

Maharaja Ganga Singh University, Bikaner
Combined Entrance Test for M.Phil./Ph.D. - 2014

Duration : 2 Hours

Max. Marks : 300

SYLLABI

The question paper will contain 100 Multiple Choice Questions of 3 marks each. There will be negative marking of 1 mark for each wrong answer. Answers will be made on OMR sheet. Question papers in Law and Science subjects will be in English and rest, other than those of languages, will be both in English and Hindi.

1. Hindi
2. English
3. Urdu
4. Sanskrit
5. Rajasthani
6. Political Science
7. Public Administration
8. Economics
9. Sociology
10. History
11. Geography
12. Philosophy
13. Commerce
14. Education
15. Law
16. Botany
17. Zoology
18. Physics
19. Chemistry
20. Geology
21. Mathematics
22. Biotechnology
23. Environmental Science
24. Microbiology

Hindi

1. हिन्दी भाषा और उसका विकास

अपभ्रंश (अवहट्ट सहित) और पुरानी हिन्दी का सम्बन्ध, काव्यभाषा के रूप में अवधी का उदय और विकास, काव्यभाषा के रूप में ब्रजभाषा का उदय और विकास, साहित्यिक हिन्दी के रूप में खड़ी बोली का उदय और विकास, मानक हिन्दी का भाषा वैज्ञानिक विवरण (रूपगत), हिन्दी की बोलियाँ – वर्गीकरण तथा क्षेत्र, नागरी लिपि का विकास और उसका मानकीकरण।

हिन्दी प्रसार के आन्दोलन, प्रमुख व्यक्तियों तथा संस्थाओं का योगदान, राजभाषा के रूप में हिन्दी।

हिन्दी भाषा-प्रयोग के विविध रूप – बोली, मानकभाषा, सम्पर्कभाषा, राजभाषा और राष्ट्रभाषा, संचार माध्यम और हिन्दी।

2. हिन्दी साहित्य का इतिहास

हिन्दी साहित्य का इतिहास-दर्शन, हिन्दी साहित्य के इतिहास-लेखन की पद्धतियाँ।

हिन्दी साहित्य के प्रमुख इतिहास-ग्रन्थ, हिन्दी के प्रमुख साहित्यिक केन्द्र, संस्थाएं एवं पत्र-पत्रिकाएं, हिन्दी साहित्य के इतिहास का काल-विभाजन और नामकरण।

आदिकाल : हिन्दी साहित्य का आरम्भ, कब और कैसे ? रासो साहित्य, आदिकालीन हिन्दी का जैन साहित्य, सिद्ध और नाथ साहित्य, अमीर खुसरो की हिन्दी कविता, विद्यापति और उनकी पदावली, आरम्भिक, गद्य तथा लौकिक साहित्य।

मध्यकाल : भक्ति-आन्दोलन के उदय के सामाजिक-सांस्कृतिक कारण, प्रमुख निर्गुण एवं सगुण सम्प्रदाय, वैष्णव भक्ति की सामाजिक-सांस्कृतिक पृष्ठभूमि, आलवार सन्त, प्रमुख सम्प्रदाय और आचार्य, भक्ति आन्दोलन का अखिल भारतीय स्वरूप और उसका अन्तःप्रादेशिक वैशिष्ट्य।

हिन्दी सन्त काव्य : सन्त काव्य का वैचारिक आधार, प्रमुख निर्गुण सन्त कवि कबीर, नानक, दादू, रैदास, सन्त काव्य की प्रमुख विशेषताएं, भारतीय धर्म साधना में सन्त कवियों का स्थान।

हिन्दी सूफी काव्य : सूफी काव्य का वैचारिक आधार, हिन्दी के प्रमुख सूफी कवि और काव्य – मुल्ला दाऊद (चन्दायन), कुतुबन (मिरमावती), मंझन (मधुमालती), मलिक मुहम्मद जायसी (पद्मावत), सूफी प्रेमाख्यानकों का स्वरूप, हिन्दी सूफी काव्य की प्रमुख विशेषताएं।

हिन्दी कृष्ण काव्य : विविध सम्प्रदाय, वल्लभ सम्प्रदाय, अष्टछाप, प्रमुख कृष्ण-भक्त कवि और काव्य, सूरदास (सूरसागर), नन्ददास (रास पंचाध्यायी), भ्रमरगीत परम्परा, गीति परम्परा और हिन्दी कृष्ण काव्य – मीरा और रसखान।

हिन्दी राम काव्य : विविध सम्प्रदाय, राम भक्ति-शाखा के कवि और काव्य, तुलसीदास की प्रमुख कृतियाँ, काव्य रूप और उनका महत्त्व।

रीति काल – सामाजिक-सांस्कृतिक परिप्रेक्ष्य, रीतिकाव्य के मूल स्रोत, रीतिकाल की प्रमुख प्रवृत्तियाँ, रीतिकालीन कवियों का आचार्यत्व, रीतिमुक्त काव्यधारा, रीतिकाल के प्रमुख कवि : केशवदास, मतिराम, भूषण, बिहारीलाल, देव, घनानन्द और पद्माकर, रीतिकाव्य में लोकजीवन।

आधुनिक काल : हिन्दी गद्य का उद्भव और विकास।

भारतेन्दु पूर्व हिन्दी गद्य, 1857 की राज्य क्रान्ति और सांस्कृतिक पुनर्जागरण, भारतेन्दु और उसका मण्डल, 19वीं शताब्दी के उत्तरार्द्ध की हिन्दी पत्रकारिता।

द्विवेदी युग : महावीरप्रसाद द्विवेदी और उनका युग, हिन्दी नवजागरण और सरस्वती, मैथिलीशरण गुप्त और राष्ट्रीय काव्यधारा, राष्ट्रीय काव्यधारा के प्रमुख कवि, स्वच्छन्दतावाद और उसके प्रमुख कवि।

छायावाद : विशेषताएँ एवं प्रमुख कवि, प्रगतिवाद : विशेषताएँ एवं प्रमुख कवि, प्रयोगवाद : विशेषताएँ एवं प्रमुख कवि, नई कविता : विशेषताएँ एवं प्रमुख कवि, नई कविता : विशेषताएँ एवं प्रमुख कवि, साठोत्तर कविता एवं समकालीन कविता : विशेषताएँ एवं प्रमुख कवि।

3. हिन्दी साहित्य की गद्य विधाएँ

हिन्दी उपन्यास : प्रेमचन्द पूर्व उपन्यास, प्रेमचन्द और उनका युग, प्रेमचन्द के परवर्ती प्रमुख उपन्यासकार : जैनेन्द्र, अज्ञेय, हजारीप्रसाद द्विवेदी, यशपाल, अमृतलाल नागर, फणीश्वरनाथ 'रेणु', भीष्म साहनी, कृष्णा सोबती, निर्मल वर्मा, नरेश मेहता, श्रीलाल शुक्ल, राही मासूम रजा, रांगेय राघव, मन्नू भण्डारी।

हिन्दी कहानी : बीसवीं सदी की हिन्दी कहानी और प्रमुख कहानी आन्दोलन।

हिन्दी नाटक : हिन्दी नाटक और रंगमंच, विकास के चरण और प्रमुख नाट्यकृतियाँ : अंधेर नगरी, चन्द्रगुप्त, अन्धायुग, आधे-अधूरे, आठवाँ सर्ग, हिन्दी एकांकी।

हिन्दी निबन्ध : हिन्दी निबन्ध के प्रकार और प्रमुख निबन्धकार : रामचन्द्र शुक्ल, हजारीप्रसाद द्विवेदी, कुबेरनाथ राय, विद्यानिवास मिश्र, हरिशंकर परसाई।

हिन्दी आलोचना : हिन्दी आलोचना का विकास और प्रमुख आलोचक : रामचन्द्र शुक्ल, नन्ददुलारे वाजपेयी, हजारीप्रसाद द्विवेदी, रामविलास शर्मा, डॉ. नगेन्द्र, डॉ. नामवर सिंह, विजयदेव नारायण साही।

हिन्दी की अन्य गद्य विधाएँ : रेखाचित्र, संस्मरण, यात्रा-साहित्य, आत्मकथा, जीवनी और रिपोर्टाज।

4. काव्यशास्त्र और आलोचना

भरत मुनि का रस सूत्र और उसके प्रमुख व्याख्याकार।

रस के अवयव।

साधारणीकरण।

शब्द शक्तियाँ और ध्वनि का स्वरूप।

अलंकार : यमक, श्लेष, वक्रोक्ति, उपमा, रूपक, उत्प्रेक्षा, संदेह, भ्रान्तिमान, अतिशयोक्ति, अन्योक्ति, समासोक्ति, अत्युक्ति, विशेषोक्ति, दृष्टान्त, उदाहरण, प्रतिवस्तूपमा, निदर्शना, अर्थान्तरन्यास, विभावना, असंगति तथा विरोधाभास ।

रीति, गुण, दोष ।

मिथक, फन्तासी, कल्पना, प्रतीक और बिम्ब ।

स्वच्छन्दतावाद और यथार्थवाद, संरचनावाद, उत्तर संरचनावाद, आधुनिकता, उत्तर आधुनिकता ।

समकालीन आलोचना की कतिपय अवधारणाएँ : विडम्बना (आयरनी), अजनबीपन (एलियनेशन), विसंगति (एब्सर्ड), अन्तर्विरोध (पैराडॉक्स), विखण्डन (डिकन्स्ट्रक्शन) ।

English

1. Multiple Choice Questions will be based on the critical history of English

Literature emphasizing on the following ages :

- | | | | |
|--|---|----|---|
| (i) Age of Chaucer | - | 30 | M |
| (ii) Age of Elizabeth | - | 30 | M |
| (iii) The Puritan Age | - | 30 | M |
| (iv) The Metaphysical Age | - | 30 | M |
| (v) The Neo-Classical Age | - | 30 | M |
| (vi) The Age of Transition (The Age of the Pre-Romantics) | - | 30 | M |
| (vii) The Romantic Age | - | 30 | M |
| (viii) The Victorian Age | - | 30 | M |
| (ix) The Twentieth Century Literature | } | 30 | M |
| (x) Indo-Anglian & American Literature | } | | |
| 2. A Critical Study of Literary Theories | - | 30 | M |

Urdu

The syllabus is divided in ten parts. The question paper will be framed covering all parts of the syllabus.

I. Ghazal : Ghazal writers and Critical appreciation of Their Poetry. The following Poets are prescribed –

1. Wali
2. Dard
3. Meer
4. Atish
5. Ghalib
6. Momin
7. Shad
8. Hasrat
9. Fanee
10. Firaque
11. Asghar
12. Jigar
13. Yagana
14. Jazbi
15. Majrooh
16. Khaleelur Rehman Azmi

II. Masnavi : Critical and artistic study of following Masnavis -

1. Qutub Mushtari
2. Gulshane-Ishque
3. Alinama
4. Phool ban
5. Khabo - Khayal
6. Sehrul Bayan
7. Gulzar –e- Naseem
8. Zehre-e-Ishque

III. Qaseeda : Critical and artistic study of some Important Poets of Urdu Qasida. : The following poets are prescribed

1. Souda
2. Zouque
3. Ghalib
4. Mohsin Kakorvi

IV. Marsiya : Critical and artistic study of Poets of Urdu Marsiya.
: The following poets are prescribed

1. Anees
2. Dabeer
3. Halee
4. Joush

V. Nazm : Urdu Poets of Nazm and critical and artistic study of their Poetry.

The following Poets are prescribed –

1. Nazeer Akbarabadi
2. Halee
3. Mohammed Husain Azad
4. Akbar Allahabadi
5. Suroor Jahana Abadi
6. Nazm Taba Tabai
7. Chakbast
8. Iqbal
9. Joush
10. Meerajee
11. Faiz Ahmed Faiz
12. Akhtarul Eiman
13. Makhdoom Muhaiddeen

VI. Afsanavi Nasr (Fiction) : (Dastan Novel, Afsana and Drama)

(a) Dastan - Critical study of following Urdu Dastans.

1. Sabras
2. Bagh-o-Bahar
3. Fasana-e-Ajaib
4. Bostane-Khayal

5. Rani Kaitaki Ki Kahani

(b) Novel - Critical study of following Urdu Novels.

1. Fasana-e-Azad
2. Toubatun NusooH
3. Firdose-Bareen
4. Umrau Jan Ada
5. Goudan
6. London Ki Ek Raat
7. Terhi Lakeer
8. Ek Chader Maili si
9. Aag ka darya

(c) Afsana and Drama - Critical study of important Urdu Short story and dram Writers. The following are prescribed.

• **Afsana Writers -**

1. Prem Chand
2. Krishan Chander
3. Sa-adt Hasan Minto
4. Rajender Singh Baidi
5. Khwaja Ahmed Abbas
6. Hayatullah Ansari

• **Drama Writers -**

1. Amanat
2. Agha Hashr Kashmeeri
3. Imtiyaz Ali 'Taj'
4. Habeeb Tanveer
5. Mohammed Hasan

VII. Ghair Afsanavi Nasr (Non-fictional prose) :- Critical study of Essay, Light essay, Letters, Biography and Auto-Biography. The following are prescribed.

1. Maqalate Sir Sayyed
2. Maqalate-e-Shiblee
3. Nairange-Khayal
4. Seepara-e-dil
5. Mazameen-e-Rasheed

6. Mazameen pitras
7. Khutoote-Ghalib
8. Ghubar-e-Khatir
9. Yadgar-e-Ghalib
10. Nazeer Ahmed Ki Kahani Kuch unki Kuch mairi zubani
11. Yadon Ki Barat

VIII. Criticism: - Principles and concepts-

1. Elements of criticism in Urdu Tazkiras.
2. Aritotle's Thoughts of criticism.
3. Various schools of thoughts in criticism.
4. Relation between researches in Criticism.
5. Concept of criticism of Halee & Shible.

IX. Practical Criticism of following critiques:

1. Ahtisham Hussain
2. Kaleemuddeen Ahmed
3. Ale Ahmed Suroor
4. Mohammed Hasan
5. Shamshur Rahman Farooqui

X. History of Urdu Language:

1. A Short history Indo Aryan in Language.
2. Various theories and concepts about the origin of Urdu Language.
3. Fundamental elements of Urdu Structure.
4. Linguistic features of Dakani Urdu.
5. Linguisti Identify of Urdu Language.

विषय – उर्दू

1 गज़ल :- मुनदरजा ज़ैल गज़ल गो शोअरा और उनके कलाम का फ़न्नी-ओ-तनकीदी मुतालिआ –

1. वली
2. दर्द
3. मीर
4. आतिश
5. ग़ालिब
6. मोमिन
7. शाद
8. हसरत
9. फ़ानी
10. फ़िराक
11. असगर
12. जिगर
13. यगाना
14. जज़बी
15. मजरूह
16. ख़लीलुर रहमान आजमी

2 मसनवी :- मुनदरजा ज़ैल अहम मसनवियो का फ़न्नी-ओ-तनकीदी मुतालिआ–

1. कुतुब मुश्तरी
2. गुलशन ईश्क़
3. अली नामा
4. फूल बन
5. ख़्वाबो ख़याल
6. सहरूल बयान
7. गुलज़ारे-नसीम
8. ज़हरे-ईश्क़

3 क़सीदा :- मुनदरजा ज़ैल उर्दू के क़सीदा गो शोअरा का फ़न्नी-ओ-तनकीदी मुतालिआ–

1. सौदा

2. जौक
3. गालिब
4. मोहसिन काकोरवी

4 मरसिया :- मुनदरजा जैल उर्दू के मर्सिया गो शोअरा का और उनके कलाम का फन्नी-ओ-तनकीदी मुतालिआ-

1. अनीस
2. दबीर
3. हाली
4. जोश

5 नज़्म :- मुनदरजा जैल उर्दू के नज़्म गो शोअरा और उनके कलाम का फन्नी-ओ- तनकीदी मुतालिआ-

1. नज़ीर अकबराबादी
2. हाली
3. मुहम्मद हुसैन आज़ाद
4. अकबर इलाहाबादी
5. सरूर जहानाबादी
6. नज़्म तबा तबाई
7. चकबस्त
8. इक़बाल
9. जोश
10. मीराजी
11. फ़ैज़
12. अख़्तरूल ईमान
13. मख़दूम मुहिय्युद्दीन

6 अफ़सानवी नस्र :- (दास्तान, नाविल, अफ़साना, ड्रामा)

दास्तान : मुनदरजा जैल उर्दू दास्तानों का फन्नी और तनकीदी मुतालिआ-

1. सबरस
2. बागो बहार
3. फ़साना-ए-अजाएब

4. बोस्ताने ख्याल
5. रानी केतकी की कहानी

नाविल : मुनदरजा जैल उर्दू नाविलो का फन्नी और तनकीदी मुतालिआ

1. फसाना—ए—आजाद
2. तोबतुन—नसूह
3. फिरदोसे बरी
4. उमराव जान अदा
5. गौदान
6. लन्दन की एक रात
7. टेढ़ी लकीर
8. एक चादर मैली सी
9. आग का दरिया

अफसाना—ओ—ड्रामा : मुनदरजा जैल उर्दू के अहम अफसाना निगारों और ड्रामा निगारों का फन्नी और तनकीदी मुतालिआ—

अफसाना निगार

1. प्रेम चन्द
2. सआदत हसन मिन्टो
3. कृष्ण चन्द्र
4. राजेन्द्र सिंह बैदी
5. इस्मत चुगताई
6. कुर्रतुल—ऐन हैदर
7. ख्वाजा अहमद अब्बास
8. हयातुल्लाह अंसारी

ड्रामा निगार

9. अमानत
10. आगा हशर काश्मीरी
11. इम्तियाज़ अली ताज
12. हबीब तनवीर
13. मुहम्मद हसन

VII. गैर अफ़सानवी नम्र :- मज़मून, ईशांइया, खुतूत, सवानेह और खुद नविशत का फ़न्नी-ओ-तनकीदी मुतालिआ। मुनदरजा ज़ैल निसाब में शामिल है-

1. मक़ालाते-सर सैय्यद
2. मक़ालाते-शिवली
3. नैरंगे-ख़्याल
4. सी-पाराए-दिल
5. मजामीने-रशीद
6. मजामीने-पतरस
7. खुतूते-ग़ालिब
8. गुबारे ख़ातिर
9. यादगारे-ग़ालिब
10. नज़ीर अहमद की कहानी, कुछ उनकी कुछ मेरी जुबानी
11. यादों की बारात

VIII. तनकीद :- उसूल और नज़रियात-

1. उर्दू तज़करो मैं तनकीदी अनासिर
2. अरस्तु का तनकीदी नज़रिया
3. तनकीद के मुख्तलिफ़ दबिस्तान
4. तहकीक-ओ-तनकीद का बाहमी रिश्ता
5. हाली-ओ-शिवली का नज़रियाए तनकीद

IX. अमली तनकीद :- (मुनदरजा ज़ैल नक्क़ादो का खुसूसी मुतालिआ)

1. एहतशाम हुसैन
2. कलीमुद्दीन अहमद
3. आले अहमद सुरूर
4. मुहम्मद हसन
5. शमसुरहमान फ़ारूकी

X. तारीख़े :- जुबान उर्दू

1. हिन्द आर्यायी ज़बान की मुख्तसर तारीख

2. उर्दू की इब्तिदा के बारे में मुख्तलिफ़ नज़रियात
3. उर्दू साख़्त के बुनियादी अनासिर
4. दकनी उर्दू की लिसानी खुसूसियात
5. उर्दू और उसकी अहम बोलियाँ ; कपंसमबजेद्व
6. उर्दू की लिसानी इनफ़रादियत

Sanskrit

1. वैदिक-साहित्य

देवता-स्वरूप

अग्नि; सवितृ; विष्णु; इन्द्र; रुद्र; बृहस्पति; अश्विनी; वरुण; उषस्; सोम

विषय-वस्तु :

