सिद्धांत।

अ-संक्रमण (Non-Transitional), तत्वों के गुणों का सामान्य विवेचना, भिन्न-भिन्न तत्वों की विशिष्टताएं तथा उनके हैलाइड्स व ऑक्साइड्स का संश्लेषण, गुण तथा संरचनाएं, कार्बन, फॉस्फोरस तथा सल्फर की बहुरूपता, बोरॉन हाइड्राइड, बोरेन, कार्बाइड, सिलिकेट की संरचनाएं, जिओलाइट-मृदायें, सिलिकोन्स, फॉस्फोजीन, गंधक, नाइट्रोजन, फॉस्फोरस तथा हैलोजन के ऑक्साइड तथा ऑक्सीअम्ल, अंतर हैलोजन यौगिक, धातु कार्बोनिल।

**संक्रमण तत्वों का रसायन:**

धात्विक आयनों का संकुल रसायन, संकुल यौगिकों के स्थायित्व-नियतांक तथा उनका निर्धारण, संकुल यौगिकों का त्रिविम-रसायन, क्रिस्टल-क्षेत्र तथा लिगेण्ड-क्षेत्र सिद्धांत, इलेक्ट्रॉनिक स्पेक्ट्रा तथा चुम्बकीय गुणों का विवेचन।

**अम्ल व क्षार:**

ब्रांस्टेड तथा लेविस अम्ल, pH,  $pK_a$ ,  $pK_b$  मान, अजलीय विलायक, कठोर तथा मृदु अम्ल तथा क्षारों की संकल्पना, बफर विलयन, लवण जल-अपघटन, ऑक्सीकरण अपचयन (redox) अभिक्रियाएं, ऑक्सीकरण संख्या, ऑक्सीकरण-अपचयन अभिक्रियाओं का संतुलन, ऑक्सीकरण अपचयन विभव।

### कार्बनिक रसायन

**भौतिक कार्बनिक रसायन:**

प्रेरणित तथा अन्य क्षेत्र प्रभाव, माध्यमिक यौगिक, कार्बोकेटायन, कार्बोनियन, मुक्तमूलक, कार्बिन, नाइट्रीन तथा एराईन की संरचना, कार्बनिक अभिक्रियाएं तथा उनकी क्रिया-विधि, नाभिक स्नेही तथा इलेक्ट्रॉनस्नेही विस्थापन तथा योग अभिक्रियाएं, विलोपन अभिक्रियाएं, बेकमान, शिमट, हॉफमेन, कर्टियस, वेग्नर-मीरविन, फ्राइस, वुल्फ, रिफार्मेट्स्की पुनर्विन्यास की क्रियाविधि।

त्रिविम-रसायन तथा संरूपण विश्लेषण, अभिविन्यास तथा संरूपण, ज्यामितीय एवं प्रकाशकीय समावयवता, R, S तथा E, Z नामकरण की विधियां, असममित संश्लेषण, चक्रीय तथा अचक्रीय निकायों का संरूपणीय विश्लेषण, सायक्लोहेक्सेनों की क्रियाशीलता पर संरूपण के प्रभाव, प्रकाशकीय घूर्णक, प्रवकीर्णन (ORD) तथा वृत्तीय द्विवर्णता (CD)।

**एलिफैटिक यौगिक:**

निम्न वर्गों के यौगिकों के बनाने की विधियां, विशिष्ट अभिक्रियाएं (क्रियाविधि सहित), संरचनाएं तथा उपयोग : एल्केन, सायक्लो एल्केन, ऐल्कीन, डाईन तथा एल्काईन, ऐल्किलहेलाइड, अल्कोहल, ईथर, ऐलिडहाइड, कीटोन, कॉर्बोक्सिलिक अम्ल तथा उनके व्युत्पन्न, नाइट्रो-यौगिक, थायोल कार्बोहात्त्विक तथा सक्रिय मिथिलीन यौगिकों के संश्लेषणात्मक अनुप्रयोग।

**एरोमैटिक यौगिक:**

ह्यूकल का नियम तथा ऐरोमेटिसिटी की संकल्पना, एन्यूलीन, एज्यूलीन, निम्नलिखित ऐरोमैटिक यौगिकों के बनाने की विधियां तथा रासायनिक अभिक्रियाएं : हेलोजन-व्युत्पन्न, नाइट्रोबेन्जीन, ऐमीन, डाइजोनियम लवण, सल्फोनिक अम्ल, ऐरोमैटिक ऐल्कोहल, फीनाल, ऐलिडहाइड, कीटोन तथा कार्बोक्सिलिक अम्ल

**विषमचक्रीय यौगिक तथा प्राकृतिक उत्पाद:**

फ्यूरोन, पॉयरोल, थायोफीन, पिरिडीन, पिरिमिडीन, इन्डोल तथा विनोलीन के संश्लेषण तथा सामान्य अभिक्रियाएं, एंजाइम, रंजक, टर्पीन्स तथा बहुलक, ऐल्कोलाइड तथा प्यूरीन्स, अमीनोअम्ल, प्रोटीन्स (प्राथमिक तथा द्वितीयक संरचना), कार्बाहाइड्रेट्स (मोनो, डाई तथा पॉलिसैकेराइड) का सामान्य अध्ययन।

**कार्बनिक प्रकाश रसायन:**

कार्बनिक अणुओं की उत्तेजित अवस्थाएं, क्वाण्टम परिलक्षियों, जेब्लॉन्की आरेख, नारीस प्रकार। तथा नॉरीस प्रकार II अभिक्रियाएं, पटेर्नो-बुशी अभिक्रिया, प्रकाश-द्विमरीकरण, पैरिसाइक्लिक अभिक्रियाओं का सामान्य अध्ययन।

## (09) - CHEMISTRY

### Physical Chemistry:

**Thermodynamics:**

First law of thermodynamics, relation between  $C_p$  and  $C_v$ , Enthalpy of physical and chemical changes, temperature dependence of enthalpy, Second law of thermodynamics, entropy, Gibbs and Helmholtz functions, evaluation of entropy & Gibbs function, Third law of thermodynamics, Maxwell's relations, temperature and pressure dependence of Gibbs function, Gibbs Helmholtz equation.

**Chemical Equilibrium:**

Free energy and entropy of mixing, partial molar quantities, Gibbs-Duhem equation, equilibrium constant, temperature dependence of equilibrium constant, Phase diagram, Phase rule, Ideal solutions and colligative properties, Partition coefficient, activities, concept of hydration number, activities in electrolytic solutions, mean ionic activity coefficient, Debye-Huckel treatment of strong electrolytes, Equilibrium in electrochemical cells, Nernst equation, applications of EMF measurements, Types of concentration cells.

**Surface phenomenon:**

Surface tension, adsorption on solids, electrical phenomenon at interfaces, elementary knowledge of methods for the study of surfaces e.g. photo electron spectroscopy, Micelles & Solubilisation.

**Reaction Kinetics:**

Rates of chemical reactions, methods of determining rate law, Arrhenius equation, collision theory of reaction rates, steric factor, treatment of unimolecular reactions, theory of absolute reaction rates, comparison of collision theory with theory of absolute reactions rates, salt effect, homogeneous catalysis and enzyme kinetics.

**Photochemistry:**

Biomolecular photochemical reactions, photophysical & photochemical processes, chain reactions, Kinetics of photochemical reactions, Macromolecules, determination of number average and weight average molecular weights of macromolecules, Kinetics of polymerization, Stereochemistry and mechanism of polymerization.

**Solid state:**

Bragg's equation, Bravais lattices, Miller indices and labeling of planes, determination of the dimensions of a unit cubic cell, calculations of number of atoms and molecules per unit cell, lattice energy of ionic crystals, Madelung constant, Born-Haber cycle, Schottky and Frenkel defects, dislocation, electrical properties of solids, insulators, semi-conductors

**Nuclear Chemistry :**

Radioactive decay and equilibrium, nuclear reactions, Q value, nuclear cross section, type of nuclear reactions, chemical effects of nuclear transformation, fission and fusion products, radioactive tracer technique, nuclear activation analysis, Mossbauer spectroscopy, principles and chemical application, counting techniques.

**Molecular Spectroscopy:**

Principles of the rotational and vibration spectroscopy of diatomic molecules, Applications of group theory to spectroscopic selection rules, Principles of Electron Paramagnetic and Nuclear Magnetic Resonance Spectroscopy, Electronic Spectra of atoms and molecules, Raman spectra, application of Atomic Absorption Spectroscopy

**Physico-chemical methods of analysis:**

Partition and adsorption chromatography, solvent extraction, ion-exchange, Differential Thermal Analysis and Thermogravimetric Analysis, Polarography and Cyclic voltametry in chemical analysis, average, standards deviation, types of errors, propagation errors, least square analysis, Accuracy and precision.

**Inorganic Chemistry**

**Structure and Bonding:**

Atomic orbital, electronic configuration of atoms (Aufbau principle, L-S coupling) and the periodic properties of elements, ionic radii, ionization potential, electron affinity, electro negativity, Concept of hybridization, electronic configuration of diatomic molecules, shapes of polyatomic molecules, bond lengths, bond angles, bond order and bond resonance, types of chemical bonds including hydrogen bond, intermolecular forces.

**Electronic structure of atoms and molecules:**

The Schrodinger equation (SE) and the postulates of quantum mechanics, elementary application of SE (e.g. particle in a box, harmonic oscillator, rigid rotator and the hydrogen atom), the variation theorems and perturbation theory (application to the helium atom), electronic configuration, coupling schemes, the LCAO, Molecular Orbital and the valence bond treatment of H<sub>2</sub> and H<sub>2</sub><sup>+</sup>

**Chemistry of non transition elements:**

Aspects of s, p, d, and F block elements, general characteristics of each block, chemical principles involved in extraction and purification of common metals. General discussion on the properties of the non-transition elements, special features of individual elements, synthesis, properties and structure of their halides and oxides, poly-

morphism of carbon, phosphorus and sulphur, structure of boron hydrides, boranes, carbides, silicates and zeolites/clays, silicones, phosphazenes, sulphur, nitrogen, phosphorus and halogen compounds: oxides and oxy acids, inter halogen compound, metal carbonyls.

**Chemistry of Transition Elements:**

Coordination chemistry of metal ions, stability constants of complexes and their determination, stereochemistry of coordination compounds, crystal field and legend field theory, interpretation of spectral and magnetic properties,

**Acids and Bases:**

Bronsted and Lewis acids, pH, pKa and pKb values, nonaqueous solvents, concept of hard and soft acids & bases, buffer solutions, salt hydrolysis, redox reactions, oxidation number, balancing oxidation reduction reactions; oxidation/reduction potentials.

**Organic Chemistry**

**Physical Organic Chemistry:**

Inductive and other field effects, reaction intermediates, structure of carbocation, carbanions, free radicals, carbenes, nitrenes and arynes, organic reaction mechanisms, nucleophilic and electrophilic substitutions, additions and elimination reactions, mechanism of Schmidt, Hofmann, Curtius, Wagner-Meerwein, Fries, Wolf and Reformatsky rearrangements. Stereochemistry and conformational analysis: conformation & configuration, geometrical and optical isomers. R & S and E & Z nomenclature, methods of resolution, asymmetric synthesis, conformational analysis of cyclic and acyclic systems, effects of conformation on reactivity in cyclohexanes, optical rotatory dispersion and circular dichroism.

**Aliphatic Compounds:**

Preparation, typical reactions (including mechanism), structures and uses of the following classes of compounds: alkane, cycloalkane, alkene, diene, alkyne, alkylhalide, alcohol, ether, aldehyde ketone, carboxylic acid and their derivatives, thiols, nitro compounds, synthetic applications of organometallic and active methylene compounds.

**Aromatic Compounds:**

Huckels' rule and the concept of aromaticity, annulenes, azulenes, methods of preparation and chemistry of the following aromatic compounds, halogen derivatives, nitro benzene, amines, diazonium salts, sulphonic acids, aromatic alcohols, phenols, aldehydes, ketones, carboxylic acids.

**Heterocyclic Compounds and Natural Products:**

Synthesis and reactions of furan, pyrrole, thiophene, pyridine, pyrimidine, indole and quinoline, a general study of enzymes, dyes, terpenes, polymers, alkaloids and purines, amino acids, proteins (primary and secondary structure) and carbohydrates (mono, di & poly saccharides),

**Organic Photochemistry:**

Excited states of organic molecules, Jablonski diagram, quantum yields, Norrish type I and Norrish type II reactions, Paterno-Buchi reaction, photo-dimerization, general study of pericyclic reactions

**(10) - गणित**

1. **बीजगणित** :- बीजगणितीय समीकरण के मूलों की प्रकृति एवं गुण, मूलों के सममित फलनों का अवकलन, रूपांतरण, व्युत्क्रम समीकरण, संश्लेषिक विभाजन, पुनरावृत्त मूल। धनात्मक पदों की श्रेणियों का अभिसरण, तुलनात्मक परीक्षण, अनुपात एवं मूल परीक्षण, कौशी कन्डेनशंसन परीक्षण, निरपेक्ष अभिसरण।

**आव्यूह** :- आव्यूह की परिभाषा, आव्यूहों का गुणन, परिवर्त एवं व्युत्क्रम आव्यूह, आव्यूह का सह-खण्डज, आव्यूह की जाति, रैखिक समीकरण का हल, केली-हेमिल्टन प्रमेय, आइगेन मान एवं आइगेन सदिश।

2. **त्रिकोणमिति** :- सम्मिश्र संख्यायें और उनकी ज्यामितीय व्याख्या, डिमोविरस प्रमेय का सरल अनुप्रयोग, चरघाताकीय, लघुगणकीय एवं अतिपरवलयिक फलन, वास्तविक एवं अधिकल्पित भागों में पृथक्कन।  
**सदिश बीजगणित एवं सदिश फलन** :- अदिश एवं सदिश गुणनफल, सदिशों के त्रिक एवं चतुष्क गुणनफल, सदिशों का अवकलन और समाकलन, अवकलन संकारक, प्रवणता, डाइवर्जेंस एवं कर्ल।
3. **द्वि-विमीय वैश्लेषिक ज्यामिती** :- समाक्ष वृत्त एवं लम्ब कोणीय वृत्त निकाय, शांकव काट (परवलय, दीर्घ वृत्त एवं अतिपरवलय) एवं उनके गुणधर्म कार्तीय निर्देशांकों में स्पर्श रेखा, अभिलंब, ध्रुव, ध्रुवीय व्यास, संयुग्मी व्यास, (दीर्घ वृत्त एवं अतिपरवलय) एवं उनके गुणधर्म।  
**त्रिविमीय वैश्लेषिक ज्यामिती** :- दिक्कोज्या, समतल और सरल रेखाएं, लघुत्तम दूरी, गोला, शंकु, व्युत्क्रम शंकु।
4. **अवकलन** :- उत्तरोत्तर अवकलन, आंशिक अवकलन, प्रसार, अनिर्धारित रूप, उच्चिष्ठ और निम्निष्ठ, वक्रता, अन्नवालोप, अनन्तस्पर्शियाँ, विचिताबिन्द, वक्रों का अनुरेखण, चरों का परिवर्तन, (केवल दो चरों के लिए)।  
**समाकलन** :- समाकलन की विधियाँ, निश्चित समाकलन, बीटा और गामा फलन, बहु समाकलन।  
**अवकल समीकरण** :- प्रथम कोटी तथा प्रथम घात के अवकल समीकरण, यथातथ अवकल समीकरण, अचर गुणांक वाले रैखिक अवकल समीकरण एवं समघात रैखिक समीकरण।
5. **अमूर्त बीज गणित**:-समुच्चय सिद्धांत, फलन, संबंध, तुल्यता संबंध, समूह, उपसमूह, सह समुच्चय वियोजन, प्रसामान्य उपसमूह, समूहों की समाकारिता एवं तुल्यकारिता, क्रम विनिमेय समूह की समाकारिता एवं तुल्यकारिता, चक्रीय समूह, खण्डसमूह, समूहों की समाकारिता का मूलभूत प्रमेय, वलय, विभाजन वलय, पूर्णाकीय प्रान्त, क्षेत्र, गुणजावली, विभाग वलय, उच्चिष्ठ एवं अभाज्य गुणजावली, बहुपद वलय।  
**गणितीय विश्लेषण** :- डेडेकिन्ड-कट, गणनीय और अगणनीय समुच्चय, दूरीक समस्तिर्यो, सीमा बिन्दु, विवृत्त एवं संवृत समुच्चय, संहत समुच्चय, परिवद्ध एवं पूर्ण समुच्चय, बोलजानो-वीस्ट्रास प्रमेय, सांतत्य और अवकलनीयता।
6. **सम्मिश्र चर** :- सम्मिश्र चरों के विश्लेषिक फलन, घात श्रेणी, अभिसरण वृत्त, सम्मिश्र समाकलन, कॉशी का प्रमेय, टेलर और लारेन्ट श्रेणियाँ, विचित्रताएं, शुन्यक एवं ध्रुव, कॉशी का अवशि प्रमेय, कन्दूर समाकलन।  
सांस्थितिकी - सांस्थितिक समष्टि की परिभाषा और उदाहरण, आपेक्षिक सांस्थितिकी, संतत प्रतिचित्रण और समाकारिता, सीमा बिन्दु, संवृत्त समुच्चय, सामीप्य एवं व्युत्पन्न समुच्चय, आधार और उप आधार, गणीनीय समष्टि।

### (10) - MATHEMATICS

1. **Algebra** :- Nature and properties of roots of an algebraic equation, Differentiation of the Symmetric function of roots, Transformation, Reciprocal equations, Synthetic division, Repeated roots, Convergence of Series of Positive terms, Comparison test, Ratio and Root test, Cauchy's Condensation test, Absolute convergence.  
**Matrices** :- Definition of matrix, Multiplication of Matrices, Transpose and Inverse of a Matrix, Adjoint of a Matrix, Rank of a Matrix, Solution of Linear equations. Caley- Hamilton Theorem, Eigen values and Eigen vectors.
2. **Trigonometry** :- Complex numbers and their geometrical representation, De-Moivre's theorem and its applications, Exponential, Logarithmic and Hyperbolic functions, Separation into Real and Imaginary parts.  
**Vector Algebra and Vector Calculus**:- Scalar and Vector products, Triple and Quadruple products of vectors, Differentiation

and Integration of vectors, Differential operators, Gradient, Divergence and Curl.

3. **Analytical Geometry of two dimensions** :- The circle including Co-axial and Orthogonal system of circles, Conic sections and their properties (Parabola, Ellipse and Hyperbola) in Cartesian coordinates, Tangents, Normal, Pole, Polar diameter, Conjugate diameters (Ellipse and Hyperbola) and their properties, Director circle, Conjugate Hyperbola and Rectangular Hyperbola.  
**Analytical Geometry of Three Dimensions**:- Direction cosines, Plane and Straight lines, Shortest distance, Sphere, Cone, Reciprocal cone.
4. **Differential Calculus** :- Successive differentiation, Partial differentiation, Expansions, Indeterminate forms, Maxima and Minima, Curvature, Envelopes. Asymptotes, Singular points, Curve tracing, Change of variable (for two variables only).  
**Integral Calculus**:- Methods of integration, Definite integrals, Beta and Gamma functions, Multiple integrals.  
**Differential Equation**:- Differential equations of the first order and first degree, Exact differential equations. Linear differential equations with constant co-efficients and Homogeneous linear equations.
5. **Abstract Algebra** :- Theory of sets, Functions, Relations, Equivalence relations, Groups, Sub groups, Coset decomposition, Normal Sub groups, Homomorphism and Isomorphism of groups, Homomorphism and Isomorphism of commutative groups, Cyclic groups, Factor groups, Fundamental Theorem of Homomorphism of groups, Rings, Division rings, Integral domain, Fields, Ideals, Quotient rings, Maximal and Prime ideals, Ring of Polynomials.  
**Mathematical Analysis**:- Dedekind cuts, Countable and Uncountable sets, Metric spaces, Limit points, Open and Closed sets, Compact sets, Bounded and Perfect sets, Bolzano-Weirstrass Theorem, Continuity and differentiability.
6. **Complex Variable** :- Analytic functions of complex variables, Power series, Circle of convergence, Complex integration, Cauchy's theorem, Taylor's and Laurent's series, Singularities, Zeros and Poles, Cauchy's theorem of Residues, Contour Integration.  
**Topology**:- Definition and example of Topological spaces, Relative topology, Continuous mapping and Homomorphism, Limit points, Closed sets, Neighbourhoods & Derived sets, Bases and Sub bases, Countable space.

### (11) - अर्थशास्त्र

1. व्यष्टि एवं समष्टि विश्लेषण, उपभोक्ता का व्यवहार-उपयोगिता विश्लेषण, तटस्थता वक्र विश्लेषण, प्रकट अधिमान विश्लेषण, मांग सिद्धांत की पुनर्व्याख्या, उत्पादक का व्यवहार-उत्पादन फलन, परिवर्तनशील अनुपातों का नियम, उत्पादक का साम्य।
2. विभिन्न बाजार स्थितियों में मूल्य एवं उत्पादन निर्धारण, साधन मूल्य निर्धारण सिद्धान्त-लगान, मजदूरी, ब्याज एवं लाभ।
3. राष्ट्रीय आय लेखांकन - विभिन्न संबंधित योगांक एवं उनका अन्तर्सम्बन्ध, मुद्रा का मूल्य, मुद्रा मूल्य से संबंधित आधुनिक धारणाएं मिल्टन फ्रिडमैन, पेटिकिन, गुर्ले-शॉ, टोबिन। केन्द्रीय बैंक के उद्देश्य एवं संसाधन तथा साख नियंत्रण की नीतियों, केन्सवाद।
4. अन्तर्राष्ट्रीय व्यापार के सिद्धांत, विनिमय दर, प्रशुल्क, संरक्षण, भुगतान संतुलन, व्यापार की शर्तें, अन्तर्राष्ट्रीय तरलता एवं अन्तर्राष्ट्रीय मुद्रा कोष, अंकटाइ, अनुदान बनाम व्यापार। आर्थिक वृद्धि का अर्थ एवं माप। एडम स्मिथ, रिकार्डो, मार्शल, मार्क्स, कीन्स हिक्स एवं गांधी का आर्थिक विचारों में योगदान एवं आलोचनात्मक मूल्यांकन।
5. सांख्यिकी का क्षेत्र एवं उपयोगिता, सांख्यिकी समकों का संकलन, माध्य, अपकिकरण एवं विषमता, निर्देशांक, प्रतीपगमन एवं सह-संबंध।
6. भारतीय अर्थव्यवस्था- भारतीय अर्थव्यवस्था का संस्थागत ढांचा, मिश्रित अर्थव्यवस्था की समस्याएँ, नियोजित विकास एवं न्यायोचित वितरण,

गरीबी का माप एवं गरीबी दूर करने के उपाय, राष्ट्रीय आय एवं उसका क्षेत्रीय एवं व्यावसायिक वितरण, कृषि नीति, भू-सुधार, तकनीकी परिवर्तन, ग्रामीण साख संरचना, ग्रामीण विकास।

7. औद्योगिक नीति, लाईसेंसिंग नीति एवं एकाधिकार नियंत्रण, कृषि एवं औद्योगिक उत्पादन के लिए मूल्य नीति, संग्रहण एवं सार्वजनिक वितरण व्यवस्था, भारतीय अर्थव्यवस्था में मौद्रिक एवं बजट प्रवृत्ति, रिजर्व बैंक ऑफ इंडिया एवं मौद्रिक नीति, विदेशी व्यापार की प्रवृत्तियाँ एवं भुगतान संतुलन, भारत में संघीय वित्त व्यवस्था, भारत में कर ढाँचा, राजकोषीय नीति, मौद्रिक नीति, भारत में नियोजन—उद्देश्य, व्यूह रचना अनुभव एवं समस्याएँ।

### (11) - ECONOMICS

1. Micro and Macro analysis, consumer's behaviour- utility analysis, indifference curve Analysis, revealed preference analysis, revision in demand theory, producer's behaviour-production function, law of variable proportions, producer's equilibrium.
2. Determination of value and output under various market situations, theories of factor pricing-rent, wages, interest and profit.
3. National income accounting various related aggregate and their inter-relation, value of money recent development in theory of value of money friedman, Patinkin, Gurley-Shaw, Tobin. Objectives and instruments of Central Banking and credit policies, Keynesism.
4. Theories of international trade, exchange rate, tariffs, Protection, balance of payment, terms of trade, international liquidity and I.M.F., UNCTAD, aid Vs trade, meaning and measurement of economic growth, contribution of Adam Smith, Ricardo, Marshall, Marx, Keynes, Hicks and Gandhi in Economic thought and its critical evaluation.
5. Scope and utility of statistics collection of statistical data averages dispersion and skewness, index numbers regression, correlation,
6. Indian Economy, institutional framework of Indian economy, problems of the mixed economy, planned growth and distributive justice, measure of poverty and its eradication, national income its sectoral and regional distribution, agricultural policy, land reforms, technological change, rural credit structure, rural development.
7. Industrial Policy, licensing and control of monopolism, pricing policies of agricultural and industrial output, procurement and public distribution system, budgetary and monetary trends in Indian economy, Reserve Bank Of India and monetary policy. Trends in foreign trade and balance of payments. Indian federal finance, tax structure in India, fiscal policy, monetary policy, planning in India-objectives, strategy, experience and problems.

