SCHEME AND SYLLABUS FOR RECRUITMENT TO THE POST OF
DEGREE COLLEGE LECTURERS IN GOVERNMENT DEGREE COLLEGES

PART-A: Written *Examination (Objective Type)

<table>
<thead>
<tr>
<th>Papers</th>
<th>No. of Questions</th>
<th>Duration (Minutes)</th>
<th>Maximum Marks</th>
</tr>
</thead>
<tbody>
<tr>
<td>Paper-1: General Studies &amp; Mental Ability</td>
<td>150</td>
<td>150</td>
<td>150</td>
</tr>
<tr>
<td>Paper-2: Concerned Subject (One only)</td>
<td>150</td>
<td>150</td>
<td>300</td>
</tr>
<tr>
<td>PART-B: Interview (Oral Test)</td>
<td></td>
<td></td>
<td>50</td>
</tr>
<tr>
<td><strong>TOTAL</strong></td>
<td></td>
<td></td>
<td><strong>500</strong></td>
</tr>
</tbody>
</table>

NEGATIVE MARKS: As per G.O.Ms. No.235, Finance (HR-I, Plg & Policy) Dept., Dt. 06/12/2016, for each wrong answer will be penalized with 1/3rd of the marks prescribed for the question.

NB: The Candidates have to choose one of the following subjects relevant to the PG Degree for writing Paper-2:

<table>
<thead>
<tr>
<th>1. English</th>
<th>2. Telugu</th>
<th>3. Hindi</th>
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<tr>
<td>19. Computer Science</td>
<td>20. Geology</td>
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</tbody>
</table>
PAPER-1:
GENERAL STUDIES & MENTAL ABILITY

1. Events of national and international importance.
2. Current affairs- international, national and regional.
3. General Science and it applications to the day to day life Contemporary developments in Science & Technology and Information Technology
4. Social- economic and political history of modern India with emphases on Indian national movement.
5. Indian polity and governance: constitutional issues, public policy, reforms and e-governance initiatives.
6. Economic development in India since independence.
7. Physical geography of India sub-continent.
8. Disaster management: vulnerability profile, prevention and mitigation strategies, Application of Remote Sensing and GIS in the assessment of Disaster
9. Sustainable Development and Environmental Protection
10. Logical reasoning, analytical ability and data interpretation.
11. Data Analysis:
   Tabulation of data
   Visual representation of data
   Basic data analysis (Summary Statistics such as mean and variance coefficient of variation etc.) and Interpretation
12. Bifurcation of Andhra Pradesh and its Administrative, Economic, Social, Cultural, Political, and legal implications/problems, including
   a). Loss of capital city, challenges in building new capital and it's financial implications.
   b). Division and rebuilding of common Institutions.
   c). Division of employees, their relocation and nativity issues.
   d). Effect of bifurcation on commerce and entrepreneurs.
   e). Implications to financial resources of state government.
   f). Task of post-bifurcation infrastructure development and opportunities for investments.
   g). Socioeconomic, cultural and demographic impact of bifurcation.
   h). Impact of bifurcation on river water sharing and consequential issues.

PAPER-2-SUBJECT

1. ENGLISH

I. Movements and Concepts
Renaissance, Metaphysical poetry, Neo-classicism, Romanticism, Rise of the novel, Modernism, Postmodernism, Colonialism, Postcolonialism, Diaspora, Psychoanalytical criticism, Myth and archetype, Feminism, Structuralism, Poststructuralism, Deconstruction.

II. Writers and Texts
1) William Shakespeare  
   Hamlet, Tempest
2) John Milton  
   Paradise Lost-Book 1 and 9
3) William Wordsworth  
   "Immortality Ode", Tintern Abbey
4) John Keats  
   "Ode to a Nightingale", "To Autumn"
5) Robert Browning  
   "My Last Duchess", "The Last Ride Together"
6) Charles Dickens  
   David Copperfield
7) TS Eliot  
   “The Waste Land”, Murder in the Cathedral
8) GB Shaw  
   Saint Joan
9) Virginia Woolf  
   “A Room of One’s Own”
10) Samuel Beckett  
    Waiting for Godot
11) William Golding  
    Lord of the Flies
12) Robert Frost  
    “Home Burial”, “The Road Not Taken”
13) Eugene O’Neill  
    The Hairy Ape
14) Toni Morrison  
    Beloved
15) Mulk Raj Anand  
    Untouchable
16) AK Ramanujan  
    “Love Poem for a Wife”, “Small-Scale Reflections on a Great House”
17) Girish Karnad  
    Hayavadana
18) Salman Rushdie  
    Midnight’s Children
19) Chinua Achebe  
    Things Fall Apart
20) Margaret Atwood  
    Edible Woman
21) AD Hope  
    “Australia”, “Crossing the Frontier”
22) Bessie Head  
    A Question of Power

III. English Language Teaching

1) ELT in India: (History and status of English in India; English as Second Language, English as Foreign Language, and English as Global Language).
2) Methods and Approaches: (Grammar Translation method, Direct method, Audio-Lingual method; Structural approach, Communicative language teaching)
3) Teaching of Language Skills: (Teaching of Listening, Speaking, Reading, and Writing Skills; Teaching of Grammar and Functional English; Teaching of Vocabulary; Classroom techniques; Use of authentic materials)
4) Testing and Evaluation: (Principles, Types, Objectives of testing and evaluation)
5) Phonetics and Phonology; Syntax and Structure.
2. TELUGU

సేవకుల

1. (3) కాయలువాసన సిద్ధాంతాలలో అదేదిము - శత్రు - స్వాతంత్ర్యం

వాసన సాధనాలు, కుమ్బానిక, సిద్ధాంతాలు (సిద్ధాంతం, సహాయానం, మూలాలవంతం), సాధనాలు - ఆలంచి చేసేది రెండు, దూరంలో తెలియాడు ఉండాలంటానికి -

మూలాలవంతం - విస్తరం - ప్రతిస్థాపన దృశ్యానుసారం - ప్రతి - అదేదిము - అనేకంచే విస్తరం -

వరదలు శత్రు అనేక, షాసన సిద్ధాంతం - మూలాలవంతం - ప్రతిస్థాపన దృశ్యానుసారం - ప్రతి - అదేదిము - అనేకంచే విస్తరం -

(సాధనాలు, సాధనాలు, మూలాలవంతం, ప్రతిస్థాపన దృశ్యానుసారం - ప్రతి - అదేదిము - అనేకంచే విస్తరం).