संहिताएँ; ब्राह्मण एवं आरण्यक; उपनिषद्

सम्बाद सूक्त :

पुरुवा-उर्वशी; यम-यमी; सर्मा-पणि; विश्वामित्र-नदी

वैदिक साहित्य का इतिहास :

वैदिक काल के विषय में विभिन्न सिद्धान्त-मैक्समूलर; ए. वेबर; जैकोबी; बालगंगाधर तिलक;

एम्. विन्टरनिट्ज; भारतीय परम्परागत विचार

ऋग्वेद का क्रम

संहिताओं के पाठ-भेद

वेदांग :

शिक्षा; कल्प; व्याकरण; निरुक्त; छन्द; ज्योतिष

यास्क निरुक्त : (प्रथम व द्वितीय अध्याय)

चार प्रकार के पद, षड्भावविकार, निरुक्त के अध्ययन के उद्देश्य, निर्वचन के सिद्धान्त, प्रमुख शब्दों के निर्वचन

2. दर्शन

ईश्वरकृष्ण की सांख्यकारिका :

सत्कार्यवाद; पुरुष-स्वरूप; प्रकृति-स्वरूप; सृष्टिक्रम; प्रत्ययसर्ग; कैवल्य

सदानन्द का वेदान्तसार :

अनुबन्ध-चतुष्टय; अज्ञान; अध्यारोप-अपवाद; लिंगशरीरोत्पत्ति; पंचीकरण; विवर्त; जीवनमुक्ति

केशवमिश्र की तर्कभाषा/अन्नभट्ट का तर्कसंग्रह :

पदार्थ; कारण; प्रमाण-प्रत्यक्ष; अनुमान; उपमान; शब्द

3. व्याकरण एवं भाषा विज्ञान

व्याकरण :

परिभाषाएँ-संहिता; गुण; वृद्धि; प्रातिपदिक; नदी; घि; उपधा; अपृक्त; गति; पद; विभाषा; सवर्ण;

टि; प्रगृह्य; सर्वनाम-स्थान; निष्ठा

संज्ञा व सन्धिप्रकरण

कारक : सिद्धान्तकौमुदी के अनुसार

समास : लघुसिद्धान्तकौमुदी के अनुसार
कृदन्त : लघुसिद्धान्तकौमुदी के अनुसार
तद्धित : लघुसिद्धान्तकौमुदी के अनुसार
स्त्रीप्रत्यय : लघुसिद्धान्तकौमुदी के अनुसार

भाषाविज्ञान :

भाषा की परिभाषा एवं प्रकार

भाषाओं का वर्गीकरण (परिवारमूलक एवं आकृतिमूलक)

भाषा प्रक्रिया एवं ध्वनियों का वर्गीकरण : स्पर्श, संघर्षी, अर्धस्वर एवं स्वर

ध्वनियन्त्र

ध्वनि सम्बन्धी नियम

ध्वनिपरिवर्तन एवं अर्थपरिवर्तन

भारतीय आर्यभाषा की तीन अवस्थाएँ

व्याकरण महाभाष्य : पस्पशाह्निकमात्र

शब्द की परिभाषा, शब्दार्थसम्बन्ध, व्याकरणाध्ययन के उद्देश्य, व्याकरण-परिभाषा, साधुशब्द के प्रयोग का परिणाम, व्याकरण की पद्धति

4. संस्कृत साहित्य एवं काव्यशास्त्र

निम्नलिखित ग्रन्थों का सामान्य अध्ययन :

पद्य : रघुवंश; कुमारसंभव; मेघदूत; किरातार्जुनीय; शिशुपालवध; नैषधीयचरित; बुद्धचरित;
ऐतिहासिक काव्य

गद्य : दशकुमारचरित; हर्षचरित; कादम्बरी; शिवराजविजय

नाटक : स्वप्नवासवदत्ता; अभिज्ञानशाकुन्तलम्; मृच्छकटिक; उत्तररामचरित; मुद्राराक्षस; रत्नावली;
वेणीसंहार; विवेकानन्दविजय

काव्यशास्त्र :

साहित्यदर्पण :

काव्य की परिभाषा

काव्य की अन्य परिभाषाओं का खण्डन

शब्दशक्ति-संकेतग्रह; अभिधा; लक्षणा; व्यञ्जना

रस (रस-भेद स्थायी भावों सहित)

रूपक के प्रकार

नाटक के लक्षण

महाकाव्य के लक्षण

काव्यप्रकाश :

काव्यलक्षण; काव्यप्रयोजन; काव्यहेतु; काव्यभेद; शब्दशक्ति; रससूत्रविमर्श; रसदोष; काव्यगुण;

प्रमुख अलङ्कार

ध्वन्यालोक : प्रथमोद्योत

भरतनाट्यशास्त्र : प्रथम, द्वितीय व षष्ठाध्यायमात्र

दशरूपक : प्रथम व तृतीय प्रकाश

Rajasthani

इकाई-1 : राजस्थानी भाषा और बोलियाँ

राजस्थानी भाषा का उद्भव और विकास
राजस्थानी की विभिन्न बोलियाँ; क्षेत्र एवं विशेषताएँ
राजस्थानी भाषा की लिपि

इकाई-2 : राजस्थानी व्याकरण

राजस्थानी वर्णमाला, राजस्थानी की विशिष्ट ध्वनियाँ
राजस्थानी व्याकरण— सामान्य ज्ञान, राजस्थानी शब्द—कोष
राजस्थानी के लक्षण ग्रन्थों का सामान्य परिचय
राजस्थानी छन्द— दूहो, कुंडळिया, छप्पय, नीसांणी, सावझड़ौ, झूलणा, सांणोर, नाराच, मन्दाक्रान्ता एवं धनाक्षरी (केवल दस छन्द)
अलंकार— यमक, वयणसगाई, श्लेष, रूपक, अतिशयोक्ति, वक्रोक्ति, उपमा, उत्प्रेक्षा, संदेह एवं भ्रान्तिमान (केवल दस अलंकार)
काव्यदोष— छबकाळ, पांगळौ, हीण, निनंग एवं अपस (केवल पाँच दोष)

इकाई-3 : प्राचीन एवं मध्यकालीन राजस्थानी काव्य (वीर एवं नीति—काव्य)

प्राचीन एवं मध्यकालीन राजस्थानी वीर—काव्य
प्राचीन एवं मध्यकालीन राजस्थानी नीति—काव्य

इकाई-4 : प्राचीन एवं मध्यकालीन राजस्थानी काव्य (भक्ति एवं रीति—काव्य)

प्राचीन एवं मध्यकालीन राजस्थानी भक्ति—काव्य
प्राचीन एवं मध्यकालीन राजस्थानी सन्त—काव्य
प्राचीन एवं मध्यकालीन राजस्थानी रीति—काव्य
प्राचीन एवं मध्यकालीन राजस्थानी शृंगारिक—काव्य

इकाई-5 : आधुनिक राजस्थानी काव्य

राष्ट्रीय चेतना परक काव्य
प्रकृति परक काव्य
प्रगतिवादी काव्य
नई कविता

इकाई-6 : प्राचीन एवं मध्यकालीन राजस्थानी गद्य (विविध रूप)

बात

ख्यात
वचनिका
दवावैत
विगत
बालावबोध
टीका एवं टब्बा
वंशावली एवं गुर्वावली

इकाई-7 : आधुनिक राजस्थानी गद्य (विविध विधाएँ)

निबन्ध
कहानी
उपन्यास
नाटक
एकांकी
संस्मरण और रेखाचित्र

इकाई-8 : राजस्थानी लोक-साहित्य (विविध विधाएँ)

राजस्थानी लोकगीत

राजस्थानी लोककथा
राजस्थानी लोकगाथा
राजस्थानी लोकनाट्य
राजस्थानी लोकोक्ति-साहित्य (कहावतें एवं मुहावरे)

इकाई-9 : राजस्थानी लोक-संस्कृति के विविध आयाम

राजस्थानी लोक देवी-देवता
राजस्थानी लोकोत्सव (पर्व, मेले, तीज-त्यौहार)
संस्कार एवं अनुष्ठान (सामाजिक, सांस्कृति एवं धार्मिक)
लोककलाएँ (मांडणा, स्थापत्यकला, चित्रकला)
लोकविश्वास एवं शकुन
रीति-रिवाज, खान-पान, वेशभूषा, आभूषण
ऋतु-विज्ञान एवं कृषि

इकाई-10 : शोध-प्रविधि एवं पाठ-सम्पादन

शोध का स्वरूप
शोध के प्रकार
विषय का चयन एवं शोध-प्रविधि

पाठालोचन का सामान्य परिचय, महत्त्व एवं आवश्यकता
पाठ—विकृति एवं पाठालोचन की प्रक्रिया
शोध विषय की आदर्श रूपरेखा का निर्माण

सन्दर्भ ग्रन्थ

- प्रो. रामाश्रय मिश्र एवं डॉ. नरेश मिश्र : भाषा और भाषा विज्ञान
भोलानाथ तिवारी : भाषा विज्ञान
डॉ. सुनीति कुमार चाटुर्ज्या : राजस्थानी भाषा, साहित्य संस्थान, उदयपुर
डॉ. एल. पी. टैस्सीटोरी (अनु. डॉ. नामवरसिंह) : पुरानी राजस्थानी
जार्ज ए. ग्रियर्सन (अनु. आत्माराम जाजोदिया) : राजस्थान का भाषा सर्वेक्षण, राजस्थानी भाषा प्रचार
सभा, जयपुर
जगदीश कुमार कौशिक : भारतीय आर्य भाषाओं का इतिहास
डॉ. देवेन्द्रनाथ शर्मा : भाषा विज्ञान की भूमिका, राधाकृष्ण प्रकाशन, दिल्ली
नरोत्तमदास स्वामी : राजस्थानी भाषा; एक परिचय
डॉ. मोतीलाल मेनारिया : राजस्थानी भाषा और साहित्य
डॉ. देव कोठारी : राजस्थानी भाषा और उसकी बोलियाँ
डॉ. रत्नचन्द्र शर्मा : मानक हिन्दी और भाषा विज्ञान
डॉ. कल्याणसिंह शेखावत : राजस्थानी भाषा और साहित्य
डॉ. मोतीलाल मेनारिया : राजस्थानी भाषा और साहित्य, प्रयाग
डॉ. मोतीलाल मेनारिया : राजस्थानी साहित्य की रूपरेखा
डॉ. ओमप्रकाश भारद्वाज : मानव भाषा विज्ञान
डॉ. मोतीलाल मेनारिया : राजस्थानी पिंगल साहित्य
सीताराम लालस : राजस्थानी सबदकोस (प्रथम खण्ड), राजस्थानी शोध संस्थान, जोधपुर
आचार्य बदरीप्रसाद भूपतिराम साकरिया, राजस्थानी—हिन्दी शब्दकोश (तीन भाग), जयपुर
डॉ. उदयनारायण तिवारी : वीर काव्य
डॉ. गोवर्द्धन शर्मा : डिंगल साहित्य
डॉ. हजारीप्रसाद द्विवेदी : हिन्दी साहित्य का आदिकाल
रामचन्द्र शुक्ल : हिन्दी साहित्य का इतिहास
डॉ. कन्हैयालाल शर्मा : हाड़ौती बोली और साहित्य
श्याम परमार : मालवी और उसका इतिहास
डॉ. महावीर प्रसाद शर्मा : मेवाती का उद्भव और विकास
डॉ. कैलाशचन्द्र अग्रवाल : शेखावाटी बोली का विवरणात्मक अध्ययन
डॉ. एल. डी. जोशी : बागड़ी बोली का स्वरूप और तुलनात्मक अध्ययन

गौरीशंकर हीराचन्द ओझा : प्राचीन भारतीय लिपिमाला
 नरोत्तमदास स्वामी : राजस्थानी व्याकरण
 रामकरण आसोपा : मारवाड़ी व्याकरण
 सीताराम लालस : राजस्थानी व्याकरण
 परम्परा : त्रैमासिक पत्रिका के आदिकाल तथा मध्यकाल संबंधी विशेषांक
 डॉ. किरण नाहटा एवं गजादान चारण : राजस्थानी निबन्ध संग्रह
 परशुराम चतुर्वेदी : उत्तर भारत की सन्त परम्परा, भारती भंडार, प्रयाग
 परशुराम चतुर्वेदी : सन्त काव्य, किताब महल, इलाहाबाद
 परशुराम चतुर्वेदी : सन्त साहित्य के प्रेरणा स्रोत, राजपाल एण्ड संस, दिल्ली
 डॉ. पीताम्बरदत्त बड़थवाल : हिन्दी काव्य में निर्गुण सम्प्रदाय, अवध पब्लिशिंग हाउस, लखनऊ
 डॉ. विष्णुदत्त राकेश : उत्तर भारत के निर्गुण पंथ साहित्य का इतिहास, साहित्य भवन प्रा. लि.
 इलाहाबाद
 डॉ. वेदप्रकाश जुनेजा : नाथ सम्प्रदाय और साहित्य, गोरखनाथ मंदिर, गोरखपुर
 दयाबाई री वाणी : बेलवेडियर प्रेस, प्रयाग
 स्वामी केवलराम : रामस्नेही सम्प्रदाय, बीकानेर
 स्वामी मंगलदास : दादू सम्प्रदाय का इतिहास, जयपुर
 सुरजनदास : श्री जाम्भोजी महाराज का जीवनचरित्र, कोलायत
 डॉ. राधिकाप्रसाद त्रिपाठी : रामस्नेही सम्प्रदाय, फैजाबाद
 डॉ. राजदेव सिंह : सन्त साहित्य का पुनर्मूल्यांकन
 डॉ. रामखेलावन पाण्डेय : मध्यकालीन सन्त साहित्य
 डॉ. मदन कुमार जानी : राजस्थान एवं गुजरात के मध्यकालीन सन्त एवं भक्तकवि
 डॉ. हजारीप्रसाद द्विवेदी : नाथ सम्प्रदाय
 डॉ. ब्रजलाल वर्मा : सन्त कवि रज्जब, जोधपुर
 डॉ. पेमराम : मध्यकालीन राजस्थान में धार्मिक आन्दोलन, अर्चना प्रकाशन, अजमेर
 सं. डॉ. वसुमति शर्मा : राजस्थान का सन्त साहित्य
 डॉ. दिनेशचन्द्र शुक्ल, ओंकार नारायणसिंह (सं.) : राजस्थान की सन्त परम्परा एवं संस्कृति
 डॉ. सोहनदान चारण : राजस्थानी लोक-साहित्य का आलोचनात्मक अध्ययन
 डॉ. महेन्द्र भानावत : राजस्थानी लोकनाट्य परम्परा एवं प्रवृत्तियाँ
 डॉ. सत्येन्द्र : लोक-साहित्य विज्ञान
 डॉ. कृष्णदेव उपाध्याय : लोक-साहित्य की भूमिका
 श्याम परमार : भारतीय लोक वाङ्मय
 श्याम परमार : लोकधर्मी नाट्य परम्परा

सूर्यकरण पारीक : राजस्थानी लोकगीत
 नानूराम संस्कर्ता : राजस्थानी लोक-साहित्य
 कृष्णकुमार शर्मा : राजस्थानी लोकगाथा
 डॉ. कन्हैयालाल सहल : राजस्थानी लोकगाथाओं के कुछ रूढ़ तत्त्व
 लक्ष्मीलाल जोशी : मेवाड़ की कहावतें
 डॉ. कन्हैयालाल सहल : राजस्थानी कहावतें- एक अध्ययन
 डॉ. मनोहर शर्मा : राजस्थानी साहित्य और संस्कृति
 भागीरथ कानोडिया एवं गोविन्द अग्रवाल : राजस्थानी कहावत कोश
 डॉ. नन्दलाल कल्ला : राजस्थानी लोक-साहित्य एवं संस्कृति
 डॉ. सत्येन्द्र : अनुसंधान, नन्दकिशोर एण्ड ब्रदर्स, बॉस फाटक, वाराणसी
 डॉ. विनय मोहन शर्मा : शोध प्रविधि, नेशनल पब्लिशिंग हाउस, नई दिल्ली
 डॉ. नगेन्द्र : अनुसंधान और आलोचना, नेशनल पब्लिशिंग हाउस, नई दिल्ली
 डॉ. देवराज उपाध्याय तथा डॉ. 'दिनेश' : साहित्यिक अनुसंधान के प्रतिमान, नेशनल पब्लिशिंग हाउस, नई दिल्ली
 डॉ. उदयभानुसिंह : अनुसंधान का विवेचन, दिल्ली
 डॉ. बैजनाथ सिंहल : शोध : स्वरूप एवं मानक व्यावहारिक कार्य विधि, द मैकमिलन कंपनी, नई दिल्ली
 सं. विश्वनाथ प्रसाद मिश्र : अनुसंधान के मूल तत्त्व, क. मा. मशी, हिन्दी विद्यापीठ, आगरा
 डॉ. शशिभूषण सिंहल, साहित्यिक शोध के आयाम, आर्य बुक डिपो, करोल बाग, नई दिल्ली
 डॉ. सत्येन्द्र : अनुसंधान
 डॉ. सावित्री सिन्हा तथा विजयेन्द्र स्नातक : अनुसंधान की प्रक्रिया
 कन्हैयासिंह : पाठ सम्पादन के सिद्धान्त
 डॉ. मिथिलेश कांति तथा डॉ. विमलेश कांति : पाठालोचन सिद्धान्त और प्रक्रिया
 डॉ. रामगोपाल शर्मा दिनेश : पाण्डुलिपि सम्पादन कला
 डॉ. सत्येन्द्र : पाण्डुलिपि विज्ञान
 डॉ. गौरीशंकर हीराचन्द ओझा : प्राचीन लिपिमाला
 डॉ. एस. एम. कत्रे : भारतीय पाठालोचन की भूमिका
 सं. डॉ. किरण नाहटा : पाण्डुलिपियाँ री ओळख अर अंवेर
 डॉ. एम. पी. शर्मा : पाण्डुलिपि विज्ञान

Political Science

1. Political Theory and Thought

Ancient Indian Political Thought: Kautilya and Shanti Parva.

Greek Political Thought: Plato and Aristotle.

European Thought-I: Machiavelli, Hobbes, Locke, Rousseau.

European Thought-II: Bentham, J.S. Mill, Hegel and Marx

Contemporary Political Thought-I : Lenin, Mao.

Contemporary Political Thought-II: Rawls, Nozic and Communitarians.

Modern Indian Thought: Gandhi, M.N. Roy and Ambedkar.

Concepts and Issue- I: Medieval Political Thought: Church-State Relationship.

Concepts and Issue-II: Behaviouralism and Post - Behaviouralism, Decline and Resurgence of Political Theory.

Democracy, Liberty and Equality.

2. Comparative Politics and Political Analysis

Evolution of Comparative Politics as a discipline, nature and scope.

Approaches to the study of comparative politics: Traditional, Structural Functional, Systems and Marxist.

Constitutionalism: Concepts.

Forms of Government: Unitary-Federal, Parliamentary-Presidential

Organs of Government: Executive, Legislature, Judiciary-their interrelationship in comparative perspective.

Party Systems and Pressure Groups.

Bureaucracy - types and roles

Political Development and Political Modernization.

Political Culture, Political Socialization and Political Communication.

Political Elite: Elitist Theory of Democracy.

Power, Authority and Legitimacy.

3. Indian Government and Politics

Making of Indian Constitution

Ideological Bases of the Indian Constitution, Preamble, Fundamental Rights and Duties, Directive Principles.

Constitutional Amendments and Review.

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, their working.

Federalism: Theory and Practice in India; Demands of Autonomy and Separatist Movements; Emerging Trends in Center-State Relations.

Judiciary: Supreme Court, High Court, Judicial Review, Judicial Activism including Public Interest Litigation cases, judicial reforms.

Political Parties, Pressure Groups, Public Opinion, Media.

