

उत्तराखण्ड राज्य के राजकीय महाविद्यालयों में असिस्टेंट प्रोफेसर पद हेतु स्क्रीनिंग परीक्षा का पाठ्यक्रम/परीक्षा योजना

प्रतियोगिता परीक्षा दो स्तरों पर आयोजित होगी:-

1. स्क्रीनिंग परीक्षा – वस्तुनिष्ठ प्रकार
2. साक्षात्कार – 100 अंक

स्क्रीनिंग परीक्षा हेतु विषय सूची:-

विषय कोड	विषय	विषय कोड	विषय
01	हिन्दी	17	बी0एड0 (प्राविधिक पाठ्यक्रम)
02	अंग्रेजी	18	रसायन विज्ञान
03	संस्कृत	19	भौतिक विज्ञान
04	भूगोल	20	जन्तु विज्ञान
05	अर्थशास्त्र	21	वनस्पति विज्ञान
06	राजनीति शास्त्र	22	गणित
07	समाज शास्त्र	23	सैन्य विज्ञान
08	इतिहास	24	भूगर्भ विज्ञान
09	गृह विज्ञान	25	विधि
10	चित्रकला	26	बैचलर इन बिजनेस एडमिनिस्ट्रेशन
11	मनोविज्ञान	27	बैचलर इन कम्प्यूटर एप्लीकेशन
12	संगीत	28	बैचलर इन टूरिज्म स्टडीज/बी0टी0टी0एम0 (टूरिज्म एण्ड ट्रेवल्स)
13	सांख्यिकी	29	बी0एस0सी0 गृह विज्ञान
14	शिक्षा शास्त्र	30	बी0ए0 (मास कॉम)
15	शारीरिक शिक्षा	31	कम्प्यूटर विज्ञान
16	वाणिज्य		

उपरोक्त विषयों में से अभ्यर्थी स्क्रीनिंग परीक्षा हेतु विषय का चयन कर सकते हैं। चयनित विषय का 200 अंको का एक प्रश्नपत्र होगा, जिसकी समय अवधि 02 घण्टे तथा प्रश्नों की संख्या 100 (प्रत्येक प्रश्न 02 अंक) होगी। विषयवार पाठ्यक्रम परिशिष्ट-1 में दिया गया है।

## परिशिष्ट-1

### 01. हिन्दी

#### 1. हिन्दी साहित्य का इतिहास :

हिन्दी साहित्य का इतिहास-दर्शन, हिन्दी साहित्य के इतिहास लेखन की पद्धतियाँ, हिन्दी के प्रमुख साहित्यिक केन्द्र, संस्थाएँ एवं पत्र-पत्रिकाएँ, हिन्दी साहित्य के इतिहास का काल-विभाजन एवं नामकरण।

#### 2. आदिकालीन हिन्दी काव्य :

रासो साहित्य, जैन साहित्य, सिद्ध और नाथ साहित्य, अमीर खुसरो, विद्यापति और उनकी पदावली, आरंभिक गद्य तथा लौकिक साहित्य।

#### 3. मध्यकालीन हिन्दी काव्य :

(क) भक्ति काल : भक्ति आंदोलन के उदय के सामाजिक-सांस्कृतिक कारण, प्रमुख निर्गुण एवं सगुण सम्प्रदाय, वैष्णव भक्ति की सामाजिक-सांस्कृतिक पृष्ठभूमि, आलवार सन्त, प्रमुख सम्प्रदाय और आचार्य।

हिन्दी सन्त और सूफी काव्य तथा राम और कृष्ण काव्य का सामान्य परिचय।

(i) संतकाव्य : कवि और कृतियाँ – कबीरदास, नानक, दादू और रैदास।

(ii) सूफीकाव्य : कवि और कृतियाँ – मुल्ला दाऊद (चंदायन), कुतुबन (मृगावती), मंझन (मधुमालती) और मलिक मुहम्मद जायसी (पद्मावत)।

(iii) रामकाव्य : कवि और कृतियाँ – तुलसीदास।

(iv) कृष्णकाव्य : कवि और कृतियाँ – सूरदास, नन्ददास, मीराबाई और रसखान।

(ख) रीतिकाल : सामाजिक-सांस्कृतिक पृष्ठभूमि, रीतिकाव्य के मूल स्रोत, रीतिकाल की प्रमुख प्रवृत्तियाँ, रीतिकालीन कवियों का आचार्यत्व, रीतिकाल के प्रमुख कवि और कृतियाँ – केशवदास, मतिराम, भूषण, देव, पद्माकर, बिहारी, घनानन्द।

#### 4. आधुनिक हिन्दी काव्य :

भारतेन्दु युग और उसके प्रमुख कवि और कृतियाँ। द्विवेदी युग और उसके प्रमुख कवि : हरिऔध, मैथिलीशरण गुप्त।

छायावाद और उसके प्रमुख कवि तथा कृतियाँ : प्रसाद, निराला, पन्त, महादेवी वर्मा और तारा पाण्डे।

छायावादोत्तर हिन्दी काव्य : प्रगतिवाद, प्रयोगवाद, नई कविता तथा समकालीन हिन्दी कविता।

प्रगतिवाद : नागार्जुन, शिवमंगल सिंह सुमन, चन्द्रकुँवर बर्त्वाल।

प्रयोगवाद : अज्ञेय, मुक्तिबोध।

नई कविता : धर्मवीर भारती, रघुवीर सहाय।

समकालीन कविता : धूमिल, लीलाधर जगूड़ी, विनोद कुमार शुक्ल, मंगलेश डबराल, वीरेन डंगवाल।

#### 5. हिन्दी कथा एवं नाट्य—साहित्य :

(क) हिन्दी उपन्यास : प्रेमचन्द—पूर्व उपन्यास, प्रेमचन्द और उनका युग।

प्रेमचन्द के परवर्ती प्रमुख उपन्यासकार : अज्ञेय, हजारीप्रसाद द्विवेदी, यशपाल, इलाचन्द्र जोशी, रमाप्रसाद घिल्डियाल 'पहाड़ी', शैलेश मटियानी, विद्यासागर नौटियाल, भीष्म साहनी, कृष्णा सोबती, मन्नू भण्डारी, निर्मल वर्मा, श्रीलाल शुक्ल, पंकज बिष्ट।

(ख) हिन्दी कहानी : बीसवीं शताब्दी की हिन्दी कहानी और प्रमुख कहानी—आंदोलन।

कहानीकार : प्रेमचन्द, जैनेन्द्र कुमार, मनोहरश्याम जोशी, बटरोही, मोहन थपलियाल, मृणाल पाण्डे।

(ग) हिन्दी नाटक, एकांकी और रंगमंच।

नाटककार — भारतेन्दु, जयशंकर प्रसाद, गोविन्दबल्लभ पंत, लक्ष्मीनाराण मिश्र, रामकुमार वर्मा, भुवनेश्वर, जगदीश चन्द्र माथुर, लक्ष्मीनाराण लाल, मोहन राकेश, मोहन उप्रेती, गोविन्द चातक, बी० एम० शाह।

#### 6. हिन्दी निबन्ध एवं इतर गद्य विधाएँ :

निबन्धकार : रामचन्द्र शुक्ल, हजारीप्रसाद द्विवेदी, पीताम्बरदत्त बड़थवाल, विद्यानिवास मिश्र, रमेशचन्द्र शाह ।

इतर गद्यविधाएँ : रेखाचित्र, संस्मरण, यात्रा-वृत्तान्त, आत्मकथा, जीवनी, रिपोर्टाज, फीचर ।

### 7. भारतीय काव्यशास्त्र :

काव्य-लक्षण, काव्य-हेतु, काव्य-प्रयोजन, काव्य सम्प्रदाय (रस, अलंकार, रीति, ध्वनि, वक्रोक्ति और औचित्य), भरत मुनि का रस सूत्र और उसके प्रमुख व्याख्याकार, रस के अवयव, साधारणीकरण, शब्द शक्तियाँ । अलंकार : यमक, श्लेष, वक्रोक्ति, उपमा, रूपक, उत्प्रेक्षा, संदेह, भ्रांतिमान, अतिशयोक्ति, अन्योक्ति, समासोक्ति, विभावना, विशेषोक्ति, दृष्टान्त, उदाहरण, अर्थान्तरन्यास, असंगति, विरोधाभास ।

काव्यगुण, काव्यदोष ।

### 8. पाश्चात्य काव्य शास्त्र एवं हिन्दी आलोचना :

(क) पाश्चात्य काव्यशास्त्र : प्लेटो और अरस्तू का अनुकरण सिद्धान्त तथा अरस्तू का विरेचन सिद्धान्त ।

लॉजाइनस : काव्य में उदात्तत्व

क्रोचे : अभिव्यंजनावाद

आई० ए० रिचर्ड्स- संप्रेषण सिद्धान्त

(ख) हिन्दी आलोचना : हिन्दी आलोचना का विकास और प्रमुख आलोचक – रामचन्द्र शुक्ल, नन्ददुलारे बाजपेयी, रामविलास शर्मा, डॉ० नगेन्द्र, डॉ० नामवर सिंह ।

(ग) प्रमुख वाद : स्वच्छन्दतावाद, यथार्थवाद, संरचनावाद, उत्तर-आधुनिकता ।

### 9. भाषा विज्ञान और हिन्दी भाषा :

भाषा की परिभाषा और अभिलक्षण, स्वन-विज्ञान का स्वरूप और उसकी शाखाएँ ।

स्वन की अवधारणा और स्वनों का वर्गीकरण, स्वनिक परिवर्तन : कारण और दिशाएँ, हिन्दी शब्दों का वर्गीकरण (तत्सम्, तद्भव, देशज, विदेशी, रूढ़, यौगिक, योगरूढ़, विकारी और अविकारी, वाचक, लक्षक और व्यंजक), अर्थ परिवर्तन की दिशाएँ ।

अपभ्रंश (अवहट्ट सहित) और पुरानी हिन्दी का सम्बन्ध, हिन्दी की उपभाषाएँ और बोलियाँ : वर्गीकरण, क्षेत्र। नागरी लिपि का विकास और मानकीकरण, हिन्दी भाषा के विविध रूप : बोली, मानक भाषा, राजभाषा और राष्ट्रभाषा, संचार माध्यम और हिन्दी।

#### 10. लोक-साहित्य और संस्कृति :

'लोक' एवं 'संस्कृति' शब्दों की व्युत्पत्ति तथा अर्थ, लोक-साहित्य की अवधारणा और उसके विविध रूप – लोक-कथा, लोक-गाथा, लोक-नाट्य एवं लोक-गीत।

उत्तराखण्ड के देवी-देवताओं एवं विभिन्न पर्वों तथा उत्सवों से सम्बन्धित लोक-कथाओं, लोक-गाथाओं, लोक-नाट्यों एवं लोक-गीतों का सामान्य परिचय।

लोकोक्ति का अर्थ एवं स्वरूप, लोकोक्ति की रचना-प्रक्रिया, लोक-साहित्य में लोकोक्तियों का महत्त्व एवं उपादेयता।

उत्तराखण्ड की लोक भाषाओं (कुमाउनी, गढ़वाली) में लिखित साहित्य का सामान्य परिचय।

प्रमुख कवि : कुमाउनी : लोकरत्न पन्त 'गुमानी' ('गुमानी ग्रंथावली') चारुचंद्र पांडे (अवाल'), शेरदा 'अनपढ़' ('मेरी लटिपटि') : गढ़वाली : भजन सिंह 'सिंह' ('सिंहनाद'), जीवानंद श्रीयाल ('मुंडनिखूल'), कन्हैयालाल डंडरियाल ('नागरजा')

## **02. ENGLISH**

- 1- Anglo Saxon Period to Anglo Norman Period.
- 2- Chaucer to Elizabethan Period.
- 3- Jacobean to Restoration Periods.
- 4- Eighteenth Century Literature.
- 5- Nineteenth Century Literature to Victorian Period.
- 6- Modern to Post Modern Age.
- 7- American Literature of Nineteenth Century and Twentieth Century.
- 8- Post Independence Indian Writing in English and Indian Literature in English Translation.
- 9- Popular English Literature of Uttarakhand.
- 10- Literary Theory and Criticism up to T.S Eliot.
- 11- Modern Literary Theory and Criticism.
- 12- English Language Teaching.

## 03. संस्कृत

### 1. वैदिक साहित्य

#### देवता

#### ऋग्वेद –

1. अग्नि 1.1; 5.8 ; सवितृ 1.35 ; 2.38 ; 7.45 ; इन्द्र 1.32 ; 2.12 ; रुद्र 1.114 ; बृहस्पति 10.71 ; सोम 9.73 ; 9.80 ; पुरुष सूक्त 10.90 ; नासदीय 10.129 ; हिरण्यगर्भ 10.121 ;

#### यजुर्वेद – शिवसंकल्प सूक्त 34.1–6

#### अथर्ववेद – भूमि सूक्त 12.1

#### विषय–वस्तु

संहिताएँ, ब्राह्मण एवं आरण्यक, उपनिषद् (ईश ; केन ; कठ ; तैत्तिरीय ; श्वेताश्वतर ; बृहदारण्यक)

वैदिक व्याख्या पद्धति – प्राचीन एवं अर्वाचीन, वैदिक और लौकिक संस्कृत में अन्तर

#### वैदिक साहित्य का इतिहास

वैदिक काल के विषय में विभिन्न सिद्धान्त—मैक्समूलर ; ए0वेबर ; जैकोबी ; बालगंगाधर तिलक ; एम्0 विन्टरनिट्ज ; भारतीय परम्परागत विचार

#### ऋग्वेद का क्रम

संहिताओं के पाठ—भेद

वेदाङ्गों का सामान्य एवं संक्षिप्त परिचय

शिक्षा ; कल्प ; व्याकरण ; निरुक्त ; छन्द ; ज्योतिष ।

निरुक्त (अध्याय 1 और 2)

चार पद— नाम का विचार; आख्यात का विचार; उपसर्गों का अर्थ; निपातों की कोटियाँ ।

क्रिया के छः रूप (षड्भावविकार)

निरुक्त के अध्ययन के उद्देश्य

निर्वचन के सिद्धान्त

अध्याय VII—दैवत काण्ड

## निम्नलिखित शब्दों की व्युत्पत्तियाँ –

आचार्य ; वीर ; गो ; समुद्र ; वृत्र ; आदित्य ; उषस् ; मेघ ; वाक् ; उदक ;  
नदी ; पुत्र ; अश्व ; अग्नि ; जातवेदस् ; वैश्वानर ; निघण्टु ।

## 2. दर्शन

ईश्वरकृष्ण की सांख्यकारिका  
सत्कार्यवाद ; पुरुष-स्वरूप ; प्रकृति-स्वरूप ; सृष्टिक्रम ; प्रत्ययसर्ग ; कैवल्य  
सदानन्द का वेदान्तसार ;  
अनुबन्ध-चतुष्टय ; अज्ञान ; अध्यारोप-अपवाद ; लिंगशरीरोत्पत्ति ; पंजीकरण ;  
विवर्त ; जीवनमुक्ति ; गौड़पाद प्रणीत – माण्डूक्य कारिका  
पतंजलि योगसूत्र (समाधिपाद)  
केशवमिश्र की तर्कभाषा/अन्नभट्ट का तर्कसंग्रह  
पदार्थ ; कारण ; प्रमाण – प्रत्यक्ष ; अनुमान ; उपमान ; शब्द  
जैन दर्शन ; बौद्ध दर्शन

## 3. व्याकरण एवं भाषाविज्ञान

### व्याकरण

परिभाषाएँ – संहिता ; गुण ; वृद्धि ; प्रातिपदिक ; नदी ; घि ; उपधा ; अपृक्त ;  
गति ; पद ; विभाषा ; सवर्ण ; टि ; प्रगृह्य ; सर्वनामस्थान ; निष्ठा  
कारक – सिद्धान्तकौमुदी के अनुसार  
समास – लघुसिद्धान्तकौमुदी के अनुसार  
महाभाष्य (पस्पशाह्निक)  
वाक्यपदीय (ब्रह्मकाण्ड)  
व्याकरणशास्त्र का इतिहास

### भाषाविज्ञान

भाषा की परिभाषा एवं प्रकार (परिवारमूलक एवं आकृतिमूलक)  
भाषाओं का वर्गीकरण  
भाषा प्रक्रिया एवं ध्वनियों का वर्गीकरण – स्पर्श, संघर्षी, अर्धस्वर एवं स्वर  
ध्वनि सम्बन्धी नियम  
भारतीय आर्यभाषा की तीन अवस्थाएँ

## 4. संस्कृत साहित्य एवं उत्तराखण्ड का आधुनिक संस्कृत साहित्य तथा काव्यशास्त्र

### निम्नलिखित ग्रन्थों का सामान्य अध्ययन

पद्य – रघुवंश ; मेघदूत ; किरातार्जुनीय ; शिशुपालवध ; नैषधीयचरित ; बुद्धचरित  
गद्य – दशकुमारचरित ; हर्षचरित ; कादम्बरी ; भीष्मचरित ; गंगापुत्रावदान  
नाटक – स्वप्नवासवदत्ता ; अभिज्ञानशाकुन्तल ; मृच्छकटिक ; उत्तररामचरित ; मुद्राराक्षस  
;

रत्नावली ; वेणीसंहार



## काव्यशास्त्र

### साहित्यदर्पण

काव्य की परिभाषा

काव्य की अन्य परिभाषाओं का खण्डन

शब्दशक्ति – संकेतग्रह ; अभिधा ; लक्षणा; व्यंजना

रस (रस-भेद स्थायी भावों सहित)

रूपक के प्रकार

नाटक के लक्षण

महाकाव्य के लक्षण

काव्य प्रकाश (द्वितीय एवं पंचम उल्लास)

## 5. अन्य

रामायण ; महाभारत ; पुराण ; मनुस्मृति ; याज्ञवल्क्यस्मृति (व्यवहाराध्याय) ;  
कौटिलीय अर्थशास्त्र ।

## **04.GEOGRAPHY**

- 1- **Physical Geography I: Geomorphology:-** The Solar system, Origin of the earth and related hypotheses, Interior of the earth; Fundamental concepts of Geomorphology; Factors controlling landform development; Endogenetic and Exogenetic forces; Denudation and weathering; Geosynclines; Mountain building theories, Continental drift and plate tectonics; Concept of geomorphic cycle; Landforms associated with fluvial, glacial, arid, coastal and karst cycles; Slope forms and processes; Applied Geomorphology; Relief and Drainage system of Uttarakhand.
- 2- **Physical Geography II : Climatology and Oceanography:** Composition and structure of the atmosphere; Insolation; Heat budget of the earth; Distribution of temperature; Atmospheric pressure and general circulation of winds, Types of precipitation; Air masses; Monsoon mechanism and Jet Stream; El-Nino and La-Nina; Tropical and temperate cyclones; Classification of world climates - Koppen's and Thornthwate's schemes; Hydrological cycle; Origin of ocean basins; Bottom relief of Pacific, Atlantic and Indian Ocean; Ocean deposits; Coral Reefs Temperature and salinity of Oceans; Tides and Oceanic currents; Sea level change.
- 3- **Geography of Environment:-** Constituents of environment and ecology; Structure and functions of ecosystem; World distribution of plants and animals; Biodiversity; Natural Hazards and depletion of biodiversity; Man-induced causes; Pollution;

Environmental degradation; Global warming and climate change; Disasters and their management in Uttarakhand; Conservation and management of ecosystem.

- 4- **Geographic Thoughts:** Fundamental concepts of Geography, General character of Geographic knowledge during ancient and medieval period; Schools of Modern Geography -German, French, British and American; Man and environment- Determinism, Possibilism, Neo-Determinism and Probabilism, Development of Geography in India; Quantitative Revolution in Geography; Recent trends in Geography.
- 5- **Population and Settlement Geography:** Nature, scope, subject-matter and recent trends of Population Geography; Patterns of world population distribution and growth; Patterns and processes of Migration; Demographic transition; Population -Resource regions; Population policy issues; Population distribution and rural out- migration in Uttarakhand; Location, types, size, spacing and internal morphology of rural and urban settlements; Urban growth, urban fringe, city-region and umland; Primate city, rank-size rule and hierarchy of settlements; Trends of urbanization in India and Uttarakhand.
- 6- **Economic Geography:** Spatial organization and classification of economies; Sectors of economy -Primary, secondary, tertiary and quaternary; Concepts and classification of resources; Conservation of resources; Concepts and techniques of delimitation of agricultural regions; Measurement of agricultural productivity and efficiency; Crop- combination and diversification; Agricultural systems of the world; Problems associated with the development of agriculture in Uttarakhand; Classification and types of industries; Weber's and Losch's approaches; Industrial

regions of the world; Mode and models of transportation; Industrial prospects of Uttarakhand.

- 7- **Cultural and Political Geography**: Nature and scope of Cultural Geography; Environment and culture; Concepts of Cultural Realms and Cultural Regions; Human races; Nature and scope of Social Geography; Concept of Social well-being; Major societies and tribes of the world; Tribal areas and tribal societies of Uttarakhand; Definition and scope of Political Geography; Geo-politics; Global strategic views (Heartland and Rimland theories); Concepts of Nation, State and Nation-State; Boundaries and frontiers.
- 8- **Regional Planning**: Concept of region and regionalism in Geography, Concept of planning regions, Types of regions and regional delineation; Central Place theories (W.Christaller and A.Losch) Regional Planning policies in India; Indicators of development, Human Development Index; Regional imbalances; Hill Development Policies in India.
- 9- **Geography of India**: Physiographic divisions; Climate, Vegetation types and vegetation regions, Drainage and water resource utilization; Major Soil types; Irrigation and agriculture; Mineral and Power resources; Major industries and industrial regions; Population distribution and growth; Urbanization and related problems; Regional disparities in socio-economic development; Geographic personality of Uttarakhand.
- 10- **Cartography and Quantitative Techniques**: Maps and their types; Techniques of spatial pattern of distribution; Thematic mapping; Choropleth, Isopleth, Chorochromatic and choroschematic maps; Accessibility and flow maps; Remote

Sensing; Computer application in mapping; Digital mapping, GIS (Geographic Information System); Sources and types of data; Measures of Central Tendency and Dispersion; Simple and multiple co-relation; Regression; Nearest Neighbour Analysis; Scaling techniques, rank-scores and weighted ranking; Sampling techniques in geographic studies.

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## 05.Economics

### 1. Micro – Economic Analysis

- Demand Analysis – Marshallian, Hicksian and Revealed preference approaches.
- Theory of Production and Costs.
- Pricing and output under different forms of market structure.
- Factor Pricing analysis.
- Elements of general equilibrium and new welfare economics.

### 2. Macro – Economic Analysis

- Determination of output and employment – Classical approach, Keynesian approach, Consumption hypotheses.
- Demand for Money – Fisher and Cambridge versions, Approaches of Keynesian, Friedman, Patinkin, Baumol and Tobin.
- Supply of Money -- Determinants of money supply, High powered money, Money multiplier.
- Phillips Curve analysis.
- Business cycle – Models of Samuelson, Hicks and Kaldor.
- Macro economic Equilibrium – Relative roles of monetary and fiscal policies

### 3. Development and Planning

- Economic Growth, Economic Development and sustainable Development, importance of institutions – Government and markets, Perpetuation of underdevelopment – Vicious circle of poverty, circular causation, structural view of underdevelopment, Measurement of development--conventional, HDI and quality of life indices.
- Theories of Development – Classical, Marx and Schumpeter; Economic Growth – Harrod and Domar model, instability of equilibrium, Neoclassical growth model – Solow's model, state of steady growth. Approaches to development : Balanced growth -- Critical Minimum Effort, Big Push, Unlimited Supply of Labour, Unbalanced Growth, Low Income Equilibrium Trap.
- Indicators and measurement of poverty.
- Importance of agriculture and industry in economic development, choice of techniques and appropriate technology, Investment criteria, Elementary idea of Cost-Benefit Analysis.
- Trade and Development – International trade as 'engine of growth', Globalization and less developed countries.
- Objectives and role of monetary and fiscal policies in under developed countries, techniques of planning; Plan Models in India; planning in a market-oriented economy.

#### **4. Public Finance**

- Role of the Government in Economic activity – Allocation, distribution and stabilization functions; Private, Public and Merit goods.
- The Public Budgets – Kinds of Budgets, Zero based budgeting, different concepts of budget deficits;
- Public Expenditure – Hypotheses; effects and evaluation.
- Public Revenue – Different approaches to the division of tax burden, incidence and effects of taxation; elasticity and buoyancy; taxable capacity.
- Public Debt – Sources, effects, burden and its management.
- Fiscal Federalism – Theory and problems; Problems of Centre – State Financial relations in India.
- Fiscal Policy – Neutral, compensatory and functional finance; balanced budget multiplier.

#### **5. International Economics**

- Theories of International Trade : Empirical verification and Relevance, International Trade under Imperfect competition, Terms of Trade and Economic Growth – Secular Deterioration of Terms of Trade Hypothesis – a critical review.
- Equilibrium and disequilibrium in Balance of Payment – Traditional, Absorption and Monetary approaches for adjustment in the Balance of Payments, Foreign Trade multiplier.
- Impact of Tariffs, Partial and general equilibrium analysis; Political economy of Non-Tariff Barriers.
- Theory of regionalism at Global level – Collapse of Bretton Wood System, Present International Monetary System.
- Foreign Trade Policy and Foreign Sector Reforms in India.
- World Trade Organization (WTO) and India, Regional Trading Blocs—SAARC, BRICS, European Union (EU), ASEAN.

#### **6. Indian Economy**

- Basic Economic indicators – National income, performance of different sectors, trends in prices and money supply.
- Agriculture – Institutional and technological aspects, new agricultural policy, cooperative movement, rural development.
- Industry—New Industrial policy and Liberalization, Industrial Productivity, Finance and Labour problems.
- Money and banking – Concepts of money supply, inflation, monetary policy and financial sector reforms.
- Public finance – Trends in revenue and expenditures of the Central and State Governments, Major Taxation Reforms and Goods and Service Tax(GST).Public debt; analysis of the recent Union Budgets.
- Foreign trade – Trends, Balance of payments and trade reforms.
- Poverty, unemployment, migration and environment.

- Census of India and its recent characteristics.
- NITI Aayog.
- Basic features of the Uttarakhand Economy- State Domestic Products, Present Situation of Agriculture, Industry, Services and their main problems.