2. సాధనాలం అదేదిము - పట్టణానికి - విస్తరం - ప్రతిస్థాపన దృశ్యానుసారం. అదేదిము - ప్రతి - అదేదిము

(పట్టణం - విస్తరం - ప్రతిస్థాపన దృశ్యానుసారం - పట్టణం - విస్తరం - ప్రతిస్థాపన దృశ్యానుసారం, అదేదిము - అదేదిము)

విస్తరం - ప్రతిస్థాపన దృశ్యానుసారం - ప్రతి - అదేదిము - అనేకంచే విస్తరం - అదేదిము - అనేకంచే విస్తరం - అదేదిము - అనేకంచే విస్తరం -

(పట్టణం, విస్తరం, ప్రతిస్థాపన దృశ్యానుసారం)

3. సాధనాలు - పట్టణం - విస్తరం - ప్రతిస్థాపన దృశ్యానుసారం - (మూలాలవంతం - అదేదిము)

(పట్టణం, విస్తరం - ప్రతిస్థాపన దృశ్యానుసారం, ప్రతి - అదేదిము, విస్తరం - ప్రతిస్థాపన దృశ్యానుసారం)

4. మూలాలవంతం - ప్రతిస్థాపన దృశ్యానుసారం - అదేదిము - విస్తరం - ప్రతిస్థాపన దృశ్యానుసారం - మూలాలవంతం - ప్రతిస్థాపన దృశ్యానుసారం - ప్రతిస్థాపన దృశ్యానుసారం - ప్రతిస్థాపన దృశ్యానుసారం -

(పట్టణం - విస్తరం - ప్రతిస్థాపన దృశ్యానుసారం)

5. విస్తరం, ప్రతిస్థాపన దృశ్యానుసారం:

ప్రతిస్థాపన దృశ్యానుసారం (పట్టణం, విస్తరం, ప్రతిస్థాపన దృశ్యానుసారం - ప్రతిస్థాపన దృశ్యానుసారం)

(పట్టణం, విస్తరం, ప్రతిస్థాపన దృశ్యానుసారం, ప్రతిస్థాపన దృశ్యానుసారం - ప్రతిస్థాపన దృశ్యానుసారం - ప్రతిస్థాపన దృశ్యానుసారం)
1. స్మార్త్ మెర్కెట్ కార్యక్రమం - (ప్రాథమిక త్రపిత పనులు తొలగించడానికి) - ప్రథమ మొదటి
ప్రథమ స్మార్త్ మెర్కెట్ కార్యక్రమం - ప్రథమ స్మార్త్ మెర్కెట్ కార్యక్రమం.

7. శ్రీకృష్ణ అయితే శ్రీకృష్ణ అయితే - మా జోగు, మా జోగు! అయితే అయితే - అయితే అయితే - మా జోగు,
మా జోగు నిర్ధారించండి మా జోగు (అయితే అయితే అయితే అయితే అయితే)

8. స్మార్త్ మెర్కెట్ కార్యక్రమం - (ప్రాథమిక త్రపిత పనులు తొలగించడానికి)

9. త్రిశాస్తి, త్రిశాస్తి మాత్రమే అభివృద్ధి (శ్రీకృష్ణ, శ్రీకృష్ణ) అయితే స్మార్త్ మెర్కెట్ మాత్రమే.

10. స్మార్త్ మెర్కెట్ కార్యక్రమం, ప్రథమ - స్మార్త్ మెర్కెట్ కార్యక్రమం (ప్రథమ మొదటి)
ప్రథమ కార్యక్రమం, ప్రథమ కార్యక్రమం - ప్రథమ కార్యక్రమం, ప్రథమ కార్యక్రమం, ప్రథమ కార్యక్రమం.
3. हिंदी

हिंदी भाषा और उसका विकास

इकाई-1

हिंदी की ऐतिहासिक पुष्टि: प्राचीन भारतीय आर्थिक आंदोलनों - दैनिक तथा सामाजिक संस्कृति और उसकी विशेषताएं। मध्यकालीन भारतीय आर्थिक आंदोलनों - पासि; प्राकृत - शैवसेनी, अर्धमायौर, माधवी, अपभ्रंश और उनकी विशेषताएं। आधुनिक भारतीय आर्थिक आंदोलनों और उनका वर्णन।

इकाई-2

हिंदी का मौलिक विकास: हिंदी की उपभाषाएँ, पश्चिमी हिंदी, पूर्वी हिंदी, विशेषताएं।

इकाई-3

हिंदी का भाषिक स्वरूप: हिंदी की स्थायित्व व्यवस्था - खंड, खंड़ेत्र। हिंदी शब्द रचना - उपसर्गों, प्रत्ययों, समारा। रूपरचना - लिंग, प्रचार, और कारक - व्यवस्था के संदर्भ में हिंदी के संज्ञा, सर्दीलक, विशेषण और विधायक। हिंदी वाक्य रचना: पदक्रम और अखंडति।

इकाई-4

हिंदी के विविध स्वरूप: संप्रदाय भाषा, राष्ट्रभाषा, राजभाषा के रूप में हिंदी, माध्यम-भाषा, संसार-भाषा; हिंदी की साहित्यिक स्थिति। हिंदी प्रसार के आंदोलन, प्रमुख व्यक्तियों तथा संस्थाओं का योगदान।

इकाई-5

हिंदी साहित्य का इतिहास

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

हिंदी साहित्य के प्रमुख इतिहास ग्रंथ, हिंदी के प्रमुख साहित्यिक केन्द्र, संस्थाएं एवं पत्र-पत्रिकाएँ, हिंदी साहित्य के इतिहास का काल विभाजन और नामकरण
आदिकाल: हिंदी साहित्य का आरम्भ कब और कैसे ? राजी साहित्य आदिकालीन हिंदी का जन्म साहित्य, सिद्ध और नाथ साहित्य, अमेरिक युगसंग्रह की हिंदी कविता, विश्वासिति और उनका पदावली, आरम्भिक गद्य तथा लोककुछ साहित्य।

इकाई 6
मध्यकाल
भविष्य आन्दोलन के उद्देश्य के सामाजिक-सांस्कृतिक कारण, प्रमुख निर्देश एवं समग्र संप्रदाय, वैधिक भविष्य की सामाजिक- सांस्कृतिक पूर्वाभूमि, आलोचना सम्बन्ध, पुरुष संप्रदाय और आचार्य, भविष्य आन्दोलन का अर्थ के भारतीय स्वरूप और उसका अन्तःप्रादेशिक वैश्विक।

हिंदी सन्त काव्य : सन्त काव्य का वैधिक आधार, प्रमुख निर्देश नंतर कथा कविर, नानाक, दादा, रेदास, संत काव्य का प्रमुख विशेषताएँ, भारतीय धर्म साधनाएँ में संत कवियों का स्थान।

हिंदी सूफी काव्य: सूफी काव्य का वैधिक आधार, हिंदी के प्रमुख सूफी कवि और कवितावर्ग - मुल्ला दादर(दादराज), कुरुक्षेत्र (रविधात्री), गंगा (मानीनादी), मालिक मुहम्मद जाफराज़ी (मुसावला), सूफी प्रभावाचार्यों का स्वरूप, हिंदी सूफी काव्य की प्रमुख विशेषताएँ।

हिंदी कृत्तिकाल का विविध संप्रदाय, मूलभल्ला संप्रदाय, अपठिप, प्रमुख कृत्तिकाल भक्ति कवि और कवितावर्ग, सूरदास (सूरसागर), नंददास (रस पंचकथा विद्वान), बमसेरीत भक्ति, नीति परिप्रेक्ष्य और हिंदी कृत्तिकाल का भौतिक और संस्कृत उपस्थापन।

हिंदी राम काव्य विविध संप्रदाय, राम भविष्य शाखा के कवि और कवितावर्ग, तुलसीदास का प्रमुख कृत्तियाँ, काव्य स्वरूप और उनका महत्व।