Elections, Electoral Behavior, Election Commission and Electoral Reforms.

4. Public Administration

Development of Public Administration as a Discipline; Approaches to the study of Public Administration: Decision-making, Ecological and System: Development Administration.

Theories of Organization.

Principles of organization: Line and Staff, Unity of Command, Hierarchy, Span of Control, Centralization and Decentralization.

Bureaucracy: Theories, types and roles; Max Weber and his Critics. Civil Servant-Minister relationship.

Leadership

Financial Administration: Budget, Audit, Control over Finance with Special Reference to India and UK.

Good Governance; Right to Information.

Grievance Redressal Institutions: Ombudsman, Lokpal and Lakayukta.

5. International Relations

Contending Theories and Approaches to the study of International Relations; Idealist, Realist, Systems, Game, Communication and Decision-Making.

Power, Interest and Ideology

Arms and Wars: Nuclear/bio-chemical wars; deterrence, Arms race, Arms control and disarmament.

Peaceful settlement of disputes, conflict resolution, Diplomacy, World-order and Peace studies.

Alliances, Non-alignment, End of Cold war, Globalization.

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; Charter Revision; Power-struggle and Diplomacy within UN, Financing and Peace-keeping operations.

India's relations with its neighbors, distinguishing features of Indian Foreign Policy.

1. राजनीतिक सिद्धांत और विचार

प्राचीन भारतीय राजनीतिक विचार: कौटिल्य और शांति पर्व।

यूनानी राजनीतिक विचार: प्लेटो और अरस्तू।

यूरोपीय विचार- I : मैकियावली, हाब्स, लॉक और रूसो।

यूरोपीय विचार- II : बेंथम, जे.एस.मिल, हीगेल, मार्क्स

आधुनिक राजनीतिक विचार - I : लेनिन, माओ

आधुनिक राजनीतिक विचार - II : राल्स, नोजिक और सामुदायिकवादी।

आधुनिक भारतीय विचार - गाँधी, एम.एन.राय और अम्बेडकर

अवधारणाएँ एवं मुद्दे - I : मध्यकालीन राजनीतिक विचार : चर्च-राज्य सम्बंध सिद्धांत।

अवधारणाएँ एवं मुद्दे - II : व्यवहारवाद तथा उत्तर-व्यवहारवाद, राजनीतिक सिद्धांत का पतन और पुनरोत्थान।

प्रजातंत्र, स्वतंत्रता एवं समानता।

2. तुलनात्मक राजनीति एवं राजनीतिक विश्लेषण

तुलनात्मक राजनीति का एक अनुशासन के रूप में उद्भव, प्रकृति और विषय क्षेत्र।

तुलनात्मक राजनीति के अध्ययन के उपागम : पारम्परिक, संरचनात्मक-प्रकार्यात्मक, व्यवस्था और मार्क्सवादी।

संविधानवाद : अवधारणाएँ।

शासन के प्रकार : एकात्मक – संघात्मक, संसदात्मक – अध्यक्षीय।

शासन के अंग : कार्यपालिका, व्यवस्थापिका, न्यायपालिका – तुलनात्मक परिप्रेक्ष्य में उनके अंतर-संबंध।

दल प्रणालियाँ और दबाव समूह।

नौकरशाही – प्रकार तथा भूमिका।

राजनीतिक विकास और राजनीतिक आधुनिकीकरण।

राजनीतिक संस्कृति, राजनीतिक समाजीकरण एवं राजनीतिक संचार।

राजनीतिक अभिजात और प्रजातंत्र का अभिजात सिद्धांत।

शक्ति, सत्ता एवं वैधता।

3. भारतीय शासन और राजनीति

भारतीय संविधान की रचना, भारतीय संविधान के वैचारिक आधार, प्रस्तावना, मौलिक अधिकार और कर्तव्य,

नीति निर्देशक सिद्धांत।

संवैधानिक संशोधन और पुनरावलोकन।

संरचना और प्रक्रिया - I : राष्ट्रपति, प्रधानमंत्री, मंत्रि परिषद्, संसदात्मक व्यवस्था की कार्यशैली।

संरचना और प्रक्रिया - II : राज्यपाल, मुख्यमंत्री, मंत्रि परिषद्, राज्य विधायिका।

पंचायती राज संस्थाएँ : ग्रामीण और शहरी, उनकी कार्य-शैली।

संघवाद: भारत में सिद्धांत और व्यवहार, स्वायत्तता की मांगों और पृथक्तावादी आंदोलन, केंद्र-राज्य संबंधों के उभरते प्रतिमान।

न्यायपालिका : उच्चतम न्यायालय एवं उच्च न्यायालय, न्यायिक पुनरावलोकन, न्यायिक सक्रियता जनहित मुकदमों सहित, न्यायिक सुधार।

राजनीतिक दल, दबाव समूह, जनमत, संचार माध्यम।

चुनाव, चुनावी-व्यवहार, चुनाव आयोग और चुनाव सुधार।

4. लोक प्रशासन

लोक प्रशासन का एक अनुशासन के रूप में विकास, लोक प्रशासन के अध्ययन के उपागम : निर्णय-निर्माण, पर्यावरणात्मक और व्यवस्था विकास प्रशासन।

संगठन के सिद्धांत।

संगठन के नियम : सूत्र और स्टाफ, आदेश की एकता, सोपान, नियंत्रण का क्षेत्र, केन्द्रीकरण और विकेन्द्रीकरण।

नौकरशाही : सिद्धांत, प्रकार तथा भूमिका, मैक्स वेबर और उनके आलोचक, लोक सेवक—मंत्री संबंध ।

नेतृत्व ।

वित्तीय प्रशासन : बजट, लेखा परीक्षा, भारत और इंग्लैण्ड के विशेष संदर्भ में वित्त पर नियंत्रण ।

सुशासन और सूचना का अधिकार ।

शिकायत निवारण संस्थाएँ : औम्बुड्समैन, लोकपाल और लोकायुक्त ।

5. अन्तरराष्ट्रीय संबंध

अन्तरराष्ट्रीय संबंधों के अध्ययन के विभिन्न सिद्धांत और उपागम : आदर्शवादी, यथार्थवादी, व्यवस्था, खेल, संचार और निर्णय—निर्माण ।

अन्तरराष्ट्रीय संबंधों में शक्ति, हित और विचारधारा

शस्त्र और युद्ध नाभिकीय/जैवरासायनिक युद्ध, पराधन, शस्त्रस्पर्धा, शस्त्र नियंत्रण, निरस्त्रीकरण, विवादों का शांतिपूर्ण समाधान, कलह—हल, कूटनीति, विश्व व्यवस्था एवं शांति अध्ययन ।

गठबंधन, गुट—निरपेक्षता, शीत युद्ध का अंत, वैश्वीकरण ।

अन्तरराष्ट्रीय संबंधों का राजनीतिक अर्थशास्त्र, नव अन्तरराष्ट्रीय आर्थिक व्यवस्था, उत्तर—दक्षिण संवाद, दक्षिण—दक्षिण सहयोग, विश्व व्यापार संगठन, नव—उपनिवेशवाद और निर्भरता ।

क्षेत्रीय और उप—क्षेत्रीय संगठन विशेषतः सार्क, आसियान, ओपेक और ओ.ए.एस ।

संयुक्त राष्ट्र : उद्देश्य, लक्ष्य, संरचना और कार्य—प्रणाली का मूल्यांकन, चार्टर संशोधन, संयुक्त राष्ट्र में शक्ति संघर्ष एवं राजनीति, वित्तीय प्रबंध और शांति स्थापना अभियान ।

भारत के पड़ोसी देशों से संबंध, भारतीय विदेश नीति ।

Public Administration

1. Theory of Public Administration

Public administration- Meaning, Nature and scope, Public and Private Administration, New Public Administration, New Public Management.

Administrative Thinkers- Kautilya, Woodrow Wilson, Gulick and Urwick, Max Weber. F.W. Taylor, Henri Fayol, M.P.Follet, Elton Mayo. C.I. Barnard, Herbert Simon, D.H. McGregor, Abraham Maslow, Herzberg, Chris Argyris and Fred Riggs.

Theories- Classical, Human Relation, Bureaucratic, Public Choice and Principal agent relationship.

Approaches to the study of Public Administration- Scientific Management, Behavioral, systems, Structural- Functional, Decision-Making, Public policy and Marxian.

Organization- Bases of Organisation, Formal and Informal, Principles of organization- Hierarchy Span of control, Unity Of command, Delegation Decentralization and Co-ordination: Line-Staff Agencies.

Leadership, Motivation and Communication.

2. Comparative Public Administration

Comparative Public Administration-Nature and Scope.

Theories and Models of Comparative Public Administration- Contributions of Fred Riggs, Montgomery and Ferrel Heady.

A comparative study of the Administration, Institutions and Processes in U.K. , U.S.A., and India.

Various Control Mechanisms over Administration in U.K., U.S.A., and India.

Citizen and Administration- Machinery for redressal of citizen's grievances in U.K., U.S.A. and India.

3. Development Administration

Development Administration- Meaning, Nature and Scope, Concept of Development Administration; Development Administration and Traditional Administration; Characteristics of Administration in Developed and Developing Countries.

Public and Private Sectors and their Administration.

Planning- Projects and Plan Formulation, Plan Implementation and Evaluation.

Bureaucracy and Development Administration- Role of Bureaucracy in Plan Formulation and its implementation.

Development Administration- Interactions among Bureaucrats, Politicians, Technocrats, Social Scientists, Educationalist and Journalists, People's International Aid and Technical Assistance Programmes - IMF, IBRD, WTO.

4. Indian Administration

Administrative Legacies at the time of Independence- Civil Services; District and Revenue Administration.

Organisation of Government at the Central Level- Organisation, Role of Chief Secretary, Organisation of Ministries, Departments and Directorates.

Personnel Administration- Classification of Service, Recruitment, Recruitment Agencies-U.P.S.C. and State Public Service Commissions, Training, Promotion, Discipline, Morale, Staff Associations, Employer- Employee Relations.

Financial Administration- Budget, Enactment of Budget, Finance Ministry and its Role, Audit and Accounts, Comptroller and Auditor- General.

Plans- Five-Year Plans, Formulation of Plans, Planning Commission, National Development Council, Plan Implementation.

Centre-State Relations- Legislative, Administrative and Financial, Finance Commission.

Control over Administration- Legislative, Executive and Judicial Control, Transparency, Accountability and Administrative Responsiveness.

District Administration- Organisation of District Administration, Role of District Collector in Development, Local Government- Rural and Urban, Citizen and Administration- Lokpal and Lokayukta.

Delegated Legislation and Administrative Adjudication.

Administrative Reforms in India since Independence.

5. Research Methodology

Types of Research

Identification of Problem and Preparation of Research Design.

Research Methods in Social Science.

Hypothesis.

Sampling- Various Sampling Procedures.

Tools and Data Collection- Questionnaire, Interview, Content Analysis.

Processing of Data.

Measures of Central Tendency- Mean, Mode and Median.

Report Writing.

6. Social and Economic Administration

Meaning, Nature and Scope of Social Welfare and Social Justice.

Central Social Welfare Board and State Social Welfare Boards.

Major Social Sectors- Health and Education.

Industrial Policy Resolutions and Growth of Public Sector in India.

Public Sector- Features, Problems of Management, Accountability and Autonomy.

New Economic Policy- Liberalisation, Privatisation and Globalisation.

7. Local Governments- Rural and Urban

Meaning, Nature and Scope of Local Governments

Major Features and Structure of Local Government in U.K., U.S.A. France and India.

73rd and 74th Constitutional Amendments in India.

Functions and Role of Local Governments in India.

State- Local Relations in India.

1. लोक प्रशासन के सिद्धांत

लोक प्रशासन— अर्थ, प्रकृति और क्षेत्र, लोक प्रशासन और निजी प्रशासन, नवीन लोक प्रशासन, नवीन लोक प्रबन्ध।

प्रशासनिक विचारक— कौटिल्य, वुडरो विल्सन, गुलिक तथा उर्विक, मैक्स वेबर, एफ.डब्ल्यू. टेलर, हेनरी फ़ैयॉल तथा एम.पी.फालेट, एलटन मेयो, सी.आई. बरनार्ड, हर्वर्ट साइमन, डी. एच.मैकग्रेगर, अब्राहम मैस्लो, हर्जबर्ग, क्रिस एरजारिस तथा फ़ैड रिग्स।

सिद्धांत— शास्त्रीय विचारधारा, मानव-संबंध विचारधारा, नौकरशाही विचारधारा, लोक-चयन तथा मुखिया-अभिकर्ता सम्बंध।

लोक प्रशासन के अध्ययन के उपागम—वैज्ञानिक प्रबंध, व्यवहारवादी उपागम, व्यवस्थावादी उपागम, संरचनात्मक-कार्यात्मक उपागम, निर्णय-निर्माण सम्बंधी उपागम, लोक नीति व मार्क्सवादी उपागम।

संगठन—संगठन के आधार औपचारिक व अनौपचारिक संगठन, संगठन के सिद्धांत—पदसोपान, नियंत्रण का विस्तार क्षेत्र, आदेश की एकता, हस्तान्तरण, विकेन्द्रीकरण व समन्वय, सूत्र व स्टाफ अभिकरण।

नेतृत्व, अभिप्रेरणा व संचार।

2. तुलनात्मक लोक प्रशासन

तुलनात्मक लोक प्रशासन—प्रकृति एवं क्षेत्र।

तुलनात्मक लोक प्रशासन के सिद्धांत और प्रतिमान—फ्रैंड रिग्स, मांटगोमरी तथा फैरल हैडी का योगदान।

ग्रेट ब्रिटेन, संयुक्त राज्य अमेरिका तथा भारत के प्रशासनिक, संस्थाओं तथा प्रक्रियाओं का तुलनात्मक अध्ययन।

ग्रेट ब्रिटेन, संयुक्त राज्य अमेरिका तथा भारत में प्रशासन पर नियंत्रण की विभिन्न विधियां। नागरिक व प्रशासन—ग्रेट ब्रिटेन, संयुक्त राज्य अमेरिका तथा भारत में जन-शिकायत निवारण की मशीनरी।

3. विकास प्रशासन

विकास प्रशासन—अर्थ, प्रकृति व क्षेत्र, विकास प्रशासन की अवधारणा, विकास प्रशासन और परम्परागत प्रशासन, विकसित – विकासशील देशों के प्रशासन की विशेषताएं।

सार्वजनिक व निजी क्षेत्र और उनका प्रशासन।

योजना—परियोजना तथा योजना निर्माण, योजना क्रियान्वयन तथा मूल्यांकन।

नौकरशाही एवं विकास प्रशासन—योजना निर्माण व क्रियान्वयन में नौकरशाही की भूमिका।

विकास प्रशासन— नौकरशाहों, राजनीतिज्ञों, तकनीकों विशेषज्ञों, समाजशास्त्रियों, शिक्षाविदों तथा पत्रकारों में पारस्परिक क्रिया। विकास में जन सहभागिता।

अन्तरराष्ट्रीय सहयोग तथा तकनीक सहायता कार्यक्रम—अन्तरराष्ट्रीय मुद्रा कोष, आई.बी.आर. डी. विश्व व्यापार संगठन।

4. भारतीय प्रशासन

स्वतंत्रता के समय प्रशासनिक विरासतें—लोक सेवाएं, जिला और राजस्व प्रशासन।

केन्द्र स्तर पर सरकार का संगठन— सचिवालय, मंत्रालयों एवं विभागों का संगठन, मंत्रीमंडलीय सचिवालय, प्रधानमंत्री का कार्यालय।

राज्य स्तर पर सरकार का संगठन—सचिवालय, मुख्य सचिव की भूमिका, मंत्रालयों, विभागों तथा निदेशालयों का संगठन।

कार्मिक प्रशासन— सेवाओं का वर्गीकरण, भर्ती, भर्ती करने वाले अभिकरण, संघ लोक सेवा आयोग और राज्य लोक सेवा आयोग, प्रशिक्षण, पदोन्नति, अनुशासन, मनोबल, स्टाफ संघ, नियोक्ता—कर्मचारी सम्बंध।

वित्तीय प्रशासन— बजट, बजट निर्माण, वित्त मंत्रालय व इसकी भूमिका, लेखा व लेखा परीक्षण, नियंत्रक एवं महालेखा परीक्षक।

योजनाएं— पंचवर्षीय योजनाएं, योजना निर्माण, योजना आयोग, राष्ट्रीय विकास परिषद्, योजना क्रियान्वयन।

केन्द्र—राज्य सम्बंध— विधायी, प्रशासनिक तथा वित्तीय, वित्त आयोग।

प्रशासन पर नियंत्रण— विधायी, कार्यपालिका और न्यायिक नियंत्रण, पारदर्शिता, उत्तरदायित्व तथा प्रशासनिक संवेदनशीलता।

जिला प्रशासन— जिला प्रशासन का संगठन, जिला कलेक्टर की विकास संबंधी भूमिका, स्थानीय सरकारें— ग्रामीण व शहरी, पंचायती राज संस्थाएं और विकास में उनकी भूमिका।

नागरिक तथा प्रशासन—लोकपाल तथा लोकायुक्त।

प्रत्यायोजित विधायन तथा प्रशासनिक अधिनिर्णय।

स्वतंत्रता के पश्चात् भारत में प्रशासनिक सुधार।

5. शोध प्रविधि

शोध के रूप

समस्या की पहचान तथा शोध प्रारूप (योजना) निर्माण

समाज विज्ञानों में शोध पद्धतियां

परिकल्पना

प्रतिनिधि नमूना—विभिन्न प्रतिनिधि नमूनों की प्रक्रियाएं

तथ्य या आंकड़ा संकलन की विधियां— प्रश्नावली, साक्षात्कार, विषयसूची या सामग्री विश्लेषण

तथ्य या आंकड़ा प्रक्रमण

केन्द्रीय प्रवृत्ति के मापदंड— माध्य, बहुलक और मध्यांक

रिपोर्ट लेखन।

6. सामाजिक एवं आर्थिक प्रशासन

सामाजिक कल्याण तथा सामाजिक न्याय—अर्थ, प्रकृति व क्षेत्र

केन्द्रीय समाज कल्याण बोर्ड तथा राज्य समाज कल्याण बोर्ड

प्रमुख सामाजिक क्षेत्र—स्वास्थ्य तथा शिक्षा

भारत में औद्योगिक नीति—प्रस्ताव तथा सार्वजनिक क्षेत्र का विकास
सार्वजनिक क्षेत्र—विशेषताएं, प्रबंध की समस्याएं, उत्तरादायित्व और स्वायत्तता।
नई आर्थिक नीति— उदारीकरण, निजीकरण तथा वैश्वीकरण।

7. स्थानीय सरकारें—ग्रामीण व शहरी

स्थानीय प्रशासन का अर्थ, प्रकृति तथा क्षेत्र
ग्रेट ब्रिटेन, संयुक्त राज्य अमेरिका, फ्रांस तथा भारत में स्थानीय सरकारों की प्रमुख
विशेषताएं तथा संरचना
भारत में 73वां तथा 74वां संविधान संशोधन भारत
में स्थानीय शासन के कार्य तथा भूमिका भारत में
राज्य व स्थानीय सरकारों के बीच संबंध।

Economics

- | | | |
|-------|--|----------|
| I. | Micro Economic Analysis:
Demand analysis
Theory of production and costs
Factor Pricing analysis | 30 marks |
| II. | Macro Economic Analysis:
Determination of Output and employment-classical and Keynesian approaches
Demand for Money
Business Cycles | 30 marks |
| III. | Development and Planning:
Factors of Economic Growth
Growth Models- Harrod-Domar, Solow, Ricardo models
Project Selection Technique: Cost Benefit analysis | 30 marks |
| iv. | Public Finance:
Public Revenue, Public Expenditure, Public Debt
Monetary Policy, Fiscal Policy | 30 marks |
| v. | International Economics:
Theories of International Trade,
Determination of foreign Exchange Rate
International Trade Institutions- GATT, WTO, UNCTAD
Regional Eco-Cooperation among developing countries | 30 marks |
| vi. | Indian Economy:
National Income, Agriculture, Industry, foreign Trade, | 30 marks |
| vii. | Statistical Methods:
Measures of Central Tendency
Measures of Dispersion
Sampling and Census Methods, Types of Sampling | 30 marks |
| viii. | Economy of Rajasthan:
Salient Features of Economy of Rajasthan
Environmental Pollution and role of State in environmental preservation,
Tourism development in the State, | 45 marks |

- ix. Major constraints in the development of Rajasthan
General Knowledge and Current affairs 45 marks

Sociology

A: SOCIOLOGICAL CONCEPT

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

Type :Primary –Secondary, Formal –Informal, In-group- Out-group, Reference group

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, Ethnic

Theories of Social stratification, Social Mobility

8. Social Change

Concept 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. Integrationist

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 Method

Survey

Research Design and its types

Hypothesis

Sampling

Techniques of data collection : Observation, Questionnaire, Schedule.