### (12) - इतिहास

1. प्राचीन भारतीय इतिहास के स्रोत।
2. सिन्धु घाटी सभ्यता — उत्पत्ति, प्रसार, विशेषताएँ, प्रमुख व्यापार तथा संपर्क, पतन के कारण।
3. वैदिक सभ्यता — राजनैतिक, सामाजिक तथा आर्थिक ढाँचा, प्रमुख धार्मिक—विचार तथा कर्मकाण्ड।
4. जैन धर्म, बौद्धधर्म तथा अन्य सम्प्रदाय।
5. मौर्य युग, साम्राज्य विस्तार, प्रशासन, सामाजिक तथा आर्थिक दशा, अशोक की नीति तथा सुधार।
6. भारत — यूनान विजय, संस्थापन तथा पतन।
7. गुप्त युग, राजनैतिक तथा सांस्कृतिक पहलू।
8. चालुक्य, पल्लव तथा वर्धन साम्राज्य।
9. राजपूत राज्यों का अभ्युदय, उत्पत्ति, राजनीतिक स्वरूप एवं संस्कृति।
10. दिल्ली के सुल्तानों के अधीन भारत — महमूद गजनवी के आक्रमणों के समय भारतीय समाज, मोहम्मद बिन — तुगलक तथा फीरोज के

अधीन राज्य की राज्य नीति तथा प्रशासनिक सिद्धान्तों का नवीन अनुस्थापन, लोदी वंश।

11. सल्तनत के दौरान सांस्कृतिक विकास — भक्ति आंदोलन, सूफ़ीवाद, कला, वास्तुकला, साहित्य तथा समाज।
12. विजयनगर तथा बहमनी साम्राज्य — राजनीतिक स्वरूप एवं संस्कृति।
13. 1526 में भारत का स्वरूप तथा बाबर का आक्रमण।
14. बाबर, हुमायूँ तथा शेरशाह की उपलब्धियाँ।
15. अकबर के अधीन राष्ट्रीय राजतंत्र—राजतंत्र की नवीन अवधारणा, अकबर का धार्मिक, राजनीतिक दृष्टिकोण, गैर मुसलमानों से उसके सम्बन्ध तथा प्रशासनिक कार्य।
16. जहांगीर तथा शाहजहाँ का युग।
17. औरंगजेब के अधीन मुगल साम्राज्य का चरमोत्कर्ष तथा विघटन — औरंगजेब की धार्मिक नीति, दक्षिण में मुगल साम्राज्य का विस्तार, औरंगजेब के विरुद्ध विद्रोह, मराठों से संबंध, साम्राज्य का विघटन।
18. मुगल प्रशासन।
19. मुगल बादशाहों के अधीन कला, वास्तुकला तथा समाज।
20. दक्खन (डेकन) तथा बंगाल में ब्रिटिश शक्ति का उदय — अंग्रेज—फ्रांसीसी संघर्ष, बंगाल के नवाबों के साथ संबंध।
21. अंग्रेज — मराठा संबंध 1772 ई. से 1818 तक।
22. वेलेजली, लार्ड हेस्टिंग्स, विलियम बैंटिक तथा डलहौजी के विशेष संदर्भ में 1798 से 1856 तक ब्रिटिश राज्य का विस्तार तथा सुदृढीकरण।
23. 1857 का विद्रोह कारण, स्वरूप तथा परिणाम।
24. ताज के अधीन नई ब्रिटिश नीति की मुख्य विशेषताएँ—साम्राज्यी की घोषणा, मेयो के सुधार, रिपन के अधीन ब्रिटिश उदारवाद, कर्जन के सुधार।
25. सामाजिक — धार्मिक आन्दोलन — ब्रम्ह समाज, प्रार्थना समाज, आर्य समाज, थियोसॉफिकल सोसाइटी, रामकृष्ण मिशन आदि।
26. ब्रिटिश आर्थिक नीतियाँ — व्यापार, उद्योग तथा कृषि।
27. भारतीय राष्ट्रीय आंदोलन — उत्पत्ति, भारतीय राष्ट्रीय कांग्रेस की स्थापना, आन्दोलन के विभिन्न चरण, प्रारंभिक काल (1885—1919), गांधी का यगु (1919—1939) स्वतंत्रता संग्राम की तीव्रीकरण (1939—1947)
28. आधुनिक भारत के निर्माता — राजा राममोहन राय, रामकृष्ण, दयानंद सरस्वती, विवेकानन्द, तिलक, गोखले, गांधी तथा नेहरू।
29. भारत का संवैधानिक विकास 1858, 1892, 1909, 1919 तथा 1935 के अधिनियम।
30. औद्योगिक क्रांति और इसका यूरोप पर प्रभाव।
31. अमेरिका का स्वतंत्रता संग्राम।
32. फ्रांसीसी क्रांति तथा नेपोलियन युग (1789—1815) विश्व इतिहास में इसका महत्त्व।
33. इटली का एकीकरण।
34. जर्मनी का एकीकरण।
35. ब्रिटिश उदारवाद। (1830—1910)
36. अमेरिका गृह युद्ध।
37. 19 वीं तथा 20 वीं शताब्दियों में निकट पूर्व की समस्या।
38. यूरोप तथा सुदूर पूर्व (1840—1911)
39. प्रथम विश्व युद्ध।
40. वर्साय की सन्धि तथा लीग आफ नेशन्स (राष्ट्रसंघ)।
41. 1917 की रूसी क्रांति तथा उसका विश्वव्यापी प्रभाव।
42. दो विश्व युद्धों के बीच जर्मनी, इटली और जापान में अधिनायकवादी शासन का उदय।
43. इण्डोनेशिया, चीन तथा हिन्द — चीन (इन्डो—चायना) में राष्ट्रवादी आन्दोलनों का अभ्युदय।
44. चीन में साम्यवाद का उदय तथा उसकी स्थापना।

45. अरब विश्व में जागृति-स्वतंत्रता के लिये संघर्ष तथा मिस्त्र में सुधार, आधुनिक तुर्की का उदय।  
46. द्वितीय विश्व युद्ध तथा उसका प्रभाव।

### (12) - HISTORY

1. Sources of Ancient Indian History:
2. Indus valley civilisation-origin, extent, Characteristic, features, main trade and contacts, causes of decline.
3. Vedic civilisation – political, social and economic patterns, major religious ideas and rituals.
4. Jainism, Buddhism and other sects.
5. The age of the Mauryas- extent of administration, social and economic conditions. Ashoka's policy and reforms.
6. The Indo-Greek conquests, consolidation and decline.
7. The Gupta age: political and cultural aspects.
8. Chalukya, Pallava and the Vardhan Empires.
9. Emergence of the Rajput states-origin, polity and culture.
10. India under the Sultans of Delhi: Indian society on the eve of Mahamud, Ghazni's invasions, Establishment of State politics and administrative principles under Mohammad bin Tughlaq and Firoz. The Lodis.
11. Cultural development during the Sultanate- Bhakti Movement, Sufism, art & architecture, literature and the society.
12. The Vijaynagar and the Bahamani Empires: Polity and culture.
13. Profile of India in 1526 and Babar's invasion.
14. Achievements of Babar, Humayun and Shershah Suri.
15. National Monarchy under Akbar : New concept of monarchy. Akbar's religio-political out-look, his relations with the non-Muslims and administrative measures.
16. Age of Jahangir and Shahjahan.
17. Climax and disintegration of the Mughal Empire under Aurangzeb : Aurangzeb's religious policy, expansion of the Mughal Empire in Deccan, revolts against Aurangzeb, relations with the Marathas, disintegration of the Empire.
18. Mughal Administration.
19. Art, architecture and society under the Mughal Emperors.
20. Rise of the British power in Deccan and Bengal; Anglo- French struggle, relations with the Nawabs of Bengal.
21. Anglo-Maratha relations: 1772 A.D. to 1818 A.D.
22. The expansion and consolidation of British rule from 1789 to 1856: With special reference to Wellesley, Lord Hastings, William Bentinck and Dalhousie.
23. Revolt of 1857: Causes, nature and consequences.
24. Salient features of the new British policy under the Crown, Queen's Proclamation. Mayo's reforms, British liberalism under Ripon, Curzon's reforms.
25. Socio-religious Movements- Brahma Samaj, Prarthana Samaj, Arya Samaj, Theosophical Society, Ram Krishna Mission etc.
26. British economic policies: Trade, industry and agriculture.
27. Indian National Movement-Genesis, establishment of the Indian National Congress, different phases of the Movement (1885-1919), 1919-1939 (Gandhian Phases) Intensification of the freedom struggle (1939-1947) .
28. Builders of Modern India: Raja Ram Mohan Roy, Rama Krishna, Dayanand Saraswati, Vivekanand, Tilak, Gokhale, Gandhi and Nehru.
29. Indian constitutional developments- Acts of 1858, 1892, 1909, 1919 and 1935 .
30. Industrial Revolution and its impact on Europe.
31. American war of Independence.
32. The French Revolution and Napoleon Era (1789-1815). Its significance in world history.
33. The unification of Italy.
34. The unification of Germany.
35. British Liberalism (1830-1910).
36. The American Civil War.
37. The Near East problem in the 19th and 20th centuries.

38. Europe and the far East (1840-1911)-
39. The First World War.
40. The peace of Paris and the League of Nations.
41. The Russian Revolution of 1917 and its world impact.
42. Growth of totalitarian regimes in Germany, Italy and Japan between the two World Wars.
43. Rise of Nationalist Movements in Indonesia, China and Indo-China.
44. Rise and establishment of Communism in China.
45. Awakening in the Arab World-struggle for freedom and reform in Egypt, Emergence of Modern Turkey.
46. Second World War and its impact.

### (13) - वनस्पतिशास्त्र

1. **कोशिका जीव विज्ञान**— प्रोकैरिओटिक और यूकैरिओटिक कोशिका, गुणसूत्र की संरचना, विभिन्न कोशिकाओं की संरचना एवं कार्य, समसूत्री एवं अर्द्धसूत्री कोशिका विभाजन।  
**आण्विक जीव विज्ञान**— नाभिकीय अम्लों की संरचना एवं कार्य, प्रोटीन का संश्लेषण।  
**अनुवांशिकी**— मेण्डेलिज्म, सहलग्नता, जीन विनिमय एवं गुणसूत्र मानचित्र, नॉन मेण्डेलिअन अनुपात, कोशिका द्रव्य वंशागति, मात्रात्मक वंशागति, जीन की अवधारणा, उत्परिवर्तन, जीनामे का नियंत्रण, जीवाणु एवं विषाणु की अनुवांशिकी।  
**विकास**—विकासवाद का क्लासिकल सिद्धान्त एवं उनकी आधुनिक अवधारणा  
**पादप ब्रीडिंग**— पादप ब्रीडिंग के सिद्धान्त, रोग प्रतिरोधकता के लिए ब्रीडिंग, प्रारंभिक जैव सांख्यिकी
2. **जैव रसायन**— प्रोटीन, कोर्बोहाइड्रेट, लिपिड, ऐन्जाइम, एवं विटामिन की संरचना एवं पौधों के जीवन में इनकी भूमिका, पादप शरीर क्रिया विज्ञान— पादप कोशिका में जल संबंध (वाटर रिलेशन) जल एवं खनिज का अवशोषण, कार्बनिक एवं अकार्बनिक पदार्थों का स्थानांतरण, पौधों में खनिज पोषण, रन्ध्र के खुलने और बंद होने की क्रियाविधि, प्रकाश संश्लेषण, श्वसन, नाइट्रोजन मेटोबालिज्म, वृद्धि एवं पादपगति, स्ट्रेस फिजिओलॉजी, बायोरिदम, प्रतिवाष्पोत्सर्जक फोटोमॉर-फोजेनेसिस एवं वर्नेलाइजेशन, उत्तक संवर्धन एवं इसके अनुप्रयोग।
3. **सूक्ष्म जीवविज्ञान**— सूक्ष्म जीवों का वर्गीकरण, उद्योगों में सूक्ष्म जीव, अपशिष्ट जल के निस्तारण में (सीवेज के डिसपोजल) में सूक्ष्म जीव, पौधे और मानवों में सूक्ष्मजीवों द्वारा उत्पन्न बीमारियाँ, जीवाणु, विषाणु एवं लाइकेन का विस्तृत अध्ययन,  
**पादक जैव प्रौद्योगिकी**  
**निम्नवर्ग के पौधों का अध्ययन**— वर्गीकरण, संरचना का विस्तार जनन एवं मुख्य समूहों के मध्य अर्न्त संबंध। शैवाल— फिशियला, कोलिओकीट, उडोगोनियम, एसिटाबुलारिया, कारा, वाउकरिया, क्लोरेला, सारगासम, डिक्टोटोटा, बैट्टेकोस्पर्मम, पॉलीसाइफोनिया, मिक्सोफाईसी, का सामान्य विवरण  
**कवक**— सैप्रोलिगिनिया पायथियम, फायटोथोरा, ऐल्ब्यूगो, पैरेनोस्पोरा, म्यूकर, सैकरोमाइसिस, प्रोटोमाइसिस, एस्परजिलस पैनिसिलियम, क्लेविसेप्स, न्यूरोस्पोरा, पैजाइजा, मोरशेला, पकसिनिया, अस्टिलैगो, मेलमाप्सोरा, ऑल्टरनेरिया, सर्कास्पोरा, हेटैरोथैलिज्म, पैरासैक्वुएलिटी, पोषण विधि, कायिक विशिष्टीकरण।  
**बायोफाइट**— स्पोरोफाइट का विस्तार एवं वर्ध प्रजनन। टेरिडोफाइट— स्टीलर तंत्र, टीलोम सिद्धान्त, गैमीटोफाइट, फॉसिलटेरिडोफाइट, साइलोफाइट, लाइकोपोडियम, आइसोइटीस, इक्वीसीटम, ऑफिओग्लोसम, ओसमुण्डा, मासिलिया। जिमनोस्पर्म— बीज की उत्पत्ति, लाइजिनोपटेरिस, कैटोनिआ, साइकस, विलियम—सोनिआ, जिन्गो, पाइनस, एफिड्रा।
4. **एंजिओस्पर्म पादपों का अध्ययन** : विभिन्न वर्गीकरण प्रणालियाँ एवं उसके आधार, आई.सी.बी.एन, निम्न कुलों का अध्ययन— मोरसी, निम्फिएसी,

रैननकुलेसी, ऐनोनेसी, लेग्युमिनोसी (फैबेसी), रुटेसी, मीलिएसी, माल्वेसी, कैक्टोसी, मिर्टेसी, अम्बेलिफेरी, ऐपोसाइनेसी, ऐस्क्लेपिएडेसी, कान्बोल्बुलेसी, लैबिएटी, सोलेनेसी, स्कोफुलेरिएसी, बिग्नोनिएएसी, ऐकेन्थेसी, रुबियसी, कुकरबिटेसी, कॉम्पोजिटी, ऐलिस्मेटेसी, ग्रेमिनी, पोमी, म्यूसेसी, ऑर्किडेसी। ऐन्जिओस्पर्म की ऐम्ब्रिओलॉजी एवं ऐनाटॉमी, टिशूकल्चर ऐन्जिओस्पर्म का उद्गम एवं विकास, वानस्पतिक उद्यान एवं पादपालय, स्टेमेन एवं कारपेल की आकारिकी। आर्थिक और इथनोबॉटनी : भारत में इथनोबॉटनी, भैषिजीक महत्व के पादप, रेशे, इमारती लकड़ी, तेल प्रदान करने वाले एवं खाद्यान्न प्रदान करने वाले पादप।

5. **पादप परिस्थितिकी** :- पारिस्थितिकी तंत्र की संरचना एवं कार्य, प्रदूषण परिस्थितिकी, प्राकृतिक संपदा का संरक्षण, पादपभूगोल के सिद्धान्त, भारत की वनस्पतियों के प्रकार,

### (13) - BOTANY

- I. **Cell Biology** :- Prokaryotic and Eukaryotic cell; structure of chromosome; structure and functions of various cell organelles; Mitotic and Meiotic division;  
**Molecular Biology** :- Structure and functions of nucleic acids; synthesis of protein. Genetics:- Mendelism, Linkage and crossing over, chromosomal mapping; Non Mendellian ratios; Cytoplasmic inheritance; Quantitative inheritance; concept of gene, mutation; Regulation of genome; bacterial and viral genetics.  
**Evolution** :- Classical theories of evolution and its modern synthesis Plant Breeding : Principles of plant breeding and its modern synthesis for disease resistance; Elementary Bio-statistics.
- II. **Biochemistry**:- Structure of protein carbohydrate, lipid, enzymes and vitamins, their role in plant life. Plant Physiology :- Water relations of a plant cell; Absorption of water and minerals; translocation of organic and inorganic materials; Mineral nutrition in plants; mechanism of stomata opening and closing, Photosynthesis, Respiration; Nitrogen Metabolism; Growth and movements; stress physiology, Biorhythms Anti-transpirants ; Photomorphogenesis and Vernalization; tissue culture and its application.
- III. **Microbiology**:- Classification of microorganisms; Microorganisms in industry; Microorganisms in sewage disposal; Plant and human diseases caused by micro-organisms; Detailed study of Bacteria, Viruses and Lichens; Plant Biotechnology. Study of Lower Plants :- classification, range of structure and reproduction in the following forms with interrelationships in principle groups.  
Algae: Fritschia, Coleochaete, Oedogonium, Acetabularia, Chara, vaucheria, Chlorella, Sargassum, Dictyota, Batrachospermum Polysiphonia.  
General Account of Myxophyceae.  
Fungi :- Saprolegnia, Pythium, Phytophthora, Albugo, Peronospora, Mucor, Saccharomyces, Protomyces, Aspergillus, Penicillium, Claviceps, Neurospora, Peziza, Morchella, Puccinia, Ustilago, Melampsora Alternaria, Cercospora, Heterothallism, parasexuality, mode of nutrition, Physiological specilization.  
Bryophytes- range of sporophyte, vegetative propagation. Pteridophytes- Stellar organization, Telome theory, Gametophytes, Fossil Pteridophytes, Psilophyta, Lycopodium, Isoetes, Equisetum, Ophioglossum, Osmunda, Marsilea Gymnosperms- Origin of seed, Lyginopteris, Caytonia, Cycas, Williamsonia, Ginkgo, Pinus, Ephedra.
- IV. **Study of Angiospermic Plants** :- Criteria and various systems of classification, ICBN, Study of following families..  
Moraceae, Nymphaeaceae, Ranunculaceae, Annonaceae, Leguminosae (Fabaceae), Rutaceae, Meliaceae Malvaceae, Cactaceae, Myrtaceae Umbelliferae, Apocynaceae, Asclepiadaceae, Convolvulaceae, Labiatae, Solanaceae, Scrophulariaceae, Bignoniaceae, Acanthaceae, Rubiaceae, Cucurbitaceae, Compositae, Alismataceae, Gramineae, Palmae,

Musaceae Orchidaceae, Anatomy and Embryology of Angiosperms.

Tissue culture

Origin and evolution of angiosperms, Botanical gardens and Herbaria Morphology of stamen and carpel.

Economic and Ethnobotany :- Ethnobotany in India, Medicinal Plants, fibre, timber, oil-yielding and cereal plants. V Plant Ecology :- Ecosystem structure and function, Pollution ecology conservation of natural resources, Principles of phytogeography, Vegetation types of India.

### (14) - प्राणीशास्त्र

- I. **अकषेरुकी तथा कषेरुकी प्राणियों का सामान्य अध्ययन** - पेरामीषियम, प्लाज्मोडियम, ट्रिपेनोसोमा तथा सायकान की संरचना, परिवर्धन तथा आर्थिक महत्व; सीलेन्टेरेटा में बहुरूपता, कोरल रीफ तथा मीसेन्ट्री; मानव से संबंधित हेलमिन्थ्स एवं निमेटोड्स, अकषेरुकीयों की लारवल अवस्थाएं, कीट, मोलस्क, मत्स्य, पक्षी तथा स्तनियों का आर्थिक महत्व। विषैले तथा विष हीन सर्प, सर्प-दंश की किया विधि। वर्टीब्रेट प्राणियों में त्वचा, हृदय, महाधमनी चाप, मूत्र जनन तंत्र, मस्तिष्क एवं कपालीय तंत्रिकाओं का तुलनात्मक आकारिकी।
- II. **वर्गिकी तथा माइनर फाइला** - वर्गीकरण के सिद्धांत, प्राणिकीय नामांकन, वर्गीकरण समूह, प्राणी साम्राज्य के वर्गीकरण की रूपरेखा (गण तक), रोटीफेरा, ब्रैकियोपोडा, एक्टोप्रोक्टा, फोरोनिडा तथा इकाइयूरोइडिया की संरचना एवं सहजातिता। पेरार्जोआ, मीसोजोआ एवं मेटार्जोआ की उत्पत्ति।
- III. **विकास, कोशिका विज्ञान, कोशिकाआनुवंशिकी** - जीवन एवं जातियों की उत्पत्ति, विकास के प्रमाण तथा सिद्धांत, जीवाश्म, छोड़े तथा मनुष्य की जातिवृत्ति, विलगन, विविधता तथा अनुहरण, मछलियों तथा स्तनियों में अनुकूलित विकिरण, भौगोलिक तथा भूवैज्ञानिक वितरण, प्राणी कोशिका की संरचना; कोशिका कला, कोशिका-द्रव्य, केन्द्रक, माइटोकॉन्ड्रिया, गोल्जीकाय, लाइसोसोम, राइबोसोम, गुणसूत्र की संरचना तथा कार्य, डी.एन.ए. तथा आर.एन.ए. की संरचना तथा वंशानुक्रम में योगदान, सहलग्नता तथा जीन-विनिमय, लिंग निर्धारण, कोशिका द्रव्य वंशानुक्रम, सुजनकी, कर्क रोग का कोशिका विज्ञान तथा सामान्य परिचय।
- IV. **कार्यिकी** - कोशिका कार्यिकी के तत्त्व, एन्जाइम्स तथा विटामिन्स, पाचन, श्वसन तथा उत्सर्जन की कार्यिकी, समस्थापन, ताप एवं परासरण नियमन, रुधिर संरचना, थक्का जमना तथा रुधिर समूह, तंत्रिका आवेग चलन व पेशीय संकुचन के सिद्धान्त, अन्तःस्त्रावी ग्रंथियों की मूल अवधारणायें।
- V. **परिस्थितिकी एवं प्राणी व्यवहार** - पर्यावरण, अजीवीय तथा जीवीय कारक, अलवणीय जल, समुद्री तथा स्थलीय परिस्थितिकी तंत्र, परिस्थितिकी तंत्र में ऊर्जा प्रवाह, खाद्य शृंखला, खाद्य जाल, समष्टि परिस्थितिकी, वायु, जल तथा ध्वनि प्रदूषण, लर्निंग तथा स्टीरियो-टाइप व्यवहार, मधुमक्खी तथा प्राइमेट्स में सामाजिक व्यवहार, तर्क तथा संचार, भारत के वन-प्राणी, तथा उनका संरक्षण एवं प्रबंधन, मरुस्थल, वायवीय, जलीय, स्थलीय अनुकूलन।
- VI. **भूगिकी, सामान्य प्राणिकी एवं जीव सांख्यिकी** - अंडो के प्रकार, श्रुणीय कलाओं का विकास, मेटामार्फोसिस के विभिन्न प्रकार, प्लासेन्टेशन, रेशम उद्योग तथा मधुमक्खी पालन। आंकड़ों का संग्रह, आवृत्ति वितरण तथा उनका प्रस्तुतिकरण, ग्राफ, बार-चित्र, हिस्टोग्राम, रेखा-चित्र तथा आवृत्ति-वक्र, मीन, मीडियन, मोड तथा स्टेण्डर्ड डेविएशन, कार्-वर्ग ( $x^2$ ) टेस्ट।

### (14) - ZOOLOGY

- I. **General study of non-chordate and chordates** :- Structure, development and economic importance of Paramecium, Plasmodium Trypanosoma and Sycon; Polymorphism, coral reefs & mesenteries in coelenterates; Helminthes and nematodes in

relation to man, larval forms in invertebrates, Economic importance of insects, molluscs, fish, birds and mammals. Poisonous and non poisonous snakes, biting mechanism, comparative anatomy of skin, heart, aortic arches, urinogenital system, brain and cranial nerves in vertebrates.

- II. Taxonomy and minor Phyla :-** Theories of classification, Zoological nomenclature, taxonomical categories; outline classification of animal kingdom upto orders, structure and affinities of Rotifera, Brachiopoda, Ectoprocta, Phoronida and Echiuroidea, origin of parazoa, mesozoa and metazoa.
- III. Evolution, Cytology and cytogenetics :-** Origin of life and origin of species, Evidences and theories of evolution; fossils, phylogeny of horse and man, Isolation, Variation and mimicry; Adaptative radiation in fishes and mammals, Geological and Zoogeographical distribution, structure of animal cell; structure and functions of plasma membrane, cytoplasm, Nucleus, Mitochondria, Golgibodies, Lysosomes, Ribosomes, Chromosomes; structure and functions, structure of DNA and RNA and their role in inheritance, linkage and crossing over, Sex determination, cytoplasmic inheritance, Eugenics, introduction to cancer cytology.
- IV. Physiology :-** Elements of cell physiology; enzymes and vitamins, physiology of digestion, respiration and excretion, Homeostasis, thermo and osmoregulation, blood structure, coagulation, blood groups, theories of nerve conduction and muscles contraction, Basic concepts of endocrine glands.
- V. Ecology and Animal Behaviour :-** Environment, abiotic, biotic, factors; fresh water, marine, terrestrial ecosystem, energy flow in ecosystem, food chain, food web, population ecology, air, water and noise pollution, learning and stereotyped behavior, social behavior in Honey bee and primates, reasoning and communication, wild life in India, its conservation and management, desert, volant, aquatic & terrestrial adaptations.
- VI. Embryology, General Zoology & Biostatistics:-** Types of eggs, development of fetal membranes, various types of metamorphosis, Placentation, Sericulture, Apiculture, Collection of data, Frequency distribution and its presentation, Graphs, bar diagrams, Histograms, line diagrams and frequency curves, Mean, Median mode and standard deviation, Chi-square ( $x^2$ ) test.