## 7. Statistical Methods

- Measures of Central tendency, dispersion, skewness and kurtosis
- Sampling and census methods, types of sampling and errors.
- Elementary theory of probability, Binomial, Poisson and Normal distributions.
- Simple correlation and regression analysis.
- Statistical inferences -- Applications, sampling distributions (t, chi square( $x^2$ ) and F tests), association of attributes, testing of Hypothesis.
- Index numbers and time series analysis.

Quantitative methods and its implication in Economics—Linear and simultaneous equations, Integration and Differentiation, Matrices and Determinants



## **06.Political Science**

### **1. Political Theory and Thought.**

- Indian Political Thought : Manu, Kautilya, Jaiprakash, Gandhi and Ambedkar.
- Western Political Thought : Plato and Aristotle, Bentham, J. S. Mill, Hegel and Marx
- Contemporary Political Thought : Lenin, Mao, Gramsci, Rawls and Nozic
- Nature of Political Theory, its main concern, decline and resurgence. democracy, liberty ,equality, justice, sovereignty, liberalism and Marxism.

### **2. Comparative Politics and Political Analysis.**

- Comparative Politics as a discipline; nature and scope.
- Approaches to the study of comparative politics : Traditional and modern.
- Forms of Government: Unitary – Federal, Parliamentary – Presidential.
- Organs of Government: Executive, Legislature, Judiciary – their interrelationship in comparative perspective.
- Party Systems and Pressure Groups; Electoral Systems.
- Political Development, Political Culture and Political Socialization.
- Political Elite; Elitist theory of Democracy.
- Power, Authority and Legitimacy.

### **3. Indian Government and Politics.**

- National Movement- (i) Consequences of first war of Independence.  
(ii) Formation and working of Indian National Congress.  
(iii) Gandhiji's role in Independence Movement.
- Constituent Assembly- Composition and working.
- Preamble, Fundamental Rights and Duties and Directive Principles.
- Structure and Process – I : President, Prime Minister, Council of Ministers, Working of the Parliamentary System.
- Structure and Process – II : Governor, Chief Minister, Council of Ministers, State Legislature.
- Panchayati Raj Institutions (Rural and Urban) in Uttarakhand State, role and impact of reservation for women in Panchayati Raj Institutions.
- Federalism : Federal structure in India; Demands of Autonomy and Separatist Movements; Emerging trends in Centre – State Relations.
- Judiciary : Supreme Court, High Courts(composition and working), Judicial Review, Judicial Activism including Public Interest Litigation cases, Judicial Reforms.
- Political Parties, Pressure Groups, Public Opinion, Media, role of women in Uttarakhand State movement.
- Election Commission and Electoral Reforms in India.
- Empowerment of women in Uttarakhand State.
- Role of Human Rights Commission in Uttarakhand.

- Role of Ex-servicemen in the politics of Uttarakhand.

#### **4. Public Administration**

- Public Administration as a discipline: Approaches to the study of Public Administration.
- Principles of Organization: Line and staff, unity of command, hierarchy, span of control, centralization and decentralization, Types of organization – formal and informal; Forms of organization; department, public corporation and board.
- Chief Executive: Types, functions and roles.
- Personnel Administration: Recruitment, Training, Promotion, Morale; Employee – Employer Relations.
- Bureaucracy: Types and Roles; Max Weber and his critics. Civil servant – Minister relationship.
- Financial Administration : Budget, Budget formation in India and the role of CAG and PAC.
- Good Governance; Problems of Administrative Corruption; Transparency and Accountability with special reference to Uttarakhand and Right to Information.
- Impact of Globalization on Public Administration.

#### **5. International Relations**

- Theories and Approaches to the study of International Relations; Idealist, Realist, Systems, Game, Communication and Decision – making.
- Power; Elements of Power : Acquisition, use and limitations of power, Promotion of National Interest and determinants of foreign policy.
- Arms and Wars : Nature, causes and types of wars / conflicts including ethnic disputes; conventional, Nuclear / bio – chemical wars; deterrence, Arms Race, Arms Control and Disarmament.
- Peaceful Settlement of Disputes, Conflict Resolution, Diplomacy.
- Cold War, Alliances, Non – Alignment, End of Cold war, Globalization.
- Rights and Duties of states in international law, intervention, Treaty law, prevention and abolition of war.
- Political Economy of International Relations; New International Economic Order, North – South Dialogue, South – South Cooperation, WTO, Neo – colonialism and Dependency.
- Regional and sub – regional organizations especially SAARC, ASEAN, OPEC, OAS.
- United Nations : Aims, Objectives, Structure and Evaluation of the working of UN; Peace, development and environment perspectives; Charter Revision, Financing and Peace – keeping operations.
- India's Role in International affairs : India's relations with its neighbors and major countries(UK, USA, Russia and China) Wars, Security Concerns and Pacts, Mediatory Role, distinguishing features of Indian Foreign Policy and Diplomacy, India's Nuclear policy and space research.
- Terrorism and state sponsored terrorism.
- Changing Concept of National Security and Challenges to the Nation State system.

# 07.Sociology

## A : Sociological Concepts

### 1. Nature of Sociology

- Definition
- Sociological Perspective

### 2. Basic Concepts

- Community
- Institution
- Association
- Culture
- Norms and Values.

### 3. Social Structure

- Status and role, their interrelationship.
- Multiple roles, Role set. Status set, Status sequence.
- Role conflict.

### 4. Social Group

- Meaning
- Types : Primary – Secondary, Formal – Informal, Ingroup – Outgroup, Referencegroup.

### 5. Social Institutions

- Marriage
- Family
- Education
- Economy
- Polity
- Religion

### 6. Socialization

- Socialization, Resocialization, Anticipatory socialization, Adult socialization
- Agencies of socialization.
- Theories of socialization.

### 7. Social Stratification

- Social differentiation, Hierarchy and Inequality.
- Forms of stratification : Caste, Class, Gender, Ethnicity.
- Theories of social stratification.
- Social mobility.

## **8. Social Change**

- Concepts and Types : Evolution, Diffusion, Progress, Revolution, Transformation, Change in structure and Change of structure
- Theories : Dialectical and Cyclical.

## **B : Sociological Theory**

### **9. Structural**

- Nadel
- Radcliffe Brown
- Levi – Strauss

### **10. Functional**

- Malinowski
- Durkheim
- Parsons
- Merton

### **11. Interactionist**

- Social action : Max Weber, Pareto
- Symbolic Interactionism : G. H. Mead, Blumer

### **12. Conflict**

- Karl Marx
- Dahrendorf
- Coser
- Collins

## **C- Methodology**

### **13. Meaning and Nature of Social Research**

- Nature of social phenomena
- The scientific method

- The problems in the study of social phenomena : Objectivity and subjectivity, fact and value.

#### **14. Quantitative Methods**

- Survey
- Research Design and its types
- Hypothesis
- Sampling
- Techniques of data collection : Observation, Questionnaire, Schedule, Interview.

#### **15. Qualitative Methods**

- Participant observation
- Case study
- Content analysis
- Oral history
- Life history

#### **16. Statistics in Social Research**

- Measures of Central Tendency : Mean, Median, Mode
- Measures of dispersion
- Correlational analysis
- Test of significance
- Reliability and Validity

### **D-Contemporary Sociological Theories**

#### **Unit – I : Phenomenology and Ethnomethodology**

- Alfred Shultz, Peter Berger and Luckmann
- Garfinkel and Goffman

#### **Unit – II : Neo – functionalism and Neo – Marxism**

- J. Alexander
- Habermass, Althusser

#### **Unit – III : Structuration and Post – Modernism**

- Giddens
- Derrida
- Foucault

#### **Unit – IV : Conceptualising Indian Society**

- Peoples of India : Groups and Communities.
- Unity in diversity.
- Cultural diversity : Regional, linguistic, religious and tribal.

#### **Unit – V : Theoretical Perspectives**

- Indological / Textual Perspective : G. S. Ghurye, Louis Dumont.
- Structural – Functional Perspective : M. M.N. Srinivas, S. C. Dube.
- Marxian Perspective : D. P. Mukherjee, A. R. Desai.
- Civilisational Perspective : N. K. Bose, Surajit Sinha.
- Subaltern Perspective : B. R. Ambedkar, David Hardiman.

#### **Unit – VI : Contemporary Issues : Socio – cultural**

- Poverty
- Inequality of caste and gender
- Regional, ethnic and religious disharmonies.
- Family disharmony : (a) Domestic violence (b) Dowry (c) Divorce (d) Intergenerational conflict.

#### **Unit – VII : Contemporary Issues : Developmental**

- Population
- Regional disparity
- Slums
- Displacement
- Ecological degradation and environmental pollution
- Health problems

#### **Unit – VIII : Issues Pertaining to Deviance**

- Deviance and its forms
- Crime and delinquency
- White collar crime and corruption ,
- Changing profile of crime and criminals
- Drug addiction
- Suicide

#### **Unit – IX : Current Debates**

- Tradition and Modernity in India.
- Problems of Nation Building : Secularism, Pluralism and Nation building.

#### **Unit – X : The Challenges of Globalisation**

- Indianisation of Sociology
- Privatisation of Education
- Science and Technology Policy of India

## **E- Rural Sociology**

### **Approaches to the study of Rural Society :**

- Rural – Urban differences
- Rurbanism
- Peasant studies

### **Agrarian Institutions :**

- Land ownership and its types
- Agrarian relations and Mode of production debate.
- Jajmani system and Jajmani relations
- Agrarian class structure

### **Panchayati Raj System :**

- Panchayat before and after 73rd Amendment
- Rural Leadership and Factionalism
- Empowerment of people

### **Social Issues and Strategies for Rural Development :**

- Bonded and Migrant labourers
- Pauperization and Depeasantisation
- Agrarian unrest and Peasant movements

### **Rural Development and Change :**

- Trends of changes in rural society
- Processes of change : Migration – Rural to Urban and Rural to Rural, Mobility : Social / Economic
- Factors of change

## **F- Industry and Society**

### **Industrial Society in the Classical Sociological Tradition :**

- Division of labour
- Bureaucracy
- Rationality
- Production relations/relations of production

- Surplus value
- Alienation

### **Industry and Society :**

- Factory as a social system
- Formal and informal organization
- Impact of social structure on industry
- Impact of industry on society

### **Industrial Relations :**

- Changing profile of labour
- Changing labour – management relations
- Conciliation, adjudication, arbitration
- Collective bargaining
- Trade unions
- Worker’s participation in management ( Joint Management Councils )
- Quality circles

### **Industrialisation and Social Change in India :**

- Impact of industrialization on family, education and stratification
- Class and class conflict in industrial society
- Obstacles to and limitations of industrialization

### **Industrial Planning :**

- Industrial Policy
- Labour legislation
- Human relations in industry

## **G- Sociology of Development**

### **Conceptual Perspectives on Development :**

- Economic growth
- Human development
- Social development
- Sustainable development : Ecological and Social

### **Theories of Underdevelopment :**

- Liberal : Max Weber, Gunnar Myrdal.
- Dependency : Centre – periphery ( Frank ), Uneven development ( Samir Amin ), World – system ( Wallerstein ).



### **Paths of Development :**

- Modernisation, Globalisation
- Socialist
- Mixed
- Gandhian

### **Social Structure and Development :**

- Social structure as a facilitator / inhibitor
- Development and socio – economic disparities
- Gender and development

### **Culture and Development :**

- Culture as an aid / impediment
- Development and displacement of tradition
- Development and upsurge of ethnic movements

## **H- Population and Society**

### **Theories of Population Growth :**

- Malthusian
- Demographic transition

### **Population Growth and Distribution in India :**

- Growth of Indian population since 1901
- Determinants of population

### **Concepts of Fertility, Mortality, Morbidity and Migration :**

- Age and Sex composition and its consequences
- Determinants of fertility
- Determinants of mortality, infant, child and maternal mortality
- Morbidity rates.
- Determinants and consequences of migration

### **Population and Development :**

- Population as a constraint on and a resource for development
- Socio – cultural factors affecting population growth

### **Population Control :**

- Population policy : Problems and perspectives
- Population education
- Measures taken for population control

## **I- Gender and Society**

### **Gender as a Social Construct :**

- Models of Gendered socialisation
- Cultural symbolism and gender roles

### **Social Structure and Gender Inequality :**

- Patriarchy and Matriarchy
- Division of Labour – Production and reproduction

### **Theories of Gender Relations :**

- Liberalist
- Radical
- Socialist
- Post – modernist

### **Gender and Development :**

- Effect of development policies on gender relations
- Perspectives on gender and development – Welfarist, developmentalist
- Empowerment

### **Women and Development in India :**

- Indicators of women's status : Demographic, social, economic and cultural
- Special schemes and strategies for women's development
- Voluntary sector and women's development
- Globalisation and women's development
- Eco – feminism.

## 08.HISTORY

### **Ancient India :-**

Sources of Ancient Indian History:-Archaeological sources- Epigraphy,numismatics,literary sources,folklore and travel accounts.

Evolution of human being-Palaeolithic,Mesolithic and Neolithic.

Indus Valley Civilization:- origin,date,extent ,characteristics and decline.

The Vedic Age- evolution of society,economy,religion and polity;Vedic Literature.

Iron Age-the second urbanization.

Emergence of states-from Janapadas to Mahajanapadas-society,polity,economy and growth of urban culture; Rise of Magadhan Empire.

Era of New Religions:- Jainism and Buddhism-their basic tenets,philosophies and extent of influence;subsequent split in the two religions;other sects.

Foreign invasions-Iranian and Macedonian influences.

Mauryan Empire-Foundation of Mauryan Empire –it’s consolidation,expansion and decline ; Asoka and his Dhamma;Asokan edicts; Mauryan administration,society and economy;art,architecture and sculpture.

Post –Mauryan India:- Indo-Greeks,Shakas,Kushanas,Pahlavs and Western Kshatrapas;Urban centres,society,art and architecture,economy and coinage.

Satvahans;Sangam Age-Sangam literature;Kharvela and spread of Jainism.

Gupta Empire :-foundation,consolidation,extent and downfall; administration;society and culture;art and architecture;trade ;guild system;land grants;caste system;position of women;educational system-Universities of Nalanda,Vikramshila and Vallabhi;contact with foreign countries.

Vakatakas;Maukharis ;age of Harsha-his political and religious;achievements ;art and literature.

Emergence of new powers-Chalukyas of Badami,Kadambas; administration ,trade guilds,Sanskrit literature and growth of regional scripts; Vaishnavism and Saivism-Sankaracharya;temple architecture.

Chalukyas of Kalyani,Cholas,Hoysalas,Pandyas and Pallavas-Administration and local government;art and architecture,economy and trade;contact with Sri Lanka and South East Asia.

Varmans of Kamrup and Palas,Pratihars, Rashtrakutas, Paramaras,Chandels, Kalachuris,Chedis, Senas, ;Chalukyas of Gujarat ;Invasion of Islam-Mohammad-bin-Qasim,Mahmud of Ghazni;Al beruni.

### **Medieval India :-**

**Sources**-Archaeological sources,epigraphy and ,numismatics,monuments. Literaray sources-Persian,Sanskrit and regional language;.Accounts of foreign travelers.

The Sultanate period-Ghorids,Turks,Khaljis,Tughlaqs,Saiyyads and Lodhis.

Administration,economy and society- position of women; culture-art and architecture;religious movements-Sufi and Bhakti movements ;education and literature;decline of the Delhi Sultanate and emergence of regional powers.

Advent of the Mughals-Babar to Aurangzeb and later Mughals;Afghan interlude-Sher Shah Suri and his reforms.

Mughal Administration-land reforms-Mansabdari and Jagirdari system;economy,trade and commerce-internal and external;society and culture,art and architecture-Indo-Islamic architecture; painting;music;literature-Persian ,Sanskrit and regional languages.

Disintegration of the Mughal Empire –causes and ramifications

Rise of Maratha power :-Maratha Confederacy-extent –administration ,society and culture; Contribution of the Peshwas toward Maratha supremacy;decline of the Maratha power.

South of the Vindhyas:- Vijayanagar and Bahmani kingdoms-their extent ,administration,society and culture,economy,art and architecture,literature;causes of decline.

### **Modern India-**

Sources-Archaeological & Archival material-coins and monuments; literature-European as well as Indian; biographies and memoirs,travelogues,newspapers,missionary text;oral traditions ,paintings

Concerns in Modern Historiography-Imperialist,Nationalist,Marxist and Subaltern.

Advent of colonial powers and the rise and consolidation of the British Empire ; European traders in India and inter –colonial rivalry-Portuguese,Dutch ,English and French.

Relations of East India Company with principal Indian states- Bengal,Oudh,Hyderabad,Mysore,Marathas and Sikhs.

Administration under the East India Company and the Crown-Evolution of central and provincial structure under the Company-1773-1853; Paramountcy,Civil service,Judiciary,Police and the Army.

Economy under British regime :- Changing composition of economy,the “Tribute”; expansion and commercialization of agriculture,land rights,land settlements,rural indebtedness ,decline of handicrafts.

British Industrial policy;major industries; factory legislations;labour and trade union movements.

Monetary policy:- banking,currency and exchange;Railways and surface transport.

Emergence of new urban centres-town planning and architecture.

Famines and epidemics- their socio-political impact and the response of the government .

Economic thought-The Utilitarians, Indian economic historians ;the Drain of Wealth theory.

Indian society in transition:- The advent of Christianity;Missionary activities and it's attendant benefits to the masses-Education,health care,social hygiene .

Educational system under the British-primacy of science;discovery of India's past;the Asiatic Society.

Indian Renaissance-Socio-religious and its prominent proponents;emergence of Indian middle class;caste associations and caste mobility.

Gender issues-emancipation of women;legislations and constitutional remedies.

Advent of the printing press-journalistic activity and its role in creating public opinion.

Modernization of regional languages; changing imageries of Indian paintings, music and performing arts.

Struggle for independence:- Rise of Indian Nationalism;social and economic base of national movement.

Uprising of 1857-causes and consequences; various movements including tribal and peasant movements.

Birth and growth of Indian National Congress-initial years-1885-1920.

Left parties and left wing politics in India.

Swadeshi Movement;Partition of Bengal.

Activities of Indian revolutionaries, both at home and abroad.

Gandhi and Gandhian ideology as manifested in mass movements.

Movements related to depressed classes-Justice Party,Ambedkar ,Periyar.

Rise of communal politics and emergence of Jinnah.

Indian National Army and Subhash Chandra Bose.

Towards independence and partition of India.

Role of Uttarakhand in National Movement.

Post independence scenario-Partition riots and rehabilitation.

Integration of Indian states-problems and solutions.

Making of Indian constitution.

Linguistic reorganization of states.

### **World History :-**

Pre-history-Paleolithic ,Mesolithic and Neolithic ages.

Human beings' movement towards civilization.

Concept of Mother Goddess.

Ancient Greece-Athenian Republics.

Imperial Rome.

Slavery and Slave mode of production.

Confucianism.

Feudalism.

Holy Roman Empire and primacy of the Church

Divine Right theory of kingship

Renaissance and Reformation.

Emergence of nation states-autocratic regimes.

Industrial and Agrarian Revolutions.

Enlightened despotism.

Age of Revolutions (1789-1848).

The Eastern Question.

Socialism and Communism-with special reference to Karl Marx.

Russia in transition-Menshevik and Bolshevik revolutions.

Imperialism and the struggle for hegemony.

Europe between the World Wars I and II.

The Great Depression and The New Deal.

Nazism and Fascism.

Influence of Communism in China-The Kuomintang and the Long March of Mao.

United Nations Organization.

The Cold War and balance of power.

Non Aligned Movement; India's post-independence foreign policy.

Apartheid and its eradication.

Human Rights.

Research in History:- Scope and value of history; sources-primary and secondary.

Objectivity, subjectivity and inquiry in history.

History and its auxiliary sciences.

Modern historical writings.



## 09.Home Science

### Unit I : Food Science

- Food groups and their nutritional contribution
- Changes in nutrients during cooking
- Cooking methods
- Food processing and preservation
- Food quality, safety, sanitation and standards
- Food microbiology

### Unit II: Nutrition Science and Meal Planning

- Fundamentals of nutrition- Functions, dietary sources; deficiency diseases/excess of macro and micro-nutrients
- Dietary guidelines for Indians – Dietary Reference Intakes, Recommended Dietary Allowances- 2010; Food Pyramid; Balanced diets
- Nutrition for various age groups and physiological conditions
- Meal planning – Use of food exchange lists; Normal and Therapeutic nutrition
- Community nutrition
- Breast feeding and Complementary feeding.
- National nutrition policy and Nutrition programmes
- Role of National and International agencies in nutrition

### Unit III: Clothing

- Clothing terminology, principles
- Family clothing
- Clothing construction techniques - drafting, flat pattern and draping methods
- Equipment used in clothing construction
- Anthropometric measurements and paper patterns for different garments
- Use of construction features in design
- Traditional embroideries of India
- Fashion design – Fashion cycles; Business and Merchandizing.

### Unit V: Textiles

- Textile design- Principles, Concepts, Elements
- Care and maintenance of textile materials/garments

- General properties and structure of all textile fibers
- Processing and manufacturing of all natural and man-made fibers
- Definition and classification of yarns; Identification of yarns and its use in various fabrics
- Weaves - Types and use
- Fabric construction, definition and types of woven, non-woven, knitted and other construction techniques
- Looms –parts, classification/types and motions
- Testing of fibers, yarns and fabric; quality control and research institutes
- Dyeing, printing and finishing of fibers, yarns and fabrics.
- Traditional textiles of India

### **Unit VI: Resource Management**

- Concept; Approaches, Ethics of management and management process
- Classification of resources and their characteristics
- Management of resources
- Functions of management
- Decision making process
- Work Simplification
- Household income and expenditure
- Consumer education and protection
- Housing; Interior design, Principles of interior design, Colours and Colour schemes
- Household equipment - Selection and care
- Ergonomics- Concept and its importance/application in home

### **Unit VII: Human Development**

- Human Development - Principles and stages
- Theories of Human Development - Personality, learning theories, cognitive development theories and theories of moral development
- Socialization and child rearing practices
- Children with special needs - Definition, classification and need for special education, education and management of children with disabilities, policies and laws
- Early childhood care and education
- Guidance and Counseling - meaning, types, need and use of psychological testing
- Advanced child study methods and assessment

- Women and child welfare programs in India
- National and International agencies for child and women welfare

### **Unit VII: Non-Formal Education and Extension Education**

- History and development of Home Science in Formal / Non-formal and Extension Education
- Difference in Formal/ Non- formal and Extension Education
- Extension education: History, concept, goals, philosophy, principles and methods
- Community development – Organization, principles, characteristics and functions
- Role of Home Scientist in community development
- Self-employment and entrepreneurship through Home Science
- Extension Institutes in India
- Programmes and agencies for rural development

### **Unit VIII: Communication and developmental communications**

- Communication: history, functions, types, scope, uses, elements, methods and barriers.
- Audio- visual aids: Concepts, classifications, characteristics and scope.
- Developmental communication: Concept, models, characteristics, philosophy and role
- Traditional and modern media (Printed and Electronic): Types, characteristics and role in developmental communication
- Scope and use of ICT in developmental communication

### **Unit IX: Methods of Research**

- Research- definition, nature, need and steps
- Research designs and types of research
- Sampling techniques
- Selection and preparation of tools for data collection
- Variables and their selection
- Data collection and classification / coding
- Analysis of data and report writing

## **10. Drawing and Painting (CHITRAKALA)**

### **Unit-I**

General characteristics of Visual art / Fundamentals of art : Space, form, shape, line, color, texture, tonal values, perspective, design and aesthetic organization of visual elements in art object ( composition ). The uses of two and three dimensions in visual art. Tactile quality in art. Environment and art.

Interrelationship of various arts - Rhythm, structure, use of space, visual properties. materials, techniques ( traditional and modern ), ideas, themes ( narrative and non – narrative ) conceptual, abstract elements between literary and plastic art.

Principal of Art- perspective, harmony, balance, dimension unity. Chronology of the development of ideas. Visual reality, conceptual reality. Tradition and the gradual development of the art of combining the elements of ideas of different visual arts specialization.

### **Unit — II**

Traditional and Modern mediums and materials in making visual arts - Painting, sculpture, print – making, mural, graphic design and multimedia art. Inventions, adaptations and development of these mediums and materials from the pre – historic period to present-day all over the world.

Traditional and Modern techniques, processes and procedures, used in making painting, different way of handling of colour pigment.

Media and materials and their use, sketching and drawing. Application of materials, oil painting — Alla Prima and old master process, glazing and scumbling, priming of canvas, different types of oil, brushing etc. Tempera and Gouache and their uses in painting in both traditional and non-traditional art. Wash method on paper and silk, Acrylic, pastel, mixed media, water colour mural and mural techniques — Fresco secco and Buono fresco, Ajanta and different modern media relief and mixed media in mural.

Collage, Encaustic Wax Supports in Painting ( Canvas, paper, wood, silk, etc. )

Types of paintings, open air paintings, portrait paintings, study of head and full length figures, male and female. Landscape paintings, patronised art. paintings under different art movements, still life, thematic and abstract, etc.

### **Unit-III**

Principles of compositions, reflection of artists personal views, development of concept. Process of creative paintings. Expression of ideas under some aesthetical and philosophical views. Artistic expression during different social and structural changes. Art and Changes.

Application of techniques, colours and colour theory and the application of colour theory in art activities. Colour harmony, traditional application of colour and the application of colour with reasoning.

Colour preparation, texture, technical aspect of pigment. Sources and influences of various traditions. Study and understanding of artistic value, construction of forms, shapes, planes, volume and totality, understanding of two and three dimensional approaches and the purpose.

#### **Unit-IV**

Definition of Art, meaning of Art and definition of Indian and western aesthetic, relevance of the study of aesthetics in Fine Arts / Visual Arts. The early Philosophical thoughts in Indian Culture. Nature and function of works of art in society. Concepts of Rasa, theory of Rasa, Sadanga, Dhvani, Alankara, Guna and Dosh, Vyanjana, in traditional art. Theory of expression, art and society, concept of art and beauty, idea, imagination, intuition form and content, sublime, sympathy, empathy, catharsis creativity allegory, myth. Philosophy and aesthetical views of Plato and Aristotle, Boumgarton, Kant, Hegel, Croce, Sigmond Friedud and Herbart Read.

#### **Unit-V**

Pre – historic Indian Painting, Classical Indian Paintings. Mural ( Ajanta, Bagh ) and later Mural traditions. Manuscript Painting, Miniature Painting, Folk and Tribal Paintings. Folk and traditional art of Uttarakhand.