रीति काव्य: सामाजिक-सांस्कृतिक परिप्रेक्ष्य, रीतिकाल के मूल रूप स्थ, रीतिकाल की प्रमुख पृष्ठिकालीन कवियों का आधार, रीतिमूर्ति काव्यावली, रीतिकाल के प्रमुख कवि: केशवदास, मानिसराम, भूपण, विनोबासुला, देव, धानान्द और दयाकर, रीतिकाल में लोककौशल।
इकाई 7
आधुनिक काल: हिन्दी गाथा का उदय और विकास। भारतेन्दु पूर्व हिन्दी नग., 1857 की राजनीतिक तथा सांस्कृतिक पूर्वजोन्यागमन, भारतेन्दु और उनका मण्डल, 1860 की शताब्दी के उत्तरार्द्ध की हिन्दी लेखकों का पत्रकारिता।

इकाई 8
हिन्दी साहित्य की गद्ध विधाएँ
हिन्दी उपन्यास: प्रेमचंद पूर्व उपन्यास, प्रेमचंद और उनका युग, प्रेमचंद के पश्चात्ताप्रमुख उपन्यासकार: जैनेन्द्र, अर्जुन, हजारी प्रसाद द्विवेदी, यशपाल, अमृतलाल नागर, फलिनधराथ रेणु, भीष्म सहाय, कृपण सोबू, हिरासम यमी, नरेश मेहता, शीलाल शुक्ल, राधि मासूम राजा, रंगेय राघव, मन्नू, मण्डरी।

इकाई 9
काव्य शास्त्र और आलोचना:
काव्य के संदर्भ, शादियों सहित काव्यम् (आमह), तत्त्वीय शादियों संतुष्टिसंस्कृति पुनः
कवाणि (मम्मट), काव्यं रसायनम् काव्यम् (विश्वास), रामणियार्ध-प्रतिपादकः शाल्म;
काव्यम् (पशुदस्यात् जगन्नाय), काव्य की अलमा।
शिस्विध शम्पदाय, प्रमुख सिद्धांत-रस, उपस्थर, शीतलध्वनि, व्यक्तिविचि और आधिपत्य।
तर का स्वर्ण और सार्पार्णिकरण।
सहमा की अवधारणा।
हिंदी आलोचना – रामचंद्र शुक्ल और उनके आलोचनात्मक प्रतिसन्दर्शन।
शुक्लात्मक समीक्षा और समीक्षक – हंजारी प्रसाद दिवंदेवी, नन्ददुलार वाजाणेवरी, डॉ.
रामचन्द्र शरण, डॉ. नामधव सिंह, विज्ञापन नात्यन्याय साही, समकालीन आलोचना।
ध्रुव और अरसू का अनुभुत सिद्धांत तथा अरसू का विशेष विचार।
वाईवर्त का कायम- भाषा सिद्धांत।
कालिन्द जाप्तेन और फैल्सियर।
आई.ए.रिचर्ड्स – मुख्य सिद्धांत तथा काव्य भाषा सिद्धांत,
टी.ए.एस. इलिययन- विशेषज्ञानिकता का सिद्धांत, परन्तुज्ञात सह-सम्भविक, परम्परा की
अवधारणा।
रसो – सुपवल, नवी समीक्षा।
संस्थान, उन्नत संस्थान, आधिपत्य, उन्नत आधुनिकवाद, विषयवस्तु।
ङ्गः 10
कवीर – हंजारी प्रसाद दिवंदेवी – दोहा – पद सं 180-209
जापसी शंघावती – सं रामचंद्र शुक्ल – संगीतशास्त्रियों विशेष खण्ड
धुराणा – भारतीय – सार – सं रामचंद्र शुक्ल 21 से 70 तक
तुंगसेवरुः – उल्लेख, रामचंद्र मापेन्स – मीता प्रेस, मोरपुर
प्रसाद – कामजीभी – झाड़ा, जो नागरी
सिद्धांत – राम की शरीर पुजा, युक्तिपूर्णता
अनेक – असंबंधितवाद, नवीन के द्वार
भूतिसारें – अपने में।
इक्काई 11
प्रयोजनमुक्त हिंदी
प्रयोजनमुक्त हिंदी : अर्थ, परिभाषा और क्षेत्र, ज्ञान प्रदान, सूचनात्मक और रचनात्मक साहित्य में प्रयुक्त भाषा भेद, हिन्दी का क्षेत्रीय, राष्ट्रीय एवं अंतरराष्ट्रीय संदर्भ हिंदी भाषा-नियोजन एवं भाषा प्रक्षेपण भारतीय वादुवादकता और हिंदी, हिंदी की व्यापक संकल्पना प्रयुक्त का अर्थ और प्रकार प्रयोजनमुक्त हिंदी की विशेष प्रवृत्तियाँ प्रयुक्त क्षेत्र - वैज्ञानिक, तकनीकी, कार्यालयी, व्यवसायिक आदि इन क्षेत्रों से संबंधित विशेष अभिव्यक्तियों एवं पारिभाषिक शब्दावली का सामान्य परिचय प्रयोजनमुक्त हिंदी और अनुवाद
इक्काई 12
हिंदी में कंप्यूटर की सुविधाएँ शब्द संसाधन, हिंदी साक्षात्कार, हिंदी में कंप्यूटर अनुप्रयोग और मशीनी अनुवाद
इक्काई 13
भारतीय साहित्य
भारतीय साहित्य का स्वरूप भारतीय साहित्य के अवयव की समस्याएँ भारतीय साहित्य का इतिहास और हिंदी साहित्य के विकास में भारतीय साहित्य की भूमिका
The Syllabus covers all important topics related to Urdu Language and Literature. It deals with the Origin & Development of Urdu Language, Deccan Urdu Literature, Evolution & Development of different Forms of Literature, both in Prose and Poetry with reference to the works of prominent writers and poets, Literature Movements and Criticism.

The Syllabus is detailed as follows:

1. **ORIGIN & DEVELOPMENT OF URDU LANGUAGE**

2. **DECCANIYAT**:
   a) Bahmani Daur : Fakhruddin Nizami (Kadamrao Padamrao).
   b) Adilshahi Daur : Nusrati (Gulshan-e-Ishq).
   c) Qutubshahi Daur : Mohammed Quli Qutub Shah (Deewas-e-Mohammed Quli QutubShah), Mulla Wajhi (Sabras & Qutub Mushtari), Ghawwasi (Saiful Mulook-o-Badeel Jamaal), Ibne Nishati (Phool Ban)
3. DEVELOPMENT OF DIFFERENT FORMS OF LITERATURE:
   a) POETRY:
      i. GHAZAL: (Tareef, Tareekh aur Tanqeed) The following Poets: Mir, Dard, Atish, Ghalib, Momin, Iqbal, Hasrat, Fani, Jigar, Firaq, Nasir Kazmi.
      ii. QASEEDA: (Tareef, Tareekh aur Tanqeed) The following poets: Sauda and Zauq.
      iii. MASIYA: (Tareef, Tareekh aur Tanqeed). The following poets: Mir Anees and Mirza Daber.
      iv. RUBAYEE: (Tareef, Tareekh aur Tanqeed) The following Poets: Anees, Akbar, Amjad and Josh.
   b) PROSE:
      i. DASTAN: (Tareef, Tareekh aur Tanqeed) : Bagh-o-Bahar, Fasana-e-Ajayeb.
      ii. NOVEL: (Tareef, Tareekh aur Tanqeed) Fasana-e-Azad (Ratan Nath Sharshar) Taubatun Nusoo (Deputy Nazeer Ahamed) Umroo Jan Ada (Mirza Hadi Ruswa) Gowdan (Prem Chand) Ek Chadar Malii si (Rajender Singh Bedi), Tedi Lakee (Ismath Chuftyayee), Aiwaan Ghazal (Jeelani Bano).
      iii. AFSANA: (Tareef, Tareekh aur Tanqeed) Premchand (Najaat), Manto (Tobatek Singh), Krishen Chander (Mahalakshmi ka Pul), Quratul Ayen Hyder (Nazaara Darmiyan Hai).
      vi. KHUTOOT: (Tareef, Tareekh aur Tanqeed) : Nikatush-Shoara, Gulshan-e-Bekhar.
   c) LITERARY CRITICISM:
      ii. Hali ke Tanqeedi Nazar: Muqaddama-e-Sher-o-Shairi.
      iii. Mukhtalif Tanqeedi Dabistaan (Unki Tareef aur Tareekh) : Taassurati Tanqeed, Jamaliyati Tanqeed, Nafsiyati Tanqeed, Marxi Tanqeed aur Saakhtiyati Tanqeed.
      vi. URDU JOURNALISM, TRANSLATION & MASS MEDIA, Print and Electronic.
5. ORIYA

* ଓଡ଼ିଆ ଯାପତ୍ତ୍ତ୍ତ୍ତ୍ତ୍ତ୍ତ୍ତ୍ତ୍ତ୍ତ୍ତ୍ତ୍ତ୍ତ୍ତ୍ତ୍ତ୍ତ୍ତ୍ତ୍ତ୍ତ୍ତ୍ତ୍ତ୍ତ୍ତ୍ତ୍ତ୍ତ୍ତ୍ତ୍ତ୍ତ୍ତ୍ତ୍ତ୍ତ୍ତ୍ତ୍ତ୍ତ୍ତ୍ତ୍ତ୍ତ୍ତ୍ତ୍ତ୍ତ୍ତ୍ତ୍ତ୍ତ୍ତ୍ତ୍ତ୍ତ୍ତ୍ତ୍ତ୍ତ୍ତ୍ତ୍ତ୍ତ୍ତ୍ତ୍ତ୍ତ୍ତ୍ତ୍ତ୍ତ୍ତ୍ତ୍ତ୍ତ୍ତ୍ତ୍ତ୍ତ୍ତ୍ତ୍ତ୍ତ୍ତ୍ତ୍ତ୍ତ୍ତ୍ତ୍ତ୍ତ୍ତ୍ତ୍ତ୍ତ୍ତ୍ତ୍ତ୍ତ୍ତ୍ତ୍ତ୍ତ୍ତ୍ତ୍ତ୍ତ୍ତ୍ତ୍ତ୍ତ୍ତ୍ତ୍ତ୍ତ୍ତ୍ତ୍ତ୍ତ୍ତ୍ତ୍ତ୍ତ୍ତ୍ତ୍ତ୍ତ୍ତ୍ତ୍ତ୍ତ୍ତ୍ତ୍ତ୍ତ୍ତ୍ତ୍ତ୍ତ୍ତ୍ତ୍ତ୍ତ୍ତ୍ତ୍ତ୍ତ୍ତ୍ତ୍ତ୍ତ୍ତ୍ତ୍ତ୍ତ୍ତ୍ତ୍ତ୍ତ୍ତ୍ତ୍ତ୍ତ୍ତ୍ତ୍ତ୍ତ୍ତ୍ତ୍ତ୍ତ୍ତ୍ତ୍ତ୍ତ୍ତ୍ତ୍ତ୍ତ୍ତ୍ତ୍ତ୍ତ୍ତ୍ତ୍ତ୍ତ୍ତ୍ତ୍ତ୍ତ୍ତ୍ତ୍ତ୍ତ୍ତ୍ତ୍ତ୍ତ୍ତ୍ତ୍ତ୍ତ୍ତ୍ତ୍ତ୍ତ୍ତ୍ତ୍ତ୍ତ୍ତ୍ତ୍ତ୍ତ୍ତ୍ତ୍ତ୍ତ୍ତ୍ତ୍ତ୍ତ୍ତ୍ତ୍ତ୍ତ୍ତ୍ତ୍ତ୍ତ୍ତ୍ତ୍ତ୍ତ୍ତ୍ତ୍ତ୍ତ୍ତ୍ତ୍ତ୍ତ୍ତ୍ତ୍ତ୍ତ୍ତ୍ତ୍ତ୍ତ୍ତ୍ତ୍ତ୍ତ୍ତ୍ତ୍ତ୍ତ୍ତ୍ତ୍ତ୍ତ୍ତ୍ତ୍ତ୍ତ୍ତ୍ତ୍ତ୍ତ୍ତ୍ତ୍ତ୍ତ୍ତ୍ତ୍ତ୍ତ୍ତ୍ତ୍ତ୍ତ୍ତ୍ତ୍ତ୍ତ୍ତ୍ତ୍ତ୍ତ୍ତ୍ତ୍ତ୍ତ୍ତ୍ତ୍ତ୍ତ୍ତ୍ତ୍ତ୍ତ୍ତ୍ତ୍ତ୍ତ୍ତ୍&
6. COMMERCE


Human resources management: HR functions. HR planning – job analysis, recruitment and job evaluation, Training and development methods. Performance appraisal methods. Trade unions and collective bargaining.

Quantitative techniques: Sampling and sampling methods. Probability and probability distributions – Hypothesis testing. Parametric tests (Z, t-tests, and ANOVA) and non-parametric tests (Chi-square test).

IT and e-commerce: E-Commerce business models – Internet and web technologies. E-payment methods – e-cash, e-cheques, credit cards, smart cards, and debit cards.

7. ECONOMICS

1. Microeconomic Analysis
Demand analysis – Marshallian, Hicksian and Revealed preference approaches; axiomatic approach Theory of Production and Costs Pricing and output under different forms of market structure; collusive and non-collusive oligopolies. Factor Pricing analysis. Elements of General Equilibrium analysis and new welfare economics.

2. Macroeconomic Analysis

3. Development and Growth
Development and Growth – Role of institutions. Theories of growth and development – Models of growth of Joan Robinson and Kaldor; Technical Progress – Hicks, Harrod and learning by doing, production function approach to the determinants of growth; Endogenous growth; role of education, research and knowledge – explanation of cross country differentials in economic development and growth. Theories of development – Classical, Marx, Schumpeter and structural analysis of development – Imperfect market paradigm, Lewis model of development, Rani-Fei model, Dependency theory of development. Factors in economic development – natural resources, population, capital, human resource development – Measurement of development – Conventional, HDI and Quality of Life indices. Trade and development – trade as engine of growth, two-gap analysis, Prebisch, Singer and Myrdal views; gains from trade and LDCs.
4. **Money and Banking**

Definition and functions of money; empirical definition of money – monetary aggregates; monetarism; demand for money – Fisher, Cambridge, Keynesian, Friedman, Baumol and Tobin; supply of money – determinants; money multiplier. Role and functions of Central bank; NBFIs; instruments of monetary control; stabilization policies; monetary and interest rate targeting. Social responsibility of banks; banking sector reforms, Basel I and II; deregulation, competition and efficiency; NPAs. Specialized financial and investment institutions.