### (15) - भूगोल

#### भाग - एक

- 1. भू - आकृति विज्ञान**
- (i) पृथ्वी की उत्पत्ति : पृथ्वी की उत्पत्ति संबंधी सिद्धान्त।
- (ii) भूपृष्ठ : चट्टानों की उत्पत्ति उनके प्रकार, पृथ्वी की आंतरिक संरचना, अनाच्छादन के कारण, अपरदन चक्र, हिमनद, पवन, समुद्री जल तथा कार्स्ट द्वारा निर्मित स्थलाकृतियों, भूकम्प ज्वालामुखी तथा उनका विश्व वितरण।
- 2. जलवायु विज्ञान**
- (i) वायु मंडल : वायु मंडल की संरचना तथा उसका संगठन, वायु मंडलीय परतों का ऊर्ध्वधर वितरण तथा उनकी विशेषताएँ।
- (ii) तापमान : पृथ्वी पर सूर्य ताप का क्षैतिज वितरण, समताप रेखाएँ।
- (iii) वायुदाब तथा पवन - पृथ्वी पर वायुदाब पेटियों, पवनों के प्रकार व उनका वितरण, स्थानीय पवन, चक्रवात तथा प्रति चक्रवात, चक्रवात उत्पत्ति की संकल्पना, वाताय, तड़ित झंझा और वायु राशियों।
- (iv) आर्द्रता तथा वर्षा : आर्द्रता, वर्षा के प्रकार तथा विश्व वितरण।
- (v) जलवायु वर्गीकरण : थार्नथ्वेट तथा कोपेन।
- 3. समुद्र विज्ञान**
- (i) समुद्र तली के उच्चावच स्वरूप, महाद्वीपीय मग्न तट, महासागरीय गर्त तथा खाईयों की उत्पत्ति संबंधी अवधारणा।

- (ii) महासागर का तापमान तथा खारापन : महासागरों के खारेपन के कारण।
- (iii) महासागरीय निक्षेप : निक्षेपों के प्रकार, वितरण तथा उनका रासायनिक संरचना, निक्षेप का स्रोत।
- (iv) प्रवाल भित्तियाँ : प्रवाल भित्ति-उनकी उत्पत्ति के सिद्धांत, विश्व की महत्वपूर्ण प्रवाल भित्तियाँ।
- (v) महासागर अध्ययन का विकास, महासागरों का आर्थिक राजनैतिक तथा कूटनीतिक महत्व।
- 4. भौगोलिक विचार धाराओं का विकास :**  
निश्चयवाद, संभववाद, नवनिश्चयवाद, 20 वीं शताब्दी में भारत में भूगोल का विकास।
- 5. मानव भूगोल :**
- (i) प्रजाति और विश्व में उनका वितरण।
- (ii) जनसंख्या: विश्व में जनसंख्या वृद्धि, घनत्व तथा वितरण, विश्वजनसंख्या की समस्याएँ तथा उनके निदान।
- 6. राजनीतिक भूगोल :**  
राजनीतिक भूगोल तथा भू-राजनीति, सीमान्त क्षेत्र तथा सीमाएँ, हिन्द महासागर तथा विश्व राजनीति।
- 7. आर्थिक भूगोल :**
- (i) कृषि : कृषि के प्रकार, प्रमुख खाद्यान्न और वाणिज्यिक फसलें तथा उनका विश्व वितरण।
- (ii) खनिज संसाधन : लौह अयस्क, मैंगनीज, ताँबा, सोना, टिन तथा बाक्साइट का विश्व में उत्पादन तथा वितरण।
- (iii) ऊर्जा स्रोत : कोयला, पेट्रोल तथा जल विद्युत का विश्व में वितरण।
- (iv) उद्योग : उत्तरी अमेरिका में लोहा तथा इस्पात, वस्त्रोद्योग, कागज तथा जहाज निर्माण उद्योग।

#### भाग - दो

#### (भारत का भूगोल छत्तीसगढ़ के विशेष संदर्भ में)

##### भौतिक पहलू :-

भारतीय उपमहाद्वीप का भूगर्भिक इतिहास, प्राकृतिक विभाग तथा प्रवाह प्रणाली।  
जलवायु - भारतीय मानसून की उत्पत्ति तथा उसके कारण, वर्षा का वितरण, बाढ़ग्रस्त तथा सूखाग्रस्त क्षेत्र।  
मिट्टी तथा प्राकृतिक वनस्पति - मिट्टी के प्रकार तथा उनका वितरण, वनों के प्रकार तथा उनका वितरण।

##### मानवीय पहलू :-

भारत की प्रमुख जनजातियाँ।  
कृषि - प्रमुख फसलें, हरित क्रान्ति, भूमि सुधार नीति, फसल प्रतिरूप, मिश्रित कृषि का विकास, सिंचाई के विविध साधन तथा उनका महत्व, भूजल प्रबंध।  
उद्योग - औद्योगिक विकास का इतिहास, खनिज आधारित, कृषि आधारित तथा वनों पर आधारित उद्योग का अध्ययन, भारत के औद्योगिक प्रदेश।  
क्षेत्रीय विकास तथा नियोजन - क्षेत्रीय विसंगतियों, पर्वतीय तथा आदिवासी क्षेत्रों का नियोजन, बहुस्तरीय नियोजन तथा नदी घाटी विकास।

### (15) - GEOGRAPHY

#### Part - 1

- 1. Geomorphology**
- (i) Origin of the Earth - Theories regarding origin of the earth.
- (ii) Earth's Crust - Origin of rocks. their types, Interior of the Earth, Agents of Denudation, Cycle of erosion, Glacial, Arid, Marine and Karst topography, Earth quakes, Volcanoes and their distribution in the world.

**2. Climatology :**

(i) Atmosphere : Structure and Composition of atmosphere. Vertical distribution of Atmospheric layers and their characteristics.

(ii) Temperature : Horizontal distribution of Temperature over the globe, Isotherms.

(iii) Pressure and wind : Pressure belts of the globe, Types of winds and their distributions. Local winds, Cyclone and anti-cyclones, Concept regarding Origin of cyclones, Fronts, Thunder storms and Air masses.

(iv) Humidity and Precipitation : Humidity, types of precipitation, Distribution over the globe.

(v) Climatic Classification : Thornthwaite and Koppen.

**3. Oceanography :**

(i) Relief features of ocean floors, Concepts regarding origin of continental shelf, oceanic deeps, oceanic canyons.

(ii) Temperature and salinity of oceans, Causes of salinity of ocean water.

(iii) Marine deposits : Types of deposits, distribution and their chemical composition, sources of deposits

(iv) Coral Reefs : Coral reefs - concepts of their origin, important coral reefs of the world.

(v) Development of study of oceanography, Economic, Political and Strategic significance of oceans.

**4. Development of Geographical Thought**

Determinism, Possibilism, Neo-determinism, Development of geography in India in the 20th Century.

**5. Human Geography**

(i) Races of mankind and their world distribution.

(ii) Population : Growth, density and distribution in the world, problems of the world population and solutions

**6. Political Geography :**

Political Geography and Geopolitics, Frontiers and boundaries, Indian ocean and world politics.

**7. Economic Geography**

(i) Agriculture : Types of agriculture, Major food and commercial crops and their world distribution.

(ii) Mineral Resources : World Production and distribution of Iron-Ore, Manganese, Copper, Gold, Tin and Bauxite.

(iii) Power Resources : World distribution of Coal, Petroleum and Hydroelectricity

(iv) Industries : Iron and Steel, textile, paper and ship building industries of North America,

**Part - 2****(Geography of India with special reference to Chhattisgarh) Physical Aspects -**

Geological history of Indian, sub-continent, physiographic divisions and drainage systems.

Climate - Origin and mechanism of Indian monsoon, distribution of rain-fall, flood prone and drought prone areas.

Soil and Natural Vegetation - Soil types and their distribution, forest types and their distribution.

**Human Aspects -**

Major tribes of India.

Agriculture - Major crops, green revolution; land reform policy, crop patterns, development of mixed farming, different means of irrigation and their significance, ground water management. Industry - History of industrial development, study of mineral-based, agro-based and forest based industries, Industrial regions of India.

Regional Development and Planning - Regional disparities; planning for hill and tribal areas; multi-level planning and river basin development.

**(16) - समाजशास्त्र**

समाजशास्त्रीय सिद्धान्तों की प्रकृति - समाजशास्त्रीय सिद्धान्तों के विभिन्न स्तर एवं उनके व अनुसंधान (शोध) के मध्य संबंध।

संरचना - सामाजिक संरचना के संदर्भ में संरचनात्मक प्रकार्यवाद (ए. आर. रेडक्लिफ ब्राउन)-भूमिका विश्लेषण की समस्या (एस.एफ. नेडल) सामाजिक व्यवस्था के प्रकार्यात्मक मापदण्ड (टी. पारसनस) प्रकार्यात्मक विश्लेषण का वर्गीकरण, आलोचनाएँ, पुनर्संरचना (आर.के. मर्टन) नव प्रकार्यवाद-जे. अलेक्जेंडर।

संघर्ष - सिद्धान्त - मार्क्स की आलोचना एवं द्वंद्वतात्मक संघर्ष (आ.ए. डहर्न डार्फ) संघर्ष का प्रकार्यात्मक विश्लेषण (एल. क्रोजर) संघर्ष एवं सामाजिक परिवर्तन - (आर.कोलिन्स)।

नवमार्क्सवाद-संरचनात्मक मार्क्सवाद (एल. एलथ्यूजर) क्रिया सिद्धान्त-परेटो मैक्स बेवर, पारसनस।

परिसंवाद वाद - उद्देश्य, सांकेतिक परिसंवाद वाद (जी.एच. मीड एवं एच. ब्लूमर) प्राकघटनात्मक क्रिया विज्ञान का समाजशास्त्र (ए. श्यूज़) सामाजिक संरचना की वास्तविकता (पी.बर्जर एवं टी.जी. ल्युकमैन) नृजाति विज्ञान शास्त्र (एच.गरफिकल)

तात्कालीन विचारों की सामाजिक सिद्धान्तों की नवधारणाएँ-ऐथोनीगिडन, हेबिटस एवं फील्ड-बोरड्यु-पश्चआधुनिकवाद-फोकाल्ड एवं बोट्रिलाड। भारतविद्या/विययक-(जी.एस.घूरिये)-भारतीय समाज के संदर्भ में - अवधारणाएँ, विशेषताएँ तात्कालिक-संरचना के (संदर्भ में), धर्म वर्ण, आश्रम कर्म, ऋण एवं पुरुषार्थ।

दृष्टिकोण की रचना (इरावती कर्वे एवं के.एन. कापड़िया) नेटवर्क का निर्माण एवं संपर्कों की स्थापना एवं करण, समूह एवं समुदाय परिवार, विवाह एवं बन्धुत्व (नातेदारी व्यवस्था) तंत्र का अध्ययन, भारतीय सामाजिक संगठन।

संरचनात्मक प्रकार्यवाद - (एम.एन. श्रीनिवास, एस.सी.दुबे) भारतीय समाज के केन्द्र के रूप में ग्राम सामाजिक पदानुक्रम (संस्तरण), जातिव्यवस्था (भारतीय संदर्भ में जाति एवं वर्ग व्यवस्था)

सभ्यतात्मक दृष्टिकोण - एन.के. बोस, संस्कृति की मात्रात्मक पैमाना, धार्मिक, संस्थागत एवं भाषागत, भारत में विविधता, परम्परा एवं आधुनिकता, भूत एवं वर्तमान संस्थाओं की निरंतरता के परिप्रेक्ष्य में। गौण परिप्रेक्ष्य - बी.आर. अम्बेडकर, विशिष्ट, पिछड़ा वर्ग, अल्पसंख्यक एवं आदिवासी समूह अनुसूचित जाति एवं जनजाति की समस्याएँ, भारतीय समाज एवं विधायी, जाति व्यवस्था, अस्पृश्यता, सम्प्रदायवाद, क्षेत्रवाद एवं राष्ट्रीय एकता।

विज्ञान का अध्ययन और इसका महत्व तथा समाज एवं विज्ञान में संबंध, सामाजिक तंत्र के रूप में विज्ञान, विज्ञान के मानक प्रतिमान तथा विज्ञान एवं तकनीक के मध्य संबंध।

आधुनिक विज्ञान का इतिहास भारत के संदर्भ में - उपनिवेशीय स्वतंत्रता, स्वतंत्रता पश्चात का विज्ञान, विज्ञान और तकनीक की प्रकृति भारत में इसकी शिक्षा एवं गुणवत्ता भारत में शुद्ध बनाम व्यवहारिक विज्ञान, भारतीय सामाजिक संरचना एवं विज्ञान, भारतीय वैज्ञानिकों की सामाजिक पृष्ठभूमि ब्रेनड्रेन एवं ब्रेनगेन।

वैज्ञानिक नीतियाँ - भारतीय संदर्भ में वैज्ञानिक एवं सामाजिक संगठन: वैज्ञानिक प्रयोगशालाएँ एवं तकनीक के विकास में उनका योगदान। समकालीन भारत में वैज्ञानिक शिक्षा : प्राथमिक स्तर से अनुसंधान स्तर तक, तकनीकी विकास में विश्वविद्यालयों की भूमिका, विश्वविद्यालय और उद्योगों के मध्य अंतर्संबंध।

वैश्वीकरण एवं उदारीकरण का भारतीय विज्ञान एवं तकनीक पर प्रभाव, विश्व व्यापार संगठन (डब्ल्यू.टी.ओ.) एवं बौद्धिक अधिकार से जुड़े मुद्दे, बहुराष्ट्रीय कंपनियों और भारतीय उद्योग (एम.एन.सी.) एवं राष्ट्रीय एवं अंतरराष्ट्रीय स्तर पर विज्ञान एवं तकनीक का राजनैतिक अर्थव्यवस्था पर प्रभाव।

**(16) - SOCIOLOGY**

Nature of Sociological theory - Levels of theorisation in sociology-Relationship between theory and research.

- Structural-Functionalism, the idea of social structure : A.R. Radcliffe-Brown- the problems of role analysis, S.F. Nadel - Functional dimensions of social system : T. Parsons - Codification.critique and reformulation of functional analysis : R.K. Merton - Neofunctionalism : J. Alexander. Conflict Theory : Marx critique and dialectics of conflict : R. Dahrendorf - Functional analysis of conflict, L. Coser-Conflict and social change : R Collins . Neo Marxism : Structuralism Marxism : L. Althusser : Action theory. Pareto. Max Weber and Parsons. Interactionist perspective : symbolic Interactionism : G.H. Mead and H. Blumer - Phenomenological Sociology : A Schutz - Social Constructuon of reality : P Berger and T.G Luckmann, Ethnomethodology : H. Garflinkel. Recent trends in sociological theorising : Structuration : Anthony Giddens - Habitus and field : Bourdieu - Postmodernism-Focault and Botrilard. Indological/Textual (G.S.Ghure) Conceptualizing Indian Society in terms of certain characteristics and configuration Dharma Varna, Ashrama, Karma, Rin (Debt) and Purushartha. Synthesis of Textual and Field views (Irawati Karve, K.M. Kapadia) Linkage and Network building reasons group and community family, marriage, kinship system and Indian social organization. Structural functionalism (M.N. Srinivas, S.C. Dube) The village as a nucleus of Indian Society, Social Hierarchy, Caste System, Caste and class in contemporary India. Civilizational View (N.K. Bose) The scale of magnitude of Culture: religions, Institutional and Linguistic diversity in India, Tradition and modernity as a continuity between past and present institutions. Subaltern perspectives (B.R. Ambedkar) Elites, Backward classes, Minorities and Tribes, Problems of Schedule caste and Scheduled Tribe, Indian society and Legislation, Castism, Untouchability, communalism, Regionalism and National Integration. The study of Science-its importance, relationship between society and science and vice-versa. Science as a social system. Norms of science. Relationship between science and technology. History of modern science in India : colonial-independence and post-independence science, Nature of science and technology, education in India and its quality. Pure vs. Applied science in India. Indian social structure and science. Social background of Indian scientists. Brain drain and brain-gain. Science policy, social organization of science in India : Scientific laboratories and their contribution to the development of technology. Science education in contemporary India : primary level to research level, Performance of universities in the development of technology. Inter-relationship between industry and universities. Globalization and liberalization and their impact on Indian science and technology, WTO and issues related to intellectual property rights. MNCs and Indian industry, Political economy of science & technology at the national and international levels.

### (17) - TASAR TECHNOLOGY

#### **Morphology, Anatomy & Physiology Of Tasar Silkworm & Agronomy**

1. History of Non-Mulberry Sericulture.
2. Outline classification of Non-Mulberry silkworm, their distribution in India and Other countries.

3. General organisation and life-cycle of *Antheraea Mylitta*, & Morphology & Anatomy of larva, pupa & moth.
4. Structure of EGG, fertilization, Embryogenesis, Incubation & Hatching.
5. Reproduction-structure of re-productive system, oogenesis, spermatogenesis, development & growth.
6. Moulting and voltinism in tasar silkworm.
7. Role of hormone in development & metamorphosis.
8. silk glands, structure of silk gland, formation and biochemistry of silk.
9. Rearing-rearing equipment, preparation for rearing environment condition for rearing of tasar silk work.
10. Rearing of larvae, young age and late age tasar silkworm.
11. Disinfection and disinfectants.
12. Spinning & harvesting of cocoon.
13. Diseases of tasar silkworm- protozoan, viral, Bacterial, Fungal, Symptoms, Causative agents, preventive & control Measures.
14. Primary food plants of Tasar silk worm (*Terminalia arjuna*, *T. tomentosa*, *shora robusta* etc.) and their culture methods.
15. Out line classification of primary & secondary food plants of tasar worm, their distribution in India. (with the special references to C.G.) and other State. 16. Farm Management : selection of soil & preparation of land for tasar plant cultivation.
17. Propagation of Tasar food plants- seedlings, saplings, Grafting, Layering.
18. Harvesting of Leaf.
19. Diseases of Non-mulberry food plants, Fungal, Bacterial, Viral, Deficiency, Insect pest, control method.

#### **Tasar Silkworm - Genetics And Breeding**

1. Moth Emergence : pairing, oviposition, moth examination.
  2. Incubation of Univoltine, bivoltine and multivoltine eggs.
  3. Preparation of loose eggs- Advantages of loose eggs, handling of loose eggs.
  4. Seed Technology : seed areas and importance of quality seed in tasar industry
  5. Seed cocoon : Harvesting of cocoon, gradation and selection consignment for processing.
  6. Storage & preservation of cocoon : Types of building, Methods of storing-problems, care in different season.
  7. Grainage: Definition, model grainage house, location, orientation and grainage equipment, condition required in grainage work.
  8. Hybridization- Interspecific & intra specific with special reference to tasar. its impact & future prospects.
  9. Breeding-methods and its application, qualitative and quantitative improvement by breeding.
  10. Breeding of Tasar silk worm ; Aims, pre-requirements, variability selection for breeding.
  11. Inbreeding : Advantage and dis - Advantage, exploitation of inbreeding of non-mulberry silk worms, general and specific combining.
  12. Selection : Methods of selection, criteria of selection, Individual and batch selection.
  13. Structure of typical animal cell, mitosis & meiosis, chromosome number of different Non-mulberry silkworm.
  14. Hereditary traits, in tasar silk worm- Egg, Larvae and pupae.
  15. Mutation: Type of mutation, spontaneous and induced, chemical mutagens, effect of radiation.
  16. Polyploidy : nature and induction of polyploidy.
  17. Genetics of larval and cocoon characters.
  18. Silk worm races: Univoltine, bivoltine and multivoltine races of different tasar silk worm.
  19. Maintenance of races and basic seed of different silk worm.
- #### **Seed Technology And Reeling**
1. Spinning behaviour of non-mulberry cocoons. physical and commercial characters of cocoons.
  2. Pierced cocoons : storage and disposal.

3. Marketing of cocoons : price fixation according to silk content.
  4. Selection & transportation of cocoon for reeling.
  5. Economics of seed organisation : Equipment for preparation of economically viable unit of grainage, cocoon DFSL- ratio, manpower requirement.
  6. Organising a grainage, cost of preparation of DFSLs.
  7. Maintenance of seed production: salaries, wages, establishment, charges, cold storing of eggs, sale of eggs, cost of chemical equipments, egg sheets, furniture, contingencies & miscellaneous expenditure.
  8. Protective measures in seed production.
  9. Silk Reeling : Introduction, evolution, Importance & Statistics of silk reeling.
  10. Position of reeling Industry in India and other silk producing countries.
  11. Raw materials for silk reeling - factor affecting the production of silk yarn, different varieties their characteristics.
  12. Reeling : object, detail study of yarn passage, raw silk yarn size (denier) and importance.
  13. Physical, chemical & Microscopical Properties of tasar silk. Uses of tasar silk. different type of silk yarn & their characteristic and uses.
  14. Difference between mulberry and non-mulberry silk, Main problem of reeling of tasar silk.
  15. Silk testing & quality control : Testing of raw silk, Advantage of testing, silk conditioning and testing house winding test, seriplane and serigraph tests. cohesion and standardisation of raw silk.
  16. Reeling Machine: conventional charkha, Improved charkha, cottage basin/ filature basin, multiend silk reeling basin.
  17. Automatic & semi-automatic reeling machine, recent advances in reeling.
  18. Re-reeling & packing: object, importance of re-reeling yarn, distribution and skein formation, skein finishing, Raw silk hook making and building.
  19. Stifling : Definition, Various methods of stifling.
- Spinning, Dyeing & Printing Of Tasar Silk**
1. Spinning: principles of spinning, charkha spinning, hand spinning, spun silk mills, spun silk Industry.
  2. Silk throwing: Introduction, objective of silk throwing preparation for twisting (Highlight twist-high twist & low Twist).
  3. Winding : object of winding, principle of winding, types and methods of winding.
  4. Silk processing: Degumming of silk, bleaching, dyeing, finishing.
  5. Types of water used in processing.
  6. Process Involved in spun silk preparation : washing drying opening, filling, combing, drawing, rowing, spinning, doubling, gassing, cleaning, reeling.
  7. Introduction of Textile fibre, General properties, classification of textile fibre, physical and chemical properties of different fibres (Tasar, Wool, cotton, polystor)
  8. Establishment of small reeling unit, efficiency, machinery management, production & economics.
  9. By products of silk, pupa, different types of silk waste.
  10. Traditional ghicha preparation of tasar silk, blending of tasar silk with other fibre and its problems.
  11. Noil and noil yarns.
  12. Bleaching: Introduction of bleaching, purpose of bleaching, bleaching of tasar silk, wool & cotton.
  13. Dyeing: Introduction of dyeing of tasar silk, cotton and wool with different class of dyes normally used after their treatment.
  14. Printing : Introduction of printing, study of different methods and styles of printing.
  15. Printing of tasar silk & cotton by block method, with different group of colour normally used.
  16. Brief Idea of transfer and foam printing, thickening agents.
17. Finishing: Introduction of finishing, classification of finishing, study of different type of temporary and permanent finishing of tasar silk and cotton.
- Textile Design, Fabric Structures & Weaving**
1. Different types of winding method.
  2. Loom: Definition of loom, types of loom, details about handlooms, parts of loom. simple Idea of motion of the loom.
  3. Study of power loom and handloom weaving.
  4. Preparation for tasar silk weaving, warp preparation, warping, beaming, drawing, denting, weft preparation.
  5. Textile Design : Preparation of design on natural, convention and abstract forms.
  6. Planning of design, placement, repeats, transferring designs, jaquard, patterns.
  7. Design selection based on different forms of layout in colour for saree border.
  8. Design development and its suitability.
  9. Traditional and tribal motifs of design.
  10. Fabric structure: Different types of fabrics and their uses, fabric defects and grading of silk fabrics.
  11. Fabric: classification and weave notations, plain weave its varieties and ornamentation, rib & twill weave and their derivatives, satin and their derivatives.
  12. Study of coarse structure like whip cord and bodford cord pique wett and quilting fabrics, wadded structure.
  13. Tasar technology as a rural Industry, Employment potential. comparison with other cottage Industries.
  14. Tasar technology progress through five year plans, targets and achievements, future projections.
  15. Prospects and problems of tasar technology.
  16. Tasar culture: Its association with forest tribes.
  17. Role of women in tasar technology: women participation in farm and rearing management, silk reeling, twisting etc.
  18. Prospects of biotechnology to improve tasar silk production.
  19. Quality control in tasar silk weaving and its necessity.
  20. Tasar technology as a tool for rural development.
- Extension, Organization, Planning And Management**
1. Extension Education : Definition, meaning, origin and growth. Role of extension in rural development.
  2. Tasar Technology extension organization: organization at various level-development, research, training and policy at state and national levels.
  3. Tasar Technology service network: B.S.F. seed area; grainages, nurseries, C.R.C. TSCS, Cocoon markets, silk exchange and cocoon certification centre,
  4. Farmer Training programme: Departmental training programme/ Demonstration, lectures, symposium, panel and forum as extension methods. field day and field trips. farmer fair.
  5. Mass contact methods: T.V., Radio. Farm publications, film shows, merit and limitations.
  6. The labour problems, problems of personnel management in tasar Industries.
  7. Survey: object. availability of land for plantation in an area in a district. existence of tasar Industry in village. tahsil and district.
  8. Survey of weavers/ reelers enclave excluding their socio Economics status measures of drainage of traditional weavers/ reelers, step for its reclamation.
  9. Soil Types: water availability, annual rainfall, socio Economic condition, agricultural crops, profitability, financing agencies, co-operative societies.
  10. Project: Infra structure availability, its role, future programme. preparation of a project, use of survey report economics, present condition.
  11. Planning: Fundamental requirement for planning. project formulation for establishment of small, medium and large scale tasar food plants forms.
  12. Budgeting in planning.

13. Inter state tasar project programme, tribal development programme of govt. of India through tasar culture. Bank loan for tasar culture.
14. Government Intervention: Legislation, Implication, Marketing Intitution, Marketing boards.
15. Management: Definition, application and scope of farm management nature and characteristics of farm management, farm management problems.
16. Marketing Management: Tasar Industries marketing & organization of seed. cocoon, raw silk fabric.
17. Marketing costs: Defects, regulated markets, traditional and Non traditional markets, co-operative marketing, stabilisation of price. price fixation.

### (18) - SERICULTURE

General Sericulture.

History, geographical distribution of various species and economic races of silkworms.

Systematic position and distribution of silkworms in India.

Present status of sericulture industry in India. Morphology of various stages of mulberry silkworm. Morphology of various stages of non-mulberry silkworms. Problems and prospects of Sericulture in India. Silk gland complex in mulberry and non-mulberry silkworms.

Morphological structure.

Histological structure.

Development.

Biosynthesis of Silk

Types of silk protein.

Effect of exogenous and endogenous factors on silk synthesis Digestive, Circulatory, Excretory and Respiratory systems. Morphology and histology of digestive system and physiology of digestion.

Morphology of excretory system and mechanism of excretion.

Morphology of respiratory system and physiology of respiration.

Reproductive system, Embryonic development, silkworm Growth and Metamorphosis.

Male reproductive system in mulberry and non-mulberry silkworms. Female reproductive system in mulberry and non-mulberry silkworms.

Mechanism of spermatogenesis and Oogenesis. Embryonic development.

Silkworm growth and metamorphosis.

Parthenogenesis.

Neuroendocrine System.

Structure of the cephalic neuroendocrine system - (a) Neurosecretory cells (b) Corpora cardiaca (c) Corpora allata (d) Ecdycial glands.