Interview

15. Qualitative Method

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

Correlation analysis

Test of significance

Reliability and Validity

ए. समाजशास्त्रीय अवधारणा

.1 समाजशास्त्र की प्रकृति

परिभाषा

समाजशास्त्रीय परिप्रेक्ष्य

2. मुख्य अवधारणाएं

समुदाय

संस्था

समूह

संस्कृति

- मानदण्ड एवं मूल्य
- 3. सामाजिक संरचना**
प्रस्थिति एवं भूमिका, उनका अन्तर्सम्बन्ध
विविध भूमिकाएं, भूमिका पुंज, प्रस्थिति पुंज, प्रस्थिति क्रम
भूमिका संघर्ष
- 4. सामाजिक समूह**
अर्थ
प्रकार : प्राथमिक-द्वितीयक, औपचारिक-अनौपचारिक, अन्तर्समूह –बाह्यसमूह, सन्दर्भ समूह
- 5. सामाजिक संस्थाएं**
विवाह
परिवार
शिक्षा
अर्थव्यवस्था
राजव्यवस्था
धर्म
- 6. समाजीकरण**
समाजीकरण, पुनर्समाजीकरण, प्रत्याशी समाजीकरण, प्रौढ समाजीकरण
समाजीकरण के अभिकरण
समाजीकरण के सिद्धान्त
- 7. सामाजिक स्तरीकरण**
सामाजिक विभेदीकरण, उच्चोच्च क्रम एवं असमानता
स्तरीकरण के स्वरूप : जाति, वर्ग, लिंग, नृजाति
सामाजिक स्तरीकरण के सिद्धान्त
सामाजिक गतिशीलता
- 8. सामाजिक परिवर्तन**
अवधारणाएं एवं प्रकार : उद्विकास, विसरण, प्रगति, क्रान्ति, रूपान्तरण, सामाजिक संरचना में
परिवर्तन एवं सामाजिक संरचना का परिवर्तन
सिद्धान्त: द्वन्द्वात्मक एवं चक्रीय।

बी. समाजशास्त्रीय सिद्धान्त

9. संरचनात्मक

नैडिल

रेडक्लिफ ब्राउन

लेवी –स्ट्रास

10 प्रकार्यात्मक

मैलिनोवास्की

दुर्खीम

पार्सन्स

मर्टन

11. अन्तर्क्रियावादी

सामाजिक क्रिया :मैक्स वैबर, पैरेटो

प्रतीकात्मक अन्तर्क्रियावाद : जी.एच.मीड, ब्लूमर

12 संघर्षात्मक

कार्ल मार्क्स

डैहरनडाफ

कोजर

कालिन्स

सी. प्रविधि

13. सामाजिक शोध का अर्थ एवं प्रकृति

सामाजिक घटक की प्रकृति

वैज्ञानिक विधि

सामाजिक घटक के अध्ययन में समस्याएं : वस्तुनिष्ठता एवं व्यक्तिनिष्ठता, तथ्य एवं मूल्य

14. गणनात्मक विधि

सर्वेक्षण

शोध –प्रारूप एवं इसके प्रकार

उपकल्पना

दत्त संकलन की विधियां : अवलोकन, प्रश्नावली, अनूसूची, साक्षात्कार

15 गुणात्मक विधियां

सहभागी अवलोकन

वैयक्तिक अध्ययन

अन्तर्वस्तु विश्लेषण

मौखिक इतिहास

जीवन इतिहास

16. सामाजिक शोध में सांख्यिकी

केन्द्रीय प्रवृत्ति के माप : अनुपात, माध्यम, बहुलक

विचलन के माप के तरीके

सहसंबंध विश्लेषण

सार्थकता का मापन

विश्वसनीयता एवं वैधता ।

History

1. CONCEPT, IDEAS AND TERMS OF HISTORY

2. ANCIENT INDIAN HISTORY

Source: Archaeological Source

Exploration, excavation, epigraphy, numismatics, monuments **Literary**

Source Indigenous: Primary and Secondary- problems of dating, myths, legends, poetry, scientific literature in regional languages, religious literature.

Foreign accounts: Greek, Chinese and Arab writers.

Pre-history and Proto-history

Man and Environment- geographical factors. Hunting and gathering (Paleolithic and Mesolithic) beginning of agriculture (Neolithic and Chalcothic)

Indus Valley Civilization – Origin, date, extent. Characteristics, decline, survival, and significance.

Iron age; Second urbanization.

Vedic Period : Migrations and settlements ; dating the Vedic literary and archaeological evidences, evolution of social and political institutions ; religious and philosophical ideas, rituals and practices.

Period of Mahajanapadas

Formation of States (Mahajanapadas) ; Republic and Monarchies ; rise of urban centers ;

trade routes ; economic growth ; introduction of coinage ; spread of Jainism and Buddhism ; rise of Magadha and Nandas.

Iranian and Macedonian invasions and their impact.

Mauryan Empire

Foundation of the Mauryan Empire. Chandragupta. Kautilya and Arthashastra ; Ashoka ; Concept of Dharma ; Edicts; Brahmi and Kharosthi scripts.

Administration; economy; architecture and sculpture; external contacts.

Disintegration of the empire -; Sungas – and Kanvas:

Post-Mauryan Period

(Indo-Greeks, Sakas, Kushanas, Western Kshatrapas)

Contact with outside world; growth of urban centers, economy, coinage development of religions, Mahayana, Social conditions, art and architecture, literature and science.

Early state and society –in Eastern India – Deccan and south India Kharavela, The Satavahamis. Tamil States of the Sangam Age, Administration; economy, land grants, coinage. Trade guilds and urban centres. Buddhist centres. Sangam literature and culture; art and architecture.

Imperial Guptas and Regional States of India

Guptas and Vakatakas. Harsha, Administration. Economic conditions; coinage of the guptas. Land grants, decline of urban centres, Indian feudalism, caste system- position of women, education and educational institutions- Nalanda, Vikramshila and Vallabhi. Contact with neighboring countries –central Asia, South East Asia and China, Sanskrit literature, scientific art and architecture.

The Kadambas, Gangas, Pallavas and Chalukyas of Badami- Administration, trade guilds, Sanskrit literature and growth of regional languages and scripts ; growth of Vaishnava and Saiva religions, Tamil Bhakti Movement. Shankaracharya- Vedanta; Institutions of temple and temple architecture.

Varmanas of Kamrup ; Palas and Senas. Rashtrakutas, Pratiharas, Kalachuri-Chedis ; Paramaras; Chalukyas of Gujarat ; Arab contacts – Ghaznavi Conquest. Alberuni.

The Chalukyas of Kalyana, Cholas, Cheras, Hoysalas. Pandyas- Administration, and local Government, growth of art and architecture. Religious. Sects. Institutions of temple and Mathas. Agraharas, education and literature, economy and society, contact with Sri Lanka, and Southeast Asia.

3. MEDIEVAL INDIAN HISTORY

Source

Archaeological, epigraphic and numismatic materials and monuments, chronicles.

Literary source – Persian, Sanskrit and Regional languages, Archival materials.

Foreign travelers' accounts.

Political Developments

The Sultanate –the Ghorids. The Truks, the Khaljis, the Tughlaqs.the Sayyids and the Lodis.

Foundation of the Mughal Empire- Babur, Humayun and the Suris; expansion from Akbar to Aurangzeb.

Decline of the Mughal empire- political, administrative and economic causes.

Later Mughals and disintegration of the Mughal empire.

The Vijayanagara and the Bahmanis – rise, expansion and disintegration, the Maratha movement, the foundation of Swaraj by Shivaji : its expansion under the Peshwas : Marathas : Maratha Confederacy – causes of decline.

Administration-

Administration under the Sultanate-civil, judicial, revenue, fiscal and military.

Sher Shah's administrative reforms ; Mughal administration- land revenue and other source of income-; Mansabdari and Jagirdari.

Administrative system in the Deccan- the Vijayanagara, the Bahmanis and the Marathas.

Economic Aspects

Agricultural production- village economy ; Peasantry

Urban centres and population.

Industries- cotton textiles, handicrafts, agro-based industries, organization, factories, technology.

Trade. And commerce - state policies, internal and external trade:

European trade, trade centers and ports, transport and communication.

Financing trade, commerce and industries, Hundi(Bills of exchange) and insurance,

Currency.

Socio-religious Movements

The Sufis- their orders.beliefs and practices, the leading Sufi saints.

Bhakti cult – Shaivism and its branches; Vaishnavism and its branches.

The Saints of the medieval period- north and south – their impact on socio-political and religious life.

The Sikh movement- Guru Nanak Dev and his teachings and practice.

Adi Granth : the Khalsa.

Society

Classification- ruling class, major religious groups, the mercantile and professional classes.

Rural society- petty chieftains, village officials, cultivators and non cultivating classes, artisans.

Position of women.

Cultural Life

System of education and its motivations.

Literature – Persian, Sanskrit and Regional language.

Fine Arts- Major schools of painting ; music.

Architectural developments of North and South India ; Indo-Islamic architecture.

4. MODERN INDIAN HISTORY

Sources and Historiography:

Archival materials, biographies and memories. Newspapers. Oral evidence, creative literature and painting.

Concern in Modern Indian Historiography-Imperialist, Nationalist, Marxist and Subaltern.

Rise of British Power

European traders in India in the 17th and 18th centuries- Portuguese, Dutch, French and the British.

The establishment and expansion of British dominion in India.

British relation with and subjugation of the principal Indian

Powers-Bengal, Oudh, Hyderabad. Mysore, Marathas and the Sikhs.

Administration of the Company and Crown

Evolution of central and provincial structure under the East India Company, 1773-1853.

Paramountacy, Civil Service, Judiciary, Police and the Army under the Company and Crown.

Local-Self-Government .

Constitutional changes-1909-1935.

Economic history

Changing composition, volume and direction of trade; the Tribute.

Expansion and commercialization of agriculture, land rights, land settlements, rural indebtedness, landless labour.

Decline of industries – changing socio-economic conditions of artisans; De-urbanization.

British Industrial Policy : major modern industries; nature of factory legislation; labour and trade union movements.

Monetary policy, banking, currency and exchange, railways and road Transport.

Growth of new urban centers: new features of town planning and architecture.

Famines and epidemics and the government policy.

Economic Thought-English utilitarian's; Indian economic historian; the Drain theory.

Indian Society in Transition

Contact with Christianity- the Missions; critique of Indian social and economic practice and religious beliefs; educational and other activities.

The New Education – Government policy; levels and contents; English Language: modern science; Indian initiatives in education.

Raja Rammohan Roy; socio-religious reforms; emergence of middle class; caste associations and caste mobility.

Women's question- Nationalist Discourse; Women's Organizations; British legislation concerning women; Constitutional position.

The Printing Press- journalistic activity and the public opinion.

Modernization of Indian language and literary forms-reorientation in painting, music and performing arts.

5. National Movement

Rise of Indian nationalism, social and economic bases of nationalism.

Revolt of 1857 and different social classes.

Tribal and peasant movements.

Ideologies and programmes of the Indian National Congress, 1885-1920

Trends in Swadeshi movement.

Ideologies and programmes of Indian revolutionaries in India and abroad

Gandhian Mass Movements.

Ideology and programme of the Justice Party.

Left Wing Politics.

Movement of the depressed classes.

Communal politics and genesis of Pakistan.

Towards Independence and Partition.

6. Research in History Scope and

value of history. Objectivity and

Bias in History. History and its

auxiliary sciences Area of

research-proposed

Source- Primary/Secondary in the proposed area of research

Modern Historical Writing in the researcher's area of research.

Geography

- *Equal weightage will be given to research methodology and conceptual knowledge of the subject.*

1. Geomorphology : Fundamental concepts; Endogenetic and Exogenetic forces; Denudation and weathering; Geosynclines, continental drift and plate tectonics; Concept of geomorphic cycle; Landforms associated with fluvial, glacial, arid, coastal and karst cycles.

2. Climatology : Composition and structure of the atmosphere; Heat budget of the earth; Distribution of temperature; Atmospheric pressure and general circulation of winds; Monsoon and jet stream; Tropical and temperate cyclones; Classification of world climates; Koppen's and Thornthwaite's schemes.

3. Oceanography : Ocean deposits; Coral reefs; Temperature and salinity of the oceans; Density of sea water; Tides and ocean currents.

Bio-Geography : World distribution of plants and animals; Forms and functions of ecosystem; conservation and management of ecosystems; Problems of pollution.

4. Geographic Thought : General character of Geographic knowledge during the ancient and medieval period; Foundations of Modern Geography, Determinism and possibilism; Neo-determinism, Areal differentiation and spatial organization.

5. Population Geography : Patterns of world distribution; Growth and density of population; Patterns and processes of migration; Demographic transition.

Settlement Geography : Site, situation, types, size, spacing and internal morphology of rural and urban settlements; City-region; Primate city; Rank-size rule, Settlement hierarchy, Christaller's Central Place theory; August Losch's theory of market centres.

6. Economic Geography : Sectors of economy : primary, secondary, tertiary and quaternary; Quinary; Natural resources; renewable and non-renewable.

Measurement of agricultural productivity and efficiency; Crop combination and diversification; Von Thunen's Model.

Classification of industries : Weber's and Losch's approaches; Resource based and footloose industries.

7. Political Geography : Heartland and Rimland theories; Boundaries and frontiers; Nature of administrative areas and Geography of public policy and finance.

Social Geography : Ethnicity; tribe; dialect; language, caste and religion;
Concept of social well-being.

Cultural Geography : Cultural areas and cultural regions; Human races; Habitat;
Economy and Society of tribal groups.

8. Regional Planning : Regional concept in Geography; Concept of planning regions; Types of regions; Methods of regional delineation; Regional planning in India; Indicators of development; Regional imbalances; Evolution, nature and scope of town planning with special reference to India, and Fundamentals of Town and Country planning.

9. Geography of India : Physiographic divisions' Climate : Its regional variations; Vegetation types and vegetation regions; Major soil types; Irrigation and agriculture; Population distribution and growth; Settlement patterns; Mineral and power resources; major industries and industrial regions.

10. Cartography : Types of maps : Techniques for the study of spatial patterns of distribution; Choropleth; Isopleth and Chorochromatic maps and pie diagrams; Mapping of location-specific data; Accessibility and flow maps.

Statistical Methods : Data sources and types of data; Frequency distribution and cumulative frequency : Measures of central tendency; Selection of class intervals for mapping; Measures of dispersion and concentration; Standard deviation; Lorenz Curve; Methods of measuring associations among different attributes; Simple and Multiple correlation; Regression.

Nearest-neighbour analysis; Scaling techniques; Rank score; Weighted score; Sampling techniques for Geographical analysis.

Definition, scope and process of research, Types and design of research, Role and significance of research bodies and funding agencies to assist research work. Problems of geographic research, formulation of research schemes and research projects, hypothesis.

Philosophy

1. Classical Indian Philosophy

30 marks

Vedic and Upanishadic world views: Rta- the cosmic order, the divine and the human realms: the centrality of the institution of yajna (sacrifice), the concept of Rna-duty/obligation: theories of creation.

Atman- Self (and not-self), Jagrat svapna, susupti and turiya, Brahman, shreyas and preyas.

Karma, samsara, moksha.

Carvaka: Pratyaksa as the only pramana, critique of anumana and shabda, rejection of non- material entities and of dharma and moksha.

Jainism: Concept of reality – sat, dravya, guna, paryaya, jiva, ajiva, anekantavada, syadavada and nayavada: theory of knowledge; bondage and liberation.

Buddhism: Four noble truths, astangamarga, nirvana, madhyam pratipad, pratityasamutpada, kshanabhangavada, anatmavada.

Schools of Buddhism : Vaibhashika, Sautrantika, Yogachara and Madhyamika.

Nyaya:Prama and aprama, pramanya and apramanya; pramana : pratyaksha, nirvikalpaka, savikalpaka, laukika and alaukika; anumana : anvayavyatireka, lingaparamarsha, vyapti; classification : Vyaptigrahopayas, hetvabhasa, upmana; shabda: shakti, lakshana, akanksha, yogyata, sannidhi and tatparya, concept of God, arguments for the existence of God, adrshta, nihsryeasa.

Vaisesika: Concepts of padartha, dravya, guna karma, samanya, samavaya, vishesha, abhava, causation: Asatkaryavada, samavayi, asamavayi nimitta karana, paramanuvada, adrshta, nihshryeas.

Samkhya : Satkaryavada, prakati and its evolutes, arguments for the existence of prakati, nature of purusa, arguments for the existence and plurality of purusha relationship between purusha and prakrti, kevalya, atheism.

Yoga : Patanjali's concept of citta and citta-vrtti, eight-fold path of yoga, the role of God in yoga.

Purva-Mimamsa

Sruti and its importance, atheism of purvmimamsa, classification of srutivakyas, vidhi, nisedha and arthavada, dharma, bhavna, sabdanityavada, jatisaktivada.

Kumarila and prabhakara Schools of mimamsa and their major points of difference, tripiti-samvit, jn atata, abhava and anuplabdhi, anvitabhidhanavada abhidhanavada.

Vedanta

Advaita-Rejection of difference: Adhyasa, maya, three grades of satta, jiva, jivanmukti, vivartavada.

Visistadvaita: Saguna Brahman, refutation of maya, aprthaksiddhi, parinamavada, jiva, bhakti and prapatti.

Dvaita- Rejection of nirguna Brahman and maya, bheda and sakshi, bhakti.

2. Modern Indian Thinkers

30 marks

Vivekananda-Practical Vedanta, universal religion.

Aurobindo- Evolution, mind and supermind, integral yoga.

Tagore_Religion of man, ideas on education.

K.C. Bhattacharyya-Concept of Philosophy, subject as freedom, the doctrine of maya.

Radhakrishnan-Intellect and intuition, the idealist view of life.

Gandhi-Non-violence, satyagraha, swaraj, critique of modern civilization.

Ambedkar-Varna and the caste system, Neo-Buddhism.

3. Classical Western Philosophy

30 marks

The Sophists and Socrates.

Plato-Theory of knowledge, knowledge (episteme) and opinion (daxa), theory of Ideas, the method of dialectic, soul and God.

Aristotle-Classification of the sciences, the theoretical, the practical and the productive (theoria, praxis, techne), logic as an organon, critique of Plato's theory of ideas, theory of causation, form and matter, potentiality and actuality, soul and God.

St. Augustine : Problem of evil.

St. Thomas Aquines : Faith and reason, essence and existence.

Rene Descartes: Method and need for method in philosophy, method of doubt, cogito ergo sum, types of ideas, mind and matter, mind body interactionism, God: Nature and Proofs for his existence.

Spinoza: Substance; Attribute and Mode, the concept of 'God of Nature', the mind- body problem, pantheism, three order of knowing.