Company school of paintings, Raja Ravi Verma, Bengal School under Abanindranath and his disciples ( Kshitindra Nath Majumdar, Samarendranath Gupta, K. Venkatappa, Abdul Rahman Chughtai, Ashit Kr. Haider, Nandalal, etc. )

Nandalal and his disciples ( Ramkinkar, Binod Bihari, Dhirendrakrishna Dev Varma, etc. )

Amrita Shergil, Academic Realism, Calcutta Group ( Paritosh Sen, Gobardhan Ash, Nirode Majumdar, Pradosh Dasgupta, Hemanta Mishra, etc. )

Major trends in contemporary Indian Art since, 1947.

Major phases in Western Painting, Greeco – Roman, Byzantine, Gothic, Renaissance ( background of Renaissance, Humanism and the intentions and discoveries of the evolution of personal style of Early Renaissance and High Renaissance ), Mannerism, Baroque and Rococo ( background, conception with some important artists activities ).

Neo – classicism, Romanticism, Neo-Realism, Impressionism Post – impressionism, Cubism, Fauvism, Futurism, Dadaism, Surrealism, Abstract Art, Abstract Expressionism Op, Pop, Neo – figuration, Art in Post – modern time and Hperrealism.

## 11. Psychology

**1. Nature of Psychology and Theoretical Approaches to Psychology:** Behaviouristic, Cognitive, Psychodynamic and humanistic and physiological

**2. Perception:** Approaches: Gestalt and physiological approaches; Perceptual Consistency: size, shape and brightness; Perception of time, Depth perception, movement perception, Role of learning and motivation in perception.

**3. Learning:** Classical and Instrumental conditioning: Procedure, Types and Theoretical Issues; Reinforcement: Basic variables and Schedules. Learning theories; Hull, Skinner Tolman and Guthrie. Observational Learning; Verbal Learning: Methods, Material, Organizational Processes and determinants of verbal learning.

**4. Memory and Forgetting:** Memory Processes: Encoding, storage, retrieval; Stages of memory: Sensory memory, Short term memory (STM) and Long term memory (LTM); Models of memory: Atkinson and Shiffrin, Craik and Lockhart, Tulving; Biological bases of memory; Theories of Forgetting: interference, decay, psychoanalytic.

**5. Thinking and Problem-Solving:** Theories of thought process: Associationism, Gestalt, information Processing; Role of concepts in thinking. Convergent and divergent thinking; Types and strategies of problem solving. Creative thinking

**6. Motivation and Emotion:** Basic concepts of Motivation: Instincts, drives, incentives and motivational cycle; Types of motivation; biogenic and sociogenic motives; Theories of motivation; Measurement of motives; Physiological correlates of emotion, Theories of emotion, Measurement of emotion; Conflicts; sources and types.

**7. Intelligence:** Concepts and determinants, Theories of intelligence, Measurement of intelligence.

**8. Personality:** Concept and determinants; Different approaches to study the personality; Assessment of personality; Self-concept: Origin and development.

**9. Research Methodology:** Types of Psychological Research; Research problem, hypotheses, variables and their operationalization. Methods of psychological Research; Experimental, Quasi-experimental, case studies, field studies and cross-cultural studies. Sampling techniques. Methods of data collection: observation, interview and Questionnaires; Research Design: correlational, factorial, randomized block and matched group design.

**10. Statistics in Psychology:** Descriptive and inferential statistics; Testing of hypothesis; Parametric and non-parametric statistics. Correlation and regression.

**11. Psychological Assessment and Testing:** Levels of measurement; Nominal, Ordinal, interval and ratio scales; Characteristics of a good test: reliability, validity and norms. Measurement of attitude and aptitude.

**12. Biological Bases of Behavior:** Human evolution; Genes and behavior; Hormones and Glands; Nervous system: neuron, central and peripheral n.s.; the cerebral hemisphere; Monitoring neural activity.

**13. Social Psychology:** Current trends in Social Psychology; Socialization: Process and determinants; Social cognition, Social influence; Prosocial behavior; Leadership, Attitude, Prejudice and stereotypes, Interpersonal attraction.

**14. Organizational Behavior:** Organizational development and individual differences; Selection Process; Training, Performance appraisal; motivation at work; Job analysis and satisfaction, Organizational Communication.

**15. Psychopathology:** Concepts, classification (ICD-10& DSM) and causes; Types of disorders; Mental retardation.

**16. Clinical Psychology:** Diagnostic methods: Case study, interview, testing and neuropsychological testing, Approaches of Psychotherapy: psychodynamic, behavior, cognitive-behavior and existential therapies.

**17. Health Psychology:** Models and issues, Stress and health, Managing stress-diet and nutrition, relaxation, biofeedback, exercise and meditation; Mental health and mental hygiene

**18. Developmental Psychology:** Developmental processes: nature and related concepts- maturity, experience. Factors of development; Theories of

development: biogenic, psychogenic and sociogenic. Stages of development. Theories of development; Psychoanalytic, behaviouristic and cognitive. Various aspects of development; sensory-motor, cognitive, language emotional, social and moral.

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## 12. Music

### 1. Technical – Terminology

- Nada, Shruti, Swara, Grama – Moorchana, Jati, Raga, Thaata, Tala, Tan, Gamak, Gandharva – Gaan, Marga – Deshi Sangeet, Giti, Gaan, Varna, Alankar, Melody, Harmony, Musical Scales, Musical intervals, Consonance – Dissonance, Harmonics.
- Western and South Indian terminology and their explanation, Drone (Tanpura), Alpatva – Bahutva, Avirbhav – Tirobhav, Uthan, Peshkar, Kay da, Rela, Laggi, Ladi, Tala, Laya and Layakari, Matra, Avartan, Vibhag, Sashabda Kriya, Nishabda Kriya, Theka, Saral Gat, Adi Gat, Chakradar Gat.
- Farmaishi Gat and other variety of Gats and Kayadas, Upanga, Bhashanga, Giti, Kriti, Kirtana, Jatiswara, Pada, Swarjati, Ragmalika, Tillana, Nyasa Swar, Ansa Swar, Prasar, Yati, Alapana, Naraval and other terms, Gitinatya, Nritya – Natya, Basantotsav, Gita – Bitana, Swara – Bitana, Akarmatrik notation, Swar Lipi (Bhatkhande and Paluskar), Masitkhani and Rajakhani Gat.

### 2. Applied Theory

- Detailed and critical study of Ragas, classification of Ragas, i.e., Grama Raga vargikaran, Mela Raga Vargikaran, Raga – Ragini Vargikaran, Thata Raga Vargikaran, and Raganga Vargikaran, time – theory of Ragas, Application of melody and harmony in Indian Music, Placement of Shuddha and Vikrit Swaras on Shruties in ancient, medieval and modern period.
- Detailed knowledge of prevalent talas of Hindustani music, knowledge of tala Dashpranas and Marga and Deshi talas of ancient period, the original principles of making Tihai, Chakradar Gat, Chakradar Paran, comparative study of Hindustani and Karnatak tala system with special reference to ten pranas of tala, detailed study of different layakarīs viz, Dugun, Tigun, Chaugun, Ada, Kuada, Biad and method to apply them in compositions.
- Tagore's treatment of Hindustani ragas and raginis, elements of Hindustani classical music, Karnatak music, Western Music, Music from other provinces, folk music and Kirtan of Bengal and their influence on Tagore's treatment of ragas.

### 3. Compositional Forms and their Evolution

- Prabandha, Dhrupad-Dhamar, Khyal, Dhamar, Thumri, Tappa, Tarana, Chaturang, Trivat, Vrindagana, Vrinda Vadan, Javeli, Kriti, Tillana, Alap, Varnam (Pad Varnam and Tana Varnam), Padam, Ragam, Tanam, Pallavi, Geet, Varna, Swarajati, Kalpita, Sangita, Ragamalika, Narvalla, Kalpana Swara, Tevaram, Divyaprabandham, Tiruppugazh.

### 4. Gharanas and Gayaki

- Origin and Development of Gharanas in Hindustani Music and their contribution in preserving and promoting traditional Hindustani Classical Music. Merits and demerits of Gharana System.
- Origin and Development of Gharanas in Instrumental music and Percussion and their contribution in promoting traditional Indian Classical Music, merits and demerits of Gharana system.
- Study of the traditions and specialties of different gharanas in vocal (khyal), instrumental and percussion group and dhrupad vani. Desirability and possibility of gharanas in contemporary music.
- Guru Shishya parampara and different styles of singing and playing in Karnatak Music.

### 5. Contribution of Scholars to Indian Music and their textual tradition

- Narad, Bharat, Dattil, Matanga, Sharangadeva, Nanyadeva, Lochan, Ramamatya, Pundarik Vitthal, Somnath, Damodar Pandit, Ahobal, Hridaya Narain Deva, Vynkatmakhi, Srinivas, Tansen, Amir Khusro, Pt. Bhatkhande, Pt. V. D. Paluskar, Pt. Omkarnath Thakur, Acharaya Kailash Chandra Dev Brihaspati, Dr. Premlata Sharma and others.

- Study of ancient, medieval and modern treatises in Percussion instruments like Bharat Natyashastra, Sangeet Ratanakar, Sangeet Samaysar, Bhartiya Vadyon Ka Itihas, Sangeet Shastra, Bhartiya Sangeet Mein Taal aur Roop vidhan, bharityon talon ka shastriyā vivchen, Abhinav Tala Manjari, Bhartiya Sangeet Vadya, and other treatises.
  - Contribution of various Scholars to percussion instruments like Kudau Singh, Bhagwan Das, Nana panse, Raja Chatrapati Singh, Anokhe Lal, Ahmadjan thirakwa, Shamta Prasad, Kishan Maharaj, Maseet Khan, Qadir Bakhs, Allahrakha and others in ancient, medieval and modern period.
  - Tagore's Musical dramas (gitinatyas) and dance – dramas ( nrityanatyas ); e.g., Valmiki Pratibha, Kalmrigaya, Mayar Khela, Chitrangada, Chandalika, Shyama and other dramas full of various songs, i.e., dramas like Prayaschitta, Visarjan, Saradotsava, Raja, Phalguni, Taser Desh, Vasanta etc. Tagore's musical creativity in Gitabitan, Part I, II, III, Swarabitan ( notation books ) Part 1 – 63, Sangeet – Chinta ( Vishva – Bharti ).
  - Contribution of prominent Karnatak Scholars, composers and performers and their medieval and modern period like, work such as Ramamatya, Vyankatmakhi, Tyagraja, Muttu-Swami Dikshitar, Shyama Sastri, Gopal Krishna Bharati, Prof. Sambhamoorti, Papanasam Shivan, Vasantha Kumari, M.S Subbulakshmi, T. N. Krishnan and others.
6. **Historical Perspective of Music**
- A study of the historical development of Hindustani music (Vocal, Instrumental, Percussion), Karnatak Music and Rabindra Sangeet in ancient, medieval and modern period.
  - Contribution of Western Scholars to Indian Music.
7. **Aesthetics**
- Its origin, Expression and Appreciation : Principle of aesthetics and its relation to Indian Music.
  - Rasa theory and its application to Indian Music.
  - Relationship of Musical aesthetics and Rasa to Hindustani Music ( Vocal, Instrumental and Percussion ), Karnataka Music and Rabindra Sangeet.
  - Interrelationship of Fine Arts with special reference to Rag – Ragini Paintings, Dhyān of Ragas and others.
  - Bibliography of Rabindra Nath Tagore.
8. **Instruments / Dance**
- Origin, evolution, structure of various instruments and their well – known exponents of Hindustani (Vocal, Instruments and Percussion), Karnataka Music and Rabindra Sangeet. Importance of Tanpura and its Harmonics.
  - Classification of Instruments of Hindustani, Karnataka Music in ancient, medieval and modern period. Popular instruments used in Rabindra Sangeet.
  - Elementary knowledge of Indian dances like Kathak, Bharatnatyam, Kuchipudi, Oddissi, Kathakali, Mohaniattam etc.
9. **Folk Music**
- Influence of folk music on Indian Classical Music. Stylisation of folk melodies into ragas.
  - Popular folk tunes and folk dances of Hindustani, Karnatak and Rabindra Sangeet, such as Baul, Bhatiyali, Lavani, Garba, Kajri, Chaity, Maand, Bhangra, Gidda, Jhoomar, Swang, Pandawani, Jhoda, Chhapeli, Chanchari, Neoli, Kumanoni Khadi Holi, Kirtan Sari, Raivanshi, Jhumur, Karakattam, Kavadi Attam, Villuppattu, Maiyandi Melam and other prominent folk forms.
  - Analysis of the elements of Hindustani folk music, Karnatak folk music or South Indian folk music and Rabindra folk Sangeet or folk music of Bengal and the elements regarding their interrelationship.
  - General Study of the Folk Music of various regions of India like Uttar Pradesh, Uttarakhand, Rajasthan, Haryana, Punjab, Gujarat, Maharashtra, Bengal and South India.
10. **Music Teaching and Research Technologies**

- Guru Shishya Parampara, Sangeet – Sampradaya Prasikshan and the institutional system of music teaching with reference to Hindustani, Karnatak Music and Rabindra Sangeet.
- Utility of teaching aids like electronic equipments in music education with reference to Hindustani, Karnatak music and Rabindra Sangeet.
- The methodologies of music research, preparing synopsis, data collection, field work, writing project reports, finding bibliography, reference material etc. with reference to Hindustani, Karnatak music and Rabindra Sangeet.
- Study of interrelation between textual and oral tradition.

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### **13. STATISTICS**

Sample space and events, classical, empirical and axiomatic definitions of probability, basic theorems on probability, conditional probability, independence of events, Bayes theorem, random variable and its distribution, discrete and continuous random variables, independence of random variables, expectation, moments, generating functions (m.g.f. and p.g.f.), Chebyshev's inequality and its applications, Binomial, Poisson, Hyper-geometric, Negative Binomial, Geometric, Uniform, Normal, Exponential, Gamma and Beta distributions with their properties.

Probability measure and probability space, random vector, marginal and conditional distributions, convergence of a sequence of random variables in distribution and in probability, Weak and strong law of large numbers, characteristic function and its properties, Inversion theorem, Linderberg and Levy forms of central limit theorem.

Introduction to statistics, meaning, importance and limitations of statistics, collection of data, primary and secondary data, tabulation and presentation of data through diagrams and graphs, measures of central tendency and dispersion and their properties, moments, skewness and kurtosis.

Correlation, rank correlation, interclass correlation, partial and multiple correlations, simple and multiple regression and curve fitting by the method of least squares.

Population and sample, sampling unit and sampling frame, sampling Vs complete enumeration, random and purposive sampling, simple random sampling with and without replacement, stratified random sampling proportional and optimum allocations, systematic, cluster and two stage sampling, estimation of population mean and total using

above methods and their comparisons, Ratio and regression methods of estimation, probability proportional to size sampling with and without replacement, cumulative total method and Lahri's method, Desraj and Hurwitz- Thompson estimators.

Statistic, estimate and estimator, properties of a good estimator- unbiasedness, consistency, sufficiency and efficiency, Neyman-Fisher factorization theorem, distributions admitting sufficient statistics, uniformly minimum variance unbiased estimator, Cramer-Rao inequality, Rao-Blackwell theorem, completeness of a statistic, Lehman Scheffe theorem, Methods of estimation- method of moments, method of maximum likelihood and the properties of the estimators obtained by these methods.

Hypotheses-Null and alternative, simple and composite, type-I and type-II errors, critical region, level of significance, size and power function of the test, unbiased test, most powerful and uniformly most powerful test, Neyman-Pearson lemma and Likelihood Ratio test, tests based on  $t$ ,  $F$ ,  $\chi^2$  statistic, large sample tests, interval estimation and best confidence intervals.

Nonparametric tests, advantages and disadvantages of non-parametric tests, sign test, Wilcoxon signed ranked test, run test for randomness, median test, Mann-Whitney test, Kolmogorov-Smirnov test.

Sequential analysis, Wald's SPRT and its properties, OC and ASN functions, prior and posterior distributions and Baye's estimator.

Analysis of variance, one way and two way classifications, design of experiments- basic principles of design of experiments, uniformity trials, CRD, RBD, LSD, split plot design and BIBD,  $2^n$ -factorial experiments with and without confounding, missing plot technique.

Multivariate Normal distribution, its properties and characteristic function, estimation of its mean vector and dispersion matrix, Wishart distribution and its properties, Hotelling  $T^2$  statistic, its distribution and applications, Mahalanobis  $D^2$  statistic and its relationship with Hotelling  $T^2$  statistic, principal component analysis, factor analysis, canonical correlation, canonical variates and discriminant analysis.

Concept of quality and meaning of control, process and product control,

$\bar{x}$ , R,  $\sigma$ , p and c charts, sampling inspection-single and double sampling plans, OC, ASN and ATI curves, consumer's and producer's risk.

Sources of demographic data, measures of fertility and mortality, complete and abridged life tables.

Canonical and standard forms of LPP, Graphical method, Simplex method, artificial variable technique- Big-M and Two-Phase methods transportation problem, obtaining of its feasible solutions and optimal solutions by MODI method, assignment problem and its optimal solution by Hungarian method.

## 14. EDUCATION

### **Philosophical Foundations of Education:**

1. Branches of philosophy, Metaphysics, Epistemology and Axiology.
2. Philosophy and Education, Schools of Philosophy- Idealism, Realism, Naturalism, Pragmatism, Marxism, Existentialism and Humanism.
3. Indian Schools of Philosophy- Vedanta, Buddhism, Islam.
4. Contribution of Tagore, Gandhi, Vivekanand, Aurbindo, J Krishanmurti and Gijju Bhai.
5. Modern concept of Philosophy : Logical Positivism.

### **Sociological Foundations of Education:**

1. Meaning of Sociological tendency. Its influence on education.
2. Social Change- Westernization, Modernization, Cultural lag and Social Mobility.
3. Social Thoughts of Durkheim, Sorokin, M.N Srinivas and Radha Kamal Mukerjee.
4. Issues of equality of educational opportunity, Equality vs equity in education.
5. Education and Religion : Education and Democracy; Education and Politics.

### **Psychological Foundations of Education:**

1. Development of Concept formation; logical reasoning; problem solving; language development.
2. Major Theories of Learning- Association Theory; Insight Theory; Cognitive Field Theory.
3. Biology of Learning- Implications of findings of Neuroscience.
4. Guilford's Structure of Intellect (SI) and Howard Gardner's Theory of Multiple Intelligence.
5. Personality- Psychoanalytic Approach of Freud, Behavioral Approach of Miller and Bandura, Humanistic Approach of Maslow.

## **Methodology of Educational Research :**

1. Nature and scope of Educational Research.
2. Formulation of Research Problem.
3. Development of Hypothesis in various types of research; Directional and Non- Directional Hypotheses.
4. Probability and Non- Probability Sampling techniques.
5. Characteristics of a good sample and sampling techniques.
6. Variables and their types.
7. Characteristics of a good research tool.
8. Major Approaches to Research- Descriptive Research, Ex- Post Facto Research, Field Studies, Historical Research.
9. Data Analysis- Quantitative and qualitative data, Application of T- Test, F- Test and  $\chi^2$ .
10. Partial and Multiple Correlation.

## **Educational Administration**

1. Taylorism Theory of Educational Administration
2. Human Relation Approach in Administration.
3. Theories of Leadership.
4. Styles of Leadership.
5. Approaches of Educational Planning.
6. Institutional Planning.
7. Modern Supervision.
8. Functions of Supervision.
9. Organizing Supervisory Programme.
10. Implementing Supervisory Programme.

## **Educational Measurement**

1. Educational Measurement and Evaluation- Concept, Scope, Need and Relevance; Essay and Objective Type Tests, Scales, Questionnaires, Schedules and inventory.
2. Reliability and Validity of a test.



3. Steps in Standardization of a test.
4. Measurement of achievement, intelligence and interests.
5. New trends of Measurement and Evaluation- grading, semester, continuous internal assessment and qualitative analysis.

### **Educational Technology**

1. Systems Approach in Educational Technology and its characteristics.
2. Components of Educational Technology : software, hardware and multimedia approach in education.
3. Stages of Teaching - Pre- active, interactive and post active.
4. Modification of Teacher Behaviour : Micro Teaching, Flander's Interaction Analysis System.
5. Models of Teaching- Concept. Different families of teaching models.
6. Analysis and Designing of Instructional Strategies such as : Lecture, Team Teaching, Discussion, Panel Discussion, Seminar and Tutorial.
7. Distance Education and Open Learning.

### **Special Education**

1. Meaning of Special Education, Need of Integrated Education.
2. Characteristics of mentally retarded children and teaching strategies for them.
3. Characteristics of visually impaired, etiology and prevention.
4. Characteristics of hearing impaired, etiology and prevention.
5. Educational Programmes for orthopedically handicapped learners.
6. Identification of Learning Disabled Children and Educational Programmes for them.
7. Identification of Gifted and Creative Children and Educational Programmes for them.
8. Types of Juvenile Delinquents and Educational Programmes for them.

## **Teacher Education**

1. Historical development of Teacher Education in India : Teacher Education in various Commissions.
2. Aims and objectives of Teacher Education at different levels.
3. Pre- Service Teacher Education and its various levels.
4. Teacher Preparation in Specific fields such as : Physical Education, Art and Craft, Music and Special Education.
5. In-service Teacher Education
6. National and state level agencies involved in Teacher Education.
7. National Council for Teacher Education. Its impact on Teacher Education.
8. Problems of Teacher Education.
9. Distance Education System and Teacher Education.
10. Strengthening Teacher Education Programme according to National Policy on Education, 1986.

# 15. Physical Education

## Unit – I

- Introduction and definition, aim and objectives of Physical Education and other terms – health education and recreation.
- Philosophies of Education as applied to Physical Education – Idealism, Naturalism, Realism, Pragmatism, Existentialism, Humanism.
- Biological basis of physical activity – benefits of exercise, growth and exercise, exercise. and well – being sex and age characteristics of adolescent, body types.
- Psychological basis of Physical Education – Play and Play theories, general principles of growth and development, Principles of motor – skill acquisition, transfer of training effects.
- Sociological basis of Physical Education – socialization process, social nature of men and physical activity, sports as cultural heritage of mankind, customs, traditions and sport, competition and cooperation.
- Physical Education in ancient Greece, Rome and Contemporary Germany, Sweden, Denmark, Russia, USA, UK, China and Netherland
- Olympic Movement – Historical development of Ancient and Modern Olympic Games.
- Physical Education and sports in India.

## Unit – II

- Physiology of Muscular activity. Its Neurotransmission and Movement mechanism.
- Physiology of respiration.
- Physiology of blood circulation.
- Factors influencing performance in sports.
- Bioenergetics and recovery process.
- Athletic injuries – their management and rehabilitation.
- Therapeutic modalities.
- Ergogenic aids and doping.

## Unit – III

- Joints and their movements – planes and axes.
- Kinetics, Kinematics-linear and angular, levers.

- Laws of motion, principles of equilibrium, force, spin, projectile and elasticity.
- Posture, Postural deformities and their correction.
- Muscular analysis of Motor movement.
- Mechanical analysis of various sports activities.
- Mechanical analysis of fundamental movements – (running, jumping, throwing, pulling and pushing).
- Massage manipulation and therapeutic exercises.

#### **Unit – IV**

- Learning process – theories and laws of learning.
- Motivation, theories and dynamics of motivation in sports.
- Psychological factors affecting sports performance – viz., stress, anxiety, tension and aggression.
- Personality, its dimensions, theories, personality and performance.
- Individual differences and their impact on skill learning and performance.
- Group dynamics, team cohesion and leadership in sports.
- Sociometrics, economics and politics in sports.
- Media and sports.

#### **Unit – V**

- Development of teacher education in Physical Education.
- Professional courses in Sports and Physical Education in India.
- Professional Ethics.
- Qualities and Qualifications of Physical Educational Personnel.
- Principles of curriculum planning.
- Course content for academic and professional courses.
- Age characteristics of pupils and selection of activities.
- Construction of class and school Physical Education time table.

#### **Unit – VI**

- Health – Guiding principles of health and health education.
- Nutrition and dietary manipulations.
- Health – related fitness, obesity and its management.
- Environmental and occupational hazards and first aid.
- Communicable diseases – their preventive and therapeutic aspect.
- School health program and personal hygiene.
- Theories and principles of recreation.

- Recreation program for various categories of people.

## **Unit – VII**

- Sport training: Meaning, Characteristics, objectives and its principles.
- Training load, principles of load, over load their characteristics and symptoms.
- Periodization: its types and planning.
- Training methods and specific training programme for development of speed, strength, endurance and flexibility .
- Technical and Tactical preparation for sports (team sports, combat sports and racquets sports).
- Short-term and long – term training plans.
- Sports talent identification – process and procedures.
- Preparing for competition – ( build up competitions, main competition, competition frequency, psychological preparation ).
- Rules of Games and Sports and their interpretations.

## **Unit – VIII**

- Research: Meaning, Nature, scope, types and importance of research in physical education and sports.
- Formulation and selection of research problem. Major areas of Research in physical education and sports.
- Sampling – process and techniques.
- Methods of research.
- Hypothesis – formulation, types and testing.
- Data collection – tools and techniques.
- Statistical techniques of data analysis – measures of central tendency and variability, correlation, normal probability curve, t – test and f – tests, chi – square, z – test.
- Writing research report.

## **Unit – IX**

- Concept of Test, measurement and evaluation.
- Principles of measurement and evaluation
- Construction and classification of Tests.
- Criteria of test evaluation. (Reliability, validity, objectivity, norms)

- Concepts and assessment of physical fitness, motor fitness, motor ability and motor educability.
- Skill test for Badminton, Basket ball, Hockey, Lawn – tennis, Soccer, Volley ball.
- Testing psychological variables – competitive anxiety, aggression, team cohesion, motivation, self – concept.
- Anthropometric measurements and body composition.

### **Unit – X**

- Concept and principles of management.
- Organization and functions of sports bodies.
- Intramurals and Extramurals.
- Management of infrastructure, equipments, finance and personnel.
- Methods and Techniques of teaching.
- Principles of planning Physical Education lessons.
- Pupil – teacher interaction and relationship.
- Concept of techniques of supervision.

### **Unit – XI**

- Sports personalities.
- Current sports affairs.
- Sports awards in India.
- Major sports tournaments.
- Sports in Uttarakhand.

## 16.Commerce

### Unit – I :Business Environment

- Meaning and Elements of Business Environment.
- Economic environment, Economic Policies, Economic Planning.
- Legal environment of Business in India, Competition policy including Competition Act 2002, Consumer protection, Environment protection, FEMA, Corporate Social Responsibility in India.
- Policy Environment : Liberalization Privatisation and Globalisation, Second generation reforms, Industrial policy and implementation. Industrial growth and structural changes.