5. **Public Finance**


6. **International Trade and Finance**


7. **Indian Economy**

Basic features of Indian economy; growth and structural changes – composition and trends in National Income. Demography – Demographic features; demographic transition and demographic dividend; rural urban migration and rural urban divide. Planning : Objectives and strategies of planning; and achievements of programmes for poverty alleviation and regional imbalances. Agriculture : Land reforms and New Green Revolution – Role of technology; regional disparities in Indian agriculture; Pricing Policy; Food subsidy and Public distribution system. Industry : Industrial growth and Productivity – New industrial policy; Privatisation, Disinvestment – FDI and role of MNCs. SMEs and industrial development. Public Finance : Composition and growth of public expenditure and debt; Fiscal reforms and rationalization of subsidies; Centre – State financial relations. WTO and its impact on Indian economy; Energy and Environment: Energy Security; Environmental Policy of Government of India, Rationale of Social Forestry.

8. **QUANTITATIVE METHODS**

a. **Statistical Methods**

Measures of Central tendency, dispersion, skewness and kurtosis Fundamentals of probability – Binomial, Poisson and Normal distributions. Simple correlation and regression analysis

Statistical inferences – Applications, sampling distributions ( t, Chi-square and F tests). Sampling of attributes, testing of hypothesis Index numbers and time series analysis Sampling and census methods, types of sampling and errors.

b. **Econometric Methods**

i) Single Equation Linear Model
Assumption and properties of OLS
Multiple Regression Model – Estimation and Interpretation
Multi-collinearity, auto-correlation and heteroscedasticity – Causes, detection, consequences and remedy.
Dummy variables, distributed lags – need, limitations and interpretation
Applications in economics.

ii) Simultaneous Equation Models :
Structural and reduced forms, Endogenous and exogenous variables, identification problems and conditions.
Single equation methods of estimations – two stage least squares, indirect least squares, and least variance ratio.

C. Time Series Models
Auto-regressive (AR), moving average (MA) and mixed processes (ARMA, ARIMA)
Concepts of unit root, integration and cointegration, random walks.

D. Mathematical Methods
i) Principles of optimization : maxima and minima of functions of a single variable.
ii) Basic concepts of Game Theory – Two-person, Zero-sum Game, Pure and Mixed strategy, Saddle point solution, Linear programming and input output analysis.

8. HISTORY

Ancient India :

1. Pre and protohistoric background – Stone ages and Chalcolithic cultures.
2. Harappan Civilization – Extent, major cities, characteristic features, social and economic conditions, script, religious practices, causes for the decline.
4. Vedic Age : Importance literature, Political, Social and economic conditions in the early and later vedic age.
5. India in the 6th century B.C. : Political, Social and economic conditions, Rise and spread of Jainism and Buddhism.
6. Mauryan Age : Political history of the Mauryans, Ashoka, Mauryan Administration, social and economic conditions, decline of the Mauryan empire.
7. The Satavahanas : Political history, administration, contribution to the culture.
8. Gupta Period : Political history, administration, social and economic conditions, growth of culture, decline of the empire.
9. India in the 7th century A.D. : Harsha Vardhana, Pallavas and Chalukyas, Rashtrakutas their political history and their contribution to culture.

Medieval India :

10. India between 650 and 1200 A.D. – Political, social and economic conditions, Chola administration and culture.
11. Age of the Delhi Sultanate : (1206-1526), Political history, Military and Administrative organisation, changes in society and economy, Bhakti movement.
12. The Vijayanagar Empire : Origin, History, Krishnadevaraya, social and economic conditions, contribution to art and architecture, decline.
13. Mughal Age (1556-1707) : Political history, Akbar, Administration, Social and economic conditions, culture, decline of the Mauryan empire, Marattas and Shivaji.

Modern India (1757-1947) :
14. Historical forces and factors which led to the establishment of the British power in India – Early resistance to the British power in India – Hyder Ali, Tippu Sultan, causes for their failure.


17. Revolt of 1857 : Causes, results, significance.

18. Rise and growth of the Indian National Movement : Birth of the Indian National Congress, the national movement from 1885 to 1905; movement from 1905 to 1920. Role of Tilak and Annie Besant :The movement from 1920 to 1947 ; Emergence of Gandhi; Non-cooperation movement, Salt Satyagraha and the Quit India Movement.

   Freedom movement in Andhra Pradesh with special reference to the role of Alluri Sitarama Raju and Tanguturi Prakasam, Revolt against the nizam’s rule in Telangana.

Modern World :

19. Industrial Revolution – Significance and results.


22. National liberation movements in Italy and Germany in the 19th century – Mazzini, Cavour, Garibaldi, Bismarck.

23. World War-I – Causes and effects.

24. The Russian Revolution of 1917 – Causes, results and importance.

25. The World between the two world wars – Nazism in Germany, Fascism in Italy, Turkey under Mustafa Kamal Pasha.


27. World War-II – Causes and effects.

9. Political Science

I Political Science – Basic Concepts

1. Political Science - Nature and Scope – Inter disciplinary Character.


II Political Theory


2. Political Ideologies - Liberalism, Neoliberalism, Marxism, Socialism and Fascism.

3. Role of Ideology and end of Ideology.


5. Theories of Development.
III  Political Thought
1. Greek Political Thought  - Plato and Aristotle.
2. Medieval Political Thought  - Aquinas and St. Augustine.
3. Modern Political Thought  - Machiavelli and Bodin.
5. Indian Political Thought  - Manu, Kautilya, Gandhi, Phule and Ambedkar

IV  Comparative Politics
2. Constitutionalism  - Western and Non-Western.
5. Power, Authority and legitimacy.

V  Political Sociology
1. Political Socialisation and Political Culture
2. Political Development and Political Modernisation.
3. Political Elite and Theories.
5. Political Stratification  - Caste, Class and Gender.

VI  Indian Government and Politics
2. Salient Features and Ideological foundations of Indian Constitution.
3. Federalism and Centre – State Relations.
4. Union Executive, Legislature and Judiciary – President, Prime Minister,
   Council of Ministers, Loksabha and Rajyasabha, Supreme Court and Judicial Review.
5. Contemporary Socio-Political Movements – Peasant, Dalit, Backward,
   Environmenal, Regional and Sub-Regional Movements.

VII  State and Local Governments
1. Frame work for the study of State Politics.
2. State Executive & Legislature: Governor, Chief Minister and State Legislature.
3. Panchayati Raj : Genesis and Development – Structure and functions,
   73rd Amendment of India constitution
4. Urban Local Government : Structure and functions, 74th Amendment of Indian constitution
5. Regional Inequalities – Demand for Autonomy and statehood.