Other endocrine components - Mid-gut endocrine cells, gonads, ventral ganglia.

Types of hormones structure and functions.

Hormonal control of moulting and metamorphosis.

Hormonal control of reproduction.

Exocrine glands and pheromones.

Moriculture.

Distribution.

Morphology, Taxonomy and its varieties of mulberry; *Morus alba* *Morus indica*, *Morus cerata*.

Anatomy of root, stem, leaf, flower and bud.

Selection and preparation of land, climate and soil conditions. Propagation of mulberry, mulberry planting, manuring and irrigation.

Inter-cultivation, weeding, pruning, harvesting and leaf storage.

Arboriculture (Tropical and Temperate Tasar)

Distribution.

Taxonomy of host plants; Arjun, Sal, Oak.

Morphology of host plants; Arjun, Sal, Oak.

Climate, soil conditions and manuring.

Propagation and cultivation.

Intercultivation and pruning.

Arboriculture (Eri)

Distribution.

Morphology of host plants; Castor (*Ricinus communis*), Kesseru (*Heteropanax fragrans*)

Taxonomy of host plants; Castor (*Ricinus communis*), Kesseru (*Heteropanax fragrans*)

Climate, soil conditions and manuring.

Propagation and cultivation.

Intercultivation and pruning.

Physiology

Mineral nutrition

Photosynthesis

Respiration

Growth regulators

Photoperiodism

Transpiration.

Pests and Diseases of Mulberry Silkworm.

Influence of biotic and abiotic factors on the incidence of diseases.

Pests of silkworm, *B. mori* - Identification. Classification and life cycle of insects Pests - Tachinid fly (Uzifly), Dermestid beetles, Ants, Praying mantis, Earwig. Other invertebrate pests - Mites and Nematodes. Vertebrate Pests - Lizard, Birds, Rat, Squirrel and Snakes.

Diseases of *B. mori* - Etiology, Structure, Symptoms, lesions, pathogenesis and diagnosis of disease - Viral, bacterial, protozoan and fungal.

Viral: Grasserie, CPV, NPV and Infectious flacherie.

Bacterial: Bacterial septicemia, Bacterial gastro enteric disease, Bacterial toxicosis.

Protozoan: Pebrine.

Fungal: Muscardine - White, Green and Yellow, Aspergillosis

Influence of nutrition on the incidence of diseases.

Preventive and control measures of pests of mulberry silkworm.

Preventive and control measures of mulberry silkworm - chemical control, insecticides.

Pests and Diseases of Mulberry

Influence of biotic and abiotic factors on the incidence of diseases

Pests of Mulberry - Identification, classification, life cycle and nature of damage of following insect pests.

Lepidoptera: Bihar hairy caterpillar, Cut worm, Morning caterpillar, Leaf roller, Syntomids

Homoptera: Jassids

Hemiptera: Scale insects, Mealy Bugs (sucking).

Thysonoptera: Thrips.

Orthroptera: Grasshoppers.

Isoptera: Termites.

Coleoptera: Stem borers, Weevils.

Diseases of mulberry- Factors, symptoms, disease cycle. Bacterial: Bacterial leaf spot.

Fungal: Leaf spot, Powdery Mildews, Rust of Mulberry, Stem canker, Root rot.

Preventive and control measures of pests of mulberry.

Preventive and control measures of diseases of mulberry. Integrated pest management.

Pests and Diseases of Tasar Silkworm and Host Plants.

Pests of *Antheraea* sp: Uziflies, Red ant, Pentatomid bug, Praying Mantis and Lady bird beetle.

Diseases of *Antheraea* sp: Viral, Bacterial, Protozoan and fungal.

Preventive and control measures of pests and diseases of tasar silkworm, *Antheraea* sp.

Pests of tasar silkworm host plants.

Diseases of tasar silkworm host plants: Bacterial and fungal. Preventive and control measures of pests and diseases of tasar silkworm host plants, *Terminalia* sp.

Pests and Diseases of Muga Silkworm and Host Plants: Pests of muga silkworm, *A. assamensis*: Uziflies Red ant, Pentatomid bug, Praying Mantis and Lady bird beetle. Diseases of muga silkworm, *A. assamensis*: Viral, Bacterial, Protozoan and Fungal.

Preventive and control measures of pests and diseases of muga silkworm.

Pests of muga silkworm host plants.

Diseases of muga silkworm host plants: Bacterial and fungal. Preventive and control measures of pests and diseases of muga silkworm host plants.

Pests and disease of Eri Silkworm and Host Plants:

Pests of Eri silkworm. *Philosamia ricini*: Invertebrate and vertebrate Pests.

Diseases of Eri silkworm, *Philosamia ricini*: Viral, bacterial, Protozoan and fungal.

Preventive and control measures of pests and diseases of Eri silkworm.

Pests of Eri silkworm host plants.

Diseases of Eri silkworm host plants: Bacterial and fungal. Preventive and control measures of pests and diseases of Eri silkworm host plants. Cell Biology.

Ultrastructure of Golgi and Secretory mechanism.

Ultrastructure of lysosomes, synthesis, segregation and transport.

Molecular organisation of ribosomes and endoplasmic reticulum.

Genetic Code.

Protein synthesis,

Mitochondria in energy metabolism.

Molecular cell Biology.

Molecular structure of plasma membrane and mechanism of transport.

DNA replication.

RNA types, structure and function.

Enzyme kinetic - negative and positive co-operativity, regulation of enzyme activity, activators and inhibitors.

Receptor- Ligand interaction and signal transduction.

Lac operon, attenuation, tryptophan operon.

Biochemistry

Primary, secondary, tertiary and quaternary structure of proteins. Protein metabolism.

Structure, Chemistry and metabolism of carbohydrates.

Structure, chemistry and metabolism of lipids.

Nitrogen metabolism.

Biotechnology

Isolation, sequencing of DNA segments, gene amplification, synthesis of gene.

Cloning vectors of recombinant DNA - Plasmids, phages, cosmids, binary and shuttle vectors.

Gene cloning techniques in bacteria and eukaryotes. molecular probes labeling, blotting, dot and slot blots.

Animal cell and tissue culture: Methods, advantages and disadvantages.

Gene transfer, targeted gene transfer and transgenic animals.

Immunotechnology: Hybridoma technology and monoclonal antibodies.

Tools and Techniques.

Principles and Applications of compound, phase contrast and fluorescence microscope.

Principles and Applications of scanning and transmission electron microscope.

Principles and Applications of spectrophotometer and calorimeter.

Techniques of Gel electrophoresis.

Techniques of Thin layer chromatography (TLC and HPLC)

Techniques of Western blot analysis. Silkworm Seed Technology

General principles of seed technology.

Seed organisation.

Seed cocoons.

A plan of grainage.

Management of a grainage.

Management of basic seed farms.

Silkworm Seed Production : Mulberry Silkworm.

Grainage and grainage equipment.

Moth emergence, mating egg laying and mother moth examination.

Disinfection and storage of eggs.

Hibernation of bivoltine eggs.

Artificial hatching of uni and bivoltine eggs.

Incubation and transportation of eggs.

Silkworm Seed Production : Non-mulberry Silkworm.

Selection, transport and storage of seed cocoons.

Grainage of tasar silkworm.

Grainage of muga silkworm.

Grainage of eri silkworm.

Artificial hatching.

Storage and transportation of eggs.

Rearing of mulberry silkworms.

Life cycle of mulberry silkworm.

Principles of silkworms rearing.

Prerequisite for mulberry silkworm rearing: Preparation for rearing, model rearing house, environmental conditions, rearing equipment.

Rearing of early age silkworm.

Rearing of late age silkworm.

Mounting, spinning and harvesting of cocoons, precautions for rearing.

Rearing of Non-mulberry silkworms (Tropical and Temperate Tassar, Muga and Eri)

Life cycle of non-mulberry silkworms.

Rearing house.

Rearing appliances.

Larval behavior.

Rearing techniques.

Spinning process and harvesting of cocoons.

Genetics of Mulberry silkworms.

Hereditary traits in *B. mori*.

Genetics of cocoons colour.

Sex determination in *B. mori*.

Chromosome polyploidy and parthenogenesis of *B. mori*.

Mutation, chemical mutagens and their utility.

Breeding of mulberry silkworm.

Silkworm races - Genetics and distribution.

Silkworm breeding methods - Aims, advantages, inbreeding, outbreeding.

Biotechnological approach to improve silk production.

Silkworm races - Maintenance of Silkworm stock and large scale multiplication.

Heterosis.

Silkworm breeding in India - Advantages and disadvantages.

Genetics of Mulberry.

Mendelian principles of genetics.

Spontaneous and induced mutation, molecular basis of DNA damage and repair.

Biological diversity in mulberry.

Germplasm conservation - methods, center of collection.

Cytogenetics of mulberry.

Genetic control of disease resistance in mulberry.

Cocoon Quality

Types of cocoons.

Assessment and selection of cocoons.

Drying and stifling of cocoons.  
 Pests of cocoon and their management.  
 Storage of cocoons.  
 Transportation of cocoons.  
 Reeling of Mulberry cocoons.  
 Evaluation of silk reeling industry.  
 Reeling appliances.  
 Cocoon processing for reeling.  
 Reeling methods.  
 Rereeling, silk testing and spinning of silk yarn.  
 Preparation and preservation of silk yarn.  
 Reeling of Non-mulberry cocoons.  
 Reeling appliances of tasar and muga cocoons.  
 Reeling process of tasar and muga cocoons.  
 Spinning appliances of eri cocoons.  
 Spinning process of eri cocoons.  
 Testing and preservation of silk yarn.  
 Processing of silk yarn.  
 Winding machine and process of winding.  
 Doubling machine and process of doubling.  
 Twisting machine.  
 Process of twisting.  
 Stiffing of twisted yarn.  
 Twist reeling machine and process of reeling.  
 Weaving  
 Bleaching and dyeing of twisted yarn.  
 Wrapping unit and process of wrapping.  
 Bobbin filling machine and process of filling for weft.  
 Weaving machine.  
 Process of weaving.  
 Testing and storage of silk fabric.  
 Process of weaving.  
 Testing and storage of silk fabric.

### (19) - GEOLOGY

- I. **General Geology :-** History and Development of the Science of Geology, Origin and age of the earth epigene and Hypogene changes in the crust of the earth, interior of the earth as reflected by seismic studies. Isostasy, Continental drift, Earth quakes and Volcanoes, Plate tectonics.
- II. **Crystallography and Mineralogy including Geochemistry :-** Crystal symmetry and structure, Goniometry, Physical, Chemical and optical Characters of minerals, structural classification of minerals. Systematic study of Olivine, Pyroxene, Amphibole, mica, Feldspar and Quartz group of Minerals. Geochemistry of Minerals.
- III. **Petrology :-** Introduction to petrology and classification of rocks and their distinguishing characters. Basic Ideas about composition and constitution of magma. Forms, structures and textures of igneous rocks, classification of igneous rocks, Origin as assimilation and differentiation of igneous rocks. Sedimentation, weathering, transportation and deposition of sediments, lithification and diagenesis, structures and texture of sedimentary rocks, Lime stones and Sandstones Different Agents and kinds of Metamorphism. Structure and textures of metamorphic rocks, Regional and Thermal metamorphism, retrograde metamorphism and metasomatism, granitization, classification of metamorphic rocks.
- IV. **Paleontology and Stratigraphy :-** Fossils their preservation and uses, systematic study of Brachiopods, Lamellibranchs, Cephalopods, Gastropods, Arthropods, Echinoids with reference to morphology, age and stratigraphic importance. Important plant and vertebrate Fossils.  
 Stratigraphic column its divisions, correlation of rocks, physiographic divisions of India and their stratigraphic and structural relationship. Achaecans. Cuddapah, Vindhyan, Gondwanas,

Cambrian to Recent formations of India and their economic importance.

- V. **Structural and Economic Geology :-** Dip and strike of beds, unconformities, folds, Faults, joints, recognition of folds and faults in the field and on geological maps their classification and mechanics, salt domes, processes of formation of ore deposits, structural controls of mineralization.  
 Systematic study of non-metallic, Metallic ore deposits of India, fuels, industrial and economic minerals and prospecting for minerals.

### (20) - मनोविज्ञान

**प्रायोगिक मनोविज्ञान तथा संबंधित क्षेत्र:-** मनोविज्ञान की विषयवस्तु, प्रकृति एवं विषय क्षेत्र। व्यवहार के अध्ययन से सम्बन्धित पद्धतियों (विधियों), शास्त्रीय मनोभौतिक विधियों, संकेत-संज्ञापन सिद्धांत।

1. **अवधान-** प्रकृति, प्रकार, निर्धारक। चयनात्मक, अवधान, अवधान एवं व्यवधान प्रत्यक्षण: प्रकृति, निर्धारक, प्रत्यक्षण का गेस्टॉल्टवादी दृष्टिकोण। प्रत्यक्षणात्मक प्रतिरक्षण।
2. **अधिगम-** प्रत्यय, अधिगम के सिद्धांत, स्किनर, हल, टॉलमेन, गुथरी, पंवलॉवी अनुबंधन के आधारभूत सिद्धांत। वचिक अधिगम, स्मरण की विधियाँ, स्मृति में अर्थात्मक संग्रहण, अल्पकालीन व दीर्घकालीन स्मृति। स्मृति के सिद्धांत, स्मृति चिन्ह सिद्धांत, अवरोध सिद्धांत, दमन सिद्धांत।
3. **मानवीय अभिप्रेरण** - अंतर्नोद आवश्यकता, प्रलोभन तथा उद्दीपन के प्रत्यय। उपलब्धि अभिप्रेरण मानवीय अभिप्रेरण का मापन/संवेग प्रकृति एवं संघटक/जेम्स लॉजे व केनन बार्ड के संवेग सिद्धांत।
4. **बुद्धि के प्रत्यय** - स्थापना हेतु सैद्धांतिक उपागम। बुद्धि का मापन, सृजनात्मकता, प्रत्यय व उसका मापन चिन्तन, तर्कणा, समस्या समाधान प्रत्ययन-निर्माण। ज्ञानात्मक विकास में पियाजे का दृष्टिकोण। व्यक्तित्व के अध्ययन के प्रति उपागम, व्यक्तित्व के मूल आधार। व्यक्तित्व का मापन निर्धारण - मापनी, प्रेक्षण, परीक्षण तथा व्यक्तित्व प्रश्नावलियाँ तथा प्रक्षेपण प्रविधियों पर व्यापक विस्तारयुक्त महत्व।
5. **व्यक्तित्व के सिद्धांत-** मनोविश्लेषणवादी व सामाजिक एवं मनोवैज्ञानिक सिद्धांत। सामान्य व असामान्य व्यवहार, प्रत्यय व मापदण्ड। असामान्यता के लक्षण व कारण। असामान्य व्यवहार का वर्गीकरण, मनस्ताप, मनोविकृति, आंगिक मनोविकृति।
6. **मनोचिकित्सा** - प्रकृति मनोचिकित्सा की प्रक्रिया। मनोचिकित्सात्मक पद्धतियाँ। सम्मोहन-चिकित्सा, रोगी केन्द्रित, समूह-चिकित्सा। मानसिक स्वास्थ्य व मानसिक रोगों की रोकथाम। सामाजिकरण व व्यक्ति प्रत्यक्षण। गुणरोपण सिद्धांत। नेतृत्व तथा अनुनयात्मक सम्प्रेषण। पूर्वाग्रह व रुद्धियुक्ति। भारत में सामाजिक तनाव राष्ट्रीय एकीकरण के मनोवैज्ञानिक कारण। प्रसामाजिक व्यवहार। मनोविज्ञान के सम्प्रदाय: संरचनावाद, प्रकार्यवाद, गेस्टॉल्टावाद, व्यवहारवाद, मनोविश्लेषणवाद।  
 उद्योग में कर्मचारी - चयन कार्य की वातावरणात्मक दशाएँ व उनके औद्योगिक कार्यकुशलता से संबंध, व्यवहार, विश्लेषण, दुर्घटनाएँ कारण व रोकथाम आर्थिक व अनार्थिक प्रलोभन, संगठन, संचालन का आधुनिक सिद्धांत।  
 शैक्षणिक व व्यावसायिक निर्देशन के सिद्धांत व प्रविधियाँ, मनोवैज्ञानिक परीक्षण अपरीक्षण प्रविधियाँ परामर्श के उपागम परामर्श साक्षात्कार, असाधारण बालकों की शिक्षा, प्रतिभाशाली एवं मानसिक रूप से पिछड़े बालकों के विशेष संदर्भ में शिक्षा
7. **समस्या, उपकल्पना की प्रकृति तथा महत्व:** परिवर्त्य (वर) एवं उनका नियंत्रण। प्रायोगिक अभिकल्प, सांख्यिकी का महत्व, केन्द्रीय प्रवृत्ति एवं सहसंबंध। पैरॉमेट्रिक व नान-पैरॉमेट्रिक प्रविधियों से परिकल्पना परीक्षण।

### (20) - PSYCHOLOGY

**Experimental Psychology and related fields:-** Subject matter of psychology Nature & Scope, Methods related to the study of behaviors, Classical Psychophysical Methods, Signal Detection Theory,

1. **Attention-** Nature, Kind Determinants, Selective attention, Attention & Distraction Perception Nature Determinants Gestalt view of Perception, Perceptual Defence.
2. **Learning-** Concept Theories of Learning, Skinner, Hull, Tolman, Guthrie. Fundamental Principles of Pavlovian Conditioning, verbal learning, Methods of Memorizing. Semantic storage in memory, STM & LTM. Theories of Memory-Memory Trace Theory, Interference theory and repression theory.
3. **Human Motivation :-** Concept of Drive, need, incentive & arousal. Achievement motivation. Measurement of Human Motivation. Emotion nature and Component. James Lange Cannon Bard Theories of Emotion.
4. **Intelligence-** Theoretical approaches towards conceptualization of intelligence:- Measurement of intelligence. Creativity concept & its measurement. Thinking reasoning, problem solving, concept formation. Piagetian view on cognitive development. Approaches of the study of personality, basic foundation of personality. Assessment of Personality, Rating scales, Observation, test & personality inventories with detailed emphasis on projective techniques.
5. **Theories of personality:-** psychoanalytic, Social, Psychological theories of personality. Normal and abnormal behavior concept & criteria, symptoms & causes of abnormality. Classification of abnormal behavior psychoneurosis, psychosis, organic psychosis.
6. **Psychotherapy Nature & Process of Psychotherapy:-** Psychotherapeutic Methods. Hypnotherapy, client centered, groups therapy mental Health & Prevention of mental Disorders. Socialization & person perception .  
Attribut i on theory Leadership & Persuasive Communication. Prejudice & Stereotypes. Social Tension in India Psychological factors in national integration. Prosocial behavior. Schools of psychology Structuralism, Functionalism, Gestalt, Behaviorism, Psychoanalysis. Personnel Selection in industry, working condition, its relation to industrial efficiency. Job analysis, accident causes & prevention. Financial & non financial incentive. Modern theory of organization management.  
Principles & techniques of educational & vocational guidance. Psychological tests, non-testing devices. Approaches to Counselling Counselling interview, Education of exceptional children with special reference to gifted & mentally retarded children.
7. **Nature & Importance of Problem, Hypothesis:-** Variables & its control. Experimental design. Importance of statistics, central tendency and correlation, Hypothesis testing by Parametric & Non Parametric methods.

## (21) - COMPUTER SCIENCE

1. **Discrete Structures**  
Sets. Relations, Functions. Pigeonhole Principle, Inclusion-Exclusion Principle. Equivalence and Partial Orderings, Elementary Counting Techniques. Probability. Measure(s) for information and Mutual information. Computability : Models of computation-Finite Automata, Pushdown Automata. Non-determinism and NFA. DPDA and PDAs and Languages accepted by these structures. Grammars. Languages, Noncomputability and Examples of non-computable problems. Graph: Definition, walks, paths, trails, connected graphs, regular and bipartite graphs, cycles and circuits. Tree and rooted tree. Spanning trees. Eccentricity of a vertex radius and diameter of a graph. Central Graphs. Centre (s) of a tree. Hamiltonian and Eulerian graphs. Planar graphs.  
Groups : Finite fields and Error correcting/detecting codes.
2. **Computer Arithmetic**  
Propositional (Boolean) Logic, Predicate Logic, Well-formed formulae (WFF), I Satisfiability and Tautology. Logic Fami-

lies: TTL, RTL and C-MOS gates. Boolean algebra and Minimization of Boolean functions. Flip-flops-types, race condition and comparison. Design of combinational and sequential circuits. Representation of numbers : Octal, Hexa. Decimal, and Binary. 2's complement and 1's complement arithmetic. Floating point representation.

3. **Programming in C and C++**  
Programming in C: Elements of C-Tokens, identifiers, data types in C. Control structures in C. Sequence, selection and iteration(s). Structured data types in C-arrays, function, union, structure, and pointers. O-O Programming Concepts : Class, Object, Instantiation  
Inheritance, polymorphism and overloading. C++ Programming: Elements of C++-Tokens, identifiers. Variables and constants, Data types, Operators, Control statements. Functions parameter passing. Class and objects. Constructors and destructors. Overloading, Inheritance, Templates, Exception Handling.
4. **Relational Database Design and SQL**  
E-R diagrams and their transformation to relational design, normalization-1NF, 2NF, 3NF, BCNF and 4NF. Limitations of 4NF and BCNF. SQL : Data Definition Language (DDL), Data Manipulation Language (DML), Data Control Language (DCL) commands.- Database objects like-Views, indexes, sequences, synonyms, data dictionary.
5. **Data and File Structures**  
Data. Information, Definition of data structure. Arrays, stacks, queues, linked lists, trees, graphs, priority queues and heaps. File Structures : Fields, records and files. Sequential, direct, indexsequential and elactive files. Hashing, inverted lists and multi-lists. B trees and B + trees.
6. **Computer Networks**  
Network fundamentals : Local Area Networks (LAN), Metropolitan Area Networks (MAN), Wide Area Networks (WAN), Wireless Networks, Inter Networks. Reference Models : The OSI Model.; TCP/IP model. Data Communication : Channel capacity. Transmission mediatwisted pair, coaxial cables, fibre-optic cables, wireless transmission radio, microwave, infrared and millimeter waves. Light wave transmission. Telephones-local loops, trunks, multiplexing, switching, narrowband ISDN, broadband ISDN, ATM, High speed LANS. Cellular Radio. Communication satellites-geosynchronous and loworbit. Internet working : Switch/Hub, Bridge, Router, Gateways, Concatenated virtual circuits. Tunneling, Fragmentation, Firewalls. Routing : Virtual circuits and datagrams. Routing algorithms. Conjestion control. Network Security : Cryptography-public key, secret key. Domain Name System (DNS)-Electronic Mail and Worldwide Web (WWW). The DNS, Resource Records, Name servers. E-mail architecture and Serves.
7. **System Software and Compilers**  
Assembly language fundamentals (8085 based assembly language programming). Assemblers-2-pass and single-pass, Macros and macroprocessors, Loading, linking, relocation, program relocatability, Linkage editing, Text editors, Programming Environments, Debuggers and program generators, Compilation and Interpretation, Bootstrap compilers, Phases of compilation process, Lexical analysis, Lex package on Unix system, Context free grammars, Parsing and parse trees, Representation of parse (derivation) trees as rightmost and leftmost derivations, Bottom up parsers-shift-reduce, operator precedence and LR. YACC package on Unix system, Topdown parsers-left recursion and its removal, Recursive descent parser, Predictive parser, Intermediate codes-Quadruples, Triples, Intermediate code generation, Code generation, Code optimization
8. **Operating Systems (with Case Study of Unix) -**  
Main functions of operating systems. Multiprogramming, multiprocessing and multitasking. Memory Management: Virtual memory, paging, fragmentation. Concurrent Processing : Mutual exclusion. Critical regions, lock and unlock. Scheduling : CPU scheduling. I/

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

Unix

The Unix System : File system, process management, Bourne shell, shell variables, command line programming, Filters and Commands: Pr, head, tail, cut, paste, sort, uniq, tr, join, etc., grep, egrep, fgrep, etc., sed, awk, etc. System Calls (Like) : Creat, open, close, read, write, isseek, link, unlink, stat, fstat, umask, chmod, exec, fork, wait, system.

#### 9. **Software Engineering**

System Development Life Cycle (SDLC) : Steps, Water fall model. Prototypes, Spiral model. Software Metrics : Software Project Management. Software Design : System design, detailed design, function oriented design, object oriented design, user interface design. Design level metrics. Coding and Testing : Testing level metrics. Software quality and reliability. Clean room approach, software reengineering.