Leibniz : Monadology, truths of reason and truths of fact, innateness of all ideas, proofs of the existence of God, principles of non-contradiction, sufficient reason and identity of indiscernibles, the doctrine of pre-established harmony, problem of freedom and philosophy.

Locke: Ideas and their classification, refutation of innate ideas, theory of knowledge, theory of substance, distinction between primary and secondary qualities.

Berkeley: Rejection of the distinction between primary and secondary qualities, immaterialism, critique of abstract ideas, esse est percipi, the problem of solipsism; God and self.

Hume : Impressions and ideas, knowledge concerning relations of ideas and knowledge concerning matters of fact, induction of causality, the external world and the self, personal identity, rejection of metaphysics, scepticism, reason and the passions.

4. Critical Philosophy and After

30 marks

Kant : The critical philosophy, classification of judgments, possibility of synthetic a priori judgments, the Copernican revolution, forms of sensibility, categories of understanding, the metaphysical and the transcendental deduction of the categories, phenomenon and noumenon, the ideas of Reason- soul, God and world as a whole, freedom and immortality, rejection of speculative metaphysics.

Hegel: The conception of Geist (spirit), the dialectical method, concepts of being, non-being and becoming, absolute idealism.

Nietzsche: Critique of western culture, will to power.

Moore: Refutation of idealism, defense of common sense, philosophy and analysis.

Russell: Refutation of idealism, logic as the essence of philosophy, logical atomism.

Wittgenstein: Language and reality, facts and objects, names and propositions, the picture theory, philosophy and language, meaning and use, forms of life.

5. INDIAN ETHICS

30 marks

Indian Ethics; presuppositions; theory of karma, Immortality of soul.

Dharma: its meaning, definition, classification: varna-arshram dharma, sanatana dharma, sva-dharma, apad- dharma, yuga-dharma, sadharana dharma. Vidhi, nisedha, arthavada.

Ashramdharm

Nishkamkarma and loksangraha

Brahmaviharas

Purusarths and their inter-relations; purusartha sadhana.

Buddhist ethics: the Four Noble Truths and the Eight-fold Path.

Jaina ethics: Anuvratas, Mahavratas and Triratna.

6. WESTERN ETHICS

30 marks

Western Ethics: Nature and Scope

Teleological ethics: egoism; hedonism; utilitarianism.

Deontological ethics: Kant.

Intuitionism.

Virtue ethics: Socrates, Plato and Aristotle.

Free will, Theories of punishment.

Good, right, justice, duty and obligation. Cardinal virtues, Eudaemonism, freedom and responsibility, crime and punishment. Ethical cognitivism and non-cognitivism, Ethical realism and intuition, Kant's moral theory, kind of utilitarianism.

7. INDIAN LOGIC

30 marks

Definition, constituent, process and types of Anuman in Nyaya and Buddhist perspectives.

Inductive elements in Indian logic: the concept of vyaptigrahopaya ,samanyalakshan pratyasatt,tarka upadhi.

8. WESTERN LOGIC

30 marks

Truth and validity ,nature of proposition ,categorical syllogism ,law of thought ,classification of proposition ,square of opposition ,truth-function and propositional logic ,quantification and rules of quantification ,Decision procedure , Argument and Argument-form.

9. GENERAL KNOWLEDGE, CURRENT AFFAIRS AND MENTAL ABILITY

60 marks

Commerce

UNIT-I : BUSINESS ENVIRONMENT

Meaning and Elements of Business Environment.

Economic environment, Economic policies, Economic Planning

Legal environment of Business in India, Environment protection,

Policy Environment: Liberalisation, Privatisation and globalisation, Second generation reforms, Industrial policy: An implementation, Industrial growth and structural changes.

UNIT-II : FINANCIAL & CORPORATE ACCOUNTING

Basic Accounting concepts, Capital and Revenue, Financial Statements

Advanced Company Accounts : Issue, Forfeiture of Shares, Redemption of Preference Shares, Issue and Redemption of Debentures, Purchase of Business, Underwriting of Shares and Debentures, Liquidation, Valuation of Goodwill, Valuation of Shares, Reconstruction and Amalgamation of Companies, Consolidated Balance Sheet and P & L Account of Holding and Subsidiary Companies.

Cost and Management Accounting : Ratio Analysis, Fund Flow Analysis, Cash Flow Analysis, Marginal Costing and Break-even Analysis, Standard Costing, Budgetary Control, Decision-making.

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, Law of Supply and Elasticity of Supply

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 types, Data collection and analysis, sampling, need, errors and methods of sampling, Normal distribution, Hypothesis testing, Analysis and Interpretation of Data, Classification and Tabulation of Data, Measures of Central tendency, Dispersion & Skewness.

Correlation and Regression, small sample tests - t-test, Z-test, F-test and chi-square test.

UNIT-V : BUSINESS MANAGEMENT

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, Consumer behaviour, Market segmentation, Product decisions, Pricing decisions, Distribution decisions, Promotion decisions, Marketing planning, Organising and Control.

UNIT-VII : FINANCIAL MANAGEMENT

Sources of Longterm and Short-term Financing.

Capital Structure, Financial and Operating leverage, Cost of Capital, Capital Budgeting, Working Capital Management and Dividend Policy.

UNIT-VIII : HUMAN RESOURCES MANAGEMENT

Concepts, Role and Functions of Human Resource Management

Human Resource Planning, Recruitment and Selection, Training and Development.

Compensation : Wage and Salary Administration, Incentive and Fringe benefits, Morale and Productivity, Performance Appraisal, Industrial Relations in India, Health, Safety, Welfare and Social security, Workers Participation in Management.

UNIT-IX : BANKING AND FINANCIAL INSTITUTIONS

Importance of Banking to Business, Types of Banks and Their Functions, Reserve Bank of India, NABARD and Rural Banking.

Banking Sector Reforms in India, NPA, Capital adequacy 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.

Education

1- Philosophical & Sociological Foundations of Education 75 marks

Relationship of Education and Philosophy

Western Schools of Philosophy:

Idealism, Realism, Naturalism, Pragmatism, with special reference to the concepts of knowledge, reality and values their educational implications for aims, contents and methods of education.

Indian Schools of Philosophy (Sankhya, Vedanta, Geeta, Budhaism, Jainism, Islamic traditions) with special reference to the concept of knowledge, reality and values their educational implications

Contributions of Vivekananda, Tagore, Gandhi, Swami Keshwanand and Aurobindo to educational thinking.

National values as enshrined in the Indian Constitution and national policies of Education, Education for Values.

Relationship of Sociology and Education

Education – as a social sub-system – special characteristics

Education and the community with special reference to Indian society

Education and Modernization

Education and Culture

Education and Democracy

Education as related to social stratification and social mobility

Education of the socially and economically disadvantaged sections of the society with special reference to scheduled caste and scheduled tribes, rural population, education for gender equity.

शिक्षा के सामाजिक एवं दार्शनिक आधार –

75 अंक

शिक्षा तथा दर्शनशास्त्र का संबंध

दर्शन के पश्चिमी संप्रदाय (स्कूल) :

आदर्शवाद, यथार्थवाद, प्रकृतिवाद, प्रयोजनवाद, ज्ञान, यथार्थ तथा मूल्यों के विशेष संदर्भ में, शिक्षा के उद्देश्य, विषयवस्तु तथा शिक्षा पद्धति के लिए उनके शैक्षिक निहितार्थ।

ज्ञान, यथार्थ तथा मूल्यों के विशेष संदर्भ में भारतीय दर्शन में सांख्य, वेदान्त, गीता, बौद्ध, जैन तथा मुस्लिम संप्रदायों के शैक्षिक निहितार्थ।

विवेकानन्द, टैगोर, गांधी, स्वामी केशवानन्द और अरबिन्दो का शिक्षा विषयक चिन्तन में योगदान।

भारतीय संविधान में निहित राष्ट्रीय मूल्यों का समीक्षात्मक अध्ययन और शिक्षा की राष्ट्रीय नीतियां, मूल्यों के लिए शिक्षा

समाजशास्त्र एवं शिक्षा में सम्बन्ध

शिक्षा – सामाजिक उपव्यवस्था के रूप में – विशिष्ट लक्षण

शिक्षा तथा समुदाय, भारतीय समाज के विशेष संदर्भ में।

शिक्षा तथा आधुनिकीकरण

शिक्षा तथा संस्कृति

शिक्षा तथा लोकतन्त्र

सामाजिक स्तरीकरण तथा सामाजिक गतिशीलता से सम्बद्ध शिक्षा

समाज के सामाजिक और आर्थिक दृष्टि से वंचित वर्गों की शिक्षा, अनुसूचित जातियों तथा अनुसूचित जनजातियों, ग्रामीण जनता तथा लिंग समानीकरण के लिए शिक्षा के विशेष संदर्भ में।

2- Psychological Foundations of Education

75 marks

Relationship of Education and Psychological

Process of Growth and Development

- Physical, social, emotional and intellectual
- Development of concept formation, logical reasoning, problem solving and creative thinking; language development
- Individual Differences – determinants; role of heredity and environment implications of individual differences for organizing educational programmes

Intelligence – its theories and measurement

Learning and Motivation

Theories of learning – Thorndike is connectionism; Pavlov's classical and Skinner's operant conditioning; learning by insight; Hull's reinforcement theory and Tolman's theory of Learning; Lewin's Field theory

- Gagne's hierarchy of learning

- Factors influencing learning
- Learning and motivation
- Transfer of learning and its theories

Psychology and education of exceptional children – creative, gifted, backward, learning disabled and mentally retarded

Personality – type and trait theories – measurement of personality

Mental health and hygiene – process of adjustment, conflicts and defence mechanism, mental hygiene and mental health. Sex Education

Guidance

शिक्षा के मनोवैज्ञानिक आधार –

75 अंक

शिक्षा तथा मनोविज्ञान का संबंध

वृद्धि तथा विकास की प्रक्रिया

- शारीरिक, सामाजिक, भावात्मक और बौद्धिक
- संप्रत्यय-निर्माण, तर्कना शक्ति, समस्या समाधान और सृजनात्मक चिन्तन का विकास,

भाषा का विकास।

– वैयक्तिक विभेद तंत्र – निर्धारक तत्व, आनुवांशिकता तथा परिवेश की भूमिका, शैक्षिक कार्यक्रम आयोजित करने में वैयक्तिक अन्तरों के निहितार्थ

बुद्धि – इसके सिद्धान्त तथा मापन

अधिगम और अभिप्रेरण :

अधिगम के सिद्धान्त – थार्नडाइक का संबंधवाद, पावलाव का क्लासिकी तथा स्किनर का क्रियाप्रसूत अनुबंधन, अन्तर्दृष्टि द्वारा अधिगम, हॅल का प्रबलन सिद्धान्त, टोलमैन का अधिगम सिद्धान्त, लूविन का क्षेत्र सिद्धान्त

- गैने का अधिगम अधिकम
- अधिगम को प्रभावित करने वाले कारक
- अधिगम और अभिप्रेरण
- अधिगम का अन्तरण और इसके सिद्धान्त

असाधारण बच्चों का मनोविज्ञान एवं उनकी शिक्षा – सृजनात्मक, प्रतिभाशाली, पिछड़े,

अधिगम-असमर्थ तथा मन्दितमना सहित का मनोविज्ञान तथा शिक्षा

व्यक्तित्व – प्रकार तथा विशेषक सिद्धान्त – व्यक्तित्व का मापन

मानसिक स्वास्थ्य तथा आरोग्यता – समायोजन की प्रक्रिया, मानसिक द्वन्द्व एवं प्रतिरक्षा

क्रियाविधि, मानसिक आरोग्यता। यौन शिक्षा नेतृत्व

3- Educational Technology

75 marks

Fundamental of ET, Concept of ET, Classification of E.T., Concept, Meaning, & Characteristics of Technology, Hardware & Software & system approach, teaching technology. Instruction Technology, Behaviour Technology, Instructional Design Role of NCERT & SIERT in the field of Educational Technology.

Concept, role, characteristic and scope of Multi Media & Mass Media, Multimedia-approach to instruction, criteria for selection of media, Radio, TV, Film Tape Recorder, CD/DVD Player, Computer, LCD Projector etc.

Communication and classroom interaction, Communication in Education and its process, models and impact on Learning, Teaching, Environment technique of encoding and decoding, Interaction Analysis technique, Consent organization interaction by FIACS. T-group Training, Micro teaching, simulated teaching, Action Research, Study of Observation, Schedule and Record (OSCAR), Bale's Interaction Process Categories, Verbal Interaction Category System (VICS), Reciprocal Category System.

Concept of Teaching and instruction, training and learning, classification and specification of Instruction Behaviours, Programming Instruction, CAI, Teaching machine and its developments, concept of education innovation, latest research in education technology, Development of Education Technology in India, new innovation in Educational Technology.

शैक्षिक तकनीकी –

75 अंक

शैक्षिक तकनीकी का आधार, शैक्षिक तकनीकी का संप्रत्यय, शैक्षिक तकनीकी का वर्गीकरण, शैक्षिक तकनीकी – संप्रत्यय, अर्थ तथा विशेषताएं, कठोर, मृदुल तथा प्रणाली उपागम, शिक्षण तकनीकी, अनुदेशन तकनीकी, व्यवहार तकनीकी, अनुदेशन प्रारूप, शैक्षिक तकनीकी के क्षेत्र में एनसीईआरटी व एसआईईआरटी की भूमिका।

बहुसंचार एवं जनसंचार का संप्रत्यय, भूमिका, विशेषताएं तथा क्षेत्र, अनुदेशन का बहुसंचार उपागम, संचार के चयन का आधार, रेडियो, टी.वी., फिल्म, टेपरिकार्ड, सीडी/डीवीडी प्लेयर, कम्प्यूटर, एलसीडी प्रोजेक्टर आदि।

सम्प्रेषण तथा कक्षाकक्ष अनुदेशन, शिक्षा में संप्रेषण तथा इसकी प्रक्रिया, प्रतिमान तथा अधिगम

पर प्रभाव, शिक्षण, पर्यावरणीय तकनीक, अन्तःक्रिया विश्लेषण तकनीक, टी-समूह प्रशिक्षण, सूक्ष्म शिक्षण, अनुकरणीय शिक्षण, क्रियात्मक अनुसंधान, निरीक्षण, अनुसूची और रिकार्ड का अध्ययन, बेल का अन्तःक्रिया प्रक्रिया वर्ग, मौखिक अन्तःक्रिया वर्ग प्रणाली, दोतरफा वर्ग प्रणाली.

शिक्षण एवं अनुदेशन का संप्रत्यय, प्रशिक्षण एवं अधिगम, अनुदेशन व्यवहार का वर्गीकरण एवं विशेषीकरण, अभिक्रमित अनुदेशन, कम्प्यूटर सहाय अनुदेशन, शिक्षण मशीन और इसका विकास, शिक्षा नवाचार का संप्रत्यय, शैक्षिक तकनीकी में नवीनतम अनुसंधान, शैक्षिक तकनीकी का भारत में विकास, शैक्षिक तकनीकी में नवाचार.

4- Methodology of Educational Research

75 marks

Nature and Scope of Educational Research

Meaning and nature

Need and purpose

Scientific Inquiry and Theory Development – some emerging trends in research

Fundamental – Applied and Action research

Formulation of Research Problem

Criteria and sources for identifying the problem

Delineating and Operationalizing variables

Developing assumptions and hypothesis in various types of research

Collection of data

Concept of population and sample

Various methods of sampling

Characteristics of a good sample

Tools and Techniques

Characteristics of a good research tool

Types of research tools and techniques and their uses

Qualitative and Quantitative Research

Questionnaire –interview – observations

Test and scales, projective and sociometric techniques

Major Approaches to Research

Descriptive Research

Ex-post facto Research

Laboratory Experiment

Field Experiment
Field Studies
Historical Research

Analysis of Data

Descriptive and inferential statistics. The null hypothesis, test of significance, types of error, one –tailed and two-tailed tests

The t-test

The F-test (one- way and ANOVA)

Non-parametric tests (Chi-square test)

Biserial, point-biserial, tetrachoric and phi-coefficient of correlation

Partial and multiple correlations

शैक्षिक अनुसंधान की विधि –

75 अंक

शैक्षिक अनुसंधान का स्वरूप एवं विषय क्षेत्र

अर्थ एवं स्वरूप

आवश्यकता एवं उद्देश्य

वैज्ञानिक खोज एवं सिद्धान्त विकास – अनुसंधान की कतिपय विकासशील (उभरती हुई)

प्रवृत्तियां

मूलभूत – व्यवहृत अनुप्रयुक्त एवं क्रियात्मक अनुसंधान

अनुसंधान समस्या का निरूपण

समस्या पहचानने के लिए कसौटी और स्रोत

चरों का निरूपण और उनको कार्यपरक (संक्रियात्मक) बनाना

विभिन्न प्रकार के अनुसंधानों में पूर्व धारणाओं और परिकल्पनाओं का विकास

प्रदत्तों का संकलन

समग्र एवं प्रतिदर्श की संकल्पना

प्रतिदर्श की विभिन्न विधियां

अच्छे प्रतिदर्श की विशेषताएं

उपकरण एवं प्रविधियां

अच्छे अनुसंधान-उपकरण की विशेषताएं

शोध-उपकरणों एवं प्रविधियों के प्रकार और उनके प्रयोग

गुणात्मक एवं संख्यात्मक अनुसंधान

प्रश्नावली-साक्षात्कार-प्रेक्षण

परीक्षण और पैमाने (प्रोजेक्टिव) और समाजमतिक प्रविधियां

अनुसंधान के मुख्य उपागम

वर्णनात्मक अनुसंधान

कार्योत्तर अनुसंधान

प्रयोगशालागत प्रयोग

क्षेत्रीय प्रयोग

क्षेत्रीय अध्ययन

ऐतिहासिक अनुसंधान

प्रदत्तों का विश्लेषण

वर्णनात्मक तथा आनुमानिक सांख्यिकी। निराकरणाय परिकल्पना, सार्थकता परीक्षण, त्रुटि प्रकार

तथा एक-पुच्छीय तथा द्वि-पुच्छीय परीक्षण

टी परीक्षण

एफ- परीक्षण (एकदिश और एनोवा)

अप्राचलिक परीक्षण (काई वर्ग परीक्षण)

द्विश्रेणिक, बिन्दु-द्विश्रेणिक, चतुष्कोष्ठिक तथा फाई-सहसंबंध गुणांक

आंशिक और बहु-सहसंबंध गुणांक

Law

1. Constitution Law of India

Preamble

Fundamental Rights and Duties

Directive Principles of State Policy

Judiciary

Executive

Union state legislative relation

Emergency Provision

Amendment of the Constitution

Writ Jurisdiction

2. Legal Theory

Nature and Source of law

Positivism , natural law, theory, Sociological Jurisprudence

theories of Punishment

Rights and Duties

Concept of posse ion and ownership

3. Public International Law

Nature of international laws and it;s relationship with municipal Law

Source of international Law

Recognition of States and Governments

United Nations'

Settlements of International Dispute

Human Rights

4. Family Law

Concept in family Law

Sources of Family Law in India

Marriage and Dissolution of Marriage

5. Law of Contracts-general Principles

Essentials of a valid contract

Offer, acceptance and consideration

Capacity of Contract-Minor's contract

Element violating contract-Mistake, fraud, misinterpretation, public policy, correction
undue influence, frustration of contract
remedies for breach of contract-damages

6. Laws of Torts

Foundation of Tortious Liability
general defenses to an action of Tort
Vicarious liability
Remoteness' of Damages
Contributory Negligence's
Absolute and Strict Liability

7. Law of Crimes-General Principles

Nature and Definition of Offence
General Exceptions
Common Intention and Common Object
Criminal Attempt, Conspiracy and abetment
Offences against women's

8. Labour law

Concepts-Industry, Industrial Dispute and Workman
Trade Unions Rights and Immunities of registered Trade union, registration and its
disadvantages
Methods for settlements of industrial disputes under Industrial Disputes Act 1947
Strike and Lockout as instrument of Collective Bargaining
Retirement, Lay off and Closures

Botany

1. MOLECULES AND THEIR INTERACTION RELEVANT TO BIOLOGY

- A. Structure of atoms, molecules and chemical bonds.
- B. Composition, structure function of biomolecules (carbohydrates, lipids, protein, nucleic acids and vitamins)
- C. Principles of biophysical chemistry
(pH, buffer, reaction kinetics, thermodynamics, colligative properties)
- D. Principles of catalysis, enzymes and enzyme kinetics, enzyme regulation, mechanism of enzyme catalysis, isozymes.
- E. Confirmation of nucleic acids (A-, B-, Z-DNA), t-RNA, micro-RNA)
- F. Stability of protein and nucleic acid structures.
- G. Metabolism of carbohydrates, lipids, amino acids, nucleotides and vitamins.