### Unit – II :Financial & Management Accounting

- Basic Accounting concepts, Capital and Revenue, Financial statements, Accounting Standards in India.
- Partnership Accounts : Admission, Retirement, Death, Dissolution and Cash Distribution.
- Advanced Company Accounts : Issue, forfeiture, Purchase of Business, Liquidation, Valuation of shares, Amalgamation, Absorption and Reconstruction, Holding Company Accounts.
- Cost and Management Accounting : Ratio Analysis, Funds Flow Analysis, Cash Flow Analysis, Marginal costing and Break-even analysis, Standard costing, Budgetary control, Costing for decision-making, Responsibility Accounting, Human Resource Accounting, Social Accounting, Inflation accounting.

### Unit – III : Business Economics

- Nature and uses of Business Economics, Concept of Profit and Wealth maximization. Demand Analysis and Elasticity of Demand, Indifference Curve Analysis.
- Utility Analysis and Laws of Returns and Law of variable proportions.
- Cost, Revenue, Price determination in different market situations : Perfect competition, Monopolistic competition, Monopoly, Price discrimination and Oligopoly, Pricing strategies.

### Unit-IV :Business Statistics & Data Processing

- Data types, Data collection and analysis, sampling, need, errors and methods of sampling, Normal distribution, Hypothesis testing, Analysis and Interpretation of Data.
- Correlation and Regression, small sample tests : t-test, F-test and chi-square test.
- Data processing : Elements, Data entry, Data processing and Computer applications.
- Computer Application to Functional Areas : Accounting, Inventory control, Marketing.

### Unit – V : Business Management

- Nature, Significance and Principles of Management.
- Planning : Objectives, Strategies, Planning process, Decision-making.
- Organising, Organisational structure, Formal and Informal organisations, Organisational culture.
- Staffing
- Leading : Motivation, Leadership, Committees, Communication.
- Controlling
- Corporate Governance and Business Ethics.

### **Unit – VI :Marketing Management**

- The evolution of marketing, Concepts of marketing, Marketing mix, Marketing environment, Customer Relationship Management, Social marketing and E-Marketing.
- Consumer behaviour, Market segmentation.
- Product decisions
- Pricing decisions
- Distribution decisions
- Promotion decisions
- Marketing planning, Organising and Control.

### **Unit – VII :Financial Management**

- Capital Structure, Financial and Operating leverage.
- Cost of capital, Capital budgeting.
- Working capital management
- Dividend Policy
- Regulatory Authorities: SEBI, Rating Agencies, New Instruments: GDRs, ADRs.

### **Unit – VIII : Human Resources Management**

- Concepts, Role and Functions of Human Resource management, Human Resource Audit.
- Human Resource Planning, Job analysis, Job description and Job specifications. Recruitment and Selection.
- Training and Development, Succession Planning.
- Compensation : Wage and Salary Administration, Incentive and Fringe benefits, Morale and Productivity.
- Performance Appraisal
- Industrial Relations in India, Health, Safety, Social security and welfare, Workers' Participation in Management.

### **Unit – IX : Banking and Financial Institution**

- Importance of Banking to Business, Types of Banks and Their Functions, Reserve Bank of India, NABARD and Rural Banking.
- Banking Sector Reform in India, NPA, Capital adequacy norms, Basel Norms.



- E-banking
- Development Banking : IDBI, IFCI, SFCs, UTI, SIDBI.

### **Unit – X : International Business**

- Theoretical foundations of international business, Balance of Payments.
- International liquidity, International Economic Institutions : IMF, World Bank, IFC, IDA, ADB.
- World Trade Organisation-its functions and policies.
- Structure of India's foreign trade : Composition and direction, EXIM Bank, EXIM Policy of India, Regulation and promotion of Foreign Trade.
- Foreign Direct Investment and Multinational Corporations- MNCs Culture, MNCs and LDCs, Joint ventures.
- Regional Economic Integration: SAARC, ASEAN, EC, NAFTA.

### **Unit – XI : Income Tax Law and Tax Planning**

- Basic concepts, Residential status and tax incidence, exempted incomes, computation of taxable income under various heads.
- Computation of taxable income of individuals and firms.
- Deduction of tax, filing of returns, different types of assessment; Defaults and penalties.
- Tax Planning : Concept, significance and problems of tax planning, Tax evasion and tax avoidance, methods of tax planning.

### **Unit- XII : Legal aspects of Business**

- Companies Act, 2013- Administration of company law, Procedure of formation of a company, Buy-back of shares, insider trading and whistle Blowing.
- Information Technology Act- Major Provisions.

## 17. B.Ed (Technical Course)

नोट : कोर पाठ्यक्रम से 50 प्रश्न सभी के लिए अनिवार्य होगा। इसके अतिरिक्त शेष 50 प्रश्न संबंधित विषय क्षेत्र से होगा।

### Core Syllabus

1. Methods and functions of Educational Psychology.
2. Piaget's Theory of Cognitive development and Bruner's Theory of Cognitive Development.
3. Theories of Intelligence- Spearman's Two- factor Theory, Thorndike's Multi-Factor Theory and Thurston Primary Mental Abilities (PMA).
4. Projective Techniques of personality measurement.
5. Functions of education at individual, social and national levels.
6. Constitutional promises of freedom, justice, equality and secularism.
7. Privatization and universal elementary education.
8. Right to Education, Sarva Siksha Abhiyan, RMSA and RUSA
9. Innovations in Teaching- Micro Teaching, Programmed Instruction, Computer Assisted Learning.
10. Principles of curriculum construction – Importance of co-curricular activities.
11. Identification of teaching skills and their educational implications.
12. Difference between hardware and software technology; their role in modern educational practices.
13. Taxonomy of educational objectives in Cognitive domain; writing objectives in behavioral terms.

### B.Ed (Technical Course)

#### A-Social Studies

1. Objectives and concept of social studies.
2. Significance of social studies for national and international understanding.
3. Pedagogical approaches to teaching of social studies.
4. Audio- visual aids in social studies and their advantages.
5. Library and laboratory in teaching of social studies.
6. Construction of social studies curriculum.
7. Characteristics of a good social studies textbook.
8. Issues related to Equality, Socialism, Secularism.
9. Rights of Dalits, tribes, minorities, disabled children, women and children.

10. Directive principles of the state policy for the welfare of the people.
11. Action research; utility; steps of action research.
12. Comprehensive and continuous evaluation in social studies.
13. Criteria of a good examination.

### **B -B.Ed (हिन्दी)**

1. भाषा की परिभाषा, हिन्दी भाषा के विविध रूप, पाठ्यक्रम में हिन्दी का महत्त्व।
2. भाषा शिक्षण के सामान्य सिद्धान्त एवं शिक्षण विधियां।
3. हिन्दी भाषा शिक्षण के उद्देश्य।
4. लिखने के चरण तथा औपचारिक एवं अनौपचारिक लेखन।
5. हिन्दी पाठ्य पुस्तक की आवश्यकता व महत्त्व।
6. हिन्दी भाषा शिक्षण में भाषा प्रयोगशाला का प्रयोग व उपयोगिता
7. हिन्दी भाषा के पढ़ने व पढ़ाने की चुनौतियां।
8. संविधान में हिन्दी भाषा का स्थान।
9. राष्ट्रीय शिक्षा नीति (1986) व राष्ट्रीय पाठ्यक्रम (2005) में हिन्दी का स्थान।
10. भाषा सीखने-सिखाने की बहुभाषिक दृष्टि- (जे. प्याजे., चॉम्स्की, पाणिनी तथा किशोरीदास वाजपेयी),
11. हिन्दी शिक्षण में मूल्यांकन, अच्छे परीक्षण की विशेषता
12. भाषा शिक्षण की प्रचलित प्रणालियां।

### **B.Ed**

### **C- (English)**

1. Nature of language, language and society, importance of English for India.
2. Objectives of teaching English in schools.
3. Literature in school curriculum.
4. Principles of teaching English.
5. English morphology, syntax and kinds of sentences.
6. Methods of teaching English : Translation- cum- Grammar Method; Direct Method; West's New Method.
7. Approaches for teaching English- Structural Approach and Situational Approach.

8. Causes of faulty pronunciation and poor spelling.
9. Use of audio- visual aids in teaching English.
10. Language laboratory and its use in teaching English.
11. Role of mother tongue in teaching English.
12. Action research for problems of English teaching.
13. Continuous and comprehensive evaluation.

#### **D- B.ED (Mathematics)**

1. Importance of Mathematics as a school subject.
2. Objectives of teaching Mathematics.
3. Pedagogical Approaches for teaching Mathematics- Inductive, deductive; analytical, synthetic; heuristic method.
4. Techniques used in teaching Mathematics- drills- assignment, question-answer and self study.
5. Teaching aids in Mathematics teaching.
6. Mathematics laboratory for recreational mathematics.
7. Principles of curriculum construction and types of mathematical problems.
8. Qualities of a good textbook in Mathematics.
9. Developing speed and accuracy in mathematics.
10. Role of hypothesis, axioms, postulates and assumptions in teaching geometry.
11. Qualities of a good mathematics test.
12. Continuous and comprehensive evaluation.
13. Action research in mathematics.

#### **E- B.Ed (Science)**

1. Objectives of teaching Science in schools.
2. Importance of teaching Science in schools.
3. Scientific methods/strategies- observation, enquiry, experimentation, demonstration, laboratory method and generalization with illustrations.
4. Use of ICT in Science.
5. Video clips, power point presentation.
6. Importance of textbook and other publications in science teaching.

7. Importance of Science clubs, Science museums, Science fairs and excursions.
8. Need and importance of science laboratory and its organization.
9. Action research in Science teaching.
10. Importance of continuous and comprehensive evaluation in Science teaching.
11. Characteristics of a good examination system.
12. Audio-visual aids in Science teaching.
13. Use of Piagetian, Brunerian and Gagnesian principles in developing lesson- plan.

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## 18. CHEMISTRY

नोट : प्रत्येक भाग से बराबर-बराबर प्रश्न रखे जायेंगे। प्रत्येक भाग से सभी अभ्यर्थियों द्वारा प्रश्न हल किया जाना अनिवार्य होगा।

### INORGANIC CHEMISTRY

1. Chemical periodicity.
2. Structure and bonding in homo and hetero molecules, including shapes of molecules (VSEPR Theory).
3. Concepts of acids and bases, Hard- Soft acid base concept. Symbiosis, theoretical basis of hardness and softness, electronegativity and hardness and softness.
4. Chemistry of the main group elements and their compounds. Allotropy, synthesis, structure and bonding, industrial importance of the compounds.
5. Chemistry of transition elements, transition metal complex and coordination compounds: bonding theories, spectral and magnetic properties and reaction mechanism. Spin crossover in coordination compounds.
6. Inner transition elements: spectral and magnetic properties, analytical applications.
7. Organometallic Compounds: Nomenclature and classification based on nature of metal-carbon bond. Metal Carbonyls. EAN and 18- electron rule. Organometallics in homogeneous catalysis.
8. Cages and metal clusters.
9. Analytical Chemistry: Separation techniques, spectroscopic, electro and thermo analytical methods.
10. Bioinorganic Chemistry: Role of metal ions in biology, essential and trace elements in biological systems. Photosystems, porphyrins, metallozymes, oxygen transport, electron transfer reactions, biological nitrogen fixation, metal complexes in medicines.
11. Physical Characterisation of inorganic compounds by IR, Raman, NMR, EPR, Mossbauer, UV-Vis, NQR, MS, electron spectroscopy and microscopic techniques.
12. Nuclear Chemistry: Nuclear reactions, radio analytical techniques and activation analysis.
13. Supramolecular Chemistry.

### PHYSICAL CHEMISTRY

1. Basic principles and applications of quantum mechanics, hydrogen atom, angular momentum.
2. Approximate methods of quantum mechanics: variational principle, perturbation theory up to second order in energy, applications.
3. Basics of atomic structure, electronic configuration, shapes of orbitals, hydrogen atom spectra.
4. Theoretical treatment of atomic structures and chemical bonding.

5. Chemical applications of group theory, symmetry elements, point groups, character tables, selection rules.
6. Basic principles and application of spectroscopy: rotational, vibrational, electronic, Raman, ESR and NMR.
7. Chemical thermodynamics.
8. Phase equilibria.
9. Statistical thermodynamics: Boltzmann distribution, kinetic theory of gases, partition functions and their relation to thermodynamic quantities- calculations for model systems.
10. Chemical equilibria.
11. Electrochemistry: Nernst equation, electrode Kinetics, electrical double layer.
12. Chemical Kinetics: Empirical rate laws, Arrhenius equation, theories of reaction rates, determination of reaction mechanisms, experimental methods for fast reactions.
13. Concepts of catalysis.
14. Polymer Chemistry: Molecular weights and their determinations, kinetics of chain polymerization.
15. Solids: Structural Classification of binary and ternary compounds, diffraction techniques, bonding, thermal, electrical and magnetic properties.
16. Colloids and surface phenomena.
17. Data analysis.
18. Nano Chemistry: Scope of nanomaterials, methods of preparations, characterization, determination of particle size and surface structure.

## ORGANIC CHEMISTRY

1. IUPAC nomenclature of organic compounds including regio and stereoisomers.
2. Principles of stereochemistry, conformational analysis, isomerism and chirality, reactive intermediates and organic reaction mechanisms.
3. Concept of aromaticity.
4. Pericyclic and other related concerted reactions.
5. Name reactions: Vilsmeier reaction, Sharpless asymmetric epoxidation, Stobbe reaction, Heck reaction, Still reaction, Sonogashira and Negishi coupling. Barton reaction and Favorskii reaction.
6. Transformations and rearrangements.
7. Principles and applications of organic photochemistry. Free radical reactions.
8. Reactions involving nucleophilic carbon intermediates.
9. Oxidation and reduction of functional groups.
10. Common reagents (organic, inorganic and organometallic) in organic synthesis.
11. Chemistry of natural products such as steroids, alkaloids, terpenoids, peptides, nucleic acids and carbohydrates.

12. Selective organic transformations: Chemo selectivity, regioselectivity, stereoselectivity, enantioselectivity, protecting groups.
13. Chemistry of aromatic and aliphatic heterocyclic compounds.
14. Physical characterization of organic compounds by IR, UV-Vis, MS and NMR spectroscopy.
15. Green Chemistry: Basic principles, green reagents, green catalyst, phase transfer catalysis for green synthesis, choice of starting material.
16. Medicinal Chemistry: Development of new drugs, structure-activity relationship (SAR), Quantitative Structure activity relationship (QSAR). Chemistry of Antineoplastic agents and cardiovascular drugs.

Environmental Chemistry: Concept and scope, terminology and nomenclature, Environmental segments, Aerosols, photo chemical smog, BOD and COD.

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## **19. PHYSICS**

### **I. Mathematical Methods of Physics**

Vector algebra and vector calculus (Triple product), Gauss, Stokes and Green's theorem, Matrices: orthogonal, unitary and Hermitian matrices, Eigen values and eigen vectors of matrices, Matrix diagonalization, Cayley - Hamilton Theorem, Eigen value problem, Ordinary differential equations of second order, Special functions (Legendre, Bessel, Hermite and Laguerre functions), Fourier series, Fourier and Laplace transforms, Elements of complex analysis, Laurent series - poles, residues and evaluation of integrals, Tensor: covariant, contravariant and mixed tensors, Epsilon, Christoffel and Ricci tensor, Elements of computational techniques: roots of functions, interpolation, extrapolation, integration by trapezoid and Simpson rule, solution of first order differential equations using Runge – Kutta method, finite difference methods, Elementary probability theory, random variables, binomial, Poisson and normal distributions. Central limit theorem.

### **II. Classical Mechanics**

Newton's laws, D' Alembert's principle, Central force motions, Kepler's laws and equations, Artificial Satellite, Lagrange and Poisson bracket, Canonical transformations, Hamilton – Jacobi equation, Action angle variable, Lagrangian and Hamiltonian formalism and equations of motion, Two body Collisions - scattering in laboratory and Centre of mass frames, Rigid body dynamics - moment of inertia tensor, Non - inertial frames and pseudo forces, Variational principle, Generalized coordinates, Invariance and conservation laws and cyclic

coordinates, Periodic motion: small oscillations and normal modes, Special theory of relativity - Lorentz transformations, relativistic kinematics and mass-energy equivalence, Idea of four – vectors.

### **III. Electromagnetic Theory**

Electrostatics: Gauss's law and its applications, Laplace and Poisson equations, Magnetostatics: Biot - Savart law, Ampere's theorem, Electromagnetic induction, Maxwell's equations in free space and linear isotropic media; boundary conditions on the fields at interfaces, Scalar and vector potentials, gauge invariance, Electromagnetic waves in free space. Poynting vector, Poynting theorem, energy and momentum of electromagnetic waves, four - vector potential, electromagnetic field tensor, Lorentz invariance, Lorentz force, covariant form of Maxwell's equation, Dielectrics and conductors, Reflection and refraction, polarization, Fresnel's law, interference, coherence and diffraction, Dispersion relation in plasma, Dynamics of charged particles in static and uniform electromagnetic fields, Radiation from moving charges, dipoles and retarded potentials.

### **IV. Quantum Mechanics**

Wave - particle duality, Wave functions in coordinate and momentum representations, Commutator and Heisenberg's uncertainty principle, Dirac's notation for state vectors, Schrödinger equation (time - dependent and time - independent), Eigen value problems (particle in a box, harmonic oscillator, etc.), Tunneling through a barrier, Motion in a central potential: orbital angular momentum, angular momentum algebra, spin, addition of angular momenta;

Hydrogen atom, spin – orbit coupling, fine structure, Time - independent perturbation theory and applications, Variational method, WKB approximation, Time dependent perturbation theory and Fermi's golden rule, selection rules, Semi classical theory of radiation, Elementary theory of scattering, phase shifts, partial waves, Born approximation Identical particles, Pauli Exclusion Principle, spin -statistics connection. Relativistic quantum mechanics: Klein - Gordon and Dirac equations and their applications.

## V. **Thermodynamic and Statistical Physics**

Laws of thermodynamics and their consequences, Thermodynamic potentials, Maxwell relations, chemical potential, phase equilibria, Phase space, micro - and macro - states. Micro - canonical, canonical and grand - canonical ensembles, partition functions, Free energy and its connection with thermodynamic quantities, phase transitions, Maxwell – Boltzmann, Bose – Einstein and Fermi – Dirac Statistics, Degeneracy in Bose and Fermi gases, Liquid – Helium and electron gas in metals, Black body radiation and Plank distribution law.

## VI. **Electronics**

Semiconductor devices (diodes, junctions, transistors, field effect devices, homo- and hetero-junction devices), device structure, device characteristics, amplifier and oscillator circuits, frequency dependence and applications, Opto - electronic devices (solar cells, photo - detectors, LEDs). Operational amplifiers and their applications, Number system: binary, octal, hexadecimal, BCD code, Gray code, Boolean algebra, De Morgan's law, Logic circuits: OR- gate, AND- gate, NOT- gate, NAND - gate, NOR - gate and XOR - gate, Digital techniques and

applications (registers, counters, comparators and similar circuits), Flip –Flops: RS, JK, master slave JK, T – type and D – type flip – flops, Binary adders, half adders, full adders, decoders, multiplexers, encoders, digital comparator, Parity checker and generators, A/D and D/A converters, Microprocessor and microcontroller basics, Computer and communications, Need for communication networks, Internet, World Wide Web, Communication protocols, Local Area Network.

## **VII. Atomic & Molecular Physics**

Quantum states of an electron in an atom. Electron spin, Hund's rule, Pauli exclusion principle, Stern - Gerlach experiment, Spectrum of hydrogen, helium and alkali atom. Electric dipole transitions and selection rules, Relativistic corrections for energy levels of hydrogen atom, hyperfine structure and isotopic shift, width of spectrum lines, LS and JJ couplings, Zeeman, Paschen - Bach and Stark effect, X- ray spectroscopy, Electron spin resonance, Nuclear magnetic resonance, chemical shift, Born - Oppenheimer approximation, Electronic, rotational, vibrational and Raman spectra of diatomic molecules, Frank – Condon principle and selection rules, Lasers: spontaneous and stimulated emission, Einstein A and B coefficients, Optical pumping, population inversion, rate equation, Modes of resonators and coherence length.

## **VIII. Condensed Matter Physics**

Bravais lattices. Reciprocal lattice, Diffraction and the structure factor, Bonding of solids, Elastic properties, phonons, lattice specific heat, Free electron theory and electronic specific heat, Response and relaxation phenomena, Drude model

of electrical and thermal conductivity, Transport properties, optical, dielectric and magnetic properties of solids, Hall Effect and thermoelectric power, Diamagnetism, paramagnetism and ferromagnetism, Electron motion in a periodic potential, band theory of solids: metals, insulators and semiconductors, Superconductivity: type-I and type-II superconductor, Josephson junction, Superfluidity, Defects and dislocations, Ordered phases of matter: translational and orientational order, kinds of liquid crystalline order, Quasi crystals.

### **IX. Nuclear and Particle Physics**

Basic nuclear properties: size, shape and charge distribution, spin and parity, Binding energy, semi - empirical mass formula, liquid drop model, Nature of the nuclear force, form of nucleon - nucleon potential, charge - independence and charge - symmetry of nuclear forces, Isospin, Deuteron problem, Evidence of shell structure, single - particle shell model, its validity and limitations, Rotational spectra, Elementary ideas of alpha, beta and gamma decays and their selection rules, Fission and fusion, Nuclear reactions, reaction mechanism, compound nuclei and direct reactions, Particle accelerators and detectors: Ionization counter, Geiger Muller counter, Scintillation counter, Classification of elementary particles (quarks, baryons, mesons, leptons), Fundamental interactions, Elementary particles and their quantum numbers (charge, spin, parity, isospin, strangeness, hypercharge etc.), symmetries and conservation laws, Lepton and Baryon numbers, Gellmann - Nishijima formula, Quark model, SU(2) and SU(3) symmetries, Hadron structure in quarks, Parity, Time reversal and charge conjugation, Parity violation in weak interaction, CP - violation and CPT invariance.

## **20. ZOOLOGY**

1. Diversity of animal life
2. Cytology and molecular biology
3. Inheritance biology
4. Evolution and animal behavior
5. Applied biology
6. Animal physiology and endocrinology
7. Animal ecology
8. Molecules and their interactions
9. Developmental biology of animals
10. Vertebrate osteology
11. Methods in biology

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## 1- Diversity of animal life

### I. Principles and methods of taxonomy:

- i. Concepts of species and hierarchal taxa.
- ii. Biological nomenclature
- iii. Classical and quantitative methods of taxonomy of animals.
- iv. Evolutionary relationships among taxa.

### A- Non Chordata

#### Protozoa

- i. General characteristics of Protozoa
- ii. Protozoa: locomotion, reproduction, osmoregulation in Protozoa
- iii. Disease causing protozoan: *Plasmodium*, *Entamoeba*

#### Porifera

- i. General characteristics of Porifera.
- ii. Canal system in Porifera.
- iii. Organization and affinities in Porifera.

#### Coelenterata

- i. General characteristics of Coelenterata
- ii. Polymorphism in Coelenterata

#### Platyhelminthes

- i. General characteristics of Platyhelminthes
- ii. Parasitic adaptations.
- iii. Life History and pathogenicity of *Fasciola hepatica*, *Taenia solium*

#### Aschelminthes

- i. General characteristics of Aschelminthes
- ii. Life history and pathogenicity of *Ascaris lumbricoides*.

#### Annelida

- i. General characteristics of Annelida.
- ii. Adaptive radiations.
- iii. Segmental organs.

#### Arthropoda

- i. General characteristics of Arthropoda
- ii. Larval forms of Crustacea.
- iii. Mouth parts of insects.
- iv. Social life in wasps, ants and termites.

#### Mollusca

- i. General characteristics of Mollusca
- ii. Torsion in gastropods.

#### Echinodermata

- i. General characteristics of Echinodermata.
- ii. Water vascular system.

### B- Chordata

- i. General characteristics, organization and affinities of Hemichordata, Cephalochordata and Urochordata.
- ii. General organization and affinities of Ostrachoderms, Dipnoi and Holocephali.

- iii. **Amphibia:** Origin of tetrapods, general characteristics of Amphibia and parental care.
- iv. **Reptilia:** General characteristics and origin of reptiles, affinities of Rhynchocephalia and Crocodelia, poisonous and non-poisonous snakes of India, venom and anti-venom.
- v. **Aves:** General characteristics, migration and flightless birds.
- vi. **Mammalia:** Origin and evolution of mammals, dentition in mammals and affinities of Prototheira and Metatheria.

## 2- Cytology and molecular biology

- I. **Structure, organization and functions of animal cell organelles:** Nucleus, mitochondria, Golgi bodies, lysosomes, endoplasmic reticulum, peroxisomes and ribosomes.
- II. **Membrane structure and functions:** Structure of model membrane, lipid bilayer and membrane protein diffusion, osmosis, ion channels, active transport, membrane pumps, mechanism of sorting and regulation of intracellular transport, electrical properties of membranes.
- III. **Chromosomes:** Structure and types of eukaryotic chromosomes
- IV. **Cell Division and Cell Cycle:** Mitosis and meiosis, their regulation, steps in Cell cycle, regulation and control of cell cycle.
- V. **Molecular structure of DNA and RNA:** DNA replication, repair and recombination, unit of replication, enzymes involved, replication origin and replication fork, fidelity of replication, extra-chromosomal replication, DNA damage and repair mechanism, homologous and site specific recombinations.
- VI. **RNA synthesis and processing:** Transcription factors and machinery, formation of initiation complex, transcription activator and repressor, RNA polymerases, capping, elongation, and termination, RNA processing, RNA editing, splicing, and polyadenylation, structure and function of different types of RNA, RNA transport).
- VII. **Protein synthesis and processing:** Ribosome, formation of initiation complex, initiation factors and their regulation, elongation and elongation factors, termination, genetic code, aminoacylation of tRNA, tRNA-identity, aminoacyl tRNA synthetase, and translational proof-reading, translational inhibitors, post-translational modification of proteins.
- VIII. **Control of protein synthesis.**
- IX. **Control of gene expression at transcription and translation level:** Regulating the expression of phages, viruses, prokaryotic and eukaryotic genes, role of chromatin in gene expressing and gene silencing.
- X. **Cell signaling:** Hormones and their receptors, cell surface receptor, signaling through G-protein coupled receptors, signal transduction pathways, second messengers, regulation of signaling pathways, bacterial and plant two-component systems, bacterial chemotaxis and quorum sensing.
- XI. **Cancer:**  
Genetic rearrangements in progenitor cells, oncogenes, tumor suppressor genes, cancer and the cell cycle, virus-induced cancer, metastasis, interaction of cancer cells with normal cells, apoptosis, therapeutic interventions of uncontrolled cell growth.