#### 10. **Current Trends and Technologies**

Topics of current interest in Computer Science and Computer Applications Parallel Computing, Parallel virtual machine (pvm) and message passing interface (mpi) libraries and calls. Advanced architectures, Today's fastest computers, Mobile Computing, Mobile connectivity-Cells, Framework, wireless delivery technology and switching methods, mobile information access devices, mobile data internetworking standards, cellular data communication protocols, mobile computing applications, Mobile databases-protocols, scope, tools and technology. M-business. E-Technologies Electronic Commerce : Framework, Media Convergence of Applications, Consumer Applications, Organization Applications. Electronic Payment Systems : Digital Token, Smart Cards, Credit Cards. Risks in Electronic Payment System, Designing Electronic payment Systems. Electronic Data Interchange (EDI) : Concepts, Applications, (Legal, Security and Privacy) issues, EDI and Electronic Commerce, Standardization and EDI, EDI Software Implementation, EDI Envelope for Message Transport, Internet-Based EDI. Digital Libraries and Data Warehousing : Concepts, Types of Digital documents, Issues behind document Infrastructure, Corporate Data Warehouses. Software Agents : Characteristics and Properties of Agents, Technology behind Software Agents (Applets, Browsers and Software Agents) Broadband Telecommunications : Concepts, Frame Relay, Cell Relay, Switched Multimegabit Data Service, Asynchronous Transfer Mode. Main concepts in Geographical Information System (GIS), E-cash, E-Business, ERP packages. Data Warehousing : Data. Warehouse environment, architecture of a data warehouse methodology, analysis, design, construction and administration. Data Mining: Extracting models and patterns from large databases, data mining techniques, classification, regression, clustering, summarization, dependency modeling, link analysis, sequencing analysis, mining scientific and business data. Windows Programming: Introduction to Windows programming—Win32, Microsoft Foundation Classes (MFC), Documents and views, Resources, Message handling in windows. Simple Applications (in windows): Scrolling, splitting views, docking toolbars, status bars, common dialogs. Advanced Windows Programming: Multiple Document Interface (MDI), Multithreading. Object linking and Embedding (OLE). Active X controls. Active Template

Library (ATL). Network programming, Combinational Circuit Design, Sequential Circuit Design, Hardwired and Microprogrammed processor design, Instruction formats. Addressing modes, Memory types and organization, Interfacing peripheral devices. Interrupts. Microprocessor architecture, Instruction set and Programming (8085, P-III/P\_IV). Microprocessor applications. Database Concepts, ER diagrams, Data Models, Design of Relational Database, Normalisation. SQL and QBE. Query Processing and Optimisation, Centralised and Distributed Database. Security, Concurrency and Recovery in Centralised and Distributed Database Systems, Object Oriented Database Manage-

ment Systems (Concepts. Composite objects. Integration with RDBMS applications), ORACLE. Display systems, Input devices, 2D Geometry, Graphic operations, 3D Graphics. Animation, Graphic standard, Applications. Concepts, Storage Devices, Input Tools, Authoring Tools, Application, Files, Programming language concepts, paradigms and models, Data, Data types, Operators, Expressions, Assignment, Flow of Control-Control structures, I/O statements, User-defined and builtin functions, Parameter passing, Principles, classes, inheritance, class hierarchies, polymorphism, dynamic binding, reference semantics and their implementation, Principles, functions, lists, types and polymorphisms, higher order functions, lazy evaluation, equations and pattern matching, Principles, horn clauses and their execution, logical variables, relations, data structures, controlling the search order, program development in prolog, implementation of prolog, example programs in prolog, Principles of parallelism, coroutines, communication and execution, Parallel Virtual Machine (PVM) and Message Passing Interface (MPI) routines and calls, parallel programs in PVM paradigm as well as MPI paradigm for simple problems like matrix multiplication, Preconditions, post-conditions, axiomatic approach for semantics, correctness, denotation semantics. Compiler structure, compiler construction tools, compilation phases. Finite Automata, Pushdown Analog and Digital transmission. Asynchronous and Synchronous transmission, Transmission media, Multiplexing and Concentration. Switching techniques. Polling. Topologies. Networking Devices, OSI Reference Model, Protocols for-(i) Data link layer, (ii) Network layer, and (iii) Transport layer, TCP/IP protocols. Networks security, Network administration.

Definition, Simple and Composite structures, Arrays, Lists, Stacks queues. Priority queues, Binary trees, B-trees, Graphs. Sorting and Searching Algorithms, Analysis of Algorithms, Interpolation and Binary Search. Asymptotic notations-big ohm, omega and theta. Average case analysis of simple programs like finding of a maximum of n elements. Recursion and its systematic removal. Quicksort-Non-recursive implementation with minimal stack storage. Design of Algorithms (Divide and Conquer, Greedy method. Dynamic programming, Back tracking. Branch and Bound). Lower bound theory, Non-deterministic algorithm, Non-deterministic programming constructs. Simple non-deterministic programs. NP hard and NP-complete Problems. Object, messages, classes, encapsulation, inheritance, polymorphism, aggregation, abstract classes, generalization as extension and restriction, Object oriented design, Multiple inheritance, metadata. HTML, DHTML, XML, Scripting, Java, Servlets, Applets. Software development models, Requirement analysis and specifications, Software design, Programming techniques and tools, Software validation and quality assurance techniques, Software maintenance and advanced concepts, Software management. Introduction, Memory management. Support for concurrent process. Scheduling, System deadlock, Multiprogramming system. I/O management, Distributed operating systems, Study of Unix and Windows NT. Definition AI approach for solving problems. Automated Reasoning with Propositional logic and predicate logic—fundamental proof procedure, refutation, resolution, refinements to resolution (ordering/pruning/restriction Strategic). State space representation of problems, bounding functions, breadth first, depth first. A, A\*. AO\*. etc. Performance comparison of various search techniques. Frames, scripts, semantic nets, production systems, procedural representations. Prolog programming. Components of an expert system, Knowledge representation and

Acquisition techniques. Building expert system and Shell. RTNs, ATNs, Parsing of Ambiguous CFGs. Tree Adjoining Grammars (TAGs). Systems approach to planning, Designing, Development, Implementation and Evaluation of MIS. Decision-making processes, evaluation of DSS, Group decision support system and case studies, Adaptive design approach to DSS development, Cognitive style in DSS; Integrating expert and Decision support systems.

**(22) - BIO-TECHNOLOGY**

Cell and Molecular Biology

Cell Theory, Structure and biodiversity of Prokaryotic and Eukaryotic Cells. Cell motility-cilia, flagella of eukaryotes and prokaryotes.

Cellular organelles- Plasma membrane, cell wall, their structural organization; Mitochondria; Chloroplast, Nucleus and other organelles and their organization.

Cell cycle-molecular events and model systems, DNA Structure and Replication - Prokaryotic and eukaryotic.

Mechanism of DNA replication, Enzymes and accessory proteins involved in DNA replication. DNA Repair and Recombination,

Transcription and Translation - Prokaryotic and Eukaryotic Antisense and Ribozyme technology.

Molecular Mapping of genome - Genetic and Physical maps, physical mapping and map - based cloning, choice of mapping population. Genome Sequencing. Microbial Physiology and Genetics

Microbial Evolution, Systematics and Taxonomy - New approaches to bacterial taxonomy classification including ribotyping; Ribosomal RNA sequencing; Characteristics of primary domains nom enclature and Bergey's Manual.

Microbial Growth - The definition of growth, mathematical expression of growth, growth curve, measurement of growth and growth yields; Synchronous growth; Continuous culture; Growth affected by environment factors like temperature, acidity, alkalinity, water availability and oxygen; Prokaryotic structure and Diversity of Bacteria, Archaea, Viruses, Eukaryotic structure and Diversity of Algae, Fungi, Protozoa.

Microbial diseases - Infectious disease transmission; Virulence and Pathogenesis.

Tuberculosis; Sexually transmitted diseases including AIDS; Diseases transmitted by animals (rabies, plague), insects and ticks (Rickettsias, Lime disease, malaria) food and water borne diseases. Antibiotics, Mendel's laws of genetics; Fine structure of gene, Gene - Types of genes, Prokaryotic, Eukaryotic and Viral genes. Mutation, Types of mutations. Changes in Chromosome number and structure, Genetic disorder and syndromes, Bacterial, Genetic system; Transformation, Conjugation, Transduction, Viruses and their Genetic system. Biomolecules and Enzymology and Instrumentation, Amino acids and peptides. Sugar, Lipids, Protein, Enzyme - classification, chemical reactions and physical properties. Principles and application of Microscopy, Centrifugation, Chromatography, Electrophoresis, Colorimetry, Spectrophotometry and densitometry, Thermocycler, DNA sequencer

RIA and autoradiography in biology, ELISA,

Biotechnology and Bioinformatics, Nanotechnology, Genetic Engineering, Scope of Genetic Engineering, Molecular tools and their application - Restriction enzymes, modification enzymes, DNA and RNA markers.

Gene cloning vectors; Plasmids, bacteriophages, phagemids, cosmids, artificial chromosomes, protein engineering, cDNA synthesis and cloning, T - DNA and transposon tagging, Gene therapy; Vector engineering. Strategies of gene delivery, gene replacement/augmentation, Gene correction, gene editing, gene regulation and silencing.

Biology of Immune System

Introduction - Phylogeny of immune system, innate and acquired immunity, Clonal nature immune response. Organization and structure of lymphoid organs. Nature and biology of antigens and super antigens. Antibody structure and function,

Antigen - antibody interaction, major histocompatibility complex. Cells of immune system - Hematopoiesis and differentiation, Lymphocyte traffic, B - lymphocyte, T - lymphocyte. Macrophages Eosinophils, Neutrophils and Mast cells.

Hypersensitivity, Autoimmunity, Hybridoma Technology and Monoclonal antibodies, Transplantation; Tumor immunology. Immunity to infectious agents (intracellular parasites, helminthes and viruses), AIDS and other immuno deficiencies.

Bioprocess Engineering and Technology Fermentation, Types of fermentation process, Measurement and control of bioprocess parameters.

Downstream processing; Intoduction, removal of microbial cell and solid matter, foam separation, precipitation, filtration, centrifugation, cell disruption, liquid extraction chromatography. Membrane process Drying and crystallization, Effluent treatment; D.O.C. and C.O.D. treatment and disposal of effluents. Food technology; Elementary idea of canning and packing, Sterilization and pasteurization of food products, technology of typical food/food products (bread, cheese), Food preservation.

Environmental Biotechnology Environment; Basic concepts and issues, Environmental Pollution and Types of pollution, pollution and its control through Biotechnology, Microbiology of waste water treatments, Microbiology of degradation of Xenobiotics in Environment, Biopesticides in integrated pest management.

Solid wastes; Sources and management (composting, wormiculture and methane production). Global Environmental Problems; Ozone depletion, UV - B, green house - effect and acid rain, their impact and biotechnological approaches for management. Role of National organization in Biotechnology, IPR.

Plant Biotechnology

Cell, suspension and tissue culture, tissue culture as a technique to produce New plants and hybrids, Tissue culture media (composition and preparation), Organogenesis, somatic embryogenesis.

Shoot - tip culture; Rapid clonal propagation and production of virus free plant, Embryo culture and embryo rescue.

Anther, pollen and ovary culture for production of Haploid plants and homozygous lines protoplast isolation, culture and fusion; selection of hybrid cells and regeneration of hybrid plants; symmetric and asymmetric hybrids, cybrids. Cryopreservation, DNA banking for germplasm, conservation plant transformation technology and application, Molecular marker - RFLP maps, linkage analysis, RAPD markers, STS, microsatellites, SCAR (Sequence characterized amplified regions), SSCP (single strand conformational polymorphism), AFLP, QTL. Map based cloning, molecular marker assisted selection.

Animal Biotechnology, Structure and organization of animal cell, Primary and established cell line cultures, Serum & protein free defined media and their application, Biology and characterization of the cultured cells, measuring parameters of growth, Cell cloning and micromanipulation, Application of animal cell culture, Stem cell cultures, embryonic stem cells and their applications, Organ and histotypic cultures cell culture based vaccines, apoptosis.

**(23) - INFORMATION TECHNOLOGY****I. Object Oriented Programming with 'C++' :-**

Introduction to OOP

Advantages of OOP, The Object Oriented Approach, and Characteristics of object oriented languages- Object, Classes, Inheritance, Reusability, and Polymorphism. OMT.

Language Fundamental

Overview of C++: History of C++, Data Types - int, float, char, double, void. Constant and Variables. Operators and Expression: Arithmetic Operators, Relational Operators, Logical Operators, Conditional Operators, Bitwise Operators. Control constructor: if , ifelse, nested if-else, while(), do-while() , for(;;), break, continue, switch, goto. Storage class.

Structure and Function

Structures : A Simple structures ,specify the structures, Defining a structure variable, Accessing structures member. Enumeration data type.

Function: Function Declaration, Calling Function, Function Defintion, Passing Argument to function, Passing Constant, Passing Value, ReferenceArgument, Passing struct variable, Overloaded Function, Inline Function, Default Argument, return statement, returning by reference.

Array: Defining array, array element , initiation array, multi dimensional array, passing array to function.

Object Classes and Inheritance

Object and Class, Using the class, class construct, class destructors, object as function argument, struct and classes, array as class member, operator overloading. Type of inheritance, Derive class, Base class. Access specifier: protected. Overriding, member function, String, Templates.

Pointers and Virtual Function

Pointers: & and \* operator pointer variables, pointer to void, pointer and array, pointer and function, pointer and string, memory management, new and delete, pointer to object, pointer to pointer, link list. Virtual Function: Virtual Function, Virtual member function, accesses with pointer, Late binding, pure virtual function, Friend function, Friend class, static function, this pointer.

File and Stream

C++ streams, Stream class, string I/O, char I/O, Object I/O, I/O with multiple object, File pointer, Disk I/O,

## II. Mathematical Foundation :-

Mathematical Logic, Sets Relations and functions Mathematical Logic : Notations, Algebra of Propositions & Propositional functions, logical connectives, Truth values & Truth table, Tautologies & Contradictions, Normal Forms, Predicate Calculus, Quantifiers. Set Theory: Sets, Subsets, Power sets, Complement, Union and Intersection, De-Morgan's law, Cardinality, Relations: Cartesian Products, relational Matrices, properties of relations, equivalence relation, functions: Injection, Surjection, Bijection, Composition, of Functions, Permutations, Cardinality, the characteristic functions recursive definitions, finite induction.

Lattices & Boolean Algebra

Lattices : Lattices as Algebraic System, Sub lattices, some special Lattices (Complement, Distributive, Modular).

Boolean Algebra : Axiomatic definitions of Boolean algebra as algebraic structures with two operations, Switching Circuits.

Groups Fields & Ring

Groups : Groups, axioms, permutation groups, subgroups, cosets, normal subgroups, free subgroups, grammars, language.

Fields & Rings : Definition , Structure, Minimal Polynomials, Irreducible Polynomials, Polynomial roots & its Applications. Graphs

Graphs : Simple Graph, Multigraph & Psuedograph, Degree of a Vertex, Types of Graphs, Sub Graphs and Isomorphic Graphs, Operations of Graphs, Path, Cycles and Connectivity, Euler and Hamilton Graph, Shortest Path Problems BFS (Breadth First Search), Dijkstra's Algorithm, Representation of Graphs, Planar Graphs, Applications of Graph Theory.

Trees

Trees : Trees, Properties of trees, pendant vertices in a tree, center of tree, Spanning tree, Binary tree, Tree Traversal, Applications of trees in computer science.

Basics concept of IT, concept of data and information, Data processing, History of computer, Data processing, organization of computers and input and output device, storage device, and file organization.

## III. Essentials of Information Technology :-

Introduction -

Basics concept of IT, concept of data and information, History of computer, Data Processing, Generations of Computers, or-

ganization of computers, Input and Output devices, storage devices and file organization.

Software concept -

System software, application software, utility package, compilers, and interpreters, operating system, elementary command of DOS, UNIX and WINDOWS (file handling directory, management and general purpose user interfacing command).

Computer languages -

Machine languages, assembly languages, high level languages, 4th generation languages, general purpose, concept of oops and SQL

Communication and network technology -

Communication and system elements, communication mode (Analog and Digital, Synchronous and Asynchronous, Simplex, Half duplex, Full duplex, circuit switching), communication media (Speed and capacity, twisted pair, coaxial cable, optics, wireless), common network, protocols (ISO/OS, reference model, TCP/IP).

Internet

Technical foundation of Internet- Client server computing, Distributed Computing, Domain naming system, DNS Server, Internet Security - Fire walls, Encryptions etc.

Internet Applications - E-mail, WWW, E-commerce, Teleconferencing,

Application of Information Technology - State of Art, Application of IT, Application of IT in business, Industry, home, education and training entertainment, science and engineering and medicine.

## IV. Data Structure through Algorithms :-

Introduction and Preliminaries -

Introduction, Basic terminology, Elementary data organization, Data structure, Data structure operation, Algorithms : complexity, time-space Tradeoff, Mathematical Notation and functions, Algorithmic Notation, Control Structures, Complexity of Algorithms, Sub algorithms, Variables, Data Type.

String Processing, Arrays, Records And Pointers - Basic Terminology, Storing String, Character Data Type, String Operations, Word Processing, Pattern Matching Algorithms. Linear Array, Representation of linear Array in Memory, Traversing Linear Arrays, Inserting And Deleting, Sorting: Bubble Sort, Searching: Liner Search, Binary Search, Multidimensional Array, Pointers: Pointer Array, Records: Record Structures, Representation of Records in Memory; Parallel Arrays, Matrices, Sparse Matrices.

Linked Lists, Stacks, Queues, Recursion -

Linked list, Representation of linked lists in memory, Traversing a linked list, Searching a linked list, Memory Allocation; Garbage Collection, Insertion into a linked List, Deletion from a Linked List, Header Linked List, Two- Way Linked Lists. Stacks, Array Representation of Stack, Arithmetic Expressions; Polish Notation, Quicksort, an application of Stacks, Recursion, Tower of Hanoi, Implementation of Recursive Procedures by Stacks, Queues, Deques, Priority Queues.

Trees & Graphs -

Binary Trees, Representing Binary Trees in Memory, Traversing binary tree, Traversal Algorithms using stacks, header nodes; threads, Binary Search Tree, Searching and Inserting in Binary Search Tree, Deleting in Binary Search tree, Heap; Heap sort, Path Lengths; Huffmans Algorithms, General Tree. Graph Theory Terminology, Sequential Representation of Graph; Adjacency Matrix, Path Matrix, Linked Representation of Graph.

Sorting And Searching -

Sorting, Insertion Sort, Selection Sort, Merging, Merge Sort, Radix Sort, Searching and data modification, hashing.

## V. Operating System (with Linux as case Study) :-

Introduction:

Operating system, basic concept, terminology, batch processing, spooling, multiprogramming, time sharing, real time sys-

tems, protection, multiprocessor system, operating system as resource manager, process view point, memory management, process management, device management and information management, other views of operating system, historical, functional job control language and supervisor service control.

Memory Management:

Preliminaries of memory management, memory handling in M/C, relocation, swapping and swap time calculation, multiple partitions, partitioned allocation MFT, fragmentation, MVT, compaction, paging, job scheduling implementation of page tables, shared page, virtual memory-overlays, concepts of virtual memory demand page, memory management and performance, page replacement and page replacement algorithms. Allocation algorithms. Storage hierarchy disk and drum scheduling - physical characteristics fcfs scheduling SCAN, short of seek time first disk scheduling algorithms sector queuing.

Information Management (File System) :

File concept, file type, typed based system, disk based system, general model of file system, file directory maintenance, symbolic file system, basic file system, physical file system, file support device directory, access methods free space management contiguous, linked allocation and indexed allocation performances.

Processor Management ( CPU Scheduling ) :

Reviewing of multiprogramming concept, scheduling concept, basic concept, CPU I/O burst cycle process state, PCB ( Programme Control Block) scheduling queries, schedulers, scheduling algorithms – performance criteria, first-come - first served shortest job - first priority, preemptive algorithm, round robin, multilevel queues and multilevel feedback queues, algorithm evolution, multiprocessor scheduling, separate

system, coordinated job scheduling, master / slave scheduling.

Dead Locks :

The dead lock problem - dead lock definition, dead lock detection, detection algorithm usage, dead lock characterization, resource allocation graph, dead lock prevention, mutual exclusion, hold and wait, no preemption and circular wait, dead lock avoidance-bankers algorithm. Recovery from deadlock process termination, resource preemption, combined approach to deadlock handling.

Unix (Operating System) :

History, design principle, programmer interface, user interface, file system, process management, I/O system, interprocess communication.

Device Management :

Dedicated, shared and virtual devices, sequential access and direct access device, channel and control units, I/O schedulers. Introduction to assembly language programming, introduction to I/O programming, introduction to interrupts and their programming.

## VI. Programming in Java & HTML :-

Introduction to java programming

An overview of Java: Object Oriented Programming, Features of Java, Java Virtual Machine, Java Environment: Java Development Kit, Java Standard Library, Data Types, Variables: Declaring a variable, Dynamic Initialization, The scope and life time of variable, Type conversion and Casting: Narrowing and Widening Conversions, Numeric Promotions, Type Conversion Contexts; Operators: Arithmetic Operators, Relational Operators, Logical Operators, Bit wise Operators, Conditional Operators, new operator, [ ] and instance of operator. Control Statements: Java's Selection statement, Iteration Statement, Jump Statement, Array: Declaring Array variables, Constructing an Array, Initializing an Array, Multidimensional Arrays, Anonymous Arrays.

Define the Class and interface

Introducing Classes: Class Fundamentals, Declaring Object, Assigning Object Reference Variables, Defining Methods, method

overloading, Using objects as parameter, Constructors, Garbage collection, finalize () method. Inheritance: Inheritance basic, method overloading, object reference this and super. Chaining constructor using this () and super (), Member accessibility modifier: public, protected, default accessibility of member, private protected, private, Package: Define package, CLASSPATH, importing package, Interface: Define an interface, implementing interface, extending interface, variable in interface, Overview of nested class: Top level nested class and interface, Non static inner class, Local class, Anonymous class.

Exception handling and Multithreading

Exception Handling: Exception types, Uncaught Exception, Using try and catch, multiple catch, nested try block, throw, and throws, finally.

Multithreading: creating thread, Thread priority, synchronization, thread Scheduler, Running & yielding, sleeping and waking up, waiting and notifying, suspend and resume, miscellaneous method in thread class.

Input output, Networking and Fundamental class of java

Object class, String class, StringBuffer class, Wrapper class, Math class, Collection: Collection interface, List interface, Set interface sorted interface, ArrayList class, LikedList class, TreeSet, Comparator, Vector, Stack.

Input output classes and interface: File, BufferedStream, CharacterStream, and Random Access for files, Object Sterilization.

Networking: Socket overview, Client/Server, Proxy Server, Network class and interface, TCP/IP client socket, TCP/IP Server socket, URL Connection, Datagrams, DatagramPackets. Applet programming and AWT

Applet: Applet and Application program, Creating Applets, Applet Life Cycle, Applet and Thread, Supplying Applet parameter, Using Images and Sound in Applets, JAR files, Applet Security.

Introducing the AWT: Overview of the java.awt package, Component and Containers: Component, Container, Panel, Applet, Window, Frame, and Dialog classes. Working with Graphics, Working with Fonts, Working with Colors, GUI Control Components: Button, Canvas, Checkbox and CheckboxGroup, Choice, List, Label, Scrollbar, TextField and TextArea, Frame, Menu Bars and Menu

Layout Management: Layout Management Policies, FlowLayout, GridLayout, BorderLayout, CardLayout, GridBagLayout, Customized Layout.

Event Handling: Overview of Event Handling, Event Hierarchy, Event Delegation Model, Event Adapters, Low Level Event Processing.

Advance features of java

JDBC: JDBC/ODBC Bridge, The Driver manage class, the java.sql package, data manipulation: Insert, Update, Delete Record, Data navigation: ResultSet BDK: What is java Beans, Advantages of java Beans, the Bean Developer Kit, Jar Files, Introspection, Developing a New Bean, Using Bound Properties, Using BeanInfo interface, The java Beans API.

HTML Basics & Web Site Design Principles -

Concept of a Web Site, Web Standards, What is HTML? HTML Versions, Naming Scheme for HTML Documents, HTML document/file, HTML Editor, Explanation of the Structure of the homepage, Elements in HTML Documents, HTML Tags, Basic HTML Tags, Comment tag in HTML, Viewing the Source of a web page, How to download the web page source? XHTML, CSS, Extensible Markup Language (XML), Extensible Style sheet language (XSL), Some tips for designing web pages, HTML Document Structure. HTML Document Structure-Head Section, Illustration of Document Structure, <BASE> Element, <ISINDEX> Element, <LINK> Element, META, <TITLE> Element, <SCRIPT> Element, Practical Applications, HTML Document Structure-Body Section:-Body elements and its attributes: Background; Background Color; Text;

Link; Active Link (ALINK); Visited Link (VLINK); Left margin; Top margin, Organization of Elements in the BODY of the document: Text Block Elements; Text Emphasis Elements; Special Elements — Hypertext Anchors; Character-Level Elements; Character References, Text Block Elements: HR (Horizontal Line); Hn (Headings); P (Paragraph); Lists; ADDRESS; BLOCKQUOTE; TABLE; DIV (HTML 3.2 and up); PRE (Preformatted); FORM, Text Emphasis Elements, Special Elements — Hypertext Anchors, Character-Level Elements: line breaks (BR) and Images (IMG), Lists, ADDRESS Element, BLOCKQUOTE Element, TABLE Element, COMMENTS in HTML, CHARACTER Emphasis Modes, Logical & Physical Styles, Netscape, Microsoft and Advanced Standard Elements List, FONT, BASEFONT and CENTER.

Image, Internal and External Linking between WebPages  
Netscape, Microsoft and Advanced Standard Elements List, FONT, BASEFONT and CENTER Insertion of images using the element IMG (Attributes: SRC (Source), WIDTH, HEIGHT, ALT (Alternative), ALIGN), IMG (In-line Images) Element and Attributes; Illustrations of IMG Alignment, Image as Hypertext Anchor, Internal and External Linking between Web Pages  
Hypertext Anchors, HREF in Anchors, Links to a Particular Place in a Document, NAME attribute in an Anchor, Targeting NAME Anchors, TITLE attribute, Practical IT Application Designing web pages links with each other, Designing Frames in HTML. Practical examples. Creating Business Websites with Dynamic Web Pages –

Concept of static web pages and dynamic web pages, Introduction to scripting, Types of Scripting languages, Scripting Files, Client Side Scripting with VB/JavaScript/ JavaScript, Practical examples of Client side scripting, Identifying Objects & Events, and Creating & Implementing Common Methods, Hosting & promotion of the web site, Domain Name Registration, Web Space location, Uploading/Downloading the website- FTP, cute FTP. Web Site Promotion Search Engines, Banner Advertisements.

## VII. Computer System Architecture :-

Representation of Information

Number system, Integer & Floating point representation Character code (ASCII, EBCDIC), Error Detect and Correct code, Basic Building Blocks, Boolean Algebra, MAP Simplification, Combination Blocks, Gates, Multiplexers, Decoders, etc Sequential building block, flip-flop, registers, counters, ALU, RAM etc.

Register transfer language and micro operations

Concepts of bus, data movement along registers, a language to represent conditional data transfer, data movement from its memory, arithmetic and logical operations along with register transfer timing in register transfer

Basic Computer Organization and Design

Instruction code, Computer Instructions, Timing and Control, Execution of Instruction, Input and Output Interrupt, Design of Computer.

Computer Software

Programming Language, Assembly Language, Assembler, Program Loops, Input/Output Programming, System Software. Central Processor Organization: - Processor Bus Organization, Arithmetic Logic Unit, Stack Organization, Instruction Formats, Addressing modes, Data transfer and Manipulation, Program Control, Microprocessor Organization, Parallel Processing, Input-Output Organization

Peripheral Devices, Input/Output Interface, Asynchronous Data Transfer, Direct Memory Access (DMA), Priority Interrupt, Input-Output Processor, Multiprocessor System Organization, and Data Communication Processor.