VIII  Public Administration
1. Emergence of Public Administration as a discipline – Nature, Scope and importance of Public Administration.
2. Theories and principles of organization.
3. Human Resources Management and Bureaucracy.
4. Leadership and Decision-making.

IX Public Policy and Political Analysis
2. Theories of Public Policy – Group theory, Incrementalism, Elite theory, Decision-making theory.
3. Policy making Institutions – Legislature, Executive and Judiciary – Planning Commission

X International Relations
1. Approaches to the study of International Relations.
2. Elements of National Power.
4. UNO : Aims, objectives, structure and its changing role in the contemporary world.
5. Indian Foreign Policy – Non-Alignment, Relations with neighbors and security concerns and Globalization.

10. MATHEMATICS

I. Real Analysis

II. Metric Spaces
Metric spaces – completeness, compactness and connectedness – continuity and uniform continuity of functions from one metric space into another. Topological spaces – base and subbase – continuous function.

III. Elementary Number

IV. Group Theory
Groups, subgroups, normal subgroups – quotient groups – homomorphisms and isomorphism theorems – permutation groups, cyclic groups, Cayley’s theorem. Sylow’s theorems and their applications.

V. Ring Theory

VI. Vector Spaces

VII. Matrix Theory
Linear transformations – Rank and nullity – change of bases.

VIII. Complex Analysis
Algebra of complex numbers – the complex plane – Complex functions and their Analyticity – Cauchy-Riemann equations – Mobius transformations.
Power Series.
Complex Integration – Cauchy’s theorem – Morera’s Theorem – Cauchy’s integral formula – Liouville’s theorem – Maximum modules principle – Schwarz’s lemma – Taylor’s series – Laurents series.
Calculus of residues and evaluation of integrals.

IX. Ordinary Differential Equation
Ordinary Differential Equation (ODE) of first order and first degree – Different methods of solving them – Exact Differential equations and integrating factors.
ODE of first order and higher degree – equations solvable for p, x and y – Clairaut’s equations – Singular Solutions.
Linear differential equations with constant coefficients and variable coefficients – variation of parameters.

X. Partial Differential Equations
Formation of differential equations (PDE) – Lagrange and Charpit methods for solving first order – PDE’s – Cauchy problem for first order PDE’s – Classification of second order PDE’s – General solution of higher order PDE’s with constant coefficients.

11. PHYSICS

PART-A

I. Mathematical Methods of Physics

Data interpretation and analysis. Precision and accuracy. Error analysis, propagation of errors. Least squares fitting, Linear and non-linear curve fitting and Chi-Square Test.

II. Classical Mechanics

III. Electromagnetic Theory

IV. Quantum Mechanics

V. Thermodynamics and Statistical Physics


VI. Electronics


VII. Atomic & Molecular Physics


VIII. Condensed Matter Physics


IX. Nuclear and Particle Physics


PART-B

I. Mathematical Methods of Physics

Green’s function. Partial differential equations (Laplace, wave and heat equations in two and three dimensions). Elements of computational techniques : root of functions, interpolation, extrapolation, integration by trapezoid and Simpson’s rule, Solution of first

II. Classical Mechanics
Basic concepts of dynamical systems, Poisson brackets and canonical transformations. Symmetry, invariance and Noether's theorem. Hamilton-Jacobi theory.

III. Electromagnetic Theory
Dispersion relations in plasma. Lorentz invariance of Maxwell's equation. Transmission lines and wave guides. Radiation- from moving charges and dipoles and retarded potentials.

IV. Quantum Mechanics

V. Thermodynamics and Statistical Physics

VI. Condensed Matter Physics
Electron spin resonance, Nuclear magnetic resonance, chemical shift and applications. X-ray diffraction technique, scanning electron microscopy and transmission electron microscopy.

VII. Nuclear and Particle Physics

12. CHEMISTRY

INORGANIC CHEMISTRY

1. Atomic structure and chemical bonding – structure and bonding in homo and hetero nuclear molecules. Applications of VSEPR, Valence Bond and Molecular orbital theories in explaining the structures of simple molecules.


5. Metal complexes - EAN rule – structure and bonding of metal carbonyls of Mn, Fe, Co and Ni – Metal nitrosyls – structure and bonding.

7. Metal clusters – factors favoring M-M bonds – Structure and bonding in Re$_2$Cl$_8^{2-}$, Mo$_6$Cl$_8^{4+}$, Nb$_x$X$_{12}^{2-}$, Re$_3$Cl$_9$ and Re$_3$Cl$_{12}^{3-}$.


9. Analytical chemistry – chromatography – general principles involved in separations by paper, thin layer and column chromatography – GC and HPLC.

Physical Chemistry

1. Thermodynamics


Chemical potential: Gibbs equations for non-equilibrium systems. Material equilibrium. Phase equilibrium. Clapeyron equation and Clausius-Clapeyron equation.

Conditions for equilibrium in a closed system. Chemical potential of ideal gases. Ideal-gas reaction equilibrium-derivation of equilibrium constant. Temperature dependence of equilibrium constant-the van't Hoff equation.


Multicomponent phase equilibria: Vapour pressure lowering, freezing point depression and boiling point elevation

2. Statistical Thermodynamics


The entropy of a monoatomic ideal gas. The Sackur-Tetrode equation- derivation. Mean translational and vibrational energies.

3. Electrochemistry

Electrochemical Cells: Derivation of Nernst equation – problems. Chemical and concentration cells (with and without transference). Liquid junction potential – derivation
of the expression for LJP – its determination and elimination. Applications of EMF measurements: Solubility product, potentiometric titrations, determination of transport numbers, equilibrium constant measurements.


Concept of ion association – Bjerrum theory of ion association (elementary treatment) - ion association constant – Debye-Huckel-Bjerrum equation.

4. QUANTUM CHEMISTRY

Black body radiation-Planck’s concept of quantization-Planck’s equation, average energy of an oscillator (derivation not required). Wave particle duality and uncertain principle-significance of these for microscopic entities. Emergence of quantum mechanics. Wave mechanics and Schroedinger wave equation.


Particle in a box: one dimensional and three dimensional. Plots of \( \psi \) and \( \psi^2 \) discussion. Degeneracy of energy levels. Comparison of classical and quantum mechanical particles. Calculations using wave functions of the particle in a box-orthogonality, measurability of energy, position and momentum, average values and probabilities. Application to the spectra of conjugated molecules.

Cartesian, Polar and spherical polar coordinates and their interrelations

Schrodinger equation for the hydrogen atom- separation into three equations. Hydrogen like wave functions. Radial and angular functions. Quantum numbers \( n, l \) and \( m \) and their importance. The radial distribution functions. Hydrogen like orbitals and their representation. Polar plots, contour plots and boundary diagrams.


Bonding in molecules. Molecular orbital theory-basic ideas. Construction of MOs by LCAO, \( H_2^+ \) ion. The variationan integral for \( H_2^+ \) ion. Detailed calculation of Wave functions and energies for the bonding and antibonding MOs. Physical picture of bonding and antibonding wave functions. Energy diagram. The MO and VB wave functions for \( H_2 \) molecule and their comparison

5. CHEMICAL KINETICS

Theories of reaction rates: Collision theory, steric factor. Transition state theory. Reaction coordinate, activated complex and the transition state. Thermodynamic formulation of transition state theory. Unimolecular reactions and Lindemann’s theory.