### 3- INHERITANCE BIOLOGY

- A) **Mendelian principles** : Dominance, segregation, independent assortment.
- B) **Concept of gene** : Allele, multiple alleles, pseudoallele, complementation tests
- C) **Extensions of Mendelian principles** : Codominance, incomplete dominance, gene interactions, pleiotropy, genomic imprinting, penetrance and expressivity, phenocopy, linkage and crossing over, sex linkage, sex limited and sex influenced characters.
- D) **Gene mapping methods** : Linkage maps, tetrad analysis, mapping with molecular markers, mapping by using somatic cell hybrids.
- E) **Extra chromosomal inheritance** : Inheritance of Mitochondrial genes, maternal inheritance.
- F) **Microbial genetics** : Methods of genetic transfers – transformation, conjugation, transduction and sex-duction, mapping genes by interrupted mating, fine structure analysis of genes.
- G) **Human genetics** : Pedigree analysis, lod score for linkage testing, karyotypes, genetic disorders.
- H) **Quantitative genetics** : Polygenic inheritance, heritability and its measurements, QTL mapping.
- I) **Mutation** : Types, causes and detection, mutant types – lethal, conditional, biochemical, loss of function, gain of function, germinal versus somatic mutants, insertional mutagenesis.
- J) **Structural and numerical alterations of chromosomes** : Deletion, duplication, inversion, translocation, ploidy and their genetic implications.
- K) **Recombination** : Homologous and non-homologous recombination including transposition.

### 4- EVOLUTION AND ANIMAL BEHAVIOUR

- A. Emergence of evolutionary thoughts  
Lamarck; Darwin–concepts of variation, adaptation, struggle, fitness and natural selection; Mendelism; Spontaneity of mutations; The evolutionary synthesis, evidences of organic evolution.
- B. Origin of cells and unicellular evolution:  
Origin of basic biological molecules; abiotic synthesis of organic monomers and polymers; concept of Oparin and Haldane; experiment of Miller (1953); the first cell; evolution of prokaryotes; origin of eukaryotic cells; evolution of unicellular eukaryotes; anaerobic metabolism, photosynthesis and aerobic metabolism.
- C. Paleontology and evolutionary history:  
The evolutionary time scale; eras, periods and epoch; Major events in the evolutionary time scale; origins of unicellular and multi cellular organisms; major groups of animals; major fossil records, evolution of horse, elephant and man.
- D. Molecular evolution:  
Concepts of neutral evolution, molecular divergence and molecular clocks; molecular tools in phylogeny, classification and identification; protein and nucleotide sequence analysis; origin of new genes and proteins; gene duplication and divergence.

- E. The mechanisms:  
Population genetics: populations, gene pool, gene frequency; Hardy-Weinberg law; concepts and rate of change in gene frequency through natural selection, migration and random genetic drift; adaptive radiation; isolating mechanisms; speciation; allopatricity and sympatricity; convergent evolution; sexual selection; co-evolution.
- F. Brain, behavior and evolution:  
Approaches and methods in study of behavior; proximate and ultimate causation; altruism and evolution-group selection, kin selection, reciprocal altruism; neural basis of learning, memory, cognition, sleep and arousal: biological clocks: development of behavior: chemical, visual, light and audio communication in animals: Use of space and territoriality: mating systems, parental care: aggressive behavior; habitat selection and optimality in foraging; migration, orientation and navigation; domestication and behavioral changes, social organization in insects.

#### 5- **APPLIED BIOLOGY:**

- a. Microbial fermentation and production of small and macro molecules.
- b. Application of immunological principles, vaccines, diagnostics. Tissue and cell culture methods for animals.
- c. Transgenic animals, molecular approaches in diagnosis and strain identification.
- d. Genomics and its application to health and agriculture, including gene therapy.
- e. Bio-resources and uses of biodiversity.
- f. Breeding in plants and animals, including marker – assisted selection
- g. Bioremediation and phytoremediation
- h. Biosensors
- i. Common parasites and pathogens of humans and domestic animals.
- j. A brief study of silk culture, apiculture, lac culture, vermiculture, pearl culture and fish culture.
- k. Insects used in medicines, bio-control and food.
- l. Integrated pest management.

#### 6- **ANIMAL PHYSIOLOGY AND ENDOCRINOLOGY**

- A. Blood and circulation** - Blood corpuscles, haemopoiesis and formed elements, plasma function, blood volume, blood volume regulation, blood groups, hemoglobin, immunity, haemostasis, coagulation of blood.
- B. Cardiovascular System:** Comparative anatomy of heart structure, myogenic heart, specialized tissue, ECG – its principle and significance, cardiac cycle, heart rate, stroke volume and cardiac output, blood pressure, neural and chemical regulation of heart.
- C. Respiratory system** - Comparison of respiration in different species, anatomical considerations, transport of gases, exchange of gases, respiratory quotient, waste elimination, neural and chemical control of respiration.

- D. Nervous system** –Gross neuroanatomy of the brain and spinal cord, central and peripheral nervous system, structure and types of neurons, origin and transmission of nerve impulse through axon and synapse. Action potential, neurotransmitters, neuro-inhibitors and reflexes.
- E. Sense organs** - Vision, hearing and tactile response, chemo receptors.
- F. Excretory system** - Comparative physiology of excretion, kidney, types of nitrogenous wastes in animals, urine formation and urine concentration, regulation of water balance, blood volume, blood pressure, electrolyte balance, acid-base balance and hormonal control of urine formation.
- G. Thermoregulation** - Comfort zone, body temperature – physical, chemical, neural regulation, acclimatization.
- H. Enzymes and vitamins:** Types of enzymes and vitamins and their role in human physiology.
- I. Digestive system** - Digestion, absorption, energy balance, BMR.
- J. Muscular system** – Types of muscles, physiology of muscle contraction and single muscle twitch.
- K. Endocrinology and reproduction** – Classification of hormones, endocrine glands, their secretions and functions, basic mechanism of hormone action, hormones and diseases, gametogenesis, ovulation, neuroendocrine regulation, hormonal regulation of carbohydrates, lipids, proteins, nucleic acids and metabolism: reproductive cycles in vertebrates and hormonal control
- L. Innate and adaptive immune system** Cells and molecules involved in innate and adaptive immunity, antigens, antigenicity and immunogenicity. B and T cell epitopes, structure and function of antibody molecules. generation of antibody diversity, monoclonal antibodies, antibody engineering, antigen-antibody interactions, MHC molecules, antigen processing and presentation, activation and differentiation of B and T cells, B and T cell receptors, humoral and cell-mediated immune responses, primary and secondary immune modulation, the complement system, toll-like receptors, cell-mediated effector functions, inflammation, hypersensitivity and autoimmunity, immune response during bacterial (tuberculosis), parasitic (malaria) and viral (HIV) infections, congenital and acquired immunodeficiencies, vaccines.

## 7- ANIMAL ECOLOGY

**The environment:** Physical environment; biotic environment; biotic and abiotic factors and their interactions.

**Habitat and niche:** Concept of habitat and niche; niche width and overlap; fundamental and

realized niche; resource partitioning; character displacement.

**Population ecology:** Characteristics of a population; population growth curves; population regulation; life history strategies ( $r$  and  $K$  selection); concept of metapopulation – demes and dispersal, interdemic extinctions, age structured populations.

**Species interactions:** Types of interactions, intra-specific and inter-specific competition, herbivory, carnivory, symbiosis.

**Community ecology:** Nature of communities; community structure and attributes; levels of species diversity and its measurement; edges and ecotones.

**Ecological succession:** Types; mechanisms; changes involved in succession; concept of climax.

**Ecosystem ecology:** Ecosystem structure; ecosystem function; energy flow and mineral cycling (carbon, nitrogen, oxygen and phosphorus); food chain, food web and ecological pyramids, primary production and decomposition; structure and function of some Indian ecosystems: terrestrial (forest, grassland) and aquatic (fresh water, marine, eustarine).

**Biogeography:** Major terrestrial biomes; theory of island biogeography; bio-geographical zones of India.

**Applied ecology:** Global environmental change; biodiversity: status, monitoring and documentation; major drivers of biodiversity change; biodiversity management approaches.

**Conservation biology:** Principles of conservation, major approaches to management of natural resources, conservation/management strategy (project tiger, project elephant, national parks, sanctuaries and biosphere reserves ) in India.

**Environmental pollution:** noise, air, water and soil pollution, their sources and control measures: acid rains, global warming, green house effect and depletion of ozone layer.

**Ecological adaptations in vertebrates.**

## 8- MOLECULES AND THEIR INTERACTIONS

- A. Structure of atoms, molecules and chemical bonds.
- B. Composition, structure and function of biomolecules (carbohydrates, lipids, proteins, nucleic acids and vitamins).
- C. Stabilizing interactions (Van der Waals, electrostatic, hydrogen bonding, hydrophobic interaction).
- D Principles of biophysical chemistry (pH, buffer, reaction kinetics, thermodynamics, colligative properties).
- E. Bioenergetics, glycolysis, oxidative phosphorylation, coupled reaction, group transfer, biological energy transducers.
- F. Conformation of proteins (Ramachandran plot, secondary structure, domains, motif and folds).
- G. Conformation of nucleic acids (helix (A, B, Z), t-RNA, micro-RNA).
- H. Stability of proteins and nucleic acids.
- I. Metabolism of carbohydrates, lipids, amino acids nucleotides and vitamins.

## 9- DEVELOPMENTAL BIOLOGY OF ANIMALS

**A) Basic concepts of development :** Potency, commitment, specification, induction, competence, determination and differentiation; morphogenetic gradients; cell fate and cell lineages; stem cells; genomic equivalence and the cytoplasmic determinants; imprinting;

mutants and transgenics in analysis of development

**B) Gametogenesis, fertilization and early development:** Production of gametes, cell surface molecules in sperm-egg recognition in animals; types of eggs, zygote formation, cleavage, blastula formation, embryonic fields, gastrulation and formation of germ layers in animals; embryogenesis. development of brain, eye and heart in chick.

**C) Morphogenesis and organogenesis in animals :** Types of metamorphosis and hormonal control of metamorphosis, cell aggregation and differentiation in *Dictyostelium*; axes and pattern formation in *Drosophila*, amphibia and chick; organogenesis – vulva formation in *Caenorhabditis elegans*, eye lens induction, limb development and regeneration in vertebrates; differentiation of neurons, post embryonic development- larval formation, metamorphosis; environmental regulation of normal development; sex determination.

**D) Organizer concept:** Embryonic induction, primary organizer and its morphological differentiation, origin of primary organizer, inductive interactions, nature of inductive signal (possible mechanism of neural induction), competence.

**E. Placentation in Mammals:** Placenta, Classification of placenta, physiology and functions of placenta, placentitis

**10-VERTEBRATE OESTEOLOGY:** Endoskeleton of *Scoliodon*, frog, varanus, fowl and rabbit

## 11-METHODS IN BIOLOGY

### A. **Molecular biology and recombinant DNA methods:**

Isolation and purification of RNA, DNA (genomic and plasmid) and proteins, different separation methods.

Analysis of RNA, DNA and proteins by one and two dimensional gel electrophoresis, isoelectric focusing gels.

Molecular cloning of DNA or RNA fragments in bacterial and eukaryotic systems. Expression of recombinant proteins using bacterial, animal and plant vectors. Isolation of specific nucleic acid sequences

Generation of genomic and cDNA libraries in plasmid, phage, cosmid, BAC and YAC vectors. In vitro mutagenesis and deletion techniques, gene knock out in bacterial and eukaryotic organisms. Protein sequencing methods, detection of post translation modification of proteins. DNA sequencing methods, strategies for genome sequencing.

Methods for analysis of gene expression at RNA and protein level, large scale expression, such as micro array based techniques

Isolation, separation and analysis of carbohydrate, protein and lipid molecules RFLP, RAPD and AFLP techniques

### B. **Histochemical and immunotechniques**

Antibody generation, detection of molecules using ELISA, RIA, western blot, Immune-precipitation, fluocytometry and immune-fluorescence microscopy, detection of molecules in living cells, in situ localization by techniques such as FISH and GISH.

### C **Biophysical method:**

Molecular analysis using UV/visible, fluorescence, circular dichroism, NMR and ESR spectroscopy Molecular structure determination using X-ray diffraction and NMR,

Molecular analysis using light scattering, different types of mass spectrometry and surface plasma resonance methods.

D. **Statistical methods:**

Measures of central tendency and dispersal; probability distributions (Binomial, poisson and normal); sampling distribution; difference between parametric and non-parametric statistics; confidence interval; errors; levels of significance; regression and correlation; t-test; analysis of variance;  $\chi^2$  test; basic introduction to multivariate statistics.

E. **Microscopic techniques:**

Visualization of cells and subcellular components by light microscopy, resolving powers of different microscopes, microscopy of living cells, scanning and transmission microscopes, different fixation and staining techniques for EM, freeze-etch and freeze-fracture methods for EM, image processing methods in microscopy.

F. **Methods in field biology:**

Methods of estimating population density of animals and plants, ranging patterns through direct, indirect and remote observations, sampling methods in the study of behavior, habitat characterization: ground and remote sensing methods.

## **21. BOTANY**

1. MICROBIOLOGY, MYCOLOGY AND PLANT HEALTH MANAGEMENT
2. PHYCOLOGY AND BRYLOGY
3. PTERIDOPHYTES, GYMNOSPERMS AND ELEMENTARY PALEOBOTANY
4. TAXONOMY OF ANGIOSPERMS AND BIODIVERSITY CONSERVATION
5. PLANT MORPHOLOGY, ANATOMY AND DEVELOPMENTAL BOTANY
6. PLANT RESOURCE UTILIZATION AND ETHNOBOTANY
7. PLANT PHYSIOLOGY
8. ELEMENTARY BIOCHEMISTRY, CYTOLOGY AND MOLECULAR BIOLOGY
9. GENETICS AND PLANT BREEDING
10. ECOLOGICAL PRINCIPLES AND ENVIRONMENTAL BOTANY
11. BIOTECHNOLOGY AND GENETIC ENGINEERING
12. METHODS IN BIOLOGY

## **1. MICROBIOLOGY, MYCOLOGY AND PLANT HEALTH MANAGEMENT**

- A. General concept of microorganisms. Morphology, structure reproduction and life cycle of bacteria and viruses.
- B. Culture of microbes, isolation and purification.
- C. Role of microbes in root nodules, nif-gene organization, soil, water and air.
- D. Industrial microbiology: microbes in production of antibiotics, alcohols, bio-fertilizers, bio-pesticides and dairy products.
- E. Structure, reproduction and life cycle in fungi.
- F. Classification of fungi with characteristic features of Myxomycotina, Mastigomycotina, Oomycotina, Zygomycotina, Ascomycotina, Basidiomycotina and Deuteromycotina.
- G. Phylogeny of fungi. Economic importance of fungi.
- H. Concept of disease, symptoms of plant diseases, methods of infection.
- I. Disease resistance, vertical and horizontal resistance.
- J. Genetics of host-parasite interaction.
- K. Dissemination of pathogens, methods of disease control.
- L. Brief account of structure, disease cycle and control methods of the following:-  
1 Damping off 2. Wilt            3. Root rot    4. Stem rot    5. Powdery and Downy mildews    6. Rusts        7. Smuts        8. Leaf spots and leaf blights.
- M. Bacterial diseases, viral diseases and mycoplasma diseases: a general account
- N. Mycorrhiza.
- O. Economic importance of microbes.

## **2. PHYCOLOGY AND BRYOLOGY**

- A. Thallus organization, cell structure and reproduction in algae.
- B. Algal habitats: a general account.
- C. Classification of algae, criteria for classification.
- D. Salient features of Protochlorophyta, Chlorophyta, Charophyta, Xanthophyta, Bacillariophyta, Phaeophyta, Rhodophyta and Cyanophyta.
- E. General account of various life cycles in algae.
- F. Economic importance of algae.
- G. Origin, relationships and evolutionary trends in bryophytes.
- H. General account of morphology, structure, reproduction and life history of bryophytes.
- I. Classification of bryophytes.
- J. Salient features of the following:-  
Sphaerocarpaceae, Marchantiales, Jungermanniales, Metzgeriales, Calobryales, Anthocerotales, Sphagnales, Eubryales, Andreales, Takakiales
- K. Economic importance of bryophytes.
- L. Bryophytes as monitors of mineral deposition and air pollution indicators.

## **3. PTERIDOPHYTES, GYMNOSPERMS AND ELEMENTARY PALEOBOTANY**

- A. A brief account of origin, present and past distribution of pteridophytes.



- B. Classification of pteridophytes.
- C. Morphology and life history of the following : Psilophytosida, Psilotopsida, Lycopsidea, Sphaenopsida and Pteropsida.
- D. Heterospory and seed habit.
- E. Evolution of stellar system, telome theory, apogamy and apospory. Economic importance of pteridophytes.
- F. Gymnosperms the vessel less and fruit less seed plants.
- G. Distribution of Gymnosperms in India.
- H. Classification of Gymnosperms.
- I. Morphology and life history of the following : Pteridospermales, Bennetitales, Cycadales, Gingkoales, Coniferales, Taxales, Ephedrales, Welwitschiales and Gnetales.
- J. A general account of Pentoxylales and Cordaitales.
- K. Economic importance of Gymnosperms.
- L. Definition of fossils, different types of plant fossils as per their mode of preservation.
- M. Methods of study of fossils, reconstruction of fossils with special reference to Indian taxa.
- N. Indian Gondwana sequence. Continental Drift hypothesis.

#### **4. TAXONOMY OF ANGIOSPERMS AND BIODIVERSITY CONSERVATION**

- A. Origin of intrapopulation variation: population and the environment, ecades, ecotypes, evolution and differentiation of species.
- B. The species concept, taxonomic hierarchy, principles used in assessing relationships. Delimitation of taxa and attribution of ranks.
- C. Salient features of the International Code of Nomenclature.
- D. Important systems of classification of Angiosperms (Bentham and Hooker, Hutchinson and Cronquist).
- E. Role of anatomy, embryology, cytology, phytochemistry and palynology in taxonomy.
- F. Herbaria and Botanical Gardens: a general account.
- G. Phytogeography : the concept, plant migration evasion and introduction.
- H. Distinguishing features of the following families with their economic importance: Ranunculaceae, Magnoliaceae, Rutaceae, Fabaceae, Rosaceae, Apiaceae, Asteraceae, Primulaceae, Asclepiadaceae, Lamiaceae, Verbenaceae, Convolvulaceae, Acanthaceae, Solanaceae, Amaranthaceae, Euphorbiaceae, Orchidaceae, Cyperaceae and Poaceae.
- I. Conservation- the basic concept.
- J. Patterns of biodiversity at global and regional levels,  $\alpha$ ,  $\beta$  and  $\gamma$  diversity, Hotspots, endemism, Environmental Impact Assessment (EIA).
- K. Threats to biodiversity- habitat loss, fragmentation, genetic drift, inbreeding, disturbance, pollution, climate change, overexploitation, invasive species and diseases.
- L. Conservation of biodiversity- *in situ* and *ex situ* measures.
- M. Protected Area Network (PAN) with respect to India.
- N. Status of plants based on International Union for Conservation of Nature (IUCN).

## 5. PLANT MORPHOLOGY, ANATOMY AND DEVELOPMENTAL BOTANY

- A. Morphology: Morphology of flower, stamen and carpel, plant adaptations and their morphological nature.
- B. Shoot development- organization of the shoot apical meristem (SAM) and differentiation of tissues.
- C. Root Development: organization of root apical meristem (RAM).
- D. Leaf growth and differentiation.
- E. Secondary growth in stem and roots; abnormal secondary growth.
- F. Structure of anther, microsporogenesis and development of male gametophyte.
- G. Structure of ovule, megasporogenesis, development and organization of embryosacs.
- H. Pollination, fertilization , development of endosperm.
- I. Development of embryo and seed formation, seed dormancy.
- J. Physiology of flowering, senescence and programmed cell death (PCD).

## 6. PLANT RESOURCE UTILIZATION AND ETHNOBOTANY

- A. Plant resources: concept, status, utilization and concerns.
- B. World centers of primary and secondary diversities of domesticated plants.
- C. Origin, evolution, botany, cultivation, cytotaxonomy and uses of i. cereals and millets ii. Legumes iii. Sugar cane & starch yielding plants and iv. Forage and fodder yielding plants.
- D. Fiber yielding plants, medicinal and aromatic plants.
- E. Important timber yielding plants and non-timber forest products (NTFPs) such as bamboos, gums, tannins, dyes, resins and beverages.
- F. Plants used as ornamentals and avenue trees.
- G. Ethnobotany: concept, association with other branches, tools of ethnobotanical studies, world and Indian perspectives.
- H. Green revolution: benefits and adverse effects.
- I. Intellectual Property Rights: concept, history and protection of IPRs. Patent-requirements, procedures and limitations. International Convention on Biological Diversity (ICBD). Status of IPRs in India regarding plants.
- J. Sustainable Development: Basic concept.

## 7. PLANT PHYSIOLOGY

- A. **Plant water relations:** diffusion, osmosis, water potential and its components, plasmolysis, imbibition and absorption of water, root pressure and ascent of sap.
- B. **Water loss in plants:** Transpiration and its significance, factors affecting transpiration, mechanism of stomatal opening and closing, guttation.
- C. **Translocation in phloem-** Composition of phloem sap, girdling experiment, pressure flow model, phloem loading and unloading.
- D. **Mineral Nutrition-** Essential elements, macro and micro nutrients, criteria of essentiality of elements, role of essential elements, mineral deficiency symptoms, transport of ions across cell membrane, active and passive transport, carriers, channels

- and pumps, hydroponics and aeroponics.
- E. Photosynthesis** – General concept and historical background, Light harvesting complexes; mechanism of electron transport; photoprotective mechanisms; CO<sub>2</sub> fixation-C<sub>3</sub>, C<sub>4</sub> and CAM pathways. Photorespiration.
- F. Respiration** – Aerobic and anaerobic respiration, glycolysis, Kerbs cycle(Citric acid cycle) , oxidative phosphorylation, electron transport system, fermentation, R.Q.
- G. Nitrogen fixation, nitrogen and sulphur metabolism** – Nitrogen fixation, Nitrate and ammonium assimilation; amino acid biosynthesis, sulphate uptake transport and assimilation.
- H. Plant Growth Regulators** – Physiological effects and mechanism of auxins, gibberellins, cytokinins, ethylene, abscisic acid, polyamines, jasmonic acid; hormone receptors and vitamins, brassinoides.
- I. Sensory photobiology** - Structure, function and mechanism of action of phytochromes, cryptochromes and phototropins;
- J. Photoperiodism and Vernalization** : Photoperiodism and its significance, endogenous clock and its regulation, floral induction and development vernalization and significance of vernalization
- J. Secondary metabolites** - Biosynthesis of terpenes, phenols, nitrogenous compounds and their role.
- K. Stress physiology** – Responses of plants to biotic (pathogen and insects) and abiotic (water, temperature and salt) stresses.

## 8. ELEMENTARY BIOCHEMISTRY, CYTOLOGY AND MOLECULAR BIOLOGY

- A. Structure of atoms, molecules and chemical bonds.
- B. Composition, structure, function and metabolism of biomolecules (carbohydrates, lipids, proteins, nucleic acids ,vitamins and pigments).
- C. Stabilizing interactions (Van der Waals, electrostatic, hydrogen bonding, hydrophobic interaction.).
- D. Principles of biophysical chemistry (pH, buffer, reaction kinetics, thermodynamics, colligative properties).
- E. Principles of catalysis, enzymes, classification of enzymes, enzyme kinetics, enzyme regulation, mechanism of enzyme catalysis, isozymes and coenzymes.
- F. Proteins (Ramachandran plot, primary ,secondary and tertiary structures).
- G. **Membrane structure and function** : Structure of model membrane, lipid bilayer and membrane protein diffusion, osmosis, ion channels, active transport, membrane pumps, mechanism of sorting and regulation of intracellular transport,electrical properties of membranes.
- H. **Structural organization and function of intracellular organelles:** Cell wall, nucleus, mitochondria, Golgi bodies, lysosomes, endoplasmic reticulum, peroxisomes, plastids, vacuoles, chloroplast, structure & function of cytoskeleton and its role in motility.
- I. **Organization of chromosomes:** structure of chromosomes, chromatine, heterochromatin, euchromatin, transposons.
- J. **Cell division and cell cycle:** Mitosis and meiosis, their regulation, steps in cell cycle, regulation and control of cell cycle.
- K. **DNA replication, repair and recombination:** Unit of replication, enzymes involved, replication origin and replication fork, fidelity of replication, extrachromosomal replicons, DNA damage and repair mechanisms, homologous and site-specific recombination.
- L. **Structure of nucleic acids:** Helix (A, B, Z).

- M. **Organisation of gene:** Operon, unique and repetitive DNA, interrupted genes, gene families.
- N. **RNA synthesis and processing:** Transcription factors and machinery, formation of initiation complex, transcription activator and repressor, RNA polymerases, capping, elongation, and termination, RNAs, processing, RNA editing, splicing, and polyadenylation, structure and function of different types of RNA, RNA transport, micro-RNA.
- O. **Protein synthesis and processing:** Ribosome, formation of initiation complex, initiation factors and their regulation, elongation and elongation factors, termination, genetic code, aminoacylation of tRNA, tRNA-identity, aminoacyl tRNA synthetase, and translational proof-reading, translational inhibitors, Post- translational modification of proteins.
- P. **Control of gene expression at transcription and translation levels:** Regulating the expression of phages, viruses, prokaryotic and eukaryotic genes, role of chromatin in gene expression and gene silencing.