Memory Organization

Auxiliary Memory, Micro Computer Memory, Memory Hierarchy, Associative Memory, Virtual Memory, Cache Memory, Memory Management Hardware.

## VIII. RDBMS & ORACLE :-

Overview of Database Management -

Data, Information and knowledge, Increasing use of data as a corporate resource, data processing versus data management, file oriented approach versus database oriented approach to data management; data independence, database administration roles, DBMS architecture, different kinds of DBMS users, importance of data dictionary, contents of data dictionary, types of database languages. Data models: network, hierarchical, relational. Introduction to distributed databases, Client/Server databases, Object-oriented databases, Object-relational databases, Introduction to ODBC concept.

Relational Model -

Entity - Relationship model as a tool for conceptual design-entities attributes and relationships. ER diagrams; Concept of keys: candidate key, primary key, alternate key, foreign key; Strong and weak entities, Case studies of ER modeling Generalization; specialization and aggregation. Converting an ER model into relational Schema. Extended ER features, Introduction to UML, Representation in UML diagram (Class Diagram etc.).

Structured Query Language

Relational Algebra: select, project, cross product different types of joins (inner join, outer joins, self join); set operations, Tuple relational calculus, Domain relational calculus, Simple and complex queries using relational algebra, stand alone and embedded query languages, Introduction to SQL constructs (SELECT...FROM, WHERE... GROUP BY... HAVING... ORDERBY...), INSERT, DELETE, UPDATE, VIEW definition and use, Temporary tables, Nested queries, and correlated nested queries, Integrity constraints: Not null, unique, check, primary key, foreign key, references, triggers. Embedded SQL and Application Programming Interfaces.

Relational Database Design-

Normalization concept in logical model; Pitfalls in database design, update anomalies: Functional dependencies, Join dependencies, Normal forms (1NF, 2NF, 3NF). Boyce Codd Normal form, Decomposition, Multi-Valued Dependencies, 4NF, 5NF. Issues in physical design; Concepts of indexes, File organization for relational tables, De-normalization, Clustering of tables, Clustering indexes.

Introduction to Query Processing and Protecting the Database Parsing, translation, optimization, evaluation and overview of Query Processing. Protecting the Data Base - Integrity, Security and Recovery. Domain Constraints, Referential Integrity, Assertion, Triggers, Security & Authorization in SQL.

Data Organization -

File Organization: -Fixed length records, variable length records, Organization of records in files, Indexing: - indexed files -B-tree, B+-tree, and Hashing Techniques.

## IX. Program Based Numerical Analysis :-

Solution of Polynomial and Transcendental Algebraic Equations

Bisection method, Regula-falsi method & Newton's method, Solution of Cubic & Biquadratic Equation, Complex roots of polynomial equations.

Simultaneous Equations and Matrix

Gauss-Jordan method, Cholesky's method, Reduction to lower or upper Triangular forms, Inversion of matrix, method of partitioning, Characteristics equation of matrix, Power methods, Eigen values of matrix, Transformation to diagonal forms.

Curve-Fitting from Observed Data

Divided difference table for evenly or unevenly spaced data, polynomial curve-fitting - Newton's, Gauss and Lagranges form of interpolation and Divided Differences, method of least square for polynomials,.

Numerical Differentiation and Integration

Forward and Backward differential operators, Newton - cotes integration formula: Trapezoidal Rule, Simpson's Rule, Boole's Rule, Weddle Rule, Legendre's rule, method of weighted coefficients.

Solution of Differential Equations

Numerical Solution of ordinary differential equations, one step method, Taylor's Series, Predictor-Corrector Method, Euler's Method, Runge-Kutta Method, Milne's method.

#### X. Computer Networking and Data Communication :-

Introduction to Computer Networking

The Concept of Networking, Data Communication, Required network elements, The role of Standards Organization. Line Configuration, Various Topologies, Transmission Mode, Categories of Networks- LAN, MAN, WAN. The benefits of a Computer Networks.

The OSI and TCP/IP Reference Model

The Concept of Layered Architecture, Design Issues for the Layers. Interfaces and services, Detailed Functions of the Layers. Comparison between OSI and TCP/IP Reference model. Transmission of Digital Data Shannon's and Nyquist theorems for maximum data rate of a channel. Transmission media- Coaxial, UTP, Fiber optic and wireless. Analog and digital data Transmission- parallel and serial transmission. DTE-DCE interface using RS-232C. Study of modems- 56k and Cable Modem. Modem standards.

Multiplexing and Switching

The Concept of Multiplexing- FDM, TDM, WDM. The Concept of Switching- Circuiting, Message switching, Packet switching.

Data Link Layer and Routing Algorithms

Line Discipline, Flow Control- stop and wait, sliding window, Go back N, Error Control- ARQ stop and wait, sliding window ARQ. HDLC, SLIP, PPP. Multiple access protocols- ALOHA, Slotted ALOHA, CSMA/CD. IEEE standards for LAN's and MAN's. The IP protocol, and its header. IP address classes and subnet mask. The concept of ICMP, ARP, RARP, RSVP, CIDR and Ipv6.

Routing algorithms- shortest path first, Distance Vector, Link State. Congestion Control- The leaky bucket and Token bucket Algorithms.

Transport Layer

The Concept of client and Server in terms of Socket addressing in Transport layer. Two way and three-way handshaking. TCP header. Network Performance Issues. The Concept of Domain Name System, Various Resource Records. Architecture and services of E-mail (RFC-822 and MIME). The Concept of World Wide Web- server side and client side.

ATM

The concept of ATM, ATM Adoption layers- AAL1, AAL2, AAL3/4, AAL5, Comparison of AAL protocols. Cell formats for UNI and NNI. Service Categories, Quality of service, Congestion Control in ATM.

Comparative study of Networking Technologies X.25, Frame Relay, ATM, SONET, SMDS, ISDN.

Network Security

The Importance of Security in Networking. Traditional Cryptography, Data Encryption Standards, RSA algorithm.

#### XI. Programming in Visual Basic :-

Introduction to visual Basic

Editions of Visual Basic, Event Driven Programming, Terminology, Working environment, project and executable files, Understanding modules, Using the code editor window, Other code navigation features, Code documentation and formatting, environment options, code formatting option, Automatic code completion features.

Creating Programs

Introduction to objects, Controlling objects, Properties, methods and events, Working with forms, Interacting with the user:

MsgBox function, InputBox function, Code statements, Managing forms, Creating a program in Visual Basic, Printing.

Variable and Procedures

Overview of variables, Declaring, Scope, arrays, Userdefined data types, constants working with procedures, Working with dates and times, Using the Format function, Manipulating text strings. Controlling Program Execution Comparison and logical operators, If... Then statements, Select Case Statements looping structures, Using Do... Loop structures, For... Next statement, Exiting a loop. Working with Controls

Types of controls, Overview of standard controls, Combo Box and List Box, Option Button and Frame controls Menu, Status bars, Toolbars, Advanced standard controls, ActiveX controls, Insertable objects, Validation.

Error Trapping & Debugging

Overview of run-time errors, error handling process, The Err object, Errors and calling chain, Errors in an error-handling routine, Inline error handling, Error-handling styles, General error-trapping options Type of errors, Break mode Debug toolbar, Watch window, Immediate window, Local window, Tracing program flow with the Call Stack.

Sequential and Random Files:

Saving data to file, basic filling, data analysis and file, the extended text editor, Random access file, the design and coding.

Data Access Using the ADO Data Control

Overview of ActiveX data Objects, Visual Basic data access features, Relational database concepts Using the ADO Data control to access data, Overview of DAO, RDO, Data Control, structured query language (SQL), Manipulating data Using Data Form Wizard.

Report Generation:

Overview of Report, Data Report, and Add groups, Data Environment, Connection to database Introduction to Crystal Report Generator.

Advances Tools:

Overview of drag and drop, Mouse events, Drag and drop basics, Date Time Control, Calendar, Print Dialog, MDI (Multiple Document Interface).

#### XII. Artificial Intelligence and Expert Systems :-

General Issues and overview of AI :

The AI problems; What is an AI technique; Characteristics of AI applications

Problem solving, search and control strategies :

General problem solving; production systems; control strategies: forward and backward and backward chaining Exhaustive searches: Depth first Breadth first search.

Heuristic Search techniques :

Hill climbing; Branch and Bound technique; Best first search and A\* algorithm; AND/Or Graphs; problem reduction and AO\* algorithm; constraint satisfaction problems.

Game playing :

Minimax search procedure; Alpha-Beta cutoffs; Additional Refinements.

Knowledge Representation :

First order predicate calculus; Skolemization Resolution principle and unification; Inference Mechanisms; Horn's clauses; semantic Networks; frame systems and value inheritance. Scripts; conceptual dependency;

AI Programming Languages :

Introduction to Lisp, Syntax and Numeric functions; List manipulation functions; Iteration and Recursion; Property list and Arrays, Introduction to PROLOG.

Natural language processing :

Parsing technique; context-context- free grammar; Recursive Transition Nets (RTN); Augmented Transition Nets ((ATN); case and logic grammars; semantic analysis.

Planning :

Overview- An example Domain: The Blocks World; Component of planning systems: Goal Stack Planning (linear planning); Non-linear planning using goal sets; probabilistic reasoning and Uncertainty; probability theory; Bayes Theorem and Bayesian networks; certainty factor.

Expert Systems :

Introduction to expert systems and Applications of expert systems; various expert system shells: vidwan; frame work; knowledge acquisition; case studies; MYCIN.

Learning :

Role learning; learning by induction; Explanation based learning.

### XIII. Introduction to .NET Technology :-

Inside the .NET framework :

Overview of .net framework, Managed Execution process, CLR, JIT Compilation, MSIL, Assemblies, Common Type System , cross language, interoperability.

Programming with .NET Framework

XML, Accessing data , ADO.Net, Accessing Internet, Component Programming essentials and Throwing exceptions, Processing Transactions, Garbage Collection, Base types, working with I/O, Basic files.

Building .NET framework applications :

ASP.net Web Application, Web forms, Server controls, Introduction to windows forms, Design –Time Support.

Debugging Optimizing and Profiling :

Performance and optimization concept, monitoring and managing Windows Process, Managing process, Retrieving Information about Process.

.NET Framework common classes & tools: Microsoft.Csharp, Microsoft.Jscript,

Microsoft.VisualBasic, Microsoft.Win 32 System, System Data, System security, System Web, System XML.qms, tools-AL.exe, Aximp.exe, Ilasm.exe, LC.exe, .NET Framework Configuration Tools, Wincv.exe

### XIV. Software Engineering Fundamentals :-

Software Engineering Fundamentals :

Definition of software product; software development paradigms; software engineering; knowledge engineering and end user development approaches.

Software Analysis :

Abstraction; partitioning and projection; system specification; software requirements specification (SRS) standards; formal specification method; specification tools; flow based, data based and object orientated analysis.

Systems Design ;

Idealised and constrained design; process oriented design (Gane and Sarson and Yourdon notations); data oriented design (Warnier - Orr, E-r modeling); Object oriented design (Booch approach); Cohesion and coupling; Design metrics; design documentation standards.

Role of Case Tools :

Relevance of case tools; High-end and low-end case tools; Automated support for data dictionaries, data flow diagrams, entity relationship diagrams.

Coding And Programming :

Choice of programming languages; mixed language programming and call semantics; Re-engineering legacy systems; coding standard.

Software Quality And Testing :

Software quality assurance; types of software testing (white box, black box, unit, integration, validation, system etc); debugging and reliability analysis; program complexity analysis; software quality and metrics; software maturity model and extensions. Software cost and Time estimation. Functions points; issues in software cost estimation; introduction to the Rayleigh curve<sup>3</sup>; algorithmic cost model (COCOMO<sup>0</sup>, Putnam<sup>slim</sup>,

Watson and felix); Other approaches to software cost and size estimation (software complexity, Delphi, costing by analogy)

Software Project Management :

Planning software projects; work background structures; integrating software, software design and project planning; software project teams; project monitoring and controls.

### XV. Data Mining & Data Warehousing :-

Introduction & Data Warehousing and OLAP Technology for Data Mining - What is data mining?, Data Mining: On what kind of data?, Data mining functionality, Are all the patterns interesting?, Classification of data mining systems, What is a data warehouse?, A multi-dimensional data model, Data warehouse architecture, Data warehouse implementation, Further development of data cube technology, From data warehousing to data mining. Concept of Transaction, Transactional database, Distributed Database, Commit Protocols.

Data Preprocessing ,Data Mining Primitive , Languages and System Architecture - Why preprocess the data?, Data cleaning ,Data integration and transformation, Data reduction, Discrimination and concept hierarchy generation, Data Mining Primitive, Data Mining Query Language, Architecture of data mining system.

Mining Association Rules in Large Databases -

Association rule mining, Mining single-dimensional Boolean association rules from transactional databases, Mining multi-level association rules from transactional databases, Mining multidimensional association rules from transactional databases and data warehouse, From association mining to correlation analysis, Constraint-based association mining.

Classification and Prediction & Cluster Analysis -

What is classification? What is prediction?, Issues regarding classification and prediction, Classification by decision tree induction, Bayesian Classification, Classification by back propagation, Classification based on concepts from association rule mining, Other Classification Methods, Prediction, Classification accuracy, What is Cluster Analysis?, Types of Data in Cluster Analysis, A Categorization of Major Clustering Methods, Partitioning Methods, Hierarchical Methods, Density-Based Methods, Grid-Based Methods, Model- Based Clustering Methods, Outlier Analysis.

Mining Complex Types of Data & Applications and Trends in Data Mining -

Multidimensional analysis and descriptive mining of complex data objects, Mining spatial databases, Mining multimedia databases, Mining time-series and sequence data, Mining text databases, Mining the World- Wide Web, Data mining applications, Data mining system products and research prototypes, Additional themes on data mining, Social impact of data mining, Trends in data mining

### XVI. Satellite Mobile Communication :-

Introduction.

Introduction to Mobile Communication, Short history of wireless communication, Applications, Vehicles, Emergency, Business, Replacement of wired network, Location dependent services, infotainment, Mobile and Wireless devices, A Simplified reference model, some open research topics in mobile communication.

Satellite Systems

History of satellite system, Applications of satellite systems, Type of satellite systems, characteristics of satellite systems, satellite system infrastructure, satellite system architecture, Global Positioning system (GPS), Limitations of GPS. Beneficiaries of GPS, Applications of GPS.

Mobile Communication Systems

Introduction, Cellular System Infrastructure,, Registration, Handoff Parameters and Underlying support, Roaming Support Using System Backbone, to Mobile IP, Functions of Mobile IP, Mobile Node, Corresponding Node, Home Network, Foreign

Network, Home Agent, Foreign Agent, Care-of-Address, IP Packet Delivery, Agent Discovery, Agent Solicitation, Registration, Tunneling, Dynamic host configuration protocol.

Wireless LANs and PANs

Introduction to IEEE 802.11, Ricochet, Ricochet Wireless Modem, Services Provided by Ricochet, Home RF, Home RF Technology, Hiper LAN, Blue tooth, Advantages and disadvantages of Wireless LAN, Infra red vs radio transmission, introduction to MAC. Technologies influence WLANs/ WPANs in future. Mobile Adhoc Network

Introduction to Mobile Adhoc Network(MANET), Characteristics of MANET, Applications of MANET, Routing, Need for Routing, Routing Classification, Table- Driven Routing Protocol - Destination Sequenced Distance Vector Routing Protocol, Cluster-Head Gateway Switch Routing, Wireless Routing Protocol. Source initiated On-demand Routing- Adhoc On Demand Distance Vector Routing, Dynamic Source Routing, Temporarily Ordered Routing Algorithms, Hybrid Protocol -Zone Routing Protocol.

### (24) - COMPUTER APPLICATION

#### I. Object Oriented Programming with 'C++' :-

Introduction to OOP

Advantages of OOP, The Object Oriented Approach, and Characteristics of object oriented languages- Object, Classes, Inheritance, Reusability, and Polymorphism. OMT.

Language Fundamental

Overview of C++: History of C++, Data Types - int, float, char, double, void. Constant and Variables. Operators and Expression: Arithmetic Operators, Relational Operators, Logical Operators, Conditional Operators, Bitwise Operators. Control constructor: if, if-else, nested if-else, while(), do-while(), for(;;), break, continue, switch, goto. Storage class.

Structure and Function

Structures : A Simple structures, specify the structures, Defining a structure variable, Accessing structures member, Enumeration data type. Function: Function Declaration, Calling Function, Function Defines, Passing Argument to function, Passing Constant, Passing Value, Reference Argument, Passing struct variable, Overloaded Function, Inline Function, Default Argument, return statement, returning by reference.

Array: Defining array, array element, initiation array, multi dimensional array, passing array to function.

Object Classes and Inheritance

Object and Class, Using the class, class construct, class destructors, object as function argument, struct and classes, array as class member, operator overloading. Type of inheritance, Derive class, Base class. Access specifier: protected. Overriding, member function, String, Templates.

Pointers and Virtual Function

pointers: & and \* operator pointer variables, pointer to void, pointer and array, pointer and function, pointer and string, memory management, new and delete, pointer to object, pointer to pointer, link list. Virtual Function: Virtual Function, Virtual member function, accesses with pointer, Late binding, pure virtual function, Friend function, Friend class, static function, this pointer.

File and Stream

C++ streams, Stream class, string I/O, char I/O, Object I/O, I/O with multiple object, File pointer, Disk I/O,

#### II. Mathematical Foundation :-

Mathematical Logic, Sets Relations and functions Mathematical Logic : Notations, Algebra of Propositions & Propositional functions, logical connectives, Truth values & Truth table Tautologies & Contradictions, Normal Forms, Predicate Calculus, Quantifiers.

Set Theory: Sets, Subsets, Power sets, Complement, Union and Intersection, De-Morgan's law Cardinality, relations: Carte-

sian Products, relational Matrices, properties of relations equivalence relation functions: Injection, Surjection, Bijection, Composition, of Functions, Permutations, Cardinality, the characteristic functions recursive definitions, finite induction.

Lattices & Boolean Algebra

Lattices : Lattices as Algebraic System, Sub lattices, some special Lattices (Complement, Distributive, Modular).

Boolean Algebra : Axiomatic definitions of Boolean algebra as algebraic structures with two operations, Switching Circuits. Groups, Fields & Ring

Groups : Groups, axioms, permutation groups, subgroups, cosets, normal subgroups, free subgroups, grammars, language. Fields & Rings : Definition, Structure, Minimal Polynomials, Irreducible Polynomials, Polynomial roots & its Applications.

Graphs

Graphs : Simple Graph, Multigraph & Pseudograph, Degree of a Vertex, Types of Graphs, Sub Graphs and Isomorphic Graphs, Operations of Graphs, Path, Cycles and Connectivity, Euler and Hamilton Graph, Shortest Path Problems BFS (Breadth First Search), Dijkstra's Algorithm, Representation of Graphs, Planar Graphs, Applications of Graph Theory.

Trees

Trees : Trees, Properties of trees, pendant vertices in a tree, center of tree, Spanning tree, Binary tree, Tree Traversal, Applications of trees in computer science.

#### III. Essential of Information Technology :-

Introduction -

Basics concept of IT, concept of data and information, History of computer, Data Processing, Generations of Computers, organization of computers, Input and Output devices, storage devices and file organization.

Software concept -

Software and its need, Types of Software- System software, application software; Utility Programs; compilers, interpreters and Assemblers; Linker and Loader; Debugger; Operating system, elementary command of DOS, UNIX and WINDOWS (file handling directory, management and general purpose user interfacing command).

Computer languages -

Introduction of Programming Languages, Types of Programming Languages, Generations of Programming Languages, Programming Paradigms, general purpose and concept of oop and SQL, Functional Programming; Process oriented Programming.

Communication and network technology -

Communication process, Communication and system elements, communication mode (Analog and Digital, Synchronous and Asynchronous, Simplex, Half duplex, Full duplex, circuit switching), communication media (Speed and capacity, twisted pair, coaxial cable, optics, wireless), communication protocols, Computer Network, Types of Network, Topology, protocols (ISO/OS, reference model, TCP/IP), Medias- NIC, NOS, Bridges, HUB, Routers, Gateways.

Internet

Technical foundation of Internet, Internet Service Provider, Anatomy of Internet, ARPANET and Internet History of World Wide Web, Services Available on Internet; Basic Internet Terminologies, Net Etiquette, Applications of Internet. Client server computing, Distributed Computing, Domain naming system, DNS Server, Internet Security - Fire walls, Encryptions etc. Internet Applications - E-mail, WWW, E-commerce, Teleconferencing.

Application of Information Technology - State of Art Application of IT, Application of IT in business, Industry, home, education and training entertainment, science and engineering and medicine.

#### IV. Data Structure Through Algorithms :-

Introduction and Preliminaries -

Introduction, Basic terminology, Elementary data organization, Data structure, Data structure operation, Algorithms: complexity, time-space Tradeoff.. Mathematical Notation and functions, Algorithmic Notation, Control Structures, Complexity of Algorithms, Sub algorithms, Variables, Data Type.

String Processing, Arrays, Records And Pointers -

Basic Terminology, Storing String, Character Data Type, String Operations, Word Processing, Pattern Matching Algorithms. Linear Array, Representation of linear Array in Memory, Traversing Linear Arrays, Inserting And Deleting, Sorting: Bubble Sort, Searching; Linear Search, Binary Search, Multidimensional Array, Pointers; Pointer Array, Records; Record Structures, Representation of Records in Memory; Parallel Arrays, Matrices, Sparse Matrices. Linked Lists, Stacks, Queues, Recursion -

Linked list, Representation of linked lists in memory, Traversing a linked list, Searching a linked list, Memory Allocation; Garbage Collection, Insertion into a linked List, Deletion from a Linked List, Header Linked List, Two- Way Linked Lists. Stacks, Array Representation of Stack, Arithmetic Expressions; Polish Notation, Quick sort, an application of Stacks, Recursion, Tower of Hanoi, Implementation of Recursive Procedures by Stacks, Queues, Deques, Priority Queues.

Trees & Graphs -

Binary Trees, Representing Binary Trees in Memory, Traversing binary tree, Traversal Algorithms using stacks, header nodes; threads, Binary Search Tree, Searching and Inserting in Binary Search Tree, Deleting in Binary Search tree, Heap; Heap sort, Path

Lengths; Huffmans Algorithms, General Tree. Graph Theory Terminology, Sequential Representation of Graph; Adjacency Matrix, Path Matrix, Linked Representation of Graph.

Sorting And Searching -

Sorting, Insertion Sort, Selection Sort, Merging, Merge Sort, Radix Sort, Searching and data modification, hashing.

#### V. **Communication Skills :-**

Meaning and Process of communication, importance of effective communication, communication situation and communication skills, barriers to communicate, objective of communication, types of communication, principles of communication, essentials of effective communication, media of communication - written, oral, face to face, visual, audio visual, merits and demerits of written and oral communication prepared for oral presentation, conditional presentation, developing communication skill.

Interview - how to face and how to conduct, preparation of bio-data, seminars, pair, bibliography, graph discussion, official correspondence. Mechanics of writing, paragraphing precise, report writing, technical reports, length of written report, organizing report, writing technical report.

#### VI. **Program Based Numerical Analysis :-**

Solution of Polynomial and Transcendental Algebraic Equations

Bisection method, Regulafalsi method & Newton's method, Solution of Cubic & Biquadrate Equation, Complex roots of polynomial equations. Simultaneous Equations and Matrix Gauss-Jordan method, Cholesky's method, Reduction to lower or upper Triangular forms, Inversion of matrix, method of partitioning, Characteristics equation of matrix, Power methods, Eigen values of matrix, Transformation to diagonal forms.

Curve-Fitting from Observed Data

Divided difference table for evenly or unevenly spaced data, polynomial curve-fitting - Newton's, Gauss and Langranges form of interpolation and Divided Differences, method of least square for polynomials,.

Numerical Differentiation and Integration

Forward and Backword differential operators, Newton - cotes integration formula: Trapezoidal Rule, Simpson's Rule, Boole's Rule, Weddle Rule, Legendre's rule, method of weighted coefficients.

Solution of Differential Equations

Numerical Solution of ordinary differential equations, one step method, Taylor's Series, Predictor-Corrector Method, Euler's Method, Runga-Kutta Method, Milne's method.

#### VII. **Computer System Architecture :-**

Representation of Information

Number system, Integer & Floating point representation Character code (ASCII, EBCDIC), Error Detectand Correct code, Basic Building Blocks, Boolean Algebra, MAP Simplification, Combination Blocks, Gates, Multiplexers, Decoders, etc Sequential buildingblock, flip-flop, registers, counters, ALU, RAM etc.

Register transfer language and micro operations

Concepts of bus, data movement along registers, a language to represent conditional data transfer, data movement from its memory, arithmetic and logical operations along with register transfer timing in registertransfer.

Basic Computer Organization and Design

Instruction code, Computer Instructions, Timing and Control, Execution of Instruction, Input and Output Interrupt, Design of Computer.

Computer Software

Programming Language, Assembly Language, Assembler, Program Loops, Input /Output Programming,

System Software. Central Processor Organization: -

Processor Bus Organization, Arithmetic Logic Unit, Stack Organization, Instruction Formats, Addressing modes, Data transfer and Manipulation, Program Control, Microprocessor Organization, Parallel Processing,.

Input -Output Organization

Peripheral Devices, Input/Output Interface, Asynchronous Data Transfer, Direct Memory Access (DMA), Priority Interrupt, Input-Output Processor, Multiprocessor System Organization, and Data Communication Processor.

Memory Organization

Auxiliary Memory, Micro Computer Memory, Memory Hierarchy, Associative Memory, Virtual Memory, Cache Memory, Memory Management Hardware.

#### VIII. **RDBMS ORACLE :-**

Overview of Database Management -

Data, Information and knowledge, Increasing use of data as a corporate resource, data processing verses data management, file oriented approach verses database oriented approach to data management; data independence, database administration roles, DBMS architecture, different kinds of DBMS users, importance of data dictionary, contents of data dictionary, types of database languages. Data models: network, hierarchical, relational. Introduction to distributed databases, Client/Server databases, Object-oriented databases, Object-relational databases, Introduction to ODBC concept.