Complex reactions- Opposing reactions, parallel reactions and consecutive reactions(all first order type). Chain reactions-general characteristics, steady state treatment. Example- \( H_2 + Br_2 \) reaction. Derivation of rate law.

Effect of structure on reactivity- Linear free energy relationships. Hammett and Taft equations-substituent( \( \sigma \) and \( \sigma' \)) and reaction constant ( \( \rho \) and \( \rho' \)) with examples.

Factors affecting reaction rates in solution. Diffusion controlled reactions. Influence of dielectric constant and ionic strength on ion-ion, ion-dipole and dipole-dipole reactions. Primary and secondary salt effects. Kinetic isotope effects: Primary and secondary isotope effects. Solvent isotope effects.
Enzyme catalysis: Chemical catalysis and enzyme catalysis – distinction – energy considerations and rate accelerations – examples.


6. Photochemistry


7. Solid state chemistry
Magnetic properties of solids- classification of magnetic materials, Magnetic susceptibility, Langevin diamagnetism, Weiss theory of para magnetism


Superconductivity. Occurrence of superconductivity. Destruction of superconductivity by magnetic fields-Meissner effect. Types of superconductors. Theories of super conductivity-

ORGANIC CHEMISTRY
1. IUPAC nomenclature of organic molecules including structural, positional, functional, regio- and stereoisomers.
6. Importance of heterocyclic compounds as drugs. Nomenclature of heterocyclic systems based on ring size, number and nature of hetero atoms. Synthesis and reactivity of pyrrole, furan, thiophene, pyridine, indole, benzofuran, benzothiophene, quinoline, isoquinoline.


8. Organic Photochemistry, Photochemical energy, Frank-Condon principles, Jablonski diagram, singlet and triplet states, dissipation of photochemical energy, photosensitization, quenching, quantum efficiency and quantum yield. Photochemistry of carbonyl compounds - n→π* and π→π* transitions. Norrish type-I and Norrish type-II cleavages. Paterno-Buchi reactions. Photoreduction, photochemistry of enones - hydrogen abstraction, rearrangements of α,β-unsaturated ketones and cyclohexadienones, photochemistry of p-benzoquinones. Dienes - photochemistry of 1,3-butadienes, (2+2) additions leading to cage structures, photochemistry of cyclohexadienes, photochemistry of aromatic compounds, excited state of benzene and its 1,2-, 1,4- additions.

9. Pericyclic Reactions Molecular orbital symmetry, Frontier orbitals of ethylene, 1,3 butadiene, 1,3,5 hexatriene and allyl system. Classification of pericyclic reactions. Woodward - Hoffmann correlation diagrams. FMO and PMO (Mobius Huckel) approaches. Electrocyclic reactions-Conrotatory and disrotatory, 4n, 4n+2 and allyl systems. Cycloadditions-antarafacial and suprafacial additions, 4n and 4n+2 systems, 2+2 addition of ketene, 1,3 dipolar cycloadditions Sigmatropic rearrangements - Suprafacial and antarafacial shifts of H, Sigmatropic shifts involving carbon moieties, 3,3 and 5,5 sigmatropic rearrangements.


13. BOTANY

CELL AND MOLECULAR BIOLOGY OF PLANTS

Cell Wall: Structure and functions, biogenesis, growth.

Plasma membrane: Structure, models and functions: Sites for ATPases, Ion carriers, Channels and pumps, Receptors.

Plasmodesmata: Structure, Role in movement of molecules and macromolecules, Comparison with gap junctions.

Chloroplast: Structure, genome organization, gene expression, RNA editing, nucleo-chloroplastic interactions.

Mithochondria: Structure, genome organization, Biogenesis.

Plant Vacuoles: Tonoplast membrane, ATPases, transporters, as storage organelle.

Nucleus: Structure, nuclear pores, nucleosome organization, DNA structure: A, B and Z forms, replication, damage and repair, transcription, Plant promoters and transcription factors, splicing mRNA transport, nucleolus, rRNA biosynthesis.

Ribosomes: Structure, site of protein synthesis, mechanism of translation, initiation, elongation and termination; structure and role of tRNA.

Protein sorting: Targeting of proteins to organelles.

Cell shape and motility: The cytoskeleton; organization and role of microtubules and microfilaments; motor movements; implications in flagellar and other movements.
Cell cycle and apoptosis: Control mechanisms; role of cyclins and cyclin dependent kinases; retinoblastoma and E2F proteins; cytokinesis and cell plate formation; mechanisms of programmed cell death.

Other cellular organelles: Structure and functions of microbodies, Golgi apparatus, lysosomes, endoplasmic reticulum.

Techniques in cell biology: Immuno techniques; in situ hybridization, FISH, GISH; confocal microscopy.

CYTOLOGY, GENETICS AND CYTOGENETICS
Chromatin organization: Chromosome structure and Packaging of DNA, molecular organization of centromere and telomere; nucleolus and ribosomal RNA genes; euchromatin and heterochromatin; karyotype analysis; banding patterns; specialized types of chromosomes; polytene, lampbrush, B-chromosomes and sex chromosomes; molecular basis of chromosome pairing.

Structural and numerical alterations in chromosomes: Duplication, deficiency, inversion and translocation; autopolyploids; allopolyploids; evolution of major crop plants.

Genetics of prokaryotes and eukaryotic organelles: genetic recombination in phage; genetic transformation, conjugation and transduction in bacteria; genetics of mitochondria and chloroplasts cytoplasmic male sterility.

Gene structure and expression: Genetic fine structure; cis – trans test; Benzer’s experiment; introns and their significance; RNA splicing; regulation of gene expression in prokaryotes and eukaryotes.

Genetic recombination and genetic mapping: Recombination; independent assortment and crossing over; molecular mechanism of recombination; role of RecA and RecBCD enzymes; site-specific recombination; chromosome mapping, linkage groups, genetic markers, construction molecular maps.

Mutations: Spontaneous and induced mutations; physical and chemical mutagens; molecular basis of gene mutations; transposable elements in prokaryotes and eukaryotes; mutations induced transposons; site-directed mutagenesis; DNA damage and repair mechanisms.

Plant Breeding: Principles and methods of plant breeding; Marker assisted breeding.

Biostatistics: Mean, Variance, Standard deviation, Standard error, Student’s test, chi-square and ANOVA.

Molecular cytogenetic: Nuclear DNA content; C-value paradox; cot curve and its significance; restriction mapping – concept and techniques; multigene families and their evolution.

BIOLOGY AND DIVERSITY OF LOWER PLANTS: CRYPTOGRAMS
Microbiological techniques: Pure culture, enrichment and anaerobic culture.

Importance of microorganisms: Microbes in medicine, agriculture and environment.

Microbial growth: Nutritional requirements of microorganisms and methods to measure growth.

Microbial Ecology: Genetification; phosphorous solubilization; nitrogen fixation

Phycology: Thallus organization; cell ultra structure; reproduction (vegetative, sexual, asexual); criteria for classification of algae; pigments, reserve food, flagella; classification, salient features of Chlorophyta, Charophyta, Xanthophyta, Bacillariophyta,
Phaeophyta and Rhodophyta; algal blooms, algal biofertilizers; algae as food, feed and uses in industry.