## 9. GENETICS AND PLANT BREEDING

- A. **Mendelian principles :** Dominance, segregation, independent assortment. Inheritance and variation.
- B. **Concept of gene :** Allele, multiple alleles, pseudoalleles.
- C. **Extension of Mendelian principles :** Codominance, incomplete dominance, gene interactions, pleiotropy, genomic imprinting, phenocopy, linkage and crossing over, sex linkage, sex influenced characters.
- D. **Gene mapping methods :** Linkage maps, tetrad analysis, mapping with molecular markers, mapping by using somatic cell hybrids, development of mapping population in plants, construction of molecular maps.
- E. **Extra chromosomal inheritance :** Inheritance of mitochondrial and chloroplast genes, maternal inheritance.
- F. **Quantitative genetics :** Polygenic inheritance, heritability and its measurements, QTL mapping.
- G. **Mutation :** Types, causes and detection, mutant types – lethal, conditional, biochemical, loss of function, gain of function, germinal versus somatic mutants, insertional mutagenesis, mutagens.
- H. **Structural and numerical alterations of chromosomes :** Deletion, duplication, inversion, translocation, ploidy and their genetic implications.
- I. **Recombination :** Homologous and non-homologous recombinations including transposition.
- J. Aims, objectives and basic techniques of plant breeding.
- K. Crop improvement methods- plant introduction, selection, acclimatization, hybridization, vegetative propagation and grafting.
- L. Role of plant breeding- historical aspects and genetic basis. Mode of reproduction in relation to breeding methods, breeding techniques, method of plant breeding in relation to self- pollinated and cross-pollinated plants, clonal selection.
- M. Hybridization: Interspecific and inter-generic, pure line, back cross hybridization, self-incompatibility system.
- N. Heterosis: Its genetic and physiological basis, economic exploitation of heterosis in maize.
- O. Breeding for resistance to diseases, physiological races.
- P. Plant breeding work done in India with special reference to wheat, paddy ,potato and

sugarcane.

- Q. Maintenance of collection, registration of varieties, seed production, testing, certification and distribution.

## 10. ECOLOGICAL PRINCIPLES AND ENVIRONMENTAL BOTANY

- A. **The Environment:** Physical environment, biotic environment; biotic and abiotic interactions.
- B. **Habitat and Niche:** Concept of habitat and niche; niche width and overlap; fundamental and realized niches; resource partitioning; character displacement.
- C. **Population Ecology:** Characteristics of a population, population growth curves, population regulation, life history strategies (*r* and *K* selection), concept of metapopulation – demes and dispersal, interdemic extinctions, age structured populations.
- D. **Species Interactions:** Types of interactions, interspecific competition, herbivory, carnivory, pollination, symbiosis.
- E. **Community Ecology:** Nature of communities; community structure and attributes; levels of species diversity and its measurement; edges and ecotones.
- F. **Ecological Succession:** Types; mechanisms; changes involved in succession; concept of climax.
- G. **Ecosystem Ecology:** Ecosystem structure; ecosystem function; energy flow and mineral cycling (C,N,P); primary production and decomposition; structure and function of some Indian ecosystems: terrestrial (forest, grassland) and aquatic (fresh water, marine, eustarine).
- H. **Applied Ecology:** Environmental pollution (Air, water, soil, noise, electronic and nuclear pollution); global environmental change.
- I. **Biodiversity:** status, monitoring and documentation; major drivers of biodiversity change; biodiversity management approaches.
- J. **Remote Sensing:** Concept and stages in the acquisition of remote sensing data, spectral signature, photographic and non photographic sensors, space plate forms, application of remote sensing in ecological and forestry research, Basic principles of photogrammetry and photo interpretation.
- K. **Conservation Biology:** Principles of conservation, major approaches to management, Indian case studies on conservation/management strategy (Project Tiger, Biosphere Reserves).

## 11. BIOTECHNOLOGY AND GENETIC ENGINEERING

- A. Introduction to Biotechnology: role in modern life, isolation and culture of different types of microorganisms.
- B. Recombinant DNA technology: Tools of genetic engineering, enzymes, plasmids and cosmids, vectors; brief idea of techniques and scope of genetic engineering.
- C. Gene cloning: concept and basic steps, application of bacteria and viruses in genetic molecular biology of *E.coli* and bacteriophages in the context of their use in genetic engineering. General characteristics of the cloning vectors used in genetic engineering,

- plasmid vectors viz. PER 322, pUC plasmids, M13 vectors, lambda vectors, cosmids, phagemids, artificial chromosomes.
- D. Restriction modification, enzymes used in recombinant DNA Technology. endonucleases. ligases and other enzymes useful in gene cloning, PCR for gene/DNA detection, cDNA, use of *Agrobacterium* for genetic engineering in Plants, use of marker genes. Cloning of foreign genes. DNA delivery method, physical and biological methods, Genetic transformation in prokaryotes: transferring DNA into *E.coli*. Chemical intrusion and Electroporation.
  - E. Plant tissue culture techniques: Plant cell, tissue and organ cultures, tissue culture techniques, collection and storage of germplasm (cryopreservation), application of plant tissue culture with reference to somaclonal variation, embryo culture and embryo rescue, anther culture, meristem culture, somatic hybridization and somatic seed production.
  - F. Industrial biotechnology: Fermentation technology with reference to alcohol production. Microbial fermentation and production of small and macro molecules. Application of immunological principles.
  - G. Transgenic plants, molecular approaches to diagnosis and strain identification.
  - H. Genomics and its application to health and agriculture, including gene therapy.
  - I. Agriculture Biotechnology: Biofertilizers and biological control in fields.
  - J. Nutritional Biotechnology: Mycotoxins and Health hazards, control of mycotoxin production, single-cell-protein.
  - K. Elementary idea of the following: Genetically Modified Food Crops, Nano biotechnology , PCR, RTPCR, Gene library, Gene Bank. Vectors, general principle of cell signaling, extra cellular signal molecules and their receptors, Southern and Northern blottings , Nif and Nod Genes, Totipotency, Antibiotics, Mycoprotein, Biosensors .
  - L. Bioresource and uses of biodiversity.
  - M. Types of Molecular markers and their role.
  - N. Bioremediation and phytoremediation.
  - O. Synthetic seeds and their significance.

## 12.METHODS IN BIOLOGY

- B. **Molecular Biology and Recombinant DNA methods:**
  - Isolation and purification of RNA , DNA (genomic and plasmid) and proteins, different separation methods.
  - Analysis of RNA, DNA and proteins by one and two dimensional gel electrophoresis, Isoelectric focusing gels.
  - Molecular cloning of DNA or RNA fragments in bacterial and eukaryotic systems.
  - Expression of recombinant proteins using bacterial, animal and plant vectors.
  - Isolation of specific nucleic acid sequences.
  - Generation of genomic and cDNA libraries in plasmid, phage, cosmid, BAC and YAC vectors.
  - In vitro* mutagenesis and deletion techniques, gene knock out in bacterial and eukaryotic organisms.

Protein sequencing methods, detection of post translation modification of proteins.  
DNA sequencing methods, strategies for genome sequencing.

Methods for analysis of gene expression at RNA and protein level, large scale expression, such as micro array based techniques.

Isolation, separation and analysis of carbohydrate and lipid molecules.  
RFLP, RAPD and AFLP techniques.

**B. Statistical Methods:**

Measures of central tendency and dispersal; probability distributions (Binomial, Poisson and normal); Sampling distribution; Difference between parametric and non-parametric statistics; Confidence Interval; Errors; Levels of significance; Regression and Correlation; t-test; Analysis of variance;  $\chi^2$  test;;

**C. Microscopic techniques:**

Visualization of cells and subcellular components by light microscopy, resolving powers of different microscopes, microscopy of living cells, scanning and transmission microscopes.

**D. Methods in field biology:**

Methods of estimating population density of plants, ranging patterns through direct, indirect and remote observations, sampling methods in the study of behavior, habitat characterization: ground and remote sensing methods.

## 22. MATHEMATICS

### UNIT – I

**Analysis:** Elementary set theory, finite, countable and uncountable sets, Real number system as a complete ordered field, Archimedean property, supremum, infimum. Sequences and series, convergence, limit supremum, limit infimum. Bolzano Weierstrass theorem, Heine Borel theorem. Continuity, uniform continuity, differentiability, mean value theorem. Sequences and series of functions, uniform convergence.

Riemann sums and Riemann integral, Improper Integrals. Monotonic functions, types of discontinuity, functions of bounded variation, Lebesgue measure, Lebesgue integral.

Functions of several variables, directional derivative, partial derivative, derivative as a linear transformation.

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

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

Algebra of matrices, rank and determinant of matrices, linear equations. Eigen values and eigenvectors, Cayley-Hamilton theorem. Matrix representation of linear transformations. Change of basis, canonical forms, diagonal forms, triangular forms, Jordan forms. Inner product spaces, orthonormal basis. Quadratic forms, reduction and classification of quadratic forms

### UNIT – II

**Complex Analysis:** Algebra of complex numbers, the complex plane, polynomials, power series, transcendental functions such as exponential, trigonometric and hyperbolic functions. Analytic functions, Cauchy-Riemann equations. Contour integral, Cauchy's theorem, Cauchy's integral formula, Liouville's theorem, Maximum modulus principle, Schwarz lemma, Open mapping theorem. Taylor series, Laurent series, Calculus of residues. Conformal mappings, Mobius transformations.

**Algebra:** Permutations, combinations, pigeon-hole principle, inclusion-exclusion principle, derangements. Fundamental theorem of arithmetic, divisibility in  $\mathbb{Z}$ , congruences, Chinese Remainder Theorem, Euler's  $\phi$ -function, primitive roots.

Groups, subgroups, normal subgroups, quotient groups, homomorphisms, cyclic groups, permutation groups, Cayley's theorem, class equations, Sylow theorems. Rings, ideals, prime and maximal ideals, quotient rings, unique factorization domain, principal ideal domain, Euclidean domain. Polynomial rings and irreducibility criteria. Fields, finite fields, field extensions.



## UNIT – III

**Ordinary Differential Equations (ODEs):** Existence and uniqueness of solutions of initial value problems for first order ordinary differential equations, singular solutions of first order ODEs, system of first order ODEs. General theory of homogenous and non-homogeneous linear ODEs, variation of parameters, Sturm-Liouville boundary value problem, Green's function.

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

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

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

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

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

## Unit-IV

### Mathematical Statistics:

Collection, tabulation and representation of data, measures of central tendency and dispersion, moments, skewness and kurtosis.

Sample space and events with classical, empirical and axiomatic definition of probability, independent events, conditional probability, Baye's theorem, random variables and distribution functions. Moment generating function, Characteristic function. Probabilistic inequalities (Tchebychev, Holder and Jensen). Weak and strong laws of large numbers. Central limit theorem (i.i.d. case).

Discrete and continuous univariate distributions namely; Binomial, Poisson and Normal.

Bivariate data, scatter diagram, Simple Correlation and Rank correlation, Regression lines, Multiple and partial correlations (three variables case only).

Concept of sampling and statistic, simple random sampling with and without replacement, Stratified sampling, Probability proportional to size sampling.

Statistical Inference: Statistic, estimates and estimator. Requirements of a good estimator- unbiasedness, consistency, efficiency and sufficiency. Methods of moments and likelihood. Simple and composite hypotheses, null and and alternation hypotheses. critical region, two types of errors, level of significance and power of a test. Neyman Pearson's lemma and its application. Tests based on t, Z, F and  $\chi^2$ . Analysis of variance one way and two way classification.

### **Operations Research:**

Linear Programming Problem, Simplex methods, Dual of an LPP, Dual Simplex Method. Elementary Queuing models: M/M/1, M/M/1 with limited waiting space, M/M/C, M/M/C with limited waiting space, M/G/1 and inventory models.

Formulation of Transportation Problems, Finding initial basic feasible solution, Test of optimality, MODI method, Degeneracy, Stepping Stone method, Solutions of Assignment problems, Hungarian Method.

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## 23. Military Science

### Unit – A

#### Theories and Concepts:

1. The Concepts of Nation State, Nation – State Theories and Elements of National Power and its Components
2. National Security Objectives : Core Values, National Interests
  - Key Concepts of Security: National Security, Regional Security, Comprehensive Security, Common Security, Equal Security
  - Challenges to Security: Individual, Sub – National; National, Regional and International Levels.
3. Non – Alignment, Balance of Power, Collective Security– Concept, Development and Relevance.
4. Defence and Security Policies: Concept, Formulation, Objectives and Linkages.
5. **National Security Organizations in India :**
  - Higher Defence Structure in India
  - National Security Council
  - National Intelligence Agency
  - Para – Military and Civil Defence
  - Civil – Military Relations
6. **Deterrence and Detente:** Concept, Theories of Nuclear Deterrence and their relevance.
7. **Concepts of Geopolitics and Geo – Strategy:** Theories of Halford Mackinder and Carl Haushofer.
8. Strategic thought of Kautilya, Macaivellie, Karl Marks and Angles, Liddel Hart, J.F.C Fuller, Mao, Jomini, Clausewitz, Douhet and Alfred Mahan.

### Unit – B

#### Problems of Peace & Security:

1. **War :**
  - (a) Theories and causes of War
  - (b) Principles of War.
  - (c) Contemporary Warfare : Conventional Warfare in Nuclear age, Limited War, Revolutionary Warfare, Low Intensity Operations, Guerilla Warfare, Insurgency and Counter– Insurgency, Cyber Warfare.
2. **World Militarization :** Arms Race, Arms Trade, Arms Proliferation.

3. Military Alliances and Pacts, Peace Treaties, Defence Cooperation, Strategic Partnership and Security Dialogue.
4. **Terrorism:** Concept and types (National Terrorism, International Terrorism and Cross border Terrorism).
5. **Conflicting Ideologies:** Militarism, Nationalism, Fundamentalism, Separatism, Irredentism.
6. Nuclear Proliferation & NPT, SALT-I, SALT-II, START-I, START-II, CTBT, MTCR, NMD.

## Unit – C

### Global Security Issues:

1. Origin of Cold War, Causes and Impact, End of Cold War and Emergence of New World Order.
2. Military, Nuclear and Missile capabilities of China, Pakistan and India.
3. Origin, Organization and role of U.N.O.
4. **Environmental Issues:** Global Warming, Industrial Pollution, Deforestation.
5. India's Defence Problems, Boundaries issue, Terrain and Frontiers
  - a) Sino-India
  - b) India- Pakistan
  - c) India-Bangladesh
  - d) India-Nepal
  - e) India-Sri Lanka
  - f) India-Afghanistan
  - g) India's Land Diplomacy with her neighbors
6. **Organized Crimes:** Money Laundering, Narco – trafficking.
7. Militarization of Indian Ocean and India's National, Maritime and Security Interests in the Indian Ocean Region. India's Maritime Strategy for the 21st Century, Influence of China in Indian Ocean, Strategic Importance of South China Sea.
8. **Issues of Logistics:** Resources, Supply chain, Transportation and Communication.
9. **Refugees Problems :**
  - Causes of Migration, Population in border areas and border security.

## Unit – D

### Issues in Conflict Resolution:

1. Origin, Type and Structure of Conflict at inter – state level.
2. Images, belief systems and International conflicts.
3. Techniques of Conflict Prevention
4. **Conflict Management:** Pacific Solution of International Disputes, Coercive methods and war as an instrument.
5. International Humanitarian Laws and Laws of Armed Conflicts.
6. **Confidence Building Measures:** Concept, kinds and utility.
7. **IGOs & NGOs in Conflict Resolution:** Peace Making, Peace Keeping and Peace Building.
8. **Techniques of Preservation of Peace:** Collective Security System, Pacific Settlement, Enforcement Action. Regional Security Arrangements. Disarmament.

## Unit – E

### Economic, Science & Technology Issues and National Security:

1. Broad Survey of Technological Changes from Industrial Revolution to Inform Action Revolution.
2. Economic Theories of Defence .
3. Basics of Defence Planning, Determinants of Defence Expenditure and Defence Budgeting.
4. National Security and International Trade regimes ( WTO, TRIPS, TRIMS, NAFTA, SAPTA ).
5. India's Nuclear Energy and Space Programme.
6. **Research and Development :**
  - Relevance of Science and Technology in National Security.
  - Impact of Information Technology; Revolution in Military Affairs (RMA).
  - Choice of Weapon Systems.
7. **Impact of Economic Liberalization and Globalization :**
  - Defence Production in India Defence and Development.ichotomies.
8. Issues of Mobilization of Resources during War and Peace.
9. **Transfer of Technology:** Dual use and critical technologies and their impact on national security.

# 24. GEOLOGY

## 1. General Geology, Geomorphology and Geodynamics

Solar system, Modern theories on the origin of the Earth and other planetary bodies. Modern concept of Age of the earth, Radioactive isotopes and their applications. Internal structure of earth.

Basic concepts of geomorphology, Denudational processes: Weathering, erosion, transportation, deposition; River and drainage basin: Drainage pattern, Valleys and their development, processes of river erosion, transportation and deposition; Landforms produced by geomorphic agents: fluvial, coastal, glacial, underground, lacustrine and aeolian landforms; Applied Geomorphology; Geomorphology of India.

Geosynclines, cratons, shields and platforms; Continental drift – historical perspective and modern concepts. Sea floor spreading; Palaeomagnetism and its application. Principles of Geodesy, Isostasy, Orogeny and Epeirogeny. Earthquakes and seismic properties of earth; causes of earthquakes; earthquake belts; volcanoes-their types, products, causes and distribution. Relationship of volcanoes and earthquakes. Neotectonics; Palaeoposition of India and Geodynamics of the Indian plate. Structure and evolution of Himalaya.

## **2. Structural Geology**

Principle of geological mapping and map reading, projection diagrams. Stress-strain relationships for elastic, plastic and viscous materials. Measurement of strain in deformed rocks. Behaviour of minerals and rocks under deformation conditions. Structural analysis of folds, cleavages, lineations, joints and faults. Mechanism of folding, faulting and progressive deformation. Shear Zones: Brittle and ductile shear zones, geometry and products of shear zones; Mylonites and cataclasites, their origin and significance. Time relationship between crystallization and deformation. Unconformities and basement-cover relations. Structural behaviour of igneous plutons, diapirs and salt domes. Introduction to petrofabric analysis.

An overview of plate tectonics- lithosphere, asthenosphere, types of plate boundaries and associated important geological features. Gravity anomalies at mid-oceanic ridges, deep sea trenches, continental shield areas and mountain chains. Wilson cycle.

## **3. Stratigraphy**

Principles of Stratigraphy: History and Development of Stratigraphy; Walther's Law; Concept of stratigraphic facies; Principles of stratigraphic correlation- fossiliferous and unfossiliferous; Study of standard stratigraphic units; Concepts of biostratigraphy, magnetostratigraphy, chemostratigraphy, event stratigraphy, seismic

stratigraphy, sequence stratigraphy and quantitative stratigraphy; Nomenclature and the modern stratigraphic code. Geological time-scale. Precambrian stratigraphy of India: Archaean stratigraphy; Proterozoic schist belts and Proterozoic sedimentary basins of India. Palaeozoic and Mesozoic stratigraphy of India; Cenozoic stratigraphy and evolution of Siwalik basin; Gondwana Supergroup and Gondwanaland. Deccan Volcanics with intertrappean beds. Stratigraphic boundaries: Archean-Proterozoic, Precambrian-Cambrian, Permian-Triassic and Cretaceous-Tertiary boundary. Quaternary stratigraphy- evolution of Ganga plain and Thar Desert.

#### **4. Palaeontology**

Major evolutionary theories; Techniques in Palaeontology mega fossils- microfossils – nanofossils, ichnofossils – collection, identification and illustration – binomial Nomenclature; Evolution of life in Precambrian times-Ediacaran Biota; Invertebrate Palaeontology – A brief study of morphology, classification, evolutionary trends and geological distribution of bivalves, cephalopoda and gastropods, echinoids, corals, brachiopods and trilobites. Vertebrate Palaeontology – Brief study of vertebrate life through ages. Evolution of reptiles, birds and mammals; Siwalik vertebrate fauna; Biodiversity and mass extinction events; Use of palaeontological data in stratigraphy, palaeoecology and evolution; Introduction to micropalaeontology and techniques; Microfossils-



foraminifera, ostracodes, conodonts and radiolarians; Plant fossils: Gondwana flora and their significance. Fundamentals of palynology.

## 5. Crystallography and Mineralogy

External symmetry of crystals: Symmetry Elements, methods of projections, derivation of 32 classes, Hermann-Mauguin notation. Concepts of point groups, space lattice, space groups and lattice defects; Internal symmetry of crystals: Derivation of 230 space groups, diffraction of crystals by X-rays, Bragg's law; twinning. Principles of optical mineralogy- polarized light, behaviour of isotropic and anisotropic minerals in polarized light, refractive index, double refraction, birefringence, sign of elongation, interference figures, 2V, dispersion in minerals, optic sign, pleochroic scheme and determination of fast and slow vibrations and accessory plates.

Introduction to mineralogy: Definition and classification of minerals. Structural and chemical principles of crystals, minerals, chemical bonds, ionic radii, coordination number (CN) and polyhedron. Silicate structure; Structure, chemistry, physical and optical characters and paragenesis of mineral groups: Olivine, pyroxene, amphibole, mica and spinel groups; Feldspar, quartz, feldspathoid, aluminum silicate, magnesium silicate, epidote, beryl and garnet groups; apatite, calcite, gypsum, corundum, tourmaline, scapolite, sphene and zircon.

## 6. Igneous Petrology and Geochemistry

Origin of magmas; Phase equilibrium in igneous systems: Binary and ternary systems. Bowen's reaction principle: Reaction series and its application to petrogenesis. Magmatic evolution and differentiation: Fractional crystallization, gravitational differentiation, gas streaming, liquid immiscibility and assimilation. Structures and textures. Classification of igneous rocks: Mode, CIPW norm, IUGS and other standard classifications; Magmatism and tectonics. Igneous rock suites: Form, structure, texture, modal mineralogy, petrogenesis and distribution of Ultramafic rocks: Dunite-peridotite-pyroxenite suite; kimberlites, lamprophyres, lamproites, komatiites; Mafic rocks: Gabbro-norite-anorthosite-troctolite suite, Dolerites; Basalts and related rocks; Intermediate rocks: Diorite-monzonite-syenite suite; Andesites and related rocks; Felsic rocks: Granite-syenite-granodiorite-tonalite suite; Rhyolites and related rocks; Alkaline rocks: Shonkinite, ijolite, urtite, melteigite, malignite, alkali gabbros, alkali basalt, alkali granite, alkali syenite and phonolite; Carbonatites; Ophiolite suite.

Cosmic abundance of elements. Composition of the planets and meteorites. Structure and composition of earth and distribution of elements. Trace elements and REE and their importance in fractional crystallization during magmatic/partial melting. Elementary crystal chemistry and thermodynamics. Introduction to isotope geochemistry.

Geochronology; Law of Radioactivity; Principles of isotopic dating, Modern methods of dating of rocks. Geochemical cycle.

## **7. Sedimentary and Metamorphic Petrology**

Characteristics of sediments-size and shape. Sedimentary textures. Framework, matrix and cement. Biogenic and physical sedimentary structures. Palaeocurrent analysis. Classification of sedimentary rocks: Terrigenous clastic rocks and carbonate rocks. Provenance and diagenesis of sediments. Sedimentary environment and facies. Facies modelling for marine and non-marine sediments. Tectonics and sedimentation. Concept and classification of sedimentary basins. Sedimentary basins of India. Stratum contours and isopach maps.

Metamorphism Concepts: Types of Metamorphism and their controlling factors; Metamorphic grades and facies; Effects of Metamorphism: Phase diagrams and graphic representation of mineral assemblages; Prograde and retrograde metamorphism, Metasomatism; Deformation textures and structures related to recrystallization; Metamorphic reactions, elemental exchange and Pressure – Temperature conditions of Isograds; Mineral assemblages equilibrium/ reaction textures and geo-thermo-barometry. Role of fluids in metamorphic reactions. Metamorphism types and products: Regional and thermal metamorphism of pelitic rocks. Regional and thermal metamorphism of mafic and ultramafic rocks; Regional and

thermal metamorphism of impure, silicious carbonate rocks; Metamorphism of Granitoides, Charnockites and Migmatites. Paired metamorphic belts, Extraterrestrial Metamorphism (Impact and Shock Metamorphism); polymetamorphism.

## 8. Economic Geology

Ore deposits and ore minerals. Magmatic processes of mineralization. Porphyry, skarn and hydrothermal mineralization. Fluid inclusion studies. Mineralisation associated with (i) ultramafic, mafic and felsic rocks (ii) greenstone belts (iii) komatiites, anorthosites and kimberlites and (iv) submarine volcanism. Stratiform and stratabound ores. Residual and mechanical concentration, sedimentation, supergene enrichment and evaporites. Ores and metamorphism – cause and effect relations. Metallogenic epochs and provinces.

Occurrence and distribution in India of metalliferous deposits - iron, manganese, chromium, titanium, tungsten, molybdenum, copper, lead, zinc, nickel, gold, silver and aluminium. Indian deposits of non-metals – diamond, mica, asbestos, barytes, gypsum, graphite, apatite, fluorite and beryl. Gemstones, refractory minerals, abrasives and minerals used in glass, fertilizer, paint, ceramic and cement industries. Dimensional stones. Phosphorite deposits. Placer deposits, rare earth minerals. Strategic, critical and essential minerals. India's status in mineral

production vis a vis world scenario, National Mineral Policy. Marine mineral resources.

Coal-origin and distribution in India. Petroleum and natural gas-origin, migration, traps. Oil fields of India. Coal bed methane and gas hydrates. Radioactive minerals- their origin and occurrences in India.

## 9. Mineral exploration, Mining and Remote Sensing

Concepts of prospecting and exploration. Geological, geophysical, geochemical and geobotanical techniques of exploration. Sampling, methods of drilling, well logging. Surface and subsurface mining methods; coal mining.

Electromagnetic radiation; Types of satellites and their data set, sensor characteristics; Aerial photographs; Principles of photogrammetry- stereoscopic parallax; Digital image processing; Remote sensing applications in Geology; Thermal Infra Red remote sensing and its applications, Microwave remote sensing and its applications. Principles and components of Geographic Information System (GIS).

## 10. Engineering geology, environmental geology and hydrogeology

Elementary concepts of rock mechanics and soil mechanics. Engineering properties of rocks; Geological and geotechnical investigations for dams, reservoirs and spillways, tunnels, underground caverns, bridges,

highways, shorelines. Geological hazards their significance, causes, preparedness and mitigation.

Fundamental concepts of Environmental Geology. Global warming. Green house effect. Ozone depletion. Structure and chemical composition of the atmosphere; Pollution; Environmental health hazards. Impact of mining on geoenvironment; Elements of Environmental Impact Assessment. Seismic zonation map; Landslide hazard zonation.