2. CELLULAR ORGANISATIONS

- A. **Membrane structure and function** : Structure of model membrane, lipid bilayer and membrane, protein diffusion, osmosis, ion channels, active transport, ion pumps, mechanism of sorting and regulation of intracellular transport, electrical properties of membrane.
- B. **Structural organization and function of intracellular organelles**: Cell wall, nucleus, mitochondria, Golgi bodies, lysosomes, active transport, endoplasmic reticulum, peroxisomes, plastids, vacuoles, chloroplast, structure and function of cytoskeleton and its role in motility.
- C. **Organisation of genes and chromosomes**: Operon, interrupted genes, gene families, structure of chromatin and chromosome, unique and repetitive DNA, heterochromatin, euchromatin, transposons.
- D. **Cell division and cell cycle**: Mitosis and meiosis, their regulation, steps in cell cycle, and control of cell cycle.

3. SYSTEM PHYSIOLOGY- PLANT

- A. **Photosynthesis**: Light harvesting complexes; mechanisms of electron transport photoprotective mechanisms: CO₂ fixation-C₃, C₄ and CAM pathways.
- B. **Respiration and photorespiration**: Citric acid cycle, plant mitochondrial electron transport and ATP synthesis, alternative oxidase: photorespiratory pathway.

- C. Nitrogen metabolism:** Nitrate and ammonium assimilation: amino acid biosynthesis.
- D. Plant hormones:** Biosynthesis, storage, breakdown and transport: physiological effects and mechanism of action.
- E. Sensory photobiology:** Structure, function and mechanisms of action of Phytochromes. Cryptochromes and phototropins: stomatal movement: photoperiodism and biological clocks.
- F. Solute transport and photoassimilate translocation:** uptake, transport and translocation of water, ions, solutes and macromolecules from soil through cells, across membranes, through xylem and phloem, transpiration mechanisms of loading and unloading of photoassimilates.
- G. Secondary metabolites:** biosynthesis of terpenes, phenols and nitrogenous compounds and their roles.
- H. Stress physiology:** responses of plants to biotic (pathogen and insects) and abiotic (water temperature and salt) stresses: mechanisms of resistance to biotic stress and tolerance to abiotic stress.

4. SYSTEM PHYSIOLOGY- ANIMAL

- A. Blood and circulation:** Blood corpuscles, haemopoiesis and formed elements plasma function, blood volume, blood volume regulation, blood groups, haemoglobin, immunity, haemostasis.
- B. Cardiovascular System:** Comparative anatomy of heart structure, myogenic heart, specialized tissue, ECG- its principle and significance, cardiac cycle, heart as a pump, blood pressure, neural and chemical regulation of all above.
- C. Respiratory system:** Comparison of respiration in different species, anatomical considerations, transport of gases, exchange of gases, waste elimination, neural and chemical regulation of respiration.
- D. Nervous System:** Neurons, action potential, gross neuroanatomy of the brain and spinal cord. Central and peripheral nervous system, nervous control of muscle tone and posture.
- E. Sense Organs:** Vision, hearing and tactile response.
- F. Excretory System:** Comparative physiology of excretion, kidney, urine formation urine concentration, waste elimination, micturition, regulation of water balance, blood volume, blood pressure, electrolyte balance, acid-base balance.

- G. **Thermoregulation:** Comfort zone, body temperature, physical, chemical, neutral regulation, acclimatization.
- H. **Stress and adaptation**
- I. **Digestive System:** digestion, absorption, energy balance, BMR
- J. **Endocrinology and reproduction :** Endocrine glands, basic mechanism of hormone action, hormone and disease, reproductive processes, neuroendocrine regulation.

5. INHERITANCE BIOLOGY

- A. **Mendelian principles:** Dominance, segregation, independent assortment, deviation from Mendelian inheritance.
- B. **Concept of gene:** Allele, multiple alleles, pseudoallele, complementation tests.
- C. **Gene mapping methods:** Linkage maps, tetrad analysis, mapping with molecular markers, mapping by using somatic cell hybrids, development of mapping population in plants.
- D. **Extra chromosomal inheritance:** Inheritance of mitochondrial and chloroplast genes, maternal inheritance.
- E. **Microbial genetics:** Methods of genetic transfers- transformation, conjugation, transduction and sex-duction, mapping genes by interrupted mating, fine structure analysis of genes.
- F. **Human genetics:** Pedigree analysis, lod score for linkage testing, karyotypes, genetic disorder.
- G. **Mutation:** Types, causes and detection, mutant types- lethal, conditional, biochemical, loss of function , gain of function, germinal versus somatic mutants, insertional mutagenesis.
- H. **Structural and numerical alternations of chromosome:** Deletion, duplication, inversion, translocation, ploidy and their genetic implications.
- I. **Recombination:** Homologous and non-homologous recombination, including transposition, site-specific recombination.

6. ECOLOGY PRINCIPLES

- A. **The Environment:** Physical environment: biotic and abiotic interactions.
- B. **Habitat and niche:** Concept of habitat and niche, niche width and overlap, fundamental and realized niche: resource partitioning: character displacement.

- C. Populatrion ecology:** Characterstics 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. Ecology succession:** Types, mechanisms, changes,involved in succession: concept of succession.
- G. Ecosystem:** Structure and function: energy flow and mineral cycling (CNP): primary production and decomposition: structure and function of some Indian Ecosystem terrestrial (forest, grassland) andaquatic (freshwater,marine, eustarine).
- H. Biogeography:** Major terrestrial biomes: theory of island biogeography: biogeographical zone of India.
- I. Applied Ecology:** Enviornmental pollution, global environmental change, biodiversity-status, monitoring and documentation: major drivers of biodiversity change,: biodiversity management approaches.
- J. Conservation biology:** Principles of conservation, major approaches to management, Indian case studies on conservation management strategy (Project Tiger Biosphere reserves).
- 7. Applied Biology:**
- A.** Microbial fermentation nad production of small and macro molecules.
- B.** Application of immunological principles (vaccines,diagnostics). Tissue and cell culture methods for plants and animals.
- C.** Transgenic animal and plants, molecular approaches to diagnosis and strain identification.
- D.** Biosource and uses of biodiversity.
- E.** Biosensors.
- 8. 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 gel: 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 plasmids, phage, cosmid, BAC and YAC vectors

B. Embryology: Elementary Knowledge

C. Economic Botany: Elementary Knowledge

D. Medicinal Plants : General plants of local plants of medical importance along with ocimum, commiphora, convolvulus, centella, chorophytum, perpever Aloe etc.

E. Algae in diversified habitats (terrestrial, fresh water, marine) salient features of proto chlorophyta, chlorophyta, charophyta, xanthophyta, Bacillareophta, Phacophyta and Rhodophyta. Alegal blooms, Alegal biofertilizers, algae as food, feed and uses in industry.

F. Etiology and control of the following crop diseases-

- Paddy- Bacterial and leaf blight.
- Wheat- Tundu disease.
- Bajra- Ergot.
- Sugar Cane- Redrot
- Groundnut- Tikka disease

Zoology

1- MOLECULES AND THEIR INTERACTION RELEVANT TO BIOLOGY

- 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, etc.).
- 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. Principles of catalysis, enzymes and enzyme kinetics, enzyme regulation, mechanism of enzyme catalysis, isozymes.
- G. Conformation of proteins (Ramachandran plot, secondary, tertiary and quaternary structure; domains; motif and folds).
- H. Conformation of nucleic acids (A-, B-, Z-, DNA), t-RNA, micro-RNA).
- I. Stability of protein and nucleic acid structures.
- J. Metabolism of carbohydrates, lipids, amino acids, nucleotides and vitamins.

2- CELLULAR ORGANIZATION

- A. Membrane structure and function: Structure of model membrane, lipid bilayer and membrane protein diffusion, osmosis, ion channels, active transport, ion pumps, mechanism of sorting and regulation of intracellular transport, electrical properties of membranes.
- B. 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.
- C. Organization of genes and chromosomes: Operon, interrupted genes, gene families, structure of chromatin and chromosomes, unique and repetitive DNA, heterochromatin, euchromatin, transposons.
- D. Cell division and cell cycle: Mitosis and meiosis, their regulation, steps in cell cycle, and control of cell cycle.

E. Microbial Physiology: Growth, yield and characteristics, strategies of cell division, stress response.

3- FUNDAMENTAL PROCESSES

A. 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.

B. RNA synthesis and processing: Transcription factors and machinery, formation of initiation complex, transcription activators and repressors, RNA polymerases, capping, elongation and termination, RNA processing, RNA editing, splicing, polyadenylation, structure and function of different types of RNA, RNA transport.

C. 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, translational proof-reading, translational inhibitors, post- translational modification of proteins.

D. Control of gene expression at transcription and translation level: Regulation of phages, viruses, prokaryotic and eukaryotic gene expression, role of chromatin in regulating gene expression and gene silencing.

4. CELL COMMUNICATION AND CELL SIGNALING

A. Host parasite interaction: Recognition and entry processes of different pathogens like bacteria, viruses into animal and plant host cells, alteration of host cell behavior by pathogens, virus-induced cell transformation, pathogen-induced diseases in animals and plants, cell-cell fusion in both normal and abnormal cells.

B. 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 signaling systems, bacterial chemotaxis and quorum sensing.

C. Cellular communication: Regulation of hematopoiesis, general principles of cell communication, cell adhesion and roles of different adhesion molecules, gap junctions, extracellular matrix, integrins, neurotransmission and its regulation.

D. 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.

E. Inate and adaptive immune system: Cells and molecules involved in innate and adaptive immunity, antigens, antigenicity and immunogenicity. B and T cell epitopes, structure and fusion 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.

5. DEVELOPMENTAL BIOLOGY

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; embryo sac development and double fertilization in plants; zygote formation, cleavage, blastula formation, embryonic fields, gastrulation and formation of germ layers in animals; embryogenesis, establishment of symmetry in plants; seed formation and germination.

C. Morphogenesis and organogenesis in animals: Cell aggregation and differentiation in *Dictyostelium*; axes and pattern formation in *Dictyostelium*, amphibian 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. Programmed cell death, aging and senescence.

6. SYSTEM PHYSIOLOGY – ANIMAL

A. Blood and circulation: Blood corpuscles, haemopoiesis and formed elements, plasma function, blood volume, blood volume regulation, blood groups, haemoglobin, immunity, haemostasis.

- B. Cardiovascular System: Comparative anatomy of heart structure, myogenic heart, specialized tissue, ECG- its principle and significance, cardiac cycle, heart as a pump, blood pressure, neural and chemical regulation of all above.
- C. Respiratory system: Comparison of respiration in different species, anatomical considerations, transport of gases, exchange of gases, waste elimination, neural and chemical regulation of respiration.
- D. Nervous system: Neurons, action potential, gross neuroanatomy of the brain and spinal cord, central and peripheral nervous system, neural control of muscle tone and posture.
- E. Sense organs: Vision, hearing and tactile response.
- F. Excretory system: Comparative physiology of excretion, kidney, urine formation, urine concentration, waste elimination, micturition, regulation of water balance, blood volume, blood pressure, electrolyte balance, acid-base balance.
- G. Thermoregulation: Comfort zone, body temperature- physical, chemical, neural regulation, acclimatization
- H. Stress and adaptation
- I. Digestive system: Digestion, absorption, energy balance, BMR.
- J. Endocrinology and reproduction: Endocrine glands, basic, mechanism of hormone action, hormones and diseases; reproductive processes, neuroendocrine regulation.

7. INHERITANCE BIOLOGY

- A. Mendelian principles: Dominance, segregation, independent assortment, deviation from Mendelian inheritance.
- B. Concept of gene: Allele, multiple alleles, pseudoallele, complementation tests.
- C. Extensions of Mendelian principles: Codominance, incomplete dominance, gene interaction, 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, development of mapping population in plants.
- E. Extra chromosomal inheritance: inheritance of mitochondrial and chloroplast genes, maternal inheritance.

- F. Microbial genetics: Methods of genetic transfer- 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 alteration of chromosomes: Deletion, duplication, inversion, translocation, ploidy and their genetic implications.
- K. Recombination: Homologous and non-homologous recombination, including transposition, site-specific recombination.

8. DIVERSITY OF LIFE FORMS

- A. Principles and methods of taxonomy: Concepts of species and hierarchical taxa, biological nomenclature, classical and quantitative methods of taxonomy of animals and microorganisms.
- B. Levels of structural organization: Unicellular, colonial and multicellular forms; levels of organization of tissues, organs and systems; comparative anatomy.
- C. Outline classification of animals and microorganisms: Important criteria used for classification in each taxon; classification of animals and microorganisms; evolutionary relationships among taxa.
- D. Natural history of Indian subcontinent: Major habitat types of the subcontinent, geographic origins and migrations of species; common Indian mammals, birds; seasonality and phenology of the subcontinent.
- E. Organisms of health and agricultural importance: Common parasites and pathogens of humans, domestic animals.

9. ECOLOGICAL PRINCIPLES

- 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 niche; 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: Structure and function; energy flow and mineral cycling (CNP); primary production and decomposition; structure and function of some Indian ecosystems; terrestrial (forest, grassland) and aquatic (fresh water, marine, estuarine).
- H. Biogeography: Major terrestrial biomes; theory of island biogeography; biogeographical zones of India.
- I. Applied ecology: Environmental pollution; global environmental change; biodiversity-status, monitoring and documentation; major drivers of biodiversity change; biodiversity management approaches.
- J. Conservation biology: Principles of conservation, major approaches to management, Indian case studies on conservation/management strategy (Project Tiger, Biosphere reserves).

10. EVOLUTION AND BEHAVIOUR

- A. Emergence of evolutionary thoughts: Lamarck; Darwin-concepts of variation, adaptation, struggle, fitness and natural selection; Mendelism; spontaneity of mutation; the evolutionary synthesis.
- 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 multicellular organisms; major groups of animals; stages in primate evolution including Homo.

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 and modifications; 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; social communication; social dominance; use of space and territoriality; mating systems, parental investment and reproductive success; parental care; aggressive behavior; habitat selection and optimality in foraging; migration, orientation and navigation; domestication and behavioral changes.

11. 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 plants and animals.
- C. Transgenic animals, molecular approaches to diagnosis and strain identification.
- D. Genomics and its application to health and agriculture, including gene therapy.
- E. Bioresource and uses of biodiversity.
- F. Breeding in animals, including marker- assisted selection.
- G. Bioremediation and phytoremediation.
- H. Biosensors.

12. 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 analysis, such as micro array based techniques; isolation, separation and analysis of carbohydrate and Lipid molecules; RFLP, RAPD and AFLP techniques.

B. Histochemical and immunotechniques: Antibody generation, detection of molecules using ELISA, RIA, western blot, immunoprecipitation, flow cytometry and immunofluorescence microscopy, detection of molecules in living cells, *in situ* localization by techniques such as FISH and GISH.

C. Biophysical methods: Analysis of biomolecules using UV/ visible, fluorescence, circular dichroism, NMR and ESR spectroscopy, structure determination using X-ray diffraction and NMR; 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; level of significance; regression and correlation; t-test; analysis of variance; χ^2 test; basic introduction to Multivariate statistics, etc.

E. Radiolabeling techniques: Properties of different types of radioisotopes normally used in biology, their detection and measurement; incorporation of radioisotopes in biological tissues and cells, molecular imaging of radioactive material, safety guidelines.

F. 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.

G. Electrophysiological methods; Single neuron recording, patch-clamp recording, pharmacological testing, PET, MRI, fMRI, CAT.

H. 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.

I. Computational methods: Nucleic acid and protein sequence databases; data mining methods for sequence analysis, web-based tools for sequence searches, motif analysis and presentation.

Physics

I. Mathematical Methods of Physics

Dimensional analysis; Vector algebra and vector calculus; Linear algebra, matrices, Cayley Hamilton theorem, eigenvalue problems; Linear differential equations; Special functions (Hermite, Bessel, Laguerre and Legendre); Fourier series, Fourier and Laplace transforms; Elements of complex analysis: Laurent series-poles, residues and evaluation of integrals; Elementary ideas about tensors; Introductory group theory, $SU(2)$, $O(3)$; Elements of computational techniques: roots of functions, interpolation, extrapolation, integration by trapezoid and Simpson's rule, solution of first order differential equations using Runge-Kutta method; Finite difference methods; Elementary probability theory, random variables, binomial, Poisson and normal distributions.

II. Classical Mechanics

Newton's laws; Phase space dynamics, stability analysis; Central-force motion; Two-body collisions, scattering in laboratory and centre-of-mass frames; Rigid body dynamics, moment of inertia tensor, non-inertial frames and pseudoforces; Variational principle, Lagrangian and Hamiltonian formalisms and equations of motion; Poisson brackets and canonical transformations; Symmetry, invariance and conservation laws, cyclic coordinates; Periodic motion, small oscillations and normal modes; Special theory of relativity, Lorentz transformations, relativistic kinematics and mass-energy equivalence.

III. Electromagnetic Theory

Electrostatics: Gauss' Law and its applications; Laplace and Poisson equations, boundary value problems; Magnetostatics: Biot-Savart law, Ampere's theorem, electromagnetic induction; Maxwell's equations in free space and linear isotropic media; boundary conditions on fields at interfaces; Scalar and vector potentials; Gauge invariance; Electromagnetic waves in free space, dielectrics, and conductors; Reflection and refraction, polarization, Fresnel's Law, interference, coherence, and diffraction; Dispersion relations in plasma; Lorentz invariance of Maxwell's equations; Transmission lines and wave guides; 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; Commutators and Heisenberg's uncertainty principle; Matrix representation; Dirac's bra and ket notation; Schroedinger equation (time-dependent and time-independent); Eigenvalue problems such as 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's exclusion principle, spin-statistics connection; Relativistic quantum mechanics: Klein Gordon and Dirac equations.

V. Thermodynamic and Statistical Physics

Laws of thermodynamics and their consequences; Thermodynamic potentials, Maxwell relations; Chemical potential, phase equilibria; Phase space, micro- and macrostates; Microcanonical, canonical and grand-canonical ensembles and partition functions; Free Energy and connection with thermodynamic quantities; First- and second-order phase transitions; Classical and quantum statistics, ideal Fermi and Bose gases; Principle of detailed balance; Blackbody radiation and Planck's distribution law; Bose-Einstein condensation; Random walk and Brownian motion; Introduction to nonequilibrium processes; Diffusion equation.

VI. Electronics

Semiconductor device physics, including diodes, junctions, transistors, field effect devices, homo and heterojunction devices, device structure, device characteristics, frequency dependence and applications; Optoelectronic devices, including solar cells, photodetectors, and LEDs; High-frequency devices, including generators and detectors; Operational amplifiers and their applications; Digital techniques and applications (registers, counters, comparators and similar circuits); A/D and D/A converters; Microprocessor and microcontroller basics.