Relational Model -

Entity - Relationship model as a tool for conceptual design-entities attributes and relationships. ER diagrams; Concept of keys: candidate key, primary key, alternate key, foreign key; Strong and weak entities, Case studies of ER modeling Generalization; specialization and aggregation. Converting an ER model into relational Schema. Extended ER features, Introduction to UML, Representation in UML diagram (Class Diagram etc.).

Structured Query Language

Relational Algebra: select, project, cross product different types of joins (inner join, outer joins, self join); Set operations, Tuple relational calculus, Domain relational calculus, Simple and complex queries using relational algebra, stand alone and embedded query languages, Int roduct ion to SQL constructs (SELECT...FROM, WHERE... GROUP BY... HAVING... ORDERBY...), INSERT, DELETE, UPDATE, VIEW definition and use, Temporary tables, Nested queries, and correlated nested queries, Integrity constraints: Not null, unique, check, primary key, foreign key, ref-

erences, triggers. Embedded SQL and Application Programming Interfaces.

#### Relational Database Design-

Normalization concept in logical model; Pitfalls in database design, update anomalies: Functional dependencies, Join dependencies, Normal forms (1NF, 2NF, 3NF). Boyce Codd Normal form, Decomposition, Multi-Valued Dependencies, 4NF, 5NF. Issues in physical design; Concepts of indexes, File organization for relational tables, De-normalization, Clustering of tables, Clustering indexes.

Introduction to Query Processing and Protecting the Database Parsing, translation, optimization, evaluation and overview of Query Processing. Protecting the Data Base - Integrity, Security and Recovery. Domain Constraints, Referential Integrity, Assertion, Triggers, Security & Authorization in SQL.

#### Data Organization -

File Organization: -Fixed length records, variable length records, Organization of records in files, Indexing: - indexed files -B-tree, B+-tree, and Hashing Techniques.

### IX. **Operating System with Linux as Case Study :-**

#### Introduction:

What is operating system, basic concept, terminology, batch processing, spooling, multiprogramming, time sharing, real time systems, protection, multiprocessor system, operating system as resource manager, process view point, memory management, process management, device management and information management, other views of operating system, historical, functional job control language and supervisor service control.

#### Memory Management:

Preliminaries of memory management, memory handling in M/C, relocation, swapping and swap time calculation, multiple partitions, partitioned allocation MFT, fragmentation, MVT, compaction, paging, job scheduling implementation of page tables, shared page, virtual memory-overlays, concepts of virtual memory demand page, memory management and performance, page replacement and page replacement algorithms. Allocation algorithms. Storage hierarchy disk and drum scheduling - physical characteristics fcfs scheduling SCAN, short of seek time first disk scheduling algorithms sector queuing.

#### Information Management (File System) :

File concept, file type, typed based system, disk based system, general model of file system, file directory maintenance, symbolic file system, basic file system, physical file system, file support device directory, access methods free space management contiguous, linked allocation and indexed allocation performances. Processor Management (CPU Scheduling) : Reviewing of multiprogramming concept, scheduling concept, basic concept, CPU I/O burst cycle process state, PCB (Programme Control Block) scheduling queries, schedulers, scheduling algorithms - performance criteria, first-come - first served shortest job - first priority, preemptive algorithm, round robin, multi-level queues and multilevel feedback queues, algo rithm evolution, multiprocessor scheduling, separate system, coordinated job scheduling, master / slave scheduling.

#### Dead Locks :

The dead lock problem - dead lock definition, dead lock detection, detection algorithm usage, dead lock characterization, resource allocation graph, dead lock prevention, mutual exclusion, hold and wait, no preemption and circular wait, dead lock avoidance-bankers algorithm. Recovery from deadlock process termination, resource preemption, combined approach to deadlock handling.

#### Unix (Operating System) :

History, design principle, programmer interface, user interface, file system, process management, I/O system, inter process communication.

#### Device Management :

Dedicated, shared and virtual devices, sequential access and direct access device, channel and control units, I/O schedulers. Introduction to assembly language programming, introduction to I/O programming. Introduction to interrupts and their programming.

### X. **Programming Languages VB & VC++ :-**

#### GUI - Programming Visual Basic

##### Introduction to Visual Basic :

Windows and DOS; hardware; windows, icons and menus; Event Driven Programming; terminology; the working screen; controls and events; the menu systems; the programming language.

##### Designing and Creating Programs :

Program Design; the launch program; the form and the controls; writing the code; save your work; running and testing; making an EXE file; printouts. Program Flow : Logical testing; branching with if; Select Case; Go To; For...Next; Do Loops; While... Wend.

##### Interacting with user :

Msg boxes, the input box function, scroll bars, frames, options, check boxes, menus and various components. (Like timer, dbrgrid, dbcombo, msflex Grid, etc)

##### Testing and Debugging :

Errors and error spotting, debugging tools, break points and watches, keeping watch, stepping through, error trapping.

##### Graphics :

Objects and properties for drawing, the drawing methods, working with imported graphics, animation. Procedures, Functions and Forms : Procedures and Functions, creating a procedures, creating a function, recursive functions, multiple forms (MDI), startup forms, starting from sub main, transferring between forms, procedures and modules.

##### Arrays :

Dimensions, elements and subscripts, arrays and loops, control arrays, creating a control arrays. Sequential Files :

Saving data to files, basic filing, data analysis and file, the extended text editor.

##### Records and Random Access Files :

Record structures, random access files, the staff database, design and coding, MDI Forms - parent and child. Accessing Data - Data Manager and Data Control : Creating database, what is database, planning your database, using the data manager, adding an index, using the data manager to enter data, creating a form with data aware controls, what is data control, what are data aware controls, creating a menu bar.

##### ADO & RDO controls and introduction to ActiveX control Visual C++

Introduction to VC++- C under windows, Overview of VC++, VC++ workspace & projects, creating source code file, adding C++ code to a program.

Introduction to MFC - The part of VC++ programs, the application object, the main window object, the view object, the document object, Windows event oriented programming, What is device context., Windows Application using MFC.

OLE (object linking and embedding technique), Features of OLE, introduction to ActiveX controls, introduction to COM and DLL.

### XI. **Computer Networks and Data Communication :-**

#### Introduction to Computer Networking

The Concept of Networking, Data Communication, Required network elements, The role of Standards Organization. Line Configuration, Various Topologies, Transmission Mode, Categories of Networks- LAN, MAN, WAN. The benefits of a Computer Networks.

#### The OSI and TCP/IP Reference Model

The Concept of Layered Architecture, Design Issues for the Layers. Interfaces and services, Detailed Functions of the Layers. Comparison between OSI and TCP/ IP Reference model. Transmission of Digital Data

Shannon's and Nyquist theorems for maximum data rate of a channel. Transmission media- Co-axial, UTP, Fiber optic and wireless. Analog and digital data Transmission- parallel and serial transmission. DTE-DCE interface using RS-232C. Study of modems- 56k and Cable Modem. Modem standards. Multiplexing and Switching The Concept of Multiplexing- FDM, TDM, WDM. The Concept of Switching- Circuiting, Message switching, Packet switching.

Data Link Layer and Routing Algorithms

Line Discipline, Flow Control- stop and wait, sliding window, Go back N, Error Control- ARQ stop and wait, sliding window ARQ. HDLC, SLIP, PPP. Multiple access protocols-ALOHA, Slotted ALOHA, CSMA/CD. IEEE standards for LAN's and MAN's. The IP protocol, and its header. IP address classes and subnet mask. The concept of ICMP, ARP, RARP, RSVP, CIDR and Ipv6.

Routing algorithms- shortest path first, Distance Vector, Link State. Congestion Control-The leaky bucket and Token bucket Algorithms.

Transport Layer

The Concept of client and Server in terms of Socket addressing in Transport layer. Two way and three-way handshaking. TCP header.

Network Performance Issues. The Concept of Domain Name System, Various Resource Records. Architecture and services of E-mail (RFC-822 and MIME). The Concept of World Wide Web- server side and client side.

ATM

The concept of ATM, ATM Adoption layers- AAL1, AAL2, AAL3/4, AAL5, Comparison of AAL protocols. Cell formats for UNI and NNI. Service Categories, Quality of service, Congestion Control in ATM.

Comparative study of Networking Technologies X.25, Frame Relay, ATM, SONET, SMDS, ISDN.

Network Security

The Importance of Security in Networking. Traditional Cryptography, Data Encryption Standards, RSA algorithm

## XII. Operation Research :-

Linear Programming -

LP formulations, Graphical method for solving LP's with 2 variables, Simplex method, Duality theory in linear programming and applications, Special Linear Programming Problems, Transportation Problem (Stepping Stone Method), Assignment problem (Hungarian Method)

Network Analysis -

Examples of network flow problems, Shortest -route problems, Dijkstras Algorithm, Applications of shortest - route problems, Max flow problem, Flow network, Labeling routine, Labeling algorithm for the max flow problems, Min-cut and max -cut theorem.

Project Scheduling by PERT/CPM - Project management origin and the use of PERT origin and use of CPM, Application of PERT and CPM; Project network - Diagram representation, Critical path calculations by linear programs, Critical path calculations

by network analysis and critical path method (CPM), Determinations of floats, Constructions of time chart and resource labeling, Project cost curve and crashing in project management, Program evaluation and Review technique (pert).

Dynamic Programming -

Basic concepts - Bellman's optimality principles, Examples of D.P. models and computations. Examples to be taken from Different areas of allocations, replacement, sequencing and scheduling, networks and other related O>R areas.

Queuing Models -

Notations and assumptions, Queuing models with Poisson input and exponential service.

Sequencing Models -

Sequencing Problem, Johnson's algorithm for processing n jobs through 2 machines, Johnson's Algorithm for processing n jobs through 3 machines, Processing 2 jobs through n machines, graphical solution.

Inventory Models -

Introduction to the inventory problem, Deterministic models - The classical EOQ (Economic Order Quantity) model, Non-zero lead time, The EOQ with shortages allowed.

## XIII. Artificial Intelligence and Expert Systems :-

General Issues and overview of AI :

The AI problems; what is an AI technique; Characteristics of AI applications

Problem solving, search and control strategies :

General problem solving; production systems; control strategies: forward and backward and backward chaining Exhaustive searches: Depth first Breadth first search.

Heuristic Search techniques :

Hill climbing; Branch and Bound technique; Best first search and A\* algorithm; AND/Or Graphs; problem reduction and AO\* algorithm; constraint satisfaction problems

Game playing :

Minimax search procedure; Alpha-Beta cutoffs; Additional Refinements.

Knowledge Representation :

First order predicate calculus; Skolemization Resolution principle and unification; Inference Mechanisms; Horn's clauses; semantic Networks; frame systems and value inheritance. Scripts; conceptual dependency;

AI Programming Languages :

Introduction to Lisp, Syntax and Numeric functions; List manipulation functions; Iteration and Recursion; Property list and Arrays, Introduction to PROLOG

Natural language processing :

Parsing technique; context-context- free grammar; Recursive Transition Nets (RTN); Augmented Transition Nets (ATN); case and logic grammars; semantic analysis.

Planning :

Overview- An example Domain: The Blocks Word;

Component of planning systems: Goal Stack Planning (linear planning); Non-linear planning using goal sets; probabilistic reasoning and Uncertainty; probability theory; Bayes Theorem and Bayesian networks; certainty factor.

Expert Systems :

Introduction to expert systems and Applications of expert systems; various expert system shells: vidwan; frame work; knowledge acquisition; case studies; MYCIN.

Learning :

Role learning; learning by induction; Explanation based learning.

## XIV. System Analysis Design and MIS :-

Introduction -

Systems Concepts and the information systems environment: Definition of system, Characteristics of system, elements of system, types of system. The system Development life cycle: consideration of candidates system. The Role of system Analyst: Introduction, the multiphase role of the analyst, the analyst / user interface, the place of the analyst in the MIS Organization.

System Analysis and its Tools -

System Planning and initial investigation : basis for planning in systems analysis, fact finding, fact analysis, Feasibility study. Determination of feasibility.

Information Gathering: Information Gathering Tools & technique.

Tools of Structured Analysis, Feasibility Study & Cost- Benefit Analysis -

Structured Analysis, DFD, Data Dictionary, Decision Tree, Decision Table. System performance and feasible study, Data analysis & Cost-benefit Analysis.

System Design -

The process of Design Methodologies, Audit Consideration. Input Design, Output Design, Form Design, File Structure, File organisation, Database structure, Database design.

System Implementation -

System Testing, the test plan, quality assurance, data processing auditor. Conversion, Post Implementation review, Software Maintenance. Computer Industry, the software Industry, A procedure for Hardware Software Selection, Financial consideration in selection, Computer contract, Project scheduling & Software. System Security, disaster/recovery planning, ethics in system development.

Introduction to MIS

Definition of MIS, Benefits of MIS, Function of MIS, Characteristics of MIS, Operating Elements of Information System, Components of Information System, Three Dimension of Information System; MIS and Other Subsystems - Information Generator, Information System Levels, Open and Closed Loop System, MIS Organizations, Types of Information System, Establishing MIS. Introduction of Transaction Processing Systems.

The strategic impact of the internet and E-commerce :

About internet, an overview of internet Application. Business uses of Internet, Electronic marketing and on-line communities of worldwide web.

Information Technology Assets :

Managing Hardware Assets, Managing Software Assets, Managing Data Resources, MIS and Decision Support System, Strategic Information System.

#### XV. Programming In Java :-

Introduction to java programming

An overview of Java: Object Oriented Programming, Features of Java, Java Virtual Machine, Java Environment: Java Development Kit, Java Standard Library, Data Types, Variables: Declaring a variable, Dynamic Initialization, The scope and life time of variable, Type conversion and Casting: Narrowing and Widening Conversions, Numeric Promotions, Type Conversion Contexts; Operators: Arithmetic Operators, Relational Operators, Logical Operators, Bit wise Operators, Conditional Operators, new operator, [ ] and instance of operator. Control Statements: Java's Selection statement, Iteration Statement, Jump Statement, Array: Declaring Array variables, Constructing an Array, Initializing an Array, Multidimensional Arrays, Anonymous Arrays.

Define the Class and interface

Introducing Classes: Class Fundamentals, Declaring Object, Assigning Object Reference Variables, Defining Methods, method overloading, Using objects as parameter, Constructors, Garbage collection, finalize () method. Inheritance: Inheritance basic, method overloading, object reference this and super, Chaining constructor using this () and super (), Member accessibility modifier: public, protected, default accessibility of member, private protected, private, Package: Define package, CLASSPATH, importing package, Interface: Define an interface, implementing interface, extending interface, variable in interface, Overview of nested class: Top level nested class and interface, Non static inner class, Local class, Anonymous class.

Exception handling and Multithreading

Exception Handling: Exception types, Uncaught Exception, Using try and catch, multiple catch, nested try block, throw, and throws, finally. Multithreading: creating thread, Thread priority, synchronization, thread Scheduler, Running & yielding, sleeping and waking up, waiting and notifying, suspend and resume, miscellaneous method in thread class.

Input output, Networking and Fundamental class of java

Object class, String class, String Buffer class, Wrapper class, Math class, Collection: Collection interface, List interface, Set interface sorted interface, Array List class, Liked List class, Tree Set, Comparator, Vector, Stack.

Input output classes and interface: File, Buffer Stream, Character Stream, and Random Access for files, Object Sterilization.

Networking: Socket overview, Client/Server, Proxy Server, Network class and interface, TCP/IP client socket, TCP/IP Server socket, URL Connection, Datagrams, Datagram Packets.

Applet programming and AWT

Applet: Applet and Application program, Creating Applets, Applet Life Cycle, Applet and Thread, Supplying Applet parameter, Using Images and Sound in Applets, JAR files, Applet Security.

Introducing the AWT: Overview of the java.awt package, Component and Containers: Component, Container, Panel, Applet, Window, Frame, and Dialog classes. Working with Graphics, Working with Fonts, Working with Colors, GUI Control Components: Button, Canvas, Checkbox and Checkbox Group, Choice, List, Label, Scrollbar, Text Field and Text Area, Frame, Menu Bars and Menu

Layout Management: Layout Management Policies, Flow Layout, Grid Layout, Border Layout, Card Layout, Grid Bag Layout, Customized Layout. Event Handling: Overview of Event Handling, Event Hierarchy, Event Delegation Model, Event Adapters, Low Level Event Processing.

Advance features of java

JDBC: JDBC/ODBC Bridge, The Driver manage class, the java.sql package, data manipulation: Insert, Update, Delete Record, Data navigation: Result Set BDK: What is java Beans, Advantages of java Beans, the Bean Developer Kit, Jar Files, Introspection, Developing a New Bean, Using Bound Properties, Using BeanInfo interface, The java Beans API. Servlets : Movement to Server Side JAVA, Overview of Servlets, Common Gateway Interface (CGI), The JAVA Servlet Architecture, Generic Servlet and HTTP Servlet, The Servlet Interface, Requests and Responses, The Life Cycle of a Servlet, Retrieving Form Data in a Servlet, Session Tracking, Cookies.

#### XVI. Software Engineering :-

Software Engineering Fundamentals :

Definition of software product; software development paradigms; software engineering; knowledge engineering and end user development approaches.

Software Analysis :

Abstraction; partitioning and projection; system specification; software requirements specification (SRS) standards; formal specification method; specification tools; flow based, data based and object orientated analysis.

Systems Design :

Idealised and constrained design; process oriented design (Gane and Sarson and Yourdon notations); data oriented design (Warnier - Orr, E-r modeling); Object oriented design (Booch approach); Cohesion and coupling; Design metrics; design documentation standards.

Role of Case Tools :

Relevance of case tools; High-end and low-end case tools; Automated support for data dictionaries, data flow diagrams, entity relationship diagrams.

Coding And Programming :

Choice of programming languages; mixed language programming and call semantics; Re-engineering legacy systems; coding standard.

Software Quality And Testing :

Software quality assurance; types of software testing (white box, black box, unit, integration, validation, system etc); debugging and reliability analysis; program complexity analysis; software quality and metrics; software maturity model and extensions. Software cost and Time estimation. Functions points; issues in software

cost estimation; introduction to the Rayleigh curve<sup>3</sup>; algorithmic cost model (COCOMO, Putnam-slim, Watson and felix); Other approaches to software cost and size estimation (software complexity, Delphi, costing by analogy)

Software Project Management :

Planning software projects; work background structures; integrating software, software design and project planning; software project teams; project monitoring and controls.

## XVII. Interactive Computer Graphics :-

Display Devices

Refresh Cathode ray tubes, Random Scan and raster Scan Monitors, Direct view storage tubes, continual refresh and storage display, plasma panel displays, LED & LCD devices, color display techniques, shadow marking and penetration, hard copy devices-printer and plotters.

Output Primitives

Points and Lines, Line drawing algorithms – vecgen and Bresenham Antialiasing. Circle generating Algorithms, Bresenham Circle Algorithms Ellipse, Character generating and text display. Matrix and Stork fonts, output command for various geometrical shapes, fill areas horizontal scan for Polygons. Attribute of outputs primitives, line style, text style, bundled attributes, fill colors and patterns.

Display Description

Word/user coordinates, device coordinate, normalized device coordinates, two dimensional viewing. Transformation - Translation, scaling rotation, reflection, shearing. Matrix representation of transformation and homogenous coordinates, Concatenation of transformation. Viewing algorithms- windows and viewpoints, windowing and clipping, line, area text clipping, blanking windows to view point transformation zooming and planning. Segment, concepts and file, segment attributes.

Interactive Graphics

Physical Input devices, logical classification, interactive picture construction techniques, input function.

3-D Transformation Translation, Scaling, Rotation about standard and arbitrary axis, transformation commands.

3-D Projection

Viewing Pipeline, Viewing transformation and clipping, Normalized view volume, viewing Pipeline, hidden line and surface elimination algorithms backface removal, depth buffer method, scan line method, depth sorting method, area subdivision and octree method.

Design for User Interface

Components and user model, command language, memorization user help, backup and error handling, response time, command language style, menu design, feed back, output formats.

## XVIII. Unix/Linux :-

Introduction

Introduction to Multi-user System, Emergency and history of Unix, Feature and benefits, Versions of Unix. System Structure:-Hardware requirements, Kernel and its function, introduction to System calls and Shell.

File System

Feature of Unix File System, Concept of i-node table, links, commonly used commands like who, pwd, cd, mkdir, rm, ls, mv, lp, chmod, cp, grep, sed, awk, pr, lex, yacc, make, etc. Getting started (login / logout), File system management, file operation, system calls, buffer cache. Vi Editor:-Intro to text processing, command and edit mode, invoking vi, command structure, deleting and inserting line, deleting and replacing character, searching strings, yanking, running shell command, command macros, set windows, set auto indent, set number, intro to exrc file.

Shell Programming

Introduction to shell feature, wild card characters, i/out redirections, standard error redirection, system and user created shell variables, profile files, pipes/tee, background processing, command

line arguments, command substitution, read statement, conditional execution of commands, special shell variables \$ #, #?, \$\* etc. Shift commands, loops and decision making- for, while and until, choice making using case... esac, decision making if... fi, using test, string comparison, numerical comparison, logical operation, using expr.

Introduction to Shell

Features, changing the login shell, cshrc, login, logout files, setting environment, variables, history and alias mechanism, command line arguments, redirection/ appending safely, noclobber, noglob, ignore eof, directory stacks (pushd, popd), feature of other shell (rsh, vsh).

Process Control

Process management, process states and transition, regions and control of process, sleep and waking, process creation, process killing, signals, system boot and init process, traps, sitting process priorities.

Inter-process Communication

I/O Sub system, terminal drives, disk drives, messages, shared memory, semaphores, memory management, swapping, demand paging.

System Calls and Unix -C Interface

File handling calls like - access (), open(), create(), read(), write(), close(), fseek(), process control system calls like kill(), exec(), fork(), wait(), signal(), exit(), comparing stdio library and calls.

System Administration:-

Process and Scheduling, Security, Basic System Administration:- Adding a User, User Passwords, Delete of a User, Adding a Group, Deleting a Group, Super User, Startup and Shutdown. Advanced System Administration:- Managing Disk Space, Backup and Restore, Managing System Services. Xwindows:- Introduction to Xwindows concept

Intorduction to Linux:- Evolution of Linux, Red Hat Linux, Linux Installation and LILO, System Configuration. Gnome Desktop and the K Desktop. Xconfigurator, The X window system and window managers, Shell Operations, Linux File Structure.

## XIX. Compiler Design :-

Introduction to Compiler and one pass compiler :

Compilers & translators, Phases of compilers, Compiler writing tools, Bootstrapping; overview of one pass compiler.

Finite Automata and Lexical Analysis -

Role of Lexical Analyzer; specification of tokens, Recognition of tokens, Regular expression, Finite automata, from regular expression to finite automata, DFA and NFA, Implementation of lexical analyzer; tools for lexical analyzer -LEX.

Syntax analysis & Parsing Technique -

Context free grammars; Bottom up parsing, Shift reduce parsing, Operator Precedence parsing, Top down parsing, elimination of left recursion; recursive descent parsing, Predictive parsing.

Automatic Construction of Efficient parsers -

LR parser, construction of SLR and canonical LR parser table, Using ambiguous grammar, An automatic parser the generator, YACC, Using YACC with ambiguous grammar, creating YACC lexical analyzer with LEX, Error recovery in YACC.

Syntax Directed Translation -

Syntax directed schema, Construction of syntax tree, Translation with top down parser.

Run Time Environment -

Source Language issues, Storage organization and allocation strategies, Parameter passing, Implementation of block-structured language.

Intermediate Code Generation -

Intermediate languages, Postfix notation, Three-address code, Quadruples and triples, Translation of assignment statements, Boolean expression, and Procedure call.

Error Detection & recovery -

Lexical & syntactic phase error, semantics error.

Code Optimization -

Optimization of basic block, Loop optimization global data flow analysis, Loop in variant computation.

Code Generation -

Issue and design of code generator, the target machine, a simple code generator.

## XX. Advanced Programming Tools - Java :-

JDBC

Introduction to JDBC, JDBC Drivers Type, Connection, JDBC URLs, Driver Manager, Statement - Creating, Executing, Closing, Result Set - Data Types and Conversions. Prepared Statement, Callable Statement, Mapping SQL and Java Types, JDBC-ODBC Bridge Driver

RMI

Distributed Applications, Introduction to RMI, Java RMI Architecture, Writing an RMI Server, Designing a Remote Interface, Implementing a Remote Interface, Creating a Client Program, Compiling the Programs, Running the Programs.

Servlets

Movement to Server Side JAVA, Overview of Servlets, Common Gateway Interface (CGI), The JAVA Servlet Architecture, Generic Servlet and HTTP Servlet, The Servlet Interface, Requests and Responses, The Life Cycle of a Servlet, Retrieving Form Data in a Servlet, Session Tracking, Cookies.

Java Beans

Java Beans Concepts and the Beans Development Kit, Using the Bean Box, Writing a Simple Bean, Properties, Manipulating Events in the BeanBox, The BeanInfo Interface, Bean Customization, Bean Persistence.

Java Server Pages (JSP)

Overview of JSP, JSP Scripting elements, Compare and Contrast JSP with CGI and Servlet Technologies, List JSP directives, Integrate JSP with Java Beans Components, Handle JSP exceptions, Develop a basic Java Server Pages, Deploy Java Server Pages, Compare twotier and multi-tier web application architectures, Database Connectivity.

## XXI. Introduction to .NET Technology :-

Inside the .NET framework :

Overview of .net framework, Managed Execution process, CLR, JIT Compilation , MSIL, Assemblies, Common Type System , cross language, interoperability.

Programming with .NET Framework

XML, Accessing data, ADO.Net, Accessing Internet, Component Programming essentials and Throwing exceptions, Processing Transactions, Garbage Collection, Base types, working with I/O, Basic files.

Building .NET framework applications :

ASP.net Web Application, Web forms, Server controls, Introduction to windows forms, Design-Time Support.

Debugging Optimizing and Profiling :

Performance and optimization concept, monitoring and managing Windows Process, Managing process, Retrieving Information about Process.