Origin, occurrence and distribution of water; Hydrological Cycle and its components; Water-bearing properties of rocks — porosity, permeability, specific yield and specific retention; Darcy Law; Vertical distribution of water; Aquifers; Classification of aquifers; Aquifer parameters- transmissivity and storage coefficient; Water table and piezometric surface and their fluctuations; Water table contour maps; Springs; Geologic and geomorphic controls on groundwater; Hydrostratigraphic units; Groundwater provinces of India with special reference to hilly terrain.

## 25. LAW

### 1. Constitutional Law of India

- Preamble
- Fundamental Rights and Duties.
- Directive Principles of State Policy.
- Judiciary
- Executive
- Distribution of Legislative Powers between Union and States.
- Role of Election Commission in Democratic Process.
- Emergency Provisions.
- Amendment of the Constitution.

### 2. Legal Theory

- Sources of Law.
- Positivism, Natural Law Theory, Sociological School.
- Law and Morality
- Legal Concepts: Rights and Duties, Person, Possession and Ownership.

### 3. Public International Law

- Nature of International Law and its relationship with Municipal Law.
- Sources of International Law.
- Recognition of States and Governments.
- Extradition, Asylum, Nationality and Status of Refugees.
- United Nations.
- Settlement of International Disputes.

### 4. Family Law (Hindu Law and Muslim Law)

- Sources.
- Marriage and Dissolution of Marriage.
- Adoption and Guardianship.
- Maintenance.

## **5. Law of Contracts : General Principles**

- Offer, acceptance and consideration.
- Capacity to Contract : Minor's contract.
- Elements vitiating contract- Coercion, Undue Influence, Fraud, Misrepresentation, Mistake,
- Unlawful consideration and Object
- Frustration of Contract.
- Remedies for breach of contract.

## **6. Law of Torts**

- Nature and Definition of Tort.
- Principles of Tortious Liability.
- General Defenses.
- Vicarious Liability, Strict, and Absolute.
- Specific Torts: Negligence, Nuisance and Defamation.
- Damages in Torts.
- Consumerism and Redressal of Consumer Grievances.

## **7. Law of Crimes : General Principles**

- Meaning, Nature, Essentials and Stages of Offence.
- General Exceptions
- Joint Liability (Common Intention and Common Object), Abetment and Criminal Conspiracy.
- Offences against Human Body.
- Offences against Property.
- Offences against Women.

## **8. Labour Law**

- Concepts - Industry, Industrial Dispute and Workman.
- Trade Unions - Rights and Immunities of Registered Trade Union; Registration and its advantages.
- Methods for Settlement of Industrial Disputes under Industrial Disputes Act, 1947.
- Strike and Lockout as Instruments of Collective Bargaining.
- Retrenchment, Lay – off and Closures.



## **9. Administrative Law**

- Nature, Scope and Importance of Administrative Law.
- Principles of Natural Justice.
- Administrative Discretion and its Control.
- Judicial Review of Administrative Action- Writ Jurisdiction.
- Lokpal and Lokayukta.

## **10. Environmental Law**

- Environmental Pollution- Meaning of Environment, Environmental Pollution, Kinds of Pollution.
- Legislative Measures for Prevention and Control of Environmental Pollution in India.
- Remedies for Environmental Pollution- Civil, Criminal and Constitutional.
- International Developments for protection of Environment.
- Importance of Forests and Wildlife in Protecting Environment.
- Environmental Impact Assessment and Control of Hazardous Substances.

## **11. Company Law, Partnership and Sale of Goods**

- Companies Act, 2013; Salient Features, Directors, Doctrine of Indoor Management and Ultra Vires, Winding Up.
- Partnership Act : Formation and Dissolution.
- Sale of Goods Act : Sale and Agreement to Sell, Conditions and Warranties, Rights of Unpaid Seller.
- Negotiable Instruments Act : Definitions, Dishonor of Cheques, Remedies.

## 12. Human Rights

- Concept and Development of Human Rights.
- Contribution of United Nations in the Development and Implementation of Human Rights
- Implementation of Human Rights in India- Role of National Human Rights Commission.
- Protection of Marginalized Groups- Women, Children, Minorities and Senior Citizens.

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## **26. BACHELOR IN BUSINESS ADMINISTRATION (BBA)**

- Managerial Economics – Demand Analysis; Production Function; Cost-Output Relations; Market Structures; Macro Economics; National Income Concepts; Business Environment; Demonetization; GST and Divestment.
- Organisational Behaviour – Skills and Roles in an Organisation; Theories of Organisational Structure; Organisational Design; Individual Behaviour – Personality, Perception, Values, Attitudes, Learning and Motivation. Group Dynamics, Leadership, Managing Change, Managing Conflicts and Organisational Development.
- Production Management- Facility Location, Lay-out Planning and Analysis; Production Planning and Control – Production Process Analysis; Demand Forecasting for Operations; Determinants of Product Mix; Production Scheduling; Work Measurement; Time and Motion Study; Statistical Quality Control; Operations Research; Linear Programming; Sensitivity Analysis; Duality; Transportation Model; Inventory Control; Queueing Theory; Decision Theory; Markov Analysis; PERT / CPM and JIT.
- Probability Theory; Probability Distributions – Binomial, Poisson, Normal and Exponential; Correlation and Regression Analysis; Sampling Theory; Sampling Distributions; Tests of Hypotheses; Large and Small Samples; t, Z, F and Chi – square tests. Use of Computer in Managerial Applications; Technology Issues and Data Processing in Organizations; Information Systems; System Analysis and Design (SAD); Trends in Information Technology; Internet and Internet- Based Applications.
- Corporate Strategy-Components of Strategy Formulation; Ansoff’s Growth Vector; BCG Model; Porter’s Generic Strategies; Competitor Analysis; Strategic Dimensions and Group Mapping; Industry Analysis; Strategies in Industry Evolution; Competitive Strategy; Transnationalization of World Economy; Managing Cultural Diversity; Global Entry Strategies; Globalization of Financial System and Services; Managing International Business; Competitive Advantage of Nations.
- Entrepreneurship and Innovation; Small Scale Business – Concepts, Government Policy for Promotion of Small and Tiny Enterprises; Process of

Business Opportunity Identification; Detailed Business Plan Preparation; Managing Small Enterprises; Planning for Growth; Sickness in Small Enterprises; Rehabilitation of Sick Enterprises and Intrapreneurship .

- Ethical Issues and Analysis in Management; Value Based Organisations; Personal Framework for Ethical Choices; Ethical Pressure on Individual in Organisations; Gender Issues; Ecological Consciousness; Environmental Ethics; Corporate Social Responsibilities(CSR); Corporate Governance and Ethics.
- Human Resource Management – A Diagnostic Model; External and Internal Environment; Recruitment; Selection, Placement and Follow-up; Performance Appraisal System –Techniques and New Trends; Training, Development and Career Planning; Compensation and Benefits – Job Evaluation Techniques; Wage and Salary Administration; Fringe Benefits; Human Resource Records and Audit; Employee Discipline –Disciplinary Action; Grievance Management – Process and Practices; Employee Welfare and Social Security Measures; Industrial Relations – Industrial Conflicts; Dispute Settlement Machinery; Trade Unions –Union leadership; National Trade Union Movement; Collective Bargaining – Process; Pre-requisites and New Trends; Industrial Democracy – Pre-requisites for Industrial Democracy; Employee Participation – Forms of Employee Participation; Job Analysis; Job Description and Exit Policies.
- Marketing Myopia; Marketing Mix; Different Environments and their Influences on Marketing; Understanding the Customer and Competition; Segmentation, Targeting and Positioning (STP); Static and Dynamic Understanding of BCG Matrix; Product- Product Life Cycle (PLC), New Product Development (NPD), Brand Building Strategies; Pricing -Methods and Strategies; Distribution Channel- Hierarchy, Degrees, Wholesaling and Retailing; Promotion Mix – Advertising, Sales Promotion, Personal Selling, Public Relations, Media Planning and Management; Marketing Research – Sources of Information; Data Collection; Basic Tools used in Data Analysis; Structuring a Research Report; Marketing to Organisations – Buyer Behaviour Models; Organisational Buying Process, Consumer Behaviour Theories and Models, Customer Relationship Management(CRM);Use of Internet as a Medium of Marketing; Managerial Issues in Reaching Consumers / Organisation through Internet; Structuring and Managing Marketing Organisations; Export Marketing – Indian and Global Context.

- Financial Management-Nature and Scope; Valuation Concepts – Risk and Return; Valuation of Securities; Pricing Theories – Capital Asset Pricing Model and Arbitrage Pricing Theory – Understanding Financial Statements and Analysis Thereof; Capital Budgeting Decisions; Risk Analysis in Capital Budgeting and Long-Term Sources of Finance; Capital Structure – Theories and Factors; Cost of Capital; Dividend Policies – Theories and Determinants; Working Capital Management – Determinants and Financing; Cash Management; Inventory Management; Receivables Management; Derivatives and Options; Corporate Risk Management; Mergers, Acquisitions and Amalgamation; International Financial Management.
- India's Foreign Trade and Policy; Export Promotion Policies; Trade Agreements with Other Countries; Policy and Performance of Export Zones and Export-Oriented Units; Export Incentives; International Marketing Logistics and Structures; Export Documentation Framework; Organization of Shipping Services; Marine Cargo Insurance; International Financial Environment; Foreign Exchange Markets; Determination of Exchange Rates; Exchange Risk Measurement; International Investment; International Capital Markets; International Credit Rating Agencies and Implications of their Ratings; Multilateral Trade Agreements Pertaining to Trade in Goods; Trade in Services and TRIPS; Multilateral Environmental Agreements (MEA's); International Trade Blocks – NAFTA, ASEAN, SAARC, EU, BRICS, WTO and Dispute Settlement Mechanism; Technology Monitoring; Emerging Opportunities for Global Business.

## **27. BACHELOR IN COMPUTER APPLICATION**

### **Discrete Structures**

Sets, Relations, Functions, Inclusion- Exclusion Principles, Equivalence and orderings, Probability, Counting and Countability, Counting Principles, Functions and counting, Permutation and Combinations, Combinational arguments, Infinite Sets and countability. Graph Theory: Basic concepts, Paths and connectivity, Planar graphs, Trees, Rooted trees, Shortest path algorithm, Hamiltonian and Eulerian graphs. Groups, Finite fields, Error detecting and correcting codes.

### **Computer Organization**

Central Processing Unit: Computer registers, bus system, instruction set, timing and control, instruction cycle, memory reference, input-output and interrupt, Bus Interconnection design of basic computer, Register organization; Stack organization; Instruction Format and Addressing Modes. Control Unit : Control memory, Address Sequencing, Micro program, Design of Control Unit. Arithmetic Algorithms: Integer multiplication; Integer division, Floating point representations and Arithmetic algorithms. I/O Organization: Peripheral Devices, Input-Output Interface, Asynchronous Data Transfer, Modes of Data Transfer, Priority Interrupt, Direct Memory Access, Input Output Processor. Memory Organization : Memory Hierarchy, RAM, ROM, Associative Memory, Cache Memory Organization and Virtual Memory Organization.

### **Data and File Structure**

Definition of data structure, Complexity, Notations, Time space trade-off, Arrays, Stacks, Queues, Priority queues, Linked Lists, Trees, B trees and B<sup>+</sup> trees, heaps, graphs. File Structures: Sequential, Direct, Indexed- Sequential and Relative files, Inverted Lists and multi lists, Hashing.

### **Operating System**

Definition, Functions of operating systems, Batch systems, Multiprogramming, Time sharing, parallel, distributed and real time systems, operating Systems structure. Memory Management: Logical and physical Address space, Swapping, contiguous Allocation, Fragmentation, Compaction, Segmentation, Paging, Virtual Memory, Thrashing. Scheduling : CPU Scheduling, I/O Scheduling, Resource scheduling, scheduling criteria and algorithms, Multiple-processor Scheduling,

Deadlock and deadlock handling. File Management : File concept, File access and Allocation methods, Directory structure, File protection mechanisms, Free space management, Recovery, Disk Management, Swap space management.

UNIX : File System, Process Management, kernel and shell, shell script, Pipelining, Filtering, System commands, vi and ed editor commands, System calls.

### **Data Base Management System**

DBMS- Definition, features and applications, Data Base System versus file system, Data models, Entity- Relationship model, Design Issues, E-R Diagram. SQL : Basic structure of SQL queries, Set operations, Nested Sub queries, Views, Complex queries, Joined relations, DDL, DML and DCL commands, Embedded SQL, User Interface and Tools, Security and Authorization, Normalization. Transaction and Concurrency Control: Transaction concepts, Transaction state, Implementation of Atomicity and Durability, concurrent Executions, Serializability, Recoverability, Implementation of Isolation, Concurrency Control, Lock-based protocols, Multiple granularity, Deadlock handling.

### **Computer Networks**

Introduction to Computer Networks- overview of Data and Signal bits, Baud and Bit rate, Channel capacity, Guided and Unguided Media, Local Area Networks, Wide Area Networks, Metropolitan Area Network, Internetworking. OSI reference model, Services, TCP/IP model, Goals of layered protocols. Data Communication: Multiplexing, Switching, narrowband ISDN, broadband ISDN, ATM, Cellular Radio, Communication Satellites- geosynchronous and low- orbit. Internetworking: Switch, Hub, Bridge, Router, Gateway, Concatenated virtual circuits, Tunneling, Fragmentation, Firewalls, Routing: Virtual circuits and datagrams, Routing Algorithms, Congestion Control. Network Security: Cryptography, Symmetric- Key Algorithms, Public- Key Algorithms, Management of Public Keys, Communication Security, Web Security, Authentication Protocols.

### **Design and Analysis of Algorithms**

Time and space complexity, Asymptotic notations, Basic Algorithm Design Techniques- Divide- and- conquer, greedy, branch- and- bound, dynamic programming. Graph Algorithms, Graph traversal, Sorting and Searching

algorithms, Knuth-Morris-Pratt Pattern matching algorithm, Strassen's Matrix multiplication algorithm, NP-complete and NP-hard problems.

### **Software Engineering**

Software Development Process, system Development, Life cycle, waterfall Models, spiral model, proto- typing approach, 4 GL approach, Requirement-Analysis, Feasibility study. Software Metrics: Software Project Management. Software Design: System Design, function oriented Input/output design, object oriented design, user interface design, design level metrics. Software Testing: Testing objectives and principles, performance testing, Testing level metrics, software quality and reliability, clean room approach, software reengineering, Test data generators.

### **Theory of Computation**

Introduction to Languages; Regular Expressions; Finite Automata; Kleene's Theorem; Moore and Mealy machines, Equivalence of Moore and Mealy machines; Context-Free Grammars, Normal Forms; Push Down Automata; Parsing; Turing Machines; Post Machines, Phrase Structure Grammar; Context Sensitive Grammar; Computable Functions; Church's Thesis; Halting Problem.

### **Programming in C**

Data types, Constants, Variables, I/O functions, Operators, Control structures, Functions, Recursion, Arrays and strings, Pointers, Dynamic storage allocation, User- defined data types, Structures and Unions, Storage classes, String handling, Streams, File Operations and handlings, Macro definition predefined macros, Preprocessor directives, Low- level Programming.

### **Object Oriented Programming with C++ and Java**

Definition and basics of object oriented technique, Object-identity, Encapsulation, Information hiding, Polymorphism, Principles of modeling, object oriented modeling, Introduction to UML, Conceptual model of UML and Architecture. Basic Structural Modeling: Classes, Relationships, Common mechanisms and diagrams, Class and object diagrams, Use cases, State machine, Processes and threads, Events and signals.



C++ Programming: Inline Functions, Friend function, Virtual function, Constructors and destructors, static data member and static member function, operator overloading and function overloading, Pure Virtual Functions, Member Access Operators, casting, Templates and Generic Programming, Overloading and Function Templates. Exception Handling, Namespaces, An Object-Oriented Library, Condition States, Managing the Output Buffer, Containers. Java Programming: Introduction to Java, Features, classes and objects, Inheritance, Packages, Interfaces, abstract methods and classes, Polymorphism, Inner classes, String handling, Event Handling, Multi- threading, Java APIs, Java Beans : Application Builder tools, Bean developer kit, Developing a Bean, Java Beans API, Session Beans, Entity Beans. Java Swing : Introduction to AWT, AWT versus Swing, creating a Swing Applet and Application, Introduction to Servlets.

## **Computer Graphics**

Video display devices, Raster- scan systems, Random- scan systems, Graphics monitors, Line- drawing algorithm, Circle generating algorithms, Ellipse-generating algorithms, Two-Dimensional Transformations: Transformations of Points and Straight Lines, Mid-point Transformations, Rotation, Reflection, Scaling, Projection, Combined Transformation, Three-Dimensional Transformation: Scaling, Shearing, Rotation, Reflection, Projection and Translation, Multiple Transformation, Two Dimensional Viewing: Viewing pipeline, Viewing coordinate reference frame, Window- to viewport coordinate transformation, Clipping operations, Point clipping, Cohen- Sutherland line clipping, Sutherland- Hodgeman polygon clipping, Curve clipping, Text clipping, Exterior clipping.

## **Soft Computing**

Soft computing- Introduction, techniques and applications, Soft computing versus hard computing. Neural Network- Structure and Function of a single neuron, Biological neuron, artificial neuron, ANN- definition, characteristics and applications, Single layer network, Perceptron training algorithm. Linear Separability, Window and Hebb's learning rule/delta rule, ADALINE, MADALINE, Multi Layer Perceptron, Activation functions. Fuzzy logic : Fuzzy set theory, Fuzzy set versus crisp set, Crisp relation and fuzzy relations, Fuzzy

System: Crips logic, Fuzzy logic, Membership functions, Fuzzy rule base system : Fuzzy prepositions, formation, decomposition and aggregation of fuzzy logic. Genetic algorithm: Basic concept, Working principle, Encoding fitness function, Reproduction, Genetic modeling. Mutation operator, Bitwise operator, Convergence of GA, Applications of GA.

## **Mobile Computing**

Evolution of Mobile Computing- Benefits, Applications, Wireless network architecture, Security, Concerns and Standards, Wireless Network Technologies- 1G to 5G, Bluetooth, RFID, Wireless Broadband. Mobile IP: Introduction, Advertisement, Registration, two level addressing, abstract mobility management model, performance issue, routing in mobile, Mobile TCP, Time out freezing, GSM, PLMN interface, authentication and security, Mobile computing over Short message services, GPRS, Wireless Application Protocol, ad-hoc networks and sensor networks, wireless LAN security, Voice over Internet protocol and convergence, SIP, comparison between H.323 and SIP, Real time protocols, call routing, IMS, Mobile VoIP, security techniques and framework for mobile environment.

## **Cloud Computing**

Cloud- Characteristics and Services, Cloud models- IaaS, PaaS and SaaS, Public vs Private Cloud, NIST Reference Architecture, Cloud solutions, Cloud ecosystem, Virtualization : Basics of Virtualization, Types of Virtualization, Implementation Levels of Virtualization, Virtualization Structures, Tools and Mechanisms, Virtualization of CPU, Memory and I/O Devices, Virtual Clusters and Resource management, Virtualization for Data-center Automation, Cloud Infrastructure : Architectural Design of Compute and Storage Clouds, Layered Cloud, Architecture Development, Design Challenges, Inter Cloud Resource Management, Resource provisioning and Platform Deployment, Global Exchange of Cloud Resources, Cloud Security- Challenges and Risks, Security Governance and Risk Management.

## **E-Commerce**

Electronic commerce- Introduction, Definition, Main activities, Goals, Components, Functions, Scope, Advantages and disadvantages, Applications, E-Commerce models- B2B, B2C, C2C, C2B, G2G, B2G, B2P, B2A, P2P), Electronic Data Exchange, Types of Electronic Payment System, Electronic Fund Transfer, Secure E-Commerce Transaction, Authorisation and Authentication, Firewall, Digital Signature, Strategies for developing electronic commerce web sites.

## **PHP**

Basic syntax, data Types, Variables, Constants, Expressions, Operators, Control Structures, Loops, Arrays, Functions, PHP Form handling, PHP GET, PHP POST, PHP Form Validation, PHP Form Sanitization. PHP Cookie handling, PHP Session Handling, PHP Login Session, Managing user ACL Strings and Patterns, Matching, Extracting, Searching Replacing, Formatting, PCRE.

## **Web Technology**

Overview of Internet and web, HTML Tags, Form & Frames, Cascading Style Sheets, DHTML, Web Design Tools like Dream, Weaver, Gif Animator etc. SASP Net Working with ASP Net Web Form: Building ASP Net page, Building Form with Web server Controls, performing form Validation with validation control, Advance Control programming. Working with XML, ASP.Net Application: Creating ASP.Net: Application, Tracking User Session, Caching ASP Net Application, Application Tracking and Error Handling. Securing ASP, Net. Web Services: Introduction to Service- Oriented Architectures, EML basics, SOAP, SOAP message structure, WSDL, UDDI, Latest trends in Web technologies.

## **Windows Programming**

Introduction to Windows Program, Message processing in Windows Programming, Dialog Box, Icons, Cursor and Bitmaps. Introduction to Window Controls, Check boxes, Static control, Radio Buttons, Scroll bars, Toolbars controls, Spin control, Progress bar, Tree view, Tab controls, Text and Font. Graphics Consoles,

Multitasking Process and Threads. Clipboard Drag and Drops, Advance features of Windows Programming GDI Metafiles, Sound API, DLL. Visual C++ Basic: Introduction, Building a Basic Application, SDI and MDI, View Document Architecture Using Microsoft Foundation Class (MFC) Library, Visual C++ Resources: Application Wizard, Accelerators and Menus, Toolbars.

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## 28. BACHELOR IN TOURISM STUDIES/B.T.T.M.

### ( TOURISM and TRAVELLES)

#### Unit – I : Introduction to Tourism Business

- Forms & Types of Tourism Business: Intra-regional, Inter-regional, Inbound, Outbound and National.
- Tourist typology on the basis of tourist motivation and their destination use pattern. Tourist's subcategories: traveller, excursionist, transient, pilgrim, their definition and differentiation. Tourist profile: length of stay, expenditure pattern, place of origin.
- Determinants and motivations of tourist (push & pull factor), Tourism System, Tourism product production system, Tourism industry major and allied components and how tourism is associated with ancillary services.
- History of Tourism, development of spa & hot springs, the grand tour, development of sea side resorts and Victorian age.

**Tourism Organization :** Role of UNWTO, WTTC in the growth and expansion of tourism industry.

#### Unit – II : Tourism Resources

- Concept of tourist resource, attraction and destination in tourism industry. Tourism products: typology and their characteristics.
- Hindu Resources:- Badrinath, Rameshwaram, Dwarika, Jaggannath Puri, Kedarnath, Kashi Vishwanath, Mahakaleshwar, Omkareshwar, Somenath, Nageshwar, Triumbakeshwar, Jageshwar (Bihar), Bhimshankar, Ghushmeshwar (Ellora), Mallikarjun, Konark, Khajuraho and Hampi.
- Islamic Resources: - Red Fort (Delhi), Qutub Minar, Humayun Tomb, Fathehpur Sikri, Red Fort (Agra), The Taj Mahal, Itmad-ud-daulah, Dargah Ajmer Sharif, Hazratbal (Srinagar)
- Buddhist Resources: - Bodh Gaya, Sarnath, Kushinagar, Kapilavastu, Lumbini, Sanchi, Ajanta, Ellora. Hammis, Tabo, Tawang, Rumtek.
- Other Resources: - Churches of Goa, Jain Temples of Ranakpur, Dilwara Temple Mt. Abu, Cellular Jail Port Blair, Harmandar Sahab Amritsar, Lotus Temple Delhi, National Museum Delhi.
- Cultural Resources: - Kumbh Mela, Kullu & Mysore dusshera, Puri Rath Yatra, Kailash Mansarovar yatra, Amarnath Yatra, Nandadevi Raj Jaat, Nandadevi Mahotsav, Nainital, Pongal and Onam.

- Natural Resources: - Jim Corbett national park, Rajaji national park, Kanha, Kajiranga, Sunderbans, Bharatpur Bird Sanctuary, Kedarnath Muskdeer Sanctuary, Runn of Kutch, Nandadevi Biosphere Reserve, Nilgiri Biosphere Reserve, Manikaran Hotsprings, Munnar, Thenmala, Allepy Back waters.
- Tourism Resources of Uttarakhand: - Panch Badri, Panch Kedar, Panch Prayag, Gangotri, Yamnotri, Hardwar- Piran Kaliyar, Devprayag, Anusuya Devi, Pandukeshwar, Guptkashi, Ukhimath, Kalimath, Trijuginarayan, Panwalikantha, Sahastratal, Govind Wildlife Sanctuary, Valley of Flowers, Hemkund, Kagbhusandi Tal, Lansdowne, Chakrata, Almora, Kasar Devi, Binsar, Bageshwar, Patalbhuvaneshwar, Katarmal, Jageshwar, Baijnath, Nanakmatta, Purnagiri, Champawat, Lohaghat, Mukteshwar, Dayara Bugyal, Harshil, Narayan Ashram, Curzon's Trail, Glaciers and major river networks.

**Tourism Organization :** Origin, Organization and functions of Ministry of Environment, Forest and Wildlife, DOT Government of India, WWF, ASI, INTACH, IUCN, UTDB.

### **Unit – III : Alternative Tourism Resources**

- Major Ecotourism circuits in Uttarakhand, Sikkim, Madhya Pradesh, Kerala and Andaman and Nicobar.
- Adventure sports. Major sites of adventure sports in India. Current trends of adventure sports activities. Major trekking trails in Uttarakhand, Himanchal Pradesh, Jammu & Kashmir. Major mountain peaks of Uttarakhand, Himanchal and J&K.
- Significant sea beaches and Islands of Goa, Kerala, Lakshwadeep and Andaman and Nicobar and popular and upcoming adventure sports in these locations.

**Tourism Organization :** Origin, Organization and functions of IMF, ASAI (Adventure Sports Association of India), ATOAI (Adventure Tour Operators Association of India).

### **Unit – IV: Hospitality Industry**

- Growth and development of hospitality industry, Linkages and significance with relation to tourism. Beginning of hospitality industry with the formation of Sarai, Inns, Taverns, Lodges, Chalets, Dharamshalas, Hotel, Motels, Heritage hotels and other supplementary accommodations.

- Nature and size of hospitality industry in India in context of accommodation, eateries, midways and restaurant. Emerging trends and issues in Hospitality Industry.
- Major hotel chains and groups in India, Ashok, Taj, Oberoi, Sheraton, Best Western, Intercontinental, JW Marriot and Marriot.
- Hotel and restaurant classification and guidelines for categorization of hotels and restaurant.
- Fiscal and non-fiscal benefits and concessions available to hospitality units in India.