VII. Experimental Techniques and data analysis

Data interpretation and analysis; Precision and accuracy, error analysis, propagation of errors, least squares fitting, linear and nonlinear curve fitting, chi-square test; Transducers (temperature, pressure/vacuum, magnetic field, vibration, optical, and

particle detectors), measurement and control; Signal conditioning and recovery, impedance matching, amplification (Op-amp based, instrumentation amp, feedback), filtering and noise reduction, shielding and grounding; Fourier transforms; lock-in detector, box-car integrator, modulation techniques.

Applications of the above experimental and analytical techniques to typical undergraduate and graduate level laboratory experiments.

VIII. Atomic & Molecular Physics

Quantum states of an electron in an atom; Electron spin; Stern-Gerlach experiment; Spectrum of Hydrogen, helium and alkali atoms; Relativistic corrections for energy levels of hydrogen; Hyperfine structure and isotopic shift; width of spectral lines; LS & JJ coupling; Zeeman, Paschen Back & Stark effect; X-ray spectroscopy; Electron spin resonance, Nuclear magnetic resonance, chemical shift; Rotational, vibrational, electronic, and Raman spectra of diatomic molecules; Frank - Condon principle and selection rules; Spontaneous and stimulated emission, Einstein A & B coefficients; Lasers, optical pumping, population inversion, rate equation; Modes of resonators and coherence length.

IX. Condensed Matter Physics

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

X. Nuclear and Particle Physics

Basic nuclear properties: size, shape, charge distribution, spin and parity; Binding energy, semi-empirical mass formula; Liquid drop model; Fission and fusion; 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; Nuclear reactions, reaction mechanisms, compound nuclei and direct reactions; Classification of

fundamental forces; Elementary particles (quarks baryons, mesons, leptons); Spin and parity assignments, isospin, strangeness; Gell-Mann-Nishijima formula; C, P, and T invariance and applications of symmetry arguments to particle reactions, parity non-conservation in weak interaction; Relativistic kinematics.

Chemistry

Physical Chemistry:

1. Basic principles and applications of quantum mechanics - hydrogen atom, angular momentum.
2. Variational and perturbational methods.
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.
6. Basic principles and application of spectroscopy - rotational, vibrational, electronic, Raman, ESR, NMR.
7. Chemical thermodynamics.
8. Phase equilibria.
9. Statistical thermodynamics.
10. Chemical equilibria.
11. Electrochemistry - Nernst equation, electrode kinetics, electrical double layer, Debye-Huckel theory.
12. Chemical kinetics - empirical rate laws, Arrhenius equation, theories of reaction rates, determination of reaction mechanisms, experimental techniques 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. Collids and surface phenomena.
17. Data analysis.

Inorganic Chemistry

1. Chemical periodicity
2. Structure and bonding in homo- and heteronuclear molecules, including shapes of molecules.
3. Concepts of acids and bases.

4. Chemistry of the main group elements and their compounds. Allotropy, synthesis, bonding and structure.
5. Chemistry of transition elements and coordination compounds - bonding theories, spectral and magnetic properties, reaction mechanisms.
6. Inner transition elements - spectral and magnetic properties, analytical applications. Shift reagents
7. Organometallic compounds - synthesis, bonding and structure, and reactivity. Organometallics in homogenous catalysis.
8. Cages and metal clusters.
9. Analytical chemistry- separation techniques. Spectroscopic electro- and thermoanalytical methods.
10. Bioinorganic chemistry - photosystems, porphyrines, metalloenzymes, oxygen transport, electron- transfer reactions, nitrogen fixation.
11. Physical characterisation of inorganic compounds by IR, Raman, NMR, EPR, Mossbauer, UV-, NQR, MS, electron spectroscopy and microscopic techniques.
12. Nuclear chemistry - nuclear reactions, fission and fusion, radio-analytical techniques and activation analysis.

Organic Chemistry

1. IUPAC nomenclature of organic compounds.
2. Principles of stereochemistry, conformational analysis, isomerism and chirality.
3. Reactive intermediates and organic reaction mechanisms.
4. Concepts of aromaticity.
5. Pericyclic reactions.
6. Named reactions.
7. Transformations and rearrangements.
8. Principles and applications of organic photochemistry. Free radical reactions.
9. Reactions involving nucleophilic carbon intermediates.
10. Oxidation and reduction of functional groups.
11. Common reagents (organic, inorganic and organometallic) in organic synthesis.
12. Chemistry of natural products such as steroids, alkaloids, terpenes, peptides, carbohydrates, nucleic acids and lipids.

13. Selective organic transformations - chemoselectivity, regioselectivity, stereoselectivity, enantioselectivity. Protecting groups.
14. Chemistry of aromatic and aliphatic heterocyclic compounds.
15. Physical characterisation of organic compounds by IR, UV-, MS, and NMR.

Interdisciplinary topics

1. Chemistry in nanoscience and technology.
2. Green chemistry - Solvent free synthesis
3. Medicinal chemistry.
4. Supramolecular chemistry.
5. Environmental chemistry

Geology

1. THE EARTH AND THE SOLAR SYSTEM:

Milky Way and the solar system. Modern theories on the origin of the Earth and other planetary bodies. Earth's orbital parameters, Kepler's laws of planetary motion, Geological Time Scale; Space and time scales of processes in the solid Earth, atmosphere and oceans. Age of the Earth. Radioactive isotopes and their applications in earth sciences. Basic principles of stratigraphy. Theories about the origin of life and the nature of fossil record. Earth's gravity and magnetic fields and its thermal structure: Geoid, spheroid; Isostasy.

2. EARTH MATERIALS:

Gross composition and physical properties of important minerals and rocks; properties and processes responsible for mineral concentrations; nature and distribution of rocks and minerals in different units of the earth and different parts of India.

3. SURFACE FEATURES AND PROCESSES:

Physiography of the Earth; weathering, erosion, transportation and deposition of Earth's material; formation of soil, sediments and sedimentary rocks; energy balance of the Earth's surface processes; physiographic features and river basins in India

4. INTERIOR OF THE EARTH, DEFORMATION AND TECTONICS:

Basic concepts of seismology and internal structure of the Earth. Physico-chemical and seismic properties of Earth's interior. Concepts of stress and strain. Behaviour of rocks under stress; Folds, joints and faults. Earthquakes – their causes and measurement. Interplate and intraplate seismicity. Paleomagnetism, sea floor spreading and plate tectonics.

5. OCEANS AND ATMOSPHERE:

Hypsography of the continents and ocean floor –continental shelf, slope, rise and abyssal plains. Physical and chemical properties of sea water and their spatial variations. Residence times of elements in sea water. Ocean currents, waves and tides, important current systems, thermohaline circulation and the oceanic conveyor belt. Major water masses of the world's oceans. Biological productivity in the oceans.

Motion of fluids, waves in atmospheric and oceanic systems. Atmospheric turbulence and boundary layer. Structure and chemical composition of the atmosphere, lapse rate and stability, scale height, geopotential, greenhouse gases and global warming. Cloud formation and precipitation processes, air- sea interactions on different space and time scales. Insolation and heat budget, radiation balance, general circulation of the atmosphere and ocean. Climatic and sea level changes on different time scales. Coupled ocean-atmosphere system, El Nino Southern Oscillation (ENSO). General weather systems of India, - Monsoon system, cyclone and jet stream, Western disturbances and severe local convective systems, distribution of precipitation over India. Marine and atmospheric pollution, ozone depletion.

6. ENVIRONMENTAL EARTH SCIENCES:

Properties of water; hydrological cycle; water resources and management. Energy resources, uses, degradation, alternatives and management; Ecology and biodiversity. Impact of use of energy and land on the environment. Exploitation and conservation of mineral and other natural resources. Natural hazards. Elements of Remote Sensing.

7. MINERALOGY AND PETROLOGY:

Concept of point group, space group, reciprocal lattice, diffraction and imaging. Concepts of crystal field theory and mineralogical spectroscopy. TEM and SEM applications. Lattice defects (point, line and planar). Electrical, magnetic and optical properties of minerals. Bonding and crystal structures of common oxides, sulphides, and silicates. Transformation of minerals – polymorphism, polytypism, and polysomatism. Solid solution and exsolution.

Steady-state geotherms. Genesis, properties, emplacement and crystallization of magmas. Phase equilibrium studies of simple systems, effect of volatiles on melt equilibria. Magma-mixing, -mingling and -immiscibility.

Metamorphic structures and textures; isograds and facies. Mineral reactions with condensed phases, solid solutions, mixed volatile equilibria and thermobarometry. Metamorphism of pelites, mafic-ultra mafic rocks and siliceous dolomites. Material transport during metamorphism. P-T-t path in regional metamorphic terrains, plate tectonics and metamorphism.

Petrogenetic aspects of important rock suites of India, such as the Deccan Traps, layered intrusive complexes, anorthosites, carbonatites, charnockites, khondalites and gondites.

8. STRUCTURAL GEOLOGY AND GEOTECTONICS:

Theory of stress and strain. Behaviour of rocks under stress. Mohr circle. Various states of stress and their representation by Mohr circles. Different types of failure and sliding criteria. Geometry and mechanics of fracturing and conditions for reactivation of pre-existing discontinuities. Paleostress analyses. Common types of finite strain ellipsoids. L-, L-S-, and S-tectonic fabrics. Techniques of strain analysis. Particle paths and flow patterns. Progressive strain history and methods for its determination. Deformation mechanisms. Role of fluids in deformation processes. Geometry and analyses of brittle-ductile and ductile shear zones. Sheath folds. Geometry and mechanics of development of folds, boudins, foliations and lineations. Interference patterns and structural analyses in areas of superposed folding. Fault-related folding.

Gravity induced structures. Major tectonic features and associated structures in extensional-, compressional-, and strike-slip-terranes. Geological and geophysical characteristics of plate boundaries. Geodynamic evolution of Himalaya.

9. PALEONTOLOGY AND ITS APPLICATIONS:

Theories on origin of life. Organic evolution – Punctuated Equilibrium and Phyletic Gradualism models. Mass extinctions and their causes. Application of fossils in age determination and correlation. Paleoecology, Life

habitats and various ecosystems, Paleobiogeography. Modes of preservation of fossils and taphonomic considerations. Types of microfossils. Environmental significance of fossils and trace fossils. Use of microfossils in interpretation of sea floor tectonism. Application of micropaleontology in hydrocarbon exploration. Oxygen and Carbon isotope studies of microfossils and their use in paleoceanographic and paleoclimatic interpretation. Important invertebrate fossils, vertebrate fossils, plant fossils and microfossils in Indian stratigraphy.

10. SEDIMENTOLOGY AND STRATIGRAPHY:

Clastic sediments- gravel, sand and mud; biogenic, chemical and volcanogenic sediments. Classification of conglomerates, sandstones and mudstones, and carbonate rocks. Flow regimes and processes of sediment transport. Sedimentary textures and structures. Sedimentary facies and environments, reconstruction of paleoenvironments. Formation and evolution of sedimentary basins. Diagenesis of siliciclastic and carbonate rocks.

Recent developments in stratigraphic classification. Code of stratigraphic nomenclature – Stratotypes, Global Boundary Stratotype Sections and Points (GSSP). Lithostratigraphic, chronostratigraphic and biostratigraphic subdivisions. Methods of stratigraphic correlation including Shaw's Graphic correlation. Concept of sequence stratigraphy. Rates of sediment accumulation, unconformities. Facies concept in Stratigraphy – Walther's law. Methods for paleogeographic reconstruction. Earth's Climatic History. Phanerozoic stratigraphy of India with reference to the type areas—their correlation with equivalent formations in other regions. Boundary problems in Indian Phanerozoic stratigraphy.

11. MARINE GEOLOGY AND PALEOCEANOGRAPHY:

Morphologic and tectonic domains of the ocean floor. Structure, composition and mechanism of the formation of oceanic crust. Seawater-basalt interactions, hydrothermal vents- chemical and biological significance of hydrothermal vents systems. Ocean margins and their significance. Ocean Circulation, Coriolis effect and Ekman spiral, convergence, divergence and upwelling, El Nino. Thermohaline circulation and oceanic conveyor belt. Formation of Bottom waters; major water masses of the world's oceans.

Oceanic sediments: Factors controlling the deposition and distribution of oceanic sediments; geochronology of oceanic sediments, diagenetic changes in oxic and anoxic environments. Tectonic evolution of the ocean basins. Mineral resources. Paleo-Oceanography – Approaches to paleoceanographic reconstructions; various proxy indicators for paleoceanographic interpretation. Joint Global Ocean Flux Study (JGOFS) and its applications in Paleoceanography. Ocean Drilling Programme and its major accomplishments in paleoceanography. Opening and closing of ocean gateways and their effect on circulation and climate during the Cenozoic. Sea level processes and Sea level changes.

12. GEOCHEMISTRY:

Structure and atomic properties of elements, the Periodic Table; ionic substitution in minerals; Phase rule and its applications in petrology, thermodynamics of reactions involving pure phases, ideal and non-ideal solutions, and fluids; equilibrium and distribution coefficients. Nucleation and diffusion processes in igneous, metamorphic and sedimentary environments, redox reactions and Eh-pH diagrams and their applications. Mineral/mineral assemblages as 'sensors' of ambient environments. Geochemical studies of aerosols, surface-, marine-, and ground waters. Radioactive decay schemes and their application to geochronology and petrogenesis. Stable isotopes and their application to earth system processes.

13. ECONOMIC GEOLOGY:

Magmatic, hydrothermal and surface processes of ore formation. Metallogeny and its relation to crustal evolution; Active ore-forming systems, methods of mineral deposit studies including ore microscopy, fluid inclusions and isotopic systematics; ores and metamorphism- cause and effect relationships. Geological setting, characteristics, and genesis of ferrous, base and noble metals. Origin, migration and entrapment of petroleum; properties of source and reservoir rocks; structural, stratigraphic and combination traps. Methods of petroleum exploration.

Petroliferous basins of India. Origin of peat, lignite, bitumen and anthracite. Classification, rank and grading of coal; coal petrography, coal resources of India. Gas hydrates and coal bed methane. Nuclear and non-conventional energy resources.

14. PRECAMBRIAN GEOLOGY & CRUSTAL EVOLUTION:

Evolution of lithosphere, hydrosphere, atmosphere, biosphere, and cryosphere; lithological, geochemical and stratigraphic characteristics of granite – greenstone and granulite belts. Stratigraphy and geochronology of the cratonic nuclei, mobile belts and Proterozoic sedimentary basins of India. Life in Precambrian. Precambrian – Cambrian boundary with special reference to India.

15. QUATERNARY GEOLOGY:

Definition of Quaternary. Quaternary Stratigraphy – Oxygen Isotope stratigraphy, biostratigraphy and magnetostratigraphy. Quaternary climates – glacial-interglacial cycles, eustatic changes, proxy indicators of paleoenvironmental/ paleoclimatic changes, - land, ocean and cryosphere (ice core studies). Responses of geomorphic systems to climate, sea level and tectonics on variable time scales in the Quaternary. Quaternary dating methods, –radiocarbon, Uranium series, Luminescence, Amino-acid, relative dating methods. Quaternary stratigraphy of India– continental records (fluvial, glacial, aeolian, palaeosols and duricrust); marine records; continental-marine correlation of Quaternary record.

Evolution of man and Stone Age cultures. Plant and animal life in relation to glacial and interglacial cycles during Quaternary.

Tectonic geomorphology, neotectonics, active tectonics and their applications to natural hazard assessment.

16. APPLIED GEOLOGY:

Remote Sensing and GIS:

Elements of photogrammetry, elements of photo-interpretation, electromagnetic spectrum, emission range, film and imagery, sensors, geological interpretations of air photos and imageries. Global positioning systems. GIS- data structure, attribute data, thematic layers and query analysis.

Engineering Geology:

Engineering properties of rocks and physical characteristics of building stones, concretes and other aggregates. Geological investigations for construction of dams, bridges, highways and tunnels. Remedial measures.

Mass movements with special emphasis on landslides and causes of hillslope instability. Seismic design of buildings.

Mineral Exploration:

Geological, geophysical, geochemical and geobotanical methods of surface and sub-surface exploration on different scales. Sampling, assaying and evaluation of mineral deposits.

Hydrogeology:

Groundwater, Darcy's law, hydrological characteristics of aquifers, hydrological cycle. Precipitation, evapotranspiration and infiltration processes. Hydrological classification of water-bearing formations. Fresh and salt-water relationships in coastal and inland areas. Groundwater exploration and water pollution. Groundwater regimes in India.

Mathematics

UNIT-1

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

Sequences and series, convergence, limsup, liminf

Bolzano Weierstrass theorem, Heine Borel theorem.

Continuity, uniform continuity, differentiability, mean value theorem.

Sequences and series of functions, uniform convergence

Riemann sums and Riemann integral, Improper Integrals.

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

Metric spaces, compactness, connectedness Normed Linear Spaces

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

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

Eigenvalues and eigenvectors, Cayley-Hamilton theorem

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

Inner product space orthonormal basis

Quadratic forms, reduction and classification of quadratic forms

Unit-2

Complex Analysis: Algebra of complex numbers, the complex plane, polynomials, Power series, transcendental functions such as exponential, trigonometric and hyperbolic functions.

analytic functions, Cauchy-Riemann equations.

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

Taylor series, Laurent series, calculus of residues

Conformal mappings, Mobius transformations.

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

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.

UNIT-3

Ordinary Differential Equations (ODEs):

Existence and Uniqueness of solutions of initial value problems for first order ordinary

differential equations, singular solutions of first order ODEs, system of first order ODEs

General theory of homogenous and non-homogeneous linear ODES

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, Numerical differentiation and integration, Numerical solutions of ODEs using Picard, Euler, modified Euler and Runge-Kutta methods.

Linear Integral Equations:

Linear integral equation of the first and second kind of Fredholm and Volterra type, Solutions with separable kernels

UNIT-4

Descriptive statistics, exploratory data analysis.

Sample space, discrete probability, independent events, Bayes theorem. Random variables and distribution functions (univariate and multivariate); expectation and moments. Independent random variables, marginal and conditional distributions. Characteristic functions. Probability inequalities (Tchebyshef, Markov, Jensen). Modes of convergence, weak and strong laws of large numbers, Central Limit theorems (i.i.d. case).

Linear programming problem. Simplex methods, duality. Elementary queuing and inventory models. Steady-state solutions of Markovian queuing models : M/M/1, M/M/1 with limited waiting space, M/M/C with limited waiting space, M/G/1

Biotechnology

1. MOLECULES AND THEIR INTERACTION RELAVENT TO BIOLOGY

- A. Structure of atoms, molecules and chemical bonds.
- B. Composition, structure and function of biomolecules (carbohydrates, lipids, proteins, nucleic acids and vitamins).
- C. Stablizing interactions (Van der Waals, electrostatic, hydrogen bonding, hydrophobic interaction, etc.).
- 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. Principles of catalysis, enzymes and enzyme kinetics, enzyme regulation, mechanism of enzyme catalysis, isozymes.
- G. Conformation of proteins (Ramachandran plot, secondary, tertiary and quaternary structure; domains; motif and folds).
- H. Conformation of nucleic acids (A-, B-, Z-,DNA), t-RNA, micro-RNA).
- I. Stability of protein and nucleic acid structures.
- J. Metabolism of carbohydrates, lipids, amino acids, nucleotides and vitamins.

2. CELLULAR ORGANIZATION

- A. **Membrane structure and function:** Structure of model membrane, lipid bilayer and membrane protein diffusion, osmosis, ion channels, active transport, ion pumps, mechanism of sorting and regulation of intracellular transport, electrical properties of membranes.
- B. **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.
- C. **Organization of genes and chromosomes:** Operon, interrupted genes, gene families, structure of chromatin and chromosomes, unique and repetitive DNA, heterochromatin, euchromatin, transposons.