.NET Framework common classes & tools: Microsoft .Csharp, Microsoft .Jscript ,

Microsoft. VisualBasic, Microsoft. Win 32 System, System Data, System security, System Web, System XML.qms, tools-AL.exe, Aximp.exe, Ilasm.exe, LC.exe, .NET Framework Configuration Tools, Wincv.exe

## XXII. Data Mining & Data Warehousing :-

Introduction & Data Warehousing and OLAP Technology for Data Mining -

What is data mining?, Data Mining: On what kind of data?, Data mining functionality, Are all the patterns interesting?, Classification of data mining systems, What is a data warehouse?, A multi-dimensional data model, Data warehouse architecture, Data warehouse implementation, Further development of data cube technol-

ogy, From data warehousing to data mining. Concept of Transaction, Transactional database, Distributed Database, Commit Protocols.

Data Preprocessing, Data Mining Primitive, Languages and System Architecture -

Need for Data processing, Data cleaning ,Data integration and transformation, Data reduction, Discrimination and concept hierarchy generation, Data Mining Primitive, Data Mining Query Language, Architecture of data mining system.

Mining Association Rules in Large Databases-

Association rule mining, Mining single-dimensional Boolean association rules from transactional databases, Mining multi-level association rules from transactional databases, Mining multidimensional association rules from transactional databases and data warehouse, From association mining to correlation analysis, Constraintbased association mining.

Classification and Prediction & Cluster Analysis -

What is classification? What is prediction? Issues regarding classification and prediction, Classification by decision tree induction, Bayesian Classification, Classification by back propagation, Classification based on concepts from association rule mining, Other Classification Methods ,Prediction, Classification accuracy, What is Cluster Analysis?, Types of Data in Cluster Analysis, A Categorization of Major Clustering Methods, Partitioning Methods, Hierarchical Methods, Density-Based Methods, Grid-Based Methods, Model- Based Clustering Methods, Outlier Analysis. Mining Complex Types of Data & Applications and Trends in Data Mining- Multidimensional analysis and descriptive mining of complex data objects, Mining spatial databases, Mining multimedia databases, Mining time-series and sequence data, Mining text databases, Mining the World- Wide Web, Data mining applications, Data mining system products and research prototypes, Additional themes on datamining, Social impact of data mining, Trends in data mining

## XXIII. Soft Computing :-

Introduction to Fuzzy Logic System

Fuzzy Sets Operation Of Fuzzy Sets, Properties Of Fuzzy Sets, Fuzzy Relations, Fuzzy Arithmetic, Membership Functions, Fuzzy To Crisp Conversion. Fuzzy Logic, Fuzzy Rule Based Systems, Fuzzy Decision Making, Fuzzy Database, Fuzzy Intelligent System. Introduction to Artificial Neural Networks Introduction to Artificial Neural Network, Artificial Neuron, Classification of Artificial Neural Network, Architecture of a Artificial Neural Network, Activation Function, Training an Artificial Neural Network, Application of Artificial Neural Network. Perceptron and Associative Memories

Amari General Learning Rule, HEBB Learning Rule, ADLINE, Perceptron Layer Network, Associative memory: Auto associative Memory, Bi-directional memory, Back-propagation Network: Architecture, Training Algorithm Application of Back-propagation algorithm.

Machine Learning

Regression And Classification, Decision Tree, SPRINT, Gini Index, Entropy, Pruning, C4.5, Active Learning - Feature Selection, Clustering, Models And Methods, Neural Networks, Markov Chain/Processes, Hidden Markov Models (HMM).

Soft Computing Tools

Introduction to MATLAB, Features, Matrix Operations, Curve Plotting, Toolbox Introduction, Introduction to Simulink.

## (25) - विधि

1. संवैधानिक विधि:- भारत की संवैधानिक विधि, प्रस्तावना, नीति निर्देशक तत्व, मौलिक अधिकार व कर्तव्य, राष्ट्रपति व राष्ट्रपति की शक्तियाँ, न्यायपालिका, संघ और केन्द्र राज्य संबंध, विधायी शक्तियाँ

का वितरण, अन्तर्राज्यीय व्यापार एवं वाणिज्य, राज्य एवं संघ के अणु सेवाएँ, संविधान में संशोधन।

2. **आपराधिक विधि :-**

(अ) भारतीय दंड संहिता-क्षेत्राधिकार, परिभाषा, आपराधिक दायित्व के सामान्य अपवाद, संयुक्त एवं आन्वयिक दायित्व (धारा 34, 114, 149), लोक-प्रशान्ति के विरुद्ध अपराध, मानव शरीर के विरुद्ध अपराध, सम्पत्ति के विरुद्ध अपराध।

(ब) भारतीय साक्ष्य अधिनियम - परिभाषा, धारा 6 से 35, धारा 59 से 63, धारा 74 से 78, धारा 101 से 114, धारा 118 से 155 केवल।

3. **दण्ड प्रक्रिया संहिता 1973:-** धारा 1 से 265, धारा 300 से 327, धारा 353, धारा 354 से धारा 405 और धारा 436 से धारा 473 केवल।

4. **व्यक्तिगत कानून :-**

हिन्दु विधि: (अ) अवर्गीकृत हिन्दू विधि के स्रोत, संयुक्त हिन्दू परिवार का कर्ता और सहदायिक के अधिकार व कर्तव्य, स्त्रीधन, पिता के ऋण चुकाने में पुत्र का दायित्व, धार्मिक विन्यास।

(ब) वर्गीकृत हिन्दू विधि-हिन्दू विवाह अधिनियम 1955, हिन्दू उत्तराधिकार अधिनियम 1956, हिन्दू दत्तक तथा भरण पोषण अधिनियम 1956, हिन्दु अवयस्कता एवं संरक्षकता अधिनियम 1956.

(स) मुस्लिम विधि: स्रोत, विवाह, तलाक, मेहर, दान (हिबा), वसीयत।

5. **प्रशासनिक विधि:-** प्रशासनिक विधि की प्रकृति व क्षेत्र, प्रत्यायोजित विधान, नियंत्रण- न्यायिक एवं विधायी नियंत्रण, प्राकृतिक न्याय के सिद्धांत, लोकपाल एवं केन्द्रीय सतर्कता आयोग, लोक निगम, प्रशासनिक अभिकरण एवं न्यायाधिकरण।

6. **सामाजिक आर्थिक अपराध :-** औषधी अधिनियम, भ्रष्टाचार निवारण अधिनियम, खाद्य अपमिश्रण निवारण अधिनियम, विदेशी मुद्रा विनियमन अधिनियम (FERA)।

7. **विधिशास्त्र :-** विधिशास्त्र की क्षेत्र व प्रकृति, न्याय प्रशासन, विधि के स्रोत, विधि की संकल्पना, विधि के सिद्धान्त, प्राकृतिक विधि, विश्लेषणात्मक विचारधारा, शुद्ध विधि का सिद्धान्त, ऐतिहासिक विचार धारा, समाजशास्त्रीय विचारधारा, यथार्थवादी विचारधारा, दण्ड के सिद्धान्त, परिवीक्षा।

8. **वाणिज्यिक विधि:-** संविदा विधि के सामान्य सिद्धान्त, भारतीय संविदा अधिनियम 1872 (धारा 1 से धारा 75), क्षतिपूर्ति व प्रत्याभूति तथा उपनिधान व गिरवी की विधि, एजेंसी (अभिकरण) विधि, माल विक्रय विधि तथा साझेदारी विधि, परक्राम्य उपकरण संबंधित विधि।

(25) - **LAW**

1. **Constitutional Law :-** Constitutional Law of India, Preamble, Directive Principles of State Policy, Fundamental Rights and Duties, President and his powers, Judiciary, Union and Centre State relations, Inter- State relations, Distribution of Legislative Powers, Inter-state Trade & Commerce, Services under the Union and the States, Amendment in the Constitution.

2. **Law of Crimes :-**

(a) Indian Penal Code-Jurisdiction, Definition, General Exception to Criminal Liability, Joint & Constructive Liability (Sec. 34, 114, 149), Offences against Public Tranquility, Offences against Human body, Offences against Property.

(b) Indian Evidence Act - Definition, Section 6 to 35, Section 59 to 63, Section 74 to 78, Section 101 to 114, Section 118 to 155 only.

**Criminal Procedure Code 1973 -** Section 1 to 265, Section 300 to 327, Section 353, Section 354 to 405 and Section 436 to 473 only.

4. **Personal Laws :-**

Hindu Law: (A) Unclassified Sources of Hindu Law, Rights and Duties of Karta and Coparcener of Joint Hindu Family, Stridhan, Liability of son to pay the debt of Father, Religious Endowments

(B) Classified Hindu Law- Hindu Marriage Act 1955, Hindu Succession Act 1956, Hindu Adoption and Maintenance Act 1956, Hindu Minority and Guardianship act 1956,

(C) Muslim Law: Sources, Marriage, Divorce, Mehar, Gift, Wills.

5. **Administrative Law -** Nature and Scope of Administrative law, Delegated Legislation, Controls - Judicial and Legislative control, Principle of Natural Justice, Ombudsmen and Central Vigilance Commission, Public Corporation, Administrative Agencies and Tribunals.

6. **Socio Economic Offence:-** Drugs Act, Prevention of Corruption Act, Prevention of Food Adulteration Act, Foreign Exchange Regulation Act (FERA)

7. **Jurisprudence :-** Scope & Nature of jurisprudence, Administration of justices, Sources of Law, Concepts of Law, Theories of Law, Natural Law, Analytical school, Pure Theory of Law, Historical School, Sociological School, Realistic School, Theories of Punishment, Probation.

8. **Mercantile Law :-** General Principles of Law of Contract, Indian Contract Act 1872 (Section 1 to 75), Law of Indemnity & Guarantee, Law of Bailment & Pledge, Law of Agency, Law of Sale of Goods, Law of Partnership and Law relating to Negotiable Instruments.

(26) - **FORESTRY**

Forest Structure & their component, Classification and influences. Locality factors - Introduction & Classification of Environmental Complex

Climatic or atmospheric factors.

Topographic or Physiographic factors

Soil or Edaphic factors

Man-animal Plant Relationship.

Classification & Vegetation of forest types:- Objectives, criteria & basis of classification systems.

Principle forest types of India & their distribution.

Tropical forest

Montane subtropical forest

Montane Temperate Forests

Sub-Alpine Forests and Alpine Forests

Natural Regeneration from seed.

Seed Production

Seed dispersal

Germination

Establishment

Natural Regeneration from Vegetative parts

Cultural Operations

Regeneration survey

Artificial Regeneration

Reforestation

Afforestation

Tending Operation

Weeding

Cleaning

Thinning

Symbiotic relationship of forest & Tribal

Shifting Cultivation.

Measurement of standing trees.

Various Instruments used in measurements.

Fundamentals of Genetics - A brief History, Phenotype & Genotype, Back cross Test cross Mendel's law of inheritance, Nucleic Acid as Genetic material, DNA, RNA.

Plant Breeding, heterosis, Hybrid vigor, Economic importance of plant breeding.

General concepts of Tree Improvement Programme.

Candidate Plus trees: identification/Selection criteria of Timber, fuel and fodder trees and their maintenance.

Seed orchards: Object, Collection of bud material, Grafting, Layout, Design and Maintenance of seed orchard.

Establishment of Seed orchards.

Seed Production Areas: Objective, Identification of Seed stand and Seed Production Area, Selection criteria and its maintenance. Provenance, Provenance trial or Seed Origin, Selection, Layout and Design and its Maintenance, Progeny Trial, Hybridization, Polyploidy.

Structure and Development of Tree Seed, Seed Collection, Extraction and cleaning of Seed, Strong Longevity, Germination. Seed testing, and Seed certification.

Micropropagation of Forest Trees through tissue culture technique. Selection of plus trees, collection of plant material, Washing, Sterilization, media preparation, Aseptic condition, culture, Some Clonal variations Somatic hybridization, pathway of Tissue culture, Hardening and Field trial.

Macro-propagation of forest trees, branch cutting under mist condition. Methods of Vegetative propagation, Selection and Collection of Plant material, Preparation of cuttings, preparation of hormones, treatment of cuttings. Planting transplanting, Field trial, significance of vegetative propagation.

Soil Genesis, Soil Profile, Parent Material (Physical, Chemical & Biological, Weathering)

Soil Composition.

Physical properties of Soil - Soil Texture, Soil Structure, soil Consistence, Soil permeability.

Soil Moisture - Soil moisture constants. (PF, water table), moisture equivalents water characteristics, Sticky point, hygroscopic water, Wilting Coefficient, Capillary water, Gravitational water.

Chemical Properties of soils

Soil Colloids - Definition, inorganic & organic Colloids, Silicate & Hydrous oxide clays, Ion exchange, Cation exchange capacity & its influence on nutrient availability.

Forest management:- Objects of management, Purpose and policy, Special objects of management, Choice of objects - Attribute of the owner, Social role of forestry : social forestry includes farm forestry, extension forestry, recreational forestry and reforestation in degraded forests, Sustained yield - Definition, Concept and principles of sustained yield management, Pre-requisites for sustained yield management (Even flow) its scope and limitations, Concept of increasing and progressive yield. Arguments for and against sustained yield.

The Normal Forest: Definition, Basic facts (Attributes/Characteristics) of normality, Need for an ideal standard, Normality concept not absolute; related to treatment and rotation, Kinds of abnormality, Effect of silvicultural systems on normality: Normality in regular/even aged forests, Normality in irregular/uneven aged forests, De Lookout's law, Distribution of trees in different dim - Classes in uneven aged Sal forests.

Social forestry & rural development:- Definition, Objectives, Need, Component, N.C.A. recommendation on social forestry, Planning & Management of Social forestry. Availability of the land for social forestry. Problems of social forestry. Peoples participation in social forestry. Ecological consideration in social forestry programme. Definition & Identification of wasteland, Reclamation of wasteland, (a) Dry areas (b) Salt effected areas (Saline & alkaline) (c) Ravines, lands, Govt. Programme for wasteland development organizational support for wasteland development. Wasteland de-

velopment problems & perspectives. Afforestation of wastelands under the control of various departments & peoples participation. A holistic approach to management of wastelands.

General models of social forestry in India, SPP plantation in various lands. Village-community land, land along railway road, canal bank & degraded lands. Social forestry in C.G SPP. recommendation for planting in different type of Soil in C.G

Forest product and utilization:- Definition and nomenclature of M.F.P, Method of collection, Processing and Trade of Gum, Tans & Dyes, Grasses, Bamboo & Canes, Fibers & Flosses, Commercial leaves, Edible items: Animal, Mineral & Miscellaneous products.

M.F.P. Development Prospects in Tribal Areas, Resin Tapping: Extraction of Cutuch & Katha, Lac & manufactures of Shellac: Fatty oil and essential oil and their methods of recovery: Beedi Industry.

Forest resources economics and valuation.

Consumption - Human wants, utility, demand, supply & elasticity. Production - Production of goods & services for fulfilling wants or generating, utility, means of production - land capital, labour, organisation, risk.

Exchange market, price-fixation, money, banking.

Distribution - concepts of value, rent, wage, cost, profit, National income and its distribution for general welfare.

Revenue-National income and expenditure, debts and taxes, methods of generating income, concepts of macro & micro Economics : Economics in study of nature, laws of economics & their importance.

Need, Nature, Scope & Limitations of forest resource economics.

Introduction

Concept of resource economics - renewable resources, critical zone, forest - resources & forest economics in aid of forestry decisions.

Micro Economics theory -(i) A critical analytical approach (ii) Emphasis on relevancy of opportunity cost, (iii) Use of models (iv) A framework for the analysis of field problems, (v) Guidance to Govt. on resource administration (vi) The concept of production and productivity (a) Scarcity, (b) Choice (c) Opportunity Cost (viii) The value added concept, (viii) Aid to capital budgeting and resource allocation, Economics growth and development, Social benefits from forests, (ix) Economic-Analysis in forestry decisions, Limitation of economics.

Ecology & environmental conservation

Scope of Ecology & Ecosystem Concept: Relation of ecology to other science, importance of ecology, subdivision of ecology, concept of ecosystem's production and decomposition in nature, ecological principles in sustainable development.

Energy flow : Fundamental concept of energy; concept of productivity and its measurements; food chain, food web & trophic level, trophic structure and ecological pyramids.

Biogeochemical cycling in ecological systems: Patterns & Types of biogeochemical cycles: Sedimentary cycles, nutrient cycling in the tropics; recycle pathway.

Ecological factors: Liebigs law of the minimum, Shelfords law of tolerance, physical factors, ecological indicators, fire, grazing, drought and floods, The 'R' and 'K' species.

## (27) - BIO CHEMISTRY

Scope of genetic engineering.

Restriction enzymes and modification enzymes.

Nucleic acid purification and yield analysis.

Agarose and polyacrylamide gel electrophoresis, PAGE, centrifugation.

Polymerase chain reaction. DNA sequencing.

Gene cloning vectors: Plasmids, Bacteriophages, Phagemids, Cosmids, YAC

cDNA synthesis and cloning, mRNA enrichment, reverse transcription, DNA primers, linkers, adapters, and their synthesis, library construction and screening.

Expressed genes, nucleic acid microarrays

Site-directed mutagenesis and protein engineering.

How to study gene regulation? DNA transfection, Northern blot, primer extension, S1 mapping, reporter assays.

Expression strategies for heterologous genes. Vector engineering and codon optimization, host engineering, in vitro transcription and translation, expression in bacteria, expression in yeast, expression in insect and insect cells, expression in mammalian cells and expression in plants.

Genome sizes, organelle genomes, genomic libraries, and strategies for sequencing genome.

Genetic and physical mapping, restriction mapping of DNA fragments and map construction, SNP, SSLP, Southern and fluorescence in situ hybridization for genome analysis, RFLP, SSLP, and AFLP analysis. Molecular markers linked to disease resistance genes.

Application of RFLP in forensic, disease prognosis, genetic counseling, pedigree, variety, etc, Animal trafficking and poaching, germplasm maintenance, taxonomy and bio-diversity.

Overview of bioinformatics- Data base types: Microbiological databases, Virological databases, Organism databases, Biodiversity databases and Genome databases. Retrieving sequences, similarity searching, pair-wise and multiple alignment.

Structure function relationships: Sequence and sequence assembly using computers, phylogenetics.

Computational methods, homology algorithms (BLAST) for proteins and nucleic acids, open reading frames, annotations of genes conserved protein motifs, related structure and function (PROSITE, PFAM, Profile Scan). DNA analysis for repeats (direct and inverted) palindromes, folding programmes.

#### DNA MICROARRAY

Printing or oligonucleotides and PCR products of glass slides, microcellulose paper. Whole genome analysis for global patterns of gene expression using fluorescent labeled RNA probes. Analysis of single nucleotide polymorphisms using DNA chips. Proteome analysis: Two-dimensional separation of total cellular proteins. Protein micro-array, advantages and disadvantages of DNA and protein micro-arrays.

Use of Internet, public databases for nucleic acid and protein sequences (EMBL, Gen Bank), databases for protein structures (PDB).

Isolation of cell organelles, adsorption and transport of ions in plants, ultra structure of chloroplast, Biosynthesis of chlorophyll and associated pigments, Photosynthesis- the Hill reaction, photo-phosphorylation, light receptor-photosystem I & II, Mechanism of energy transfer between photosystems. Proton gradient and ATP synthesis. Carbondioxide fixation C3 & C4 and CAM plants. Regulation of photosynthesis. Mechanism of photorespiration and its significance.

Biological nitrogen fixation and ammonia assimilation on plants. Nitrate and sulphate reduction and their incorporation into amino acid. Secondary metabolites in plants nature, distribution, biosynthesis and function of plant phenolics, alkaloids, tannins, lignins, terpenes, terpenoids and lectins. Structure, physiological functions and mode of action of phytohormones-auxines, gibberellins, cytokinins, ethylene and abscisic acid.

Seed Aging: Desiccation and temperature inducing aging, accelerated aging, oxidative stress, membrane damage, reactive oxygen

species, antioxidant compounds and enzymes, LEA proteins and dehydrins, Macromolecules during aging. Nuclear damage, genetic aberrations and repair.

Seed Dormancy: Categories of dormancy, onset and development of dormancy, mechanical, photo and thermo-dormancy, control, release and significance of dormancy.

Seed germination: water relation in germination, repair mechanism, light and hormonal regulation of radicle elongation and food mobilization, PCD of aleurone cells, AOS in signal transduction, protein and DNA synthesis.

Cell and tissue culture: Introduction, culture medium, initiation and maintenance of callus, suspension culture, biochemical and biophysical control of morphogenesis. Single cell clone; Technique of single cell culture, factors and application.

Organogenesis: Cellular totipotency, cyto-differentiation, organogenic differentiation, caulogenesis, rhizogenesis, plantlet regeneration, hardening, performance of in vitro raised plants in the field.

Somatic Embryogenesis: Introduction, factors affecting somatic embryogenesis viz. explant, genotype, nitrogen source, polyamines, oxygen concentration, electrical stimulation, selective subculture, induction and development, molecular aspects, somatic embryo versus zygotic embryo, synchronization of embryo development, synthetic seeds, transfer and establishment of seedlings in the field. Shoot tip culture: rapid clonal propagation and production of virus free plants. Juvenility, maturity and rejuvenation. Embryo culture and embryo rescue: Technique of embryo culture, application.

Protoplast isolation, culture and fusion, selection of hybrid cells and regeneration of hybrid plants, symmetric and asymmetric hybrids, cybrids. Virus, bacteria and DNA uptake by protoplasts, Anther, pollen, and ovary culture for production of haploid plants and homozygous lines: Introduction, technique: Anther culture, Isolated pollen culture, Factors affecting androgenesis: Physiological status of donor plants, stage of pollen development, anther wall factors, Genotype, culture medium, culture density, effect of gaseous environment, Effect of light, ontogeny of androgenic haploids, introduction. Gynogenesis: Explants, pretreatment, culture medium. Haploid production through distant hybridization, Diploidization to raise homozygous diploids, application, shorting of breeding cycle, Gametoclonal variations, mutagenesis. Triploid production. Variant selection:

Classification of multi-substrate reactions with examples of each class. Kinetics of multi-substrate reactions, Derivation of the rate of expression for Ping Pong and ordered Bi Bi reactions mechanisms. Use of initial study, inhibition and exchange studies to differentiate between multi-substrate reaction mechanisms. Concept of convergent and divergent evolution of enzyme. Methods of examining enzyme - substrate complexes. Enzyme Turnover and methods employed to measure turnover of enzymes, significance of enzyme turnover. Protein - ligand binding, including measurement, analysis of binding isotherms, cooperativity phenomenon, Hill and Scatchard plots.

Allosteric enzymes, sigmoidal kinetics and their physiological significance, symmetrical and sequential modes for action of allosteric enzymes and their significance. Immobilized enzymes and their industrial applications. Effect of partition on kinetics and performance with particular emphasis on changes in pH and hydrophobicity. Multienzyme system: occurrence, isolation and their properties, mechanism of action and regulation of Pyruvate dehydrogenase complex, fatty acid synthetase complexes, mechanism of catalysis of serine proteases, ribonuclease and triose phosphate isomerase.

Types and structure of pollution and pollution control technology. Eco - toxicology and its environmental significance. Pharmacodynamics and chemodynamics. Xenobiotic metabolism, Phase I re-

action - oxidation - reduction, hydrolysis and hydration. Phase II reaction - conjugation and methylation. Detoxification, pesticide toxicity - insecticides, fungicides, herbicides and biopesticides. Toxicology of food additives. Metal toxicity - arsenic, mercury, lead and cadmium.

Toxic effects of lungs, liver, kidneys, and their diagnosis, Occupational hazards. Toxicity testing - test control, genetic toxicity testing. Air pollution, occupational toxicology and assessment of occupational hazards.

Digestive system - disorder of gastric function, method of evaluation, pancreatic diseases, steatorrea malabsorption syndrome- tests for their evaluation and significance.

Blood plasma proteins, properties, function and their variation in diseases. Plasma lipids and lipoproteins, clinical interrelationship of lipids, lipoproteins and apolipoproteins.

Erythropoiesis and abnormalities in blood formation, anemia, haemoglobinopathies. Cerebrospinal fluid - composition in health and diseases.

Liver - liver function tests - their significance, liver diseases - jaundice, Hepatitis, Gallstones, Cirrhosis and fatty livers. Kidney - formation and composition of urine, investigations of renal functions Biochemical investigations of renal disorders. Disturbances in H<sup>+</sup>homeostasis. Inborn errors of carbohydrate, proteins, lipids, purines, pyrimidines and porphyrin metabolisms. Clinical enzymology -

Iso-enzymes in health and diseases. Diagnostic importance of enzyme changes in disease.

History, an introduction to endocrinology. Organization of the endocrine system. Regulation of hormone secretion. Assay of hormones - bioassay chemical, molecular mechanisms of signal transduction (bio-signaling), nature and types of receptors, ligand receptor interaction, Satchand plot, concept of spare receptors - up and down regulation of receptors. Family of hetero-trimeric G protein and G small proteins. Second messenger system CAMP, CGMP calcium IP<sub>3</sub>, DAG, Nitric oxide, mechanism of their generation and

action. Role of different protein kinases. Pancreatic hormones- biosynthesis of insulin, regulation of secretion of insulin and glucagons in carbohydrate, lipid and protein metabolism. Gastrointestinal hormones- gastrin, secretin and cholecystokinin. Pineal gland, thymus, prostaglandin, atrial natriuretic factor. Renal hormones- renin, angiotensin and erythropoietin.

Hormones of pituitary and hypothalamus - chemistry and functions and metabolism of thyroid hormones. Parathyroid hormone - calcitonin and parathormone and their role in calcium and phosphate metabolism. Adrenal hormones chemistry, biosynthesis and mode of action of adrenaline, noradrenalin and corticosteroids.

Sex hormones - structure, biosynthesis and role of androgens, estrogens and progesterone. Female reproductive cycle, hormonal contraception, placental hormones.

Endocrine disorders, pancreatic Diabetes mellitus. Melliturias, hypoglycemia, glucose tolerance test.

Thyroids - hyper and hypothyroidism, BMR and other tests for thyroid function. Parathyroids - abnormalities of parathyroid function and methods of evaluation. Adrenals- Addison's disease and pheochromocytoma: Disorders of steroid metabolisms. Tests for the evaluation of the adrenal function. Pituitary pituitary -clinical syndrome and their evaluation. Biochemistry of reproduction disorders- influence of various factors in reproduction with special reference to prostaglandins and gonadotropins. Pregnancy tests - pregnancy toxemia. Clinical chemistry of newborn biochemical effects of tumors. Automation of clinical chemistry and quality assurance. Request in tests and reports of laboratory work and interpreting result.