**Tourism Organization** : Origin, Organization and functions of FHRAI and HRACC

### **Unit – V : Transport Industry**

- Advent of Road, Rail, Air and Waterways transportation. Ferries and jetties. Introduction of Jet engines and high speed trains. Dynamically Changing needs and means.
- Landmarks in the development of transport sector and the consequent socio – economic, Cultural and environmental implications. Tourism transport system.
- The Airlines Industry-Origin and Growth. Frill and Non Frill air services and Air taxis.
- Growth and Development of road transport system in India, Role of Regional Transport Authority. State and inter – state bus and coach networks.
- Rail Transport Network, Tourist trains; Palace on Wheels, Royal Orient, Darjeeling Mini Train, British Rail, Euro Rail and Amtrak, Indian Railways offered tour packages.
- Water Transport System in India – Historical past, Cruise ships, Ferries, Hovercraft, River and canal boats, Fly cruise. Future prospects.

**Tourism Organization** : Origin, Organization and functions of ICAO, DGCA, AAI, IRCTC and NHA.

### **Unit – VI : Travel Agency and Tour Operations Business**

- Formation and development of Travel Agency and Tour Operators since the time of Thomas Cook and its business expansion in Europe, South East Asia, Far East and Australia.

- Beginning of Travel Agency in India with the formation of SITA, TCI, Cox's & King's, Mercury and Balmer & Lowrie.
- Categories of travel agencies and tour operators. Definition, Differentiation and linkages; Organization structure and functions-Travel information counseling, Itinerary preparation, Reservation, Tour costing / pricing. Marketing of tour packages, TIM, VISA, Health regulations, Foreign Exchange.
- Guidelines of Ministry of Tourism, Government of India for operating tour companies. Incentives and concessions available. Legal & ethical guidelines for travel agencies & tour operators.
- Methods and major software used in ticketing, freedoms of air, air cargo handling, methods of estimating air cargo rates. Dangerous goods regulations. Baggage allowance, Free access baggage.

**Tourism Organization** : Origin, Organization and functions of IATA, TAAI, IATO, ASTA, WATA.

### **Unit – VII : Tourism Marketing**

- Core concepts in marketing. Difference between goods and services marketing. Service characteristics of tourism. Unique features of tourist demand and tourism product / Tourism marketing mix.
- Methods and determinants of exploring tourism markets. Demand forecasting. Market segmentation, potential tourism markets in different regions. Marketing tools and their implementation.
- Marketing environment, marketing research, product placement and product branding, formulation of marketing strategies and implementation of marketing plan. Customer Relationship Management.
- Marketing action plan for Airlines, Hotel, Resort, Travel Agencies and other tourism related services – Challenges and strategies.

### **Unit – VIII : Tourism Policy and Planning**

- Framework of Government of India's Tourism development approach and policy. General concept of tourism planning, levels and types of tourism planning.



- India's tourism policies. Incorporation of tourism in five year plan, National Action Plan for Tourism.
- Planning process, objective setting, Background analysis, Detailed research and analysis, Synthesis, Goal setting and Plan formulation, Evaluation of tourism project, Plan implementation, Development and monitoring of Tourism master plan.
- Tourism impacts, methods of assessing physical and social carrying capacity, methods of environmental impact assessment (EIA). Measuring economic costs and benefits of Tourism Development.
- Case studies of tourism planning undertaken by Government of Uttarakhand, Kerala, Rajasthan and Sikkim.

### **Unit – IX : Research Methodology**

- Meaning and objectives of research, Types of research, current trends of tourism market research, consumer behavior and destination use pattern.
- Formulating research problems, research design, steps in sampling design and selection of sample size.
- Primary data, methods of data collection, steps in handling data, types of data analysis, statistics in research, measures of dispersion, procedure for hypothesis testing.
- Analytical tools, methods and steps in Report writing, referencing and styles of referencing.

**Tourism Organization** : Origin, Organization and functions Market Research Division of Department of Tourism, Government of India.

### **Unit – X : Management**

- Nature, scope & significance of management, evolution and development of management thoughts, significance and scope of management planning.
- Organizational theories, theories of motivation, types and techniques in communication, principles and techniques of management co-ordination.
- Decision – making, Process, Tools and techniques. Decision – making models, issues and trends before future managers in 21<sup>st</sup> century.
- Tradition and modern concepts of finance function, Working Capital Management, dividend policy and share valuation, Financial institutions and markets, Term lending and lease financing. Strategic financial alliances

**Tourism Organization** : Origin, Organization and functions of Tourism Finance Corporation of India.

## 29. B.SC. HOME SCIENCE

### Unit I: Food Science

- Selection, nutritional contribution and changes during cooking of various food groups
- Methods of cooking and minimizing nutrient losses during cooking
- Food processing and preservation
- Food quality, safety, sanitation and standards
- Food analysis

### Unit II: Nutrition Science and Meal Planning

- Fundamentals of nutrition- Functions, dietary sources and clinical manifestations of deficiency/excess of macro and micro-nutrients
- Dietary guidelines for Indians – Dietary Reference Intakes, Recommended Dietary Allowances-2010; Food Pyramid; Balanced diets.
- Nutrition for various age groups and physiological conditions.
- Meal planning – Use of food exchange lists; Normal and Therapeutic Nutrition
- Public Nutrition – Assessment of nutritional status; Common nutritional deficiencies and their nutritional management
- Breast feeding and Complementary feeding.
- Nutritional biochemistry
- Food microbiology
- National nutrition policy; Nutrition Programmes
- Role of National and International agencies in nutrition

### Unit III: Institutional Management

- Kinds of food service establishments
- Food production and resources
- Management of hospitality institutes – Hospitals / Hotels / Restaurants / Cafes and Outdoor catering
- Management of social institutes – Family as an institute, Child care and Geriatric institutes, *Panchayats*
- Management of educational institutes – Pre-school, Primary and Secondary Schools, Higher educational institutes (Colleges and Universities)
- Challenges and problems faced by institutions

## **Unit IV : Clothing**

- Clothing terminology, principles
- Family clothing
- Clothing construction techniques - drafting, flat pattern and draping methods
- Equipments used in clothing construction
- Anthropometric measurements and paper patterns for different garments
- Use of construction features in design
- Traditional embroideries of India
- Fashion design – Fashion cycles; Business and Merchandizing

## **Unit V : Textiles**

- Textile design- Principles; Concepts; Elements
- Care and maintenance of textile materials/garments
- General properties and structure of all textile fibers
- Processing and manufacturing of all natural and man-made fibers
- Definition and classification of yarns; Identification of yarns and its use in various fabrics
- Weaves - Types and use
- Fabric construction, definition and types of woven, non-woven, knitted and other construction techniques
- Testing of fibers, yarns and fabric; quality control and research institutes
- Dyeing, printing and finishing of fibers, yarns and fabrics
- Traditional textiles of India
- Textile and Apparel institutes; Fundamentals of business, quality control and marketing
- Consumer and Textiles/Clothing
- Recent developments in textile and clothing

## **Unit VI: Resource Management**

- Concept; Approaches, Ethics of management and management process
- Classification of resources and their characteristics
- Management of resources
- Functions of management
- Decision making process
- Work simplification
- Household income and expenditure
- Consumer education and protection

- Housing; Interior design- Principles of interior design, Colours and Colour schemes.
- Household equipment - Selection and care.
- Ergonomics- Concepts and its importance/application in home.

### **Unit – VII: Human Development**

- Human Development - Principles and stages
- Theories of Human Development - Personality, learning theories, cognitive development theories and theories of moral development
- Socialization and child rearing practices
- Children with special needs - Definition, classification and need for special education, education and management of children with disabilities, policies and laws
- Early childhood care and education
- Guidance and Counseling - meaning, types, need and use of psychological testing
- Advanced child study methods and assessment
- Women and child welfare programs in India
- Child rights and women empowerment - Laws and programs for girls and women
- National and International agencies for child and women welfare

### **Unit VIII: Non – Formal Education and Extension Education**

- History and development of Home Science in Formal / Non-formal and Extension Education
- Difference in Formal/ Non- formal and Extension Education
- Extension education: History, concept, goals, philosophy, principles and methods
- Planning, supervision, monitoring and evaluation of Formal/ Non- Formal and Extension Education
- Community development – Organization, principles, characteristics and functions
- Role of Home Scientist in community development
- Self-employment and entrepreneurship through Home Science
- Extension Institutes in India
- Programmes and agencies for rural development

## **Unit IX: Communication and developmental communications**

- Communication: history, functions, types, scope, uses, elements, methods and barriers
- Audio- visual aids: Concepts, classifications, characteristics and scope
- Developmental communication: Concept, models, characteristics, philosophy and role
- Theories of development and trends in developmental communication
- Traditional and modern media (Printed and Electronic): Types, characteristics and role
- News reporting –Definitions, ingredients, qualities, value, types of reports, structure
- Scope and use of ICT in developmental communication

## **Unit X: Methods of Research**

- Trends in research in Home Science
- Research designs and types of research
- Sampling techniques
- Selection and preparation of tools for data collection.
- Variables and their selection
- Data collection and classification / coding
- Analysis of data and report writing

## 30. B.A. Mass Communication

### Unit – I

- Communication and mass communication; Basic terms, concepts and definitions, nature and process.
- Elements of communication
- Types of communication; Intra- personal, inter- personal, group, public and mass communication
- Verbal and non-verbal communication
- Demographics and psychographics of Indian audiences
- Functions of communication and mass communication
- Barriers of communication
- Mass communication in India – Reach and access.

### Unit – II

- Role of media in society.
- Characteristics of Indian society – Sociological and psychological impact of media.
- Impact of media on specific audiences – Women, youth, children and farmers etc.
- Mass media effect studies and their scope and limitations.
- Mass media campaigns for specific issues – Social concerns, environment, human rights, gender equality, health, education, poverty and economic inequality
- Basic media effect theories.

### Unit – III

- Journalism: Basic terms, concepts and definitions
- Journalism as a Profession.
- Journalists – Their role and responsibilities.
- Indian Constitution and freedom of press.
- Ethics and Journalism: objectivity, bias, invasion of privacy, sensationalism, trivialisation, trial by media etc.
- Careers in journalism and mass media.
- Training – Problems, perception and response by the industry.
- Professional organizations in media
- Online journalism.

## Unit – IV

- History of print and broadcast media in general with particular reference to India
- Mass media in Uttarakhand :A historical perspective
- Post – independent developments in print media.
- Newspapers – English and Indian language press – major landmarks.
- Magazines – Their role and contemporary situation.
- Small newspapers – Problems and prospects.
- News Agencies in India.
- Press Commissions, Press Council – Their recommendations and status.
- Development of radio after independence – Extension role, radio rural forums, regional and local broadcasting – General and specific audience programmes.
- Development of television: Initial developments and experimental approach; SITE phase and evaluation; Expansion of television – Post – Asiad phase, issues concerns and debates over a period of time.
- Committees in broadcasting – Background, recommendations and implementation.
- Cinema – Historical overview and contemporary analysis – Commercial, parallel and documentary genres – Problems and prospects for the film industry.
- New trends in Indian cinema.

## Unit – V

- Communication and theories of social change.
- Theories and models of Communication: Bullet Theory, Two –step and Multi-step FlowTheories, Agenda- setting, Cultivation, and Uses and Gratification Theories. Osgood, Wilbur Schramm and George Garber’s models.
- Role of media in social change – Dominant paradigms.
- Critique of the Dominant paradigm and alternative conception.
- Development initiatives – State, market and the third force (NGO sector).
- Participatory approaches and community media – Ownership and management perspectives.

## Unit – VI

- Research; Meaning, concept and scope.
- Introduction to research methods.
- Mass communication research – Historical overview
- Types of Research
- Unique characteristics of mass communication research
- New trends in mass communication research in India
- Media effects research – Strengths and limitations.
- Communication research in India – Landmark studies.
- Content analysis – Quantitative and qualitative approaches.
- Market research and its relationship to communication, particularly advertising.
- Research Process.
- Sampling techniques – Strengths and limitations.
- Statistical methods of data analysis.

## Unit – VII

- Globalisation and mass media.
- Colonial structures of communication.
- Decolonisation and aspirations of nations.
- Conflicts related to media coverage and representation.
- International news agencies.
- MacBride Commission and its Recommendations.
- “Many Voices, One World”
- Contemporary issues related to transnational broadcasting and its impact on Indian society and culture.
- Convergence of media – Problems and options.
- Media policies in an international context.
- India’s position and approaches to international and inter-cultural communication issues.

## Unit – VIII

- Radio, TV, cinema and digital media as media of mass communication.
- Grammar of Radio, TV and Film Production
- The Production Teams.
- Role of producer and director.



- Different Types of Radio and TV programmes.
- Writing for Radio, TV, Film and Digital media.
- The Visual Language.
- Camera Placement, Movements, Angles and Shots.
- Basic Theories of Composition – Cues and Commands.
- Formats for Radio and Television – News, Sitcoms, Features, Commercials, Serials and Documentaries.
- Three Stages of programme production; Pre-production, production and post-production.
- Sound design, microphones, sets and lighting.
- Satellite and cable television, computers, microchips.

### **Unit – IX**

- Advertising: Meaning, concept, nature and types.
- Advertising; A historical perspective.
- Objectives of advertising.
- Legal and ethical aspects of advertising.
- Writing an advertisement: Slogan, copy and visual etc.
- Public relations: Meaning, concepts nature and scope.
- Public relations: A historical perspective.
- Functions and tools of PR and corporate communication.
- Publicity, Propaganda, Public Opinion and Lobbying.
- Ethics of PR.

### **Unit – X**

- Media Management: Meaning, concept and scope.
- Ownership patterns; Individual, trust, society, company, multi-national companies and corporations.
- Cross-media ownership, media conglomerates
- Corporatisation of media.
- Media Economics.
- Media Organisations: INS, RNI,ABC,PIB,DAVP,TAM, BARC, PRSI,ASCI
- Managing the media.
- Image engineering.
- Media marketing.
- New trends in media management.

## 31. COMPUTER SCIENCE

### Discrete Structures

Sets, Relations, Functions, Inclusion- Exclusion Principles, Equivalence and orderings, Probability, Counting and Countability, Counting Principles, Functions and counting, Permutation and Combinations, Combinational arguments, Infinite Sets and countability. Graph Theory: Basic concepts, Paths and connectivity, Planar graphs, Trees, Rooted trees, Shortest path algorithm, Hamiltonian and Eulerian graphs. Groups, Finite fields, Error detecting and correcting codes.

### Computer Organization

Central Processing Unit: Computer registers, bus system, instruction set, timing and control, instruction cycle, memory reference, input-output and interrupt, Bus Interconnection design of basic computer, Register organization; Stack organization; Instruction Format and Addressing Modes. Control Unit : Control memory, Address Sequencing, Micro program, Design of Control Unit. Arithmetic Algorithms: Integer multiplication; Integer division, Floating point representations and Arithmetic algorithms. I/O Organization: Peripheral Devices, Input-Output Interface, Asynchronous Data Transfer, Modes of Data Transfer, Priority Interrupt, Direct Memory Access, Input Output Processor. Memory Organization : Memory Hierarchy, RAM, ROM, Associative Memory, Cache Memory Organization and Virtual Memory Organization.

### Data and File Structure

Definition of data structure, Complexity, Notations, Time space trade-off, Arrays, Stacks, Queues, Priority queues, Linked Lists, Trees, B trees and B<sup>+</sup> trees, heaps, graphs. File Structures: Sequential, Direct, Indexed- Sequential and Relative files, Inverted Lists and multi lists, Hashing.

### Operating System

Definition, Functions of operating systems, Batch systems, Multiprogramming, Time sharing, parallel, distributed and real time systems, operating Systems structure. Memory Management: Logical and physical Address space, Swapping, contiguous Allocation, Fragmentation, Compaction, Segmentation, Paging, Virtual Memory, Thrashing. Scheduling : CPU Scheduling, I/O Scheduling, Resource scheduling, scheduling criteria and algorithms, Multiple-processor Scheduling,

Deadlock and deadlock handling. File Management : File concept, File access and Allocation methods, Directory structure, File protection mechanisms, Free space management, Recovery, Disk Management, Swap space management.

UNIX : File System, Process Management, kernel and shell, shell script, Pipelining, Filtering, System commands, vi and ed editor commands, System calls.

### **Data Base Management System**

DBMS- Definition, features and applications, Data Base System versus file system, Data models, Entity- Relationship model, Design Issues, E-R Diagram. SQL : Basic structure of SQL queries, Set operations, Nested Sub queries, Views, Complex queries, Joined relations, DDL, DML and DCL commands, Embedded SQL, User Interface and Tools, Security and Authorization, Normalization. Transaction and Concurrency Control: Transaction concepts, Transaction state, Implementation of Atomicity and Durability, concurrent Executions, Serializability, Recoverability, Implementation of Isolation, Concurrency Control, Lock-based protocols, Multiple granularity, Deadlock handling.

### **Computer Networks**

Introduction to Computer Networks- overview of Data and Signal bits, Baud and Bit rate, Channel capacity, Guided and Unguided Media, Local Area Networks, Wide Area Networks, Metropolitan Area Network, Internetworking. OSI reference model, Services, TCP/IP model, Goals of layered protocols. Data Communication: Multiplexing, Switching, narrowband ISDN, broadband ISDN, ATM, Cellular Radio, Communication Satellites- geosynchronous and low- orbit. Internetworking: Switch, Hub, Bridge, Router, Gateway, Concatenated virtual circuits, Tunneling, Fragmentation, Firewalls, Routing: Virtual circuits and datagrams, Routing Algorithms, Congestion Control. Network Security: Cryptography, Symmetric- Key Algorithms, Public- Key Algorithms, Management of Public Keys, Communication Security, Web Security, Authentication Protocols.

### **Design and Analysis of Algorithms**

Time and space complexity, Asymptotic notations, Basic Algorithm Design Techniques- Divide- and- conquer, greedy, branch- and- bound, dynamic programming. Graph Algorithms, Graph traversal, Sorting and Searching

algorithms, Knuth-Morris-Pratt Pattern matching algorithm, Strassen's Matrix multiplication algorithm, NP-complete and NP-hard problems.

### **Software Engineering**

Software Development Process, system Development, Life cycle, waterfall Models, spiral model, proto- typing approach, 4 GL approach, Requirement-Analysis, Feasibility study. Software Metrics: Software Project Management. Software Design: System Design, function oriented Input/output design, object oriented design, user interface design, design level metrics. Software Testing: Testing objectives and principles, performance testing, Testing level metrics, software quality and reliability, clean room approach, software reengineering, Test data generators.

### **Theory of Computation**

Introduction to Languages; Regular Expressions; Finite Automata; Kleene's Theorem; Moore and Mealy machines, Equivalence of Moore and Mealy machines; Context-Free Grammars, Normal Forms; Push Down Automata; Parsing; Turing Machines; Post Machines, Phrase Structure Grammar; Context Sensitive Grammar; Computable Functions; Church's Thesis; Halting Problem.

### **Programming in C**

Data types, Constants, Variables, I/O functions, Operators, Control structures, Functions, Recursion, Arrays and strings, Pointers, Dynamic storage allocation, User- defined data types, Structures and Unions, Storage classes, String handling, Streams, File Operations and handlings, Macro definition predefined macros, Preprocessor directives, Low- level Programming.

### **Object Oriented Programming with C++ and Java**

Definition and basics of object oriented technique, Object-identity, Encapsulation, Information hiding, Polymorphism, Principles of modeling, object oriented modeling, Introduction to UML, Conceptual model of UML and Architecture. Basic Structural Modeling: Classes, Relationships, Common mechanisms and diagrams, Class and object diagrams, Use cases, State machine, Processes and threads, Events and signals.

C++ Programming: Inline Functions, Friend function, Virtual function, Constructors and destructors, static data member and static member function, operator overloading and function overloading, Pure Virtual Functions, Member Access Operators, casting, Templates and Generic Programming, Overloading and Function Templates. Exception Handling, Namespaces, An Object-Oriented Library, Condition States, Managing the Output Buffer, Containers. Java Programming: Introduction to Java, Features, classes and objects, Inheritance, Packages, Interfaces, abstract methods and classes, Polymorphism, Inner classes, String handling, Event Handling, Multi- threading, Java APIs, Java Beans : Application Builder tools, Bean developer kit, Developing a Bean, Java Beans API, Session Beans, Entity Beans. Java Swing : Introduction to AWT, AWT versus Swing, creating a Swing Applet and Application, Introduction to Servlets.

## **Computer Graphics**

Video display devices, Raster- scan systems, Random- scan systems, Graphics monitors, Line- drawing algorithm, Circle generating algorithms, Ellipse-generating algorithms, Two-Dimensional Transformations: Transformations of Points and Straight Lines, Mid-point Transformations, Rotation, Reflection, Scaling, Projection, Combined Transformation, Three-Dimensional Transformation: Scaling, Shearing, Rotation, Reflection, Projection and Translation, Multiple Transformation, Two Dimensional Viewing: Viewing pipeline, Viewing coordinate reference frame, Window- to viewport coordinate transformation, Clipping operations, Point clipping, Cohen- Sutherland line clipping, Sutherland- Hodgeman polygon clipping, Curve clipping, Text clipping, Exterior clipping.

## **Soft Computing**

Soft computing- Introduction, techniques and applications, Soft computing versus hard computing. Neural Network- Structure and Function of a single neuron, Biological neuron, artificial neuron, ANN- definition, characteristics and applications, Single layer network, Perceptron training algorithm. Linear Separability, Window and Hebb's learning rule/delta rule, ADALINE, MADALINE, Multi Layer Perceptron, Activation functions. Fuzzy logic : Fuzzy set theory, Fuzzy set versus crisp set, Crisp relation and fuzzy relations, Fuzzy

System: Crips logic, Fuzzy logic, Membership functions, Fuzzy rule base system : Fuzzy prepositions, formation, decomposition and aggregation of fuzzy logic. Genetic algorithm: Basic concept, Working principle, Encoding fitness function, Reproduction, Genetic modeling. Mutation operator, Bitwise operator, Convergence of GA, Applications of GA.

## **Mobile Computing**

Evolution of Mobile Computing- Benefits, Applications, Wireless network architecture, Security, Concerns and Standards, Wireless Network Technologies- 1G to 5G, Bluetooth, RFID, Wireless Broadband. Mobile IP: Introduction, Advertisement, Registration, two level addressing, abstract mobility management model, performance issue, routing in mobile, Mobile TCP, Time out freezing, GSM, PLMN interface, authentication and security, Mobile computing over Short message services, GPRS, Wireless Application Protocol, ad-hoc networks and sensor networks, wireless LAN security, Voice over Internet protocol and convergence, SIP, comparison between H.323 and SIP, Real time protocols, call routing, IMS, Mobile VoIP, security techniques and framework for mobile environment.

## **Cloud Computing**

Cloud- Characteristics and Services, Cloud models- IaaS, PaaS and SaaS, Public vs Private Cloud, NIST Reference Architecture, Cloud solutions, Cloud ecosystem, Virtualization : Basics of Virtualization, Types of Virtualization, Implementation Levels of Virtualization, Virtualization Structures, Tools and Mechanisms, Virtualization of CPU, Memory and I/O Devices, Virtual Clusters and Resource management, Virtualization for Data-center Automation, Cloud Infrastructure : Architectural Design of Compute and Storage Clouds, Layered Cloud, Architecture Development, Design Challenges, Inter Cloud Resource Management, Resource provisioning and Platform Deployment, Global Exchange of Cloud Resources, Cloud Security- Challenges and Risks, Security Governance and Risk Management.

## **System Software and Compiler**

Assemblers and Macros: Overview of Language processors, Assemblers, Design of two pass assemblers, single pass assemblers MACRO: Macro definition, macro call, macro expansion, Design of Macroprocessor. Linkers and Loaders: Relocation and linking concepts, Design of linker, self relocating programs, overlays. Dynamic linking: Loaders, Absolute loaders, relocating loaders. Compilers: Lexical analysis, handles, token specification, design of lexical analyzer, Syntax analysis– parsing definition, role of parsers, top-down parsing, bottom-up parsing, Shift reduce parsing, operator precedence parsing, predictive parsing, recursive descent parsing. LR parsing, SLR parsing, LALR parsing, Ambiguous grammars, Errors and error recovery. Syntax directed translation- Intermediate Languages, postfix, three-address code, Quadruple, triple, indirect triples, syntax tree, evaluation of expression. Code optimization: Local optimization, Loop Optimization techniques, DAG, Flow graphs, Storage allocations, Peephole optimization. Issues in Code Generation.

## **Distributed and Parallel Computing**

Distributed System- Advantages, Trends and Challenges. Communication in Distributed System- System Model, Inter Process Communication, API for internet protocols. Remote Method Invocation and Objects, Remote procedure call, File System, Middleware, Routing overlays. Synchronization and Replication, Clocks, Events and Processes, Synchronizing Physical clocks, Logical time and logical clocks, Global states, Coordination and Agreement, Distributed mutual exclusion, Election, Transactions and Concurrency Control, Transactions, Locks, Optimistic concurrency control, Timestamp ordering, Distributed deadlocks, Replication. Advent of parallel processing, PRAM model of parallel computation, PRAM Algorithms, Elementary Parallel Algorithms.

## **Artificial Intelligence**

Definition, scope, techniques and characteristics, Problems and problem spaces, Production systems, Control Strategies, Heuristic search, Problem characteristics, Production system characteristics. Problem Solving Methods- Forward versus backward reasoning, Problem Trees versus Problem graphs, Knowledge

representation and the frame problem, Generate-and-test, Hill Climbing, Breadth-First- Search, Problem Reduction, Constraint satisfaction, Game Playing : Minimax search, Alpha-beta pruning, Secondary search. Knowledge Representation using Predicate Logic: Representing simple facts using logic, Resolution, Conversion to clause form, Resolution in clause form, Unification algorithm.

## **Data Warehousing and Data Mining**

Need for Data Warehousing, Operational versus decision- support systems, Data warehouses, Datamarts and metadata, Components, Business Requirement, Requirement gathering methods, Data warehousing architecture, Characteristics, Tools, Infrastructure supporting architecture, STAR schema, Snowflake schema, Aggregate fact tables, Data Extraction, Transformation and Loading; OLAP. Data Mining: Knowledge discovery process, OLAP versus data mining, Data mining techniques, Custer detection, Decision trees, Memory-based reasoning, Link analysis, Neural networks, Genetic algorithms, Data mining application.