3. FUNDAMENTAL PROCESSES

- A. 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.
- B. RNA synthesis and processing:** Transcription factors and machinery, formation of initiation complex, transcription activators and repressors, RNA polymerases, capping, elongation and termination, RNA processing, RNA editing, splicing, polyadenylation, structure and function of different types of RNA, RNA transport.
- C. 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, translational proof-reading, translational inhibitors, post- translational modification of proteins.
- D. Control of gene expression at transcription and translation level:** Regulation of phages, viruses, prokaryotic and eukaryotic gene expression, role of chromatin in regulating gene expression and gene silencing.

4. CELL COMMUNICATION AND CELL SIGNALING

- A. 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 signaling systems, bacterial chemotaxis and quorum sensing.
- B. 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.
- C. 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.

5. SYSTEM PHYSIOLOGY - PLANT

- A. Nitrogen metabolism:** Nitrate and ammonium assimilation; amino acid biosynthesis.
- B. Plant hormones:** Biosynthesis, storage, breakdown and transport; physiological effects and mechanisms of action.
- C. Secondary metabolites -** Biosynthesis of terpenes, phenols and nitrogenous compounds and their roles.

6. SYSTEM PHYSIOLOGY - ANIMAL

- A. Blood and circulation:** Blood corpuscles, haemopoiesis and formed elements, plasma function, blood volume, blood volume regulation, blood groups, haemoglobin, immunity, haemostasis.
- B. Endocrinology and reproduction:** Endocrine glands, basic mechanism of hormone action, hormones and diseases; reproductive processes, neuroendocrine regulation.

7. INHERITANCE BIOLOGY

- A. Mendelian principles:** Dominance, segregation, independent assortment, deviation from Mendelian inheritance.
- 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, development of mapping population in plants.
- E. Extra chromosomal inheritance:** Inheritance of mitochondrial and chloroplast 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, site-specific recombination.

8. ECOLOGICAL PRINCIPLES

A. Biogeography: Major terrestrial biomes; theory of island biogeography; biogeographical zones of India.

B. Applied ecology: Environmental pollution; global environmental change; biodiversity-status, monitoring and documentation; major drivers of biodiversity change; biodiversity management approaches.

C. Conservation biology: Principles of conservation, major approaches to management, Indian case studies on conservation/management strategy (Project Tiger, Biosphere reserves).

9. EVOLUTION AND BEHAVIOUR

A. 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.

B. 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 and modifications; isolating mechanisms; speciation; allopatricity and sympatricity; convergent evolution; sexual selection; co-evolution.

10. 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 plants and animals.

C. Transgenic animals and plants, molecular approaches to diagnosis and strain identification.

- D. Genomics and its application to health and agriculture, including gene therapy.
- E. Bioresource and uses of biodiversity.
- F. Breeding in plants and animals, including marker – assisted selection.
- G. Bioremediation and phytoremediation.
- H. Biosensors.

Environmental Science

Unit-I

Definition, Principles and scope of Environmental Science.

Earth, Man and Environment, Ecosystems, Pathways in Ecosystems.

Physico-chemical and Biological factors in the Environment.

Geographical classification and zones.

Structure and composition of atmosphere, hydrosphere, lithosphere and biosphere. Mass and Energy transfer across various interfaces, material balance. First and Second law of thermodynamics, heat transfer processes. Scales of Meteorology: pressure, temperature, precipitation, humidity, radiation and wind. Atmospheric stability, inversions and mixing heights, wind roses.

Natural resources, conservation and sustainable development.

Unit-II

Fundamentals of Environmental Chemistry: Stoichiometry, Gibbs' energy, Chemical potential, chemical equilibria, acid base reactions, solubility product, solubility of gases in water, the carbonate system, unsaturated and saturated hydrocarbons, radionuclides.

Chemical composition of Air: Classification of elements, chemical speciation. Particles, ions and radicals in the atmosphere. Chemical processes for formation of inorganic and organic particulate matter. Thermochemical and photochemical reactions in the atmosphere. Oxygen and ozone chemistry, Chemistry of air pollutants, Photochemical smog.

Water Chemistry: Chemistry of water, concept of DO, BOD, COD, sedimentation, coagulation, filtration, Redox potential.

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

Toxic Chemicals in the environment - Air, Water: Pesticides in water. Bio-chemical aspects of Arsenic, Cadmium, Lead, Mercury, Carbon Monoxide, O₃ and PAN Pesticides, Insecticides, MIC, carcinogens in the air.

Unit-III

Definition, Principles and scope of ecology, Human ecology and Human settlement, Evolution, Origin of life and speciation.

Ecosystems : Structure and functions, Abiotic and Biotic components, energy flows, Food chains, Food web, Ecological pyramids, types and diversity.

Ecological Succession, Population, Community ecology and parasitism, Prey-predator relationships.

Common flora and fauna in India

Aquatic : Phytoplankton, Zooplankton and Macrophytes

Terrestrial : Forests

Endangered and Threatened Species

Biodiversity and its conservation:. Definition, 'Hotspots' of Biodiversity, Strategies for Biodiversity conservation. National Parks and Sanctuaries. Gene pool. Man and biosphere reserves.

Microflora of Atmosphere: Air Sampling techniques. Identification of aeroallergens. Air-borne diseases and allergies.

Environmental Biotechnology: Fermentation Technology, Vermiculture technology, Biofertilizer technology.

Unit-IV

Environmental Geosciences- Fundamental concepts.

The earth system: Conservation of matter in various geospheres-

lithosphere, hydrosphere, atmosphere and biosphere. Energy-budget of the earth. Earth's thermal environment and seasons. Ecosystems flow of energy and matter. Coexistence in communities-food webs., Earth's major ecosystems-terrestrial and aquatic. General relationship between landscape, biomes and climate. Climates of India, Indian monsoon, El Nino, Droughts. Tropical cyclones and Western Disturbances.

Earth's Processes and Geological Hazards : Earth's processes; concept of residence, time and rates of natural cycles. Catastrophic geological hazards. Study of floods, landslides, earthquakes, volcanism and avalanche. Prediction and perception of the hazards and adjustments to hazardous activities.

Mineral Resources and Environment: Resources and Reserves, Minerals and Population. Oceans as new areas for exploration of mineral resources. Ocean ore and recycling of resources. Environmental impact of exploitation, processing and smelting of minerals.

Water Resources and Environment : Global Water Balance, Ice sheets and fluctuations of sea levels. Origin and composition of seawater. Hydrological cycle. Factors influencing the surface water. Types of water. Resources of oceans. Ocean pollution by toxic wastes. Human use of surface and groundwaters. Groundwater pollution.

Landuse Planning : The land use plan. Soil surveys in relation to Landuse planning. Methods of site selection and evaluation. Traditional practices of conservation of water, flora and fauna.

Environmental Geochemistry: Concept of major, trace and REE. Classification of trace elements, Mobility of trace elements, Geochemical cycles. Biogeochemical factors in environmental health. Human use, trace elements and health. Possible effects of imbalance of some trace elements. Diseases induced by human use of lead.

Principles of Remote sensing and its application in Environmental Sciences.

Application of GIS in Environmental Management.

Unit-V

Sun as source of energy; solar radiation and its spectral characteristics: Fossil fuels-classification. Composition, physico-chemical characteristics and energy content of coal, petroleum and natural gas. Principles of generation of hydroelectric power, tidal, Ocean Thermal Energy Conversion, wind, geothermal energy; solar collectors, photovoltaics, solar ponds; nuclear energy-fission and fusion; magnetohydrodynamic power, bio-energy-energy from biomass and biogas, anaerobic digestion; energy use pattern in different parts of the world.

Environmental implication of energy use; CO₂ emission, global warming; air and thermal pollution; radioactive waste and radioactivity from nuclear reactors. Exploitation of Solar, Wind, Hydro and Ocean energy.

UNIT-VI

Air : Natural and anthropogenic sources of pollution. Primary and Secondary pollutants. Transport and diffusion of pollutants. Gas laws governing the behaviour of pollutants in the atmosphere. Methods of monitoring and control of air pollution .SO₂, NO₂, CO, SPM. Effects of pollutants on human beings, plants, animals, materials and on climate. Acid Rain. Air Quality Standards.

Water : Types, sources and consequences of water pollution. Physico-chemical and Bacteriological sampling and analysis of water quality. Standards, sewage and waste water treatment and recycling. Water quality standard.

Soil : Physico-chemical as bacteriological sampling as analysis. of soil quality. Soil Pollution Control. Industrial waste effluents and heavy metals, their interactions with soil components. Soil micro-organisms and their functions, degradation of different insecticides, fungicides and weedicides in soil. Different kinds of synthetic fertilizers (N, P & K) and their

interactions with different components of soil.

Noise : Sources of noise pollution, measurement of noise and Indices, effect of meteorological parameters on noise propagation. Noise exposure levels and standards. Noise control and abatement measures. Impact of noise on human health.

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

UNIT-VII

Introduction to environmental impact analysis.

Environmental impact Statement and Environmental Management Plan.

EIA guidelines 1994, Notification of Government of India.

Impact Assessment Methodologies. Generalized approach to impact analysis.

Procedure for reviewing Environmental impact analysis and statement.

Guidelines for Environmental audit.

Introduction to Environmental planning.

Base line information and predictions (land, water, atmosphere, energy, etc.)

Restoration and rehabilitation technologies.

Land use policy for India. Urban planning for India. Rural planning and land use pattern.

Concept and strategies of ' sustainable development. Cost-Benefit analysis.

Environmental priorities in India and sustainable development.

Unit-VIII

Sources and generation of solid wastes, their characterization, chemical composition and classification. Different methods of disposal and management of solid wastes (Hospital Wastes and Hazardous Wastes), Recycling of waste material. Waste minimization technologies.

Hazardous Wastes Management and Handling Rules, 1989, Resource Management, Disaster Management and Risk analysis.

Environment protection-issues and problems. International and National efforts for Environment Protection, Provision of Constitution of India regarding Environment (Article 48A and 51A (g)).

Environmental Policy Resolution. Legislation, Public Policy Strategies in Pollution Control; Wildlife Protection Act 1972 amended 1991; Forest Conservation. Act 1980; Indian Forests Act (Revised) 1982. Air (Prevention and Control of Pollution) Act -1981 as amended by Amendment Act 1987 and Rule 1982, Motor Vehicle Act 1988. The Water (Prevention and Control of Pollution) Act 1974 as amended up to 1988, and Rules 1975. The Environment (Protection) Act 1986 and Rules 1986. Biological diversity Act 2002.

Scheme of labelling of environment friendly products (Ecomark), Public Liability Insurance Act 1991 and Rules 1991.

Unit-IX

Basic elements and tools of statistical analysis. Introduction to environmental system analysis; Approaches to development of models; linear simple and multiple regression models" validation and forecasttug. Models of population growth and interactions-Lotka-Volterra model, Leslie's matrix model, point source stream pollution model, box model. Gaussian plume model.

Unit-X

Environmental Education and Awareness. Environmental Ethics and Global imperatives.

Global Environmental problems-ozone depletion, global warming and climatic change.

Current Environmental issue in Indian Context : Narmada Dam, Tehri Dam, Almetti Dam, Soil Erosion. Formation and reclamation of Usar, Alkaline and Saline Soil. Waste lands and their reclamation. Desertification and its control. Vehicular pollution and urban air quality.

Depletion of Natural resources.

Biodiversity conservation and Agenda-21.

Waste disposal, recycling and power generation. Fly ash utilization.

Water Crises-Conservation of water. Rain water harvesting.Wetlands conservation. Eutrophication and restoration of Indian lakes.

Environmental Hazards.

Environmental disaster and management.

Epidemiological issues (e.g., Goitre, Fluorosis, Arsenic, Silicosis).

Microbiology

Section I

Microbial Taxonomy and General Microbiology

Microbial Taxonomy: Taxonomic ranks, Phenetic classification, Numerical taxonomy, Phylogenetic classification and Polyphasic classification; Major characteristics used in taxonomy (Classical and Molecular characteristics); Microbial phylogeny.

Bacteriology: Historical account, Archae and Eubacteria.

Virology: Historical account, General characteristics, morphological variations, capsid and nucleic acid Isolation; purification of viruses.

Mycology: Introduction, distribution, thallus organization, cell structure, nutrition and metabolism; sexual and asexual reproduction; General life cycles of fungus.

Phycology: Important characters, reproductive cycle, cell structure of major groups of eukaryotic and prokaryotic algae.

Section II

Microscopy and Staining Techniques

Working principle and applications of bright field microscope, dark field microscope, phase contrast microscope, fluorescence microscope, electron microscope-SEM, TEM, Confocal microscope and atomic force microscope. Physical and chemical theories of staining: Principle, procedure and applications of simple-positive and negative staining. Differential staining: Gram's stain and acid fast. Structural staining: Cell wall, endospore, flagella and capsule.

Section III

Microbial Nutrition, Growth and Control

Nutritional requirements: Macro and micronutrients, growth factors and nutritional types of microbes. Culture media: Synthetic and non-synthetic; Special media-selective, enrichment, differential and transport media. Methods of isolation of bacteria and fungi: Pour plate, streak and spread plate. Enumeration of bacteria. Physical methods of control: Sterilization-Moist and heat, pasteurization, tyndallisation. HEPA filters. Radiation- γ and UV rays. Chemical methods: Alcohols, aldehydes, phenols, halogens, dyes and detergents. Antibiotics: Source, structure, spectrum and mode of action of penicillins, cephalosporins, bacitracins, streptomycins, chloramphenicol, tetracyclines and vancomycin.

Section IV Microbial

Biochemistry

Bioenergetics & Metabolism: glycolysis, oxidative phosphorylation, coupled reaction, group transfer, biological energy transducers. Principles of catalysis, enzymes and enzyme kinetics, enzyme regulation, mechanism of enzyme catalysis. Conformation of proteins (Ramachandran plot, 20, 30 & 40 structures; domains; motif and folds). Metabolism of carbohydrates, lipids, amino acids, nucleotides and vitamins.

Membrane structure and function: Structure of model membrane, lipid bilayer and membrane protein diffusion, osmosis, ion channels, active transport, ion pumps, mechanism of sorting & regulation of intracellular transport, electrical properties of membranes.

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

Section V

Molecular Biology

Nucleic acids: DNA and RNA-composition, structure, replication in prokaryotes and eukaryotes, models of replication. DNA damage: Types of DNA damage-deamination, alkylation, pyrimidine dimers. SOS response. Structural features of RNA, rRNA, mRNA, tRNA and functions of RNA. Genetic code – Triplet code, Cracking of genetic code, features of genetic code, wobble hypothesis. Gene expression – Central dogma of gene action; Transcription and Translation. Regulation of Gene expression in bacteria – Operon concept, Inducible and repressible operons. Induction and catabolite repression of *lac* operon in *E.coli*. Transposable elements in bacteria.

Section VI

Microbial Genetics

Gene concept– classical concept, modern concept. Plasmids -Definition, characteristics of plasmids, **types of plasmids**, properties of F plasmids, Genetic code, gene structure. Mutations-spontaneous and induced, detection and isolation of mutants. Transposable elements and transposable mutagenesis. Genetic

recombination in bacteria: Conjugation F⁺/F⁻, Hfr/F⁻ mechanisms transformation and transduction-generalized and specialized. Gene mapping in bacteria; Gene transfer techniques – Electroporation, Microinjection, Macroinjection, biolistics and chemical methods. Phage genetics- Lytic and lysogenic cycles, Phage T4, Phage genome organization and gene mapping.

Section VII Genetic Engineering

Tools of genetic engineering- different types of **vectors-plasmids**, transposons, viral and bacterial based vectors, BAC, YAC, restriction endonucleases. PCR principles, types of PCR and their applications. Cloning strategies – ligation and transfer of foreign DNA into host cells, screening and identification. Construction and screening of cDNA and genomic libraries. DNA sequencing, genome sequencing and physical mapping of genomes. Profiling of nucleic acids by DNA fingerprinting, RFLP. Expression of cloned genes, designing of expression vectors for over expression of recombinant proteins. Site-directed mutagenesis different approaches and its potential in changing genes.

Section VIII Medical Microbiology

Epidemiology-Types of epidemics, methods of transmission and control of epidemics. Chemotherapy: Properties of chemotherapeutic drugs, chemical nature, clinical use of Antibacterial, Antiviral and Antifungal drugs. Important bacterial diseases-Tetanus, Diphtheria, Gonorrhoea, Shigellosis, Cholera, Tuberculosis. Important viral diseases-polio, rabies, hepatitis-A, B, HIV, measles. Important fungal disease-Candidiasis, cutaneous mycoses and Important protozoan diseases: Amoebiasis, Malaria. Diagnostic Microbiology- microscopic, cultural, biochemical and serological methods of diagnosis of bacterial infections.

Section IX Immunology

Structure, composition and functions of cells and organs involved in immune system- B-cells, T-cells. Antigens and antibodies: Types of antigens, antigenicity, factors influencing antigenicity and types of immune-globulins. Antigen- antibody reactions-

agglutination, precipitation, complement fixation; and Immuno electron microscopy, ELISA, RIA. Structure of Immuno-globulins, production of polyclonal and monoclonal antibodies. Immune responses: MHC, immuno-tolerance, memory and genetics of autoimmune disorders. Hypersensitivity: Types and mechanisms, transplantation immunity. Tissue typing methods of organ and tissue transplantation in humans; organ versus host reaction and rejection. Complement system: properties, function and biochemistry. Autoimmunity- general account of autoimmune diseases.

Section X

Food and Dairy Microbiology

Sources of contamination of food and milk: Microbial spoilage of canned foods, cereals, fruits, vegetables, meat, milk and fish. Food toxins: Endotoxins, exotoxins, mode of action and control. Detection of food and milk borne pathogens: Microbiological and biochemical methods. Methods of preservation: Pasteurization, sterilization, dehydration. Microbiological examination of food: DMC, SPC, examination of faecal streptococci Microbiological examination of milk: Rapid platform tests, MBRT, reductase tests. Single cell proteins.

Section XI Industrial

Microbiology

Industrial substrates and strains: various substrates, screening, advantages, isolation, identification and evaluation methods of strains. Sterilization of media and raw materials. Types of fermentation: Batch, continuous, solid state fermentation. Process kinetics: aeration, agitation, temperature and other factors in relation to substrate utilization and kinetic principles. Types of fermentors: Construction, parts and functions. Downstream processing: methods of chromatography, purification and concentration. Production of alcohols, acids, antibiotics and supplements. Immobilized enzymes and bio-transformations.

Section XII Environmental

Microbiology

Microbiology of air and water: Air trapping devices, airborne diseases and control, waterborne diseases and control, BOD, MPN. Occupational hazards and safety standards: Allergens, allergen testing, nosocomial diseases. Microbial ecology: Life

at extremes-thermophiles, barophiles, psychrophiles, halophiles, adaptive mechanisms at life under extreme conditions, identification of non-culturable microbes. Environmental genomics: Metagenomics, metatranscriptomics and metaproteomics.

Section XIII Agricultural

Microbiology

Important agricultural microbes: Bacteria, fungi and actinomycetes. Microbial interactions: Rhizoplane, rhizosphere, mycorrhizza, symbiotic and non-symbiotic interactions. Beneficial microbes: Plant growth promoting rhizobacteria (PGPR), Plant growth promoting fungi (PGPF) and endophytic microbes. Molecular biology of nitrogen fixation: Nod factors, nif genes and rhizobium genomics. Biogeochemical cycles: Carbon, Nitrogen, Phosphorous and Sulfur, green house gases and agriculture, effects of global warming on food production. Biological control: Biopesticides, Biofertilizers, bio-insecticides and mode of action of important biocontrol agents.

Section XIV

Statistical and Computational Methods

Measures of central tendency and dispersal, Probability distributions(binomial, poisson and normal), Sampling distribution, difference between parametric and non parametric statistics, levels of significance, regression and correlation, t- test, analysis of variance, χ^2 - test. Bioinformatics -definition and introduction, nucleic acid and protein sequence databases; data mining methods for sequence analysis; web based tools for sequence searches; motif analysis and presentation.