**Mycology:** General characters of fungi; substrate relationship in fungi; cell ultrastructure; unicellular and multicellular organization; cell wall composition; nutrition (saprobic, biotrophic, symbiotic); reproduction (vegetative, asexual, sexual); heterothallism; heterokaryosis parasexuality; Molecular aspects in classification.

General account of Mastigomycotina, Zygomyctina, Ascomycotina, Basidiomycotina, Deuteromycotina; fungi in industry, medicine and as food; fungal diseases in plants and humans; Mycorrhizae; fungi as biocontrol agents.

**Bryophyta:** Morphology, structure, reproduction and life history; distribution; classification, general account of Marchantiales, Jungermaniales, Anthoceratales, Sphagnales, Funariales and Polytrcales; economic and ecological importance.

**Pteridophyta:** Morphology, anatomy and reproduction; classification; evolution of stele; heterosporang and origin of seed habit; general account of fossil pteriodophyta; introduction to Psilo psida, Lycopsida, Sphenopsida and Pteropsida.

**TAXONOMY AND DIVERSITY OF SEED PLANTS**

**Introduction and classification of Gymnosperms**

**Structure and reproduction in** Cycadales, Ginkgoales, Coniferales, Ephedrales, Welwitschiales and Gnetales.

**The species concept:** Taxonomic hierarchy, species, genus, family and other categories; principles used in assessing relationship, delimitation of taxa and attribution of rank.

Salient features of the International Code of Botanical nomenclature.

**Taxonomic tools:** Herbarium; floras; histological, cytological, phytochemical, serological, biochemical and molecular techniques; computers and GIS.

**Systems of angiosperm classification:** Phenetic versus phylogenetic systems; cladistics in taxonomy; relative merits and demerits of major systems of classification.

**Concepts of phytogeography:** Endemism, hotspots; plant explorations; invasions and introductions.

**PLANT PHYSIOLOGY AND METABOLISM**

**Energy flow:** Principles of thermodynamics, free energy and chemical potential, redox reactions, structure and functions of ATP.

**Fundamentals of enzymology:** General aspects, allosteric mechanism, regulatory and active sites, isoenzymes, kinetics of enzymatic catalysis, Michaelis – Menton equation and its significance.

**Membrane transport and translocation of water and solutes:** Plant water relations, mechanism of water transport through xylem, passive and active solute transport, membrane transport proteins.

**Signal transduction:** Receptors and G-proteins, phospholipid signaling, role of cyclic nucleotides, calcium calmodulin cascade, diversity in protein kinases and phosphatases.

**Photochemistry and photosynthesis:** Photosynthetic pigments and light harvesting complexes, photo oxidation of water, mechanisms of electron and proton transport, carbon assimilation – the Calvin cycle, photorespiration and its significance, the C4 cycle, the CAM pathway, biosynthesis of starch and sucrose.

**Respiration and lipid metabolism:** Glycolysis, the TCA cycle, electron transport and ATP synthesis, pentose phosphate pathway, glyoxylate cycle, alternative oxidase system,
structure and function of lipids, fatty acid biosynthesis, synthesis of membrane lipids, structural lipids and storage lipids and their catabolism.

Nitrogen fixation and metabolism: Biological nitrogen fixation, nodule formation and nod factors, mechanism of nitrate uptake and reduction, ammonium assimilation.


Plant growth regulators and elicitors: Physiological effects and mechanism of action of auxins, gibberellins, cytokinins, ethylene, abscisic acid, brassinosteroids, polyamines, jasmonic acid and salicylic acid.

The flowering process: Photoperiodism, endogenous clock and its regulation, floral induction and development – genetic and molecular analysis, role of vernalization.

Stress physiology: Plant responses to biotic and abiotic stress; mechanisms of biotic and abiotic stress tolerance, HR and SAR, water deficit and drought resistance, salinity stress, metal toxicity, freezing and heat stress, oxidative stress.

Coping with biotic stress: Chemical control, Biological control, IPM

PLANT DEVELOPMENT AND REPRODUCTION

Shoot development: Organization of the shoot apical meristem (SAM); control of cell division and cell to cell communication; control of tissue differentiation especially xylem and phloem; secretory ducts and laticifers.

Phyllotaxy and leaf differentiation

Root development: Organization of root apical meristem (RAM); cell fates and lineages; vascular tissue differentiation; homeotic mutants in Arabidopsis and Antirrhinum, sex determination.

Male gametophyte: Structure of anthers; microsporogenesis, role of tapetum; pollen development and gene expression; male sterility; sperm dimorphism and hybrid seed production; pollen germination, pollen tube growth and guidance; pollen storage; pollen allergy, pollen embryos.

Female gametophyte: Ovule development; megasporogenesis; organization of the embryo sac, structure of the embryo sac cells.

Pollination, pollen – pistil interaction and fertilization: Floral characteristics, pollination mechanisms and vectors; self-incompatibility; double fertilization.

Seed development and fruit growth: Endosperm development during early, maturation and desiccation stages; embryogenesis, cell lineages during late embryo development; storage proteins of endosperm and embryo; polyembryony; apomixes; embryo culture; fruit maturation.

Dormancy: Seed dormancy; overcoming seed dormancy; bud dormancy.

Senescence and programmed cell death (PCD): Types of cell death, PCD in the life cycle of plants, metabolic changes associated with senescence and its regulation; influence of hormones and environmental factors on senescence.

PLANT ECOLOGY

Climate, soil and vegetation patterns of the world: Life zones; major biomes and major vegetation and sol types of the world.

Vegetation organization: Concepts of community and continuum; analysis of communities (analytical and synthetic characters)

Ecological succession: Hydrosere and xerosere.
**Ecosystem organization**: Structure and functions; primary production (methods of measurement, global pattern, controlling factors); energy dynamics (trophic organization, energy flow pathways, ecological efficiencies); litter fall and decomposition (mechanism, substrate quality, land climatic factors); global biogeochemical cycles of C, N, P and S; mineral cycles (pathways, processes, budgets) in terrestrial and aquatic ecosystems.

**Biological diversity**: Concept and levels; role of biodiversity in ecosystem functions and stability; speciation and extinction; IUCN categories of threat; distribution and global patterns, terrestrial biodiversity hot spots; inventory.

**Air, water and soil pollution**: Kinds, sources, quality parameters; effects on plants, ecosystems.

**Climate change**: Green house gases (CO₂, CH₄, N₂O, CFCs: sources, trends and role); ozone layer and ozone hole; consequences of climate change (CO₂ fertilization, global warming, sea level rise, UV radiation).

**Ecosystem stability**: Concept (resistance and resilience); ecological perturbations (natural and anthropogenic) and their impact on plants and ecosystems; ecology of plant invasion; environmental impact assessment; ecosystem restoration.

**Ecological management**: Concepts; sustainable development; sustainability indicators.

**PLANT RESOURCE UTILIZATION AND CONSERVATION**

**Plant Biodiversity and sustainable development**

Origin, evolution, botany, cultivation and uses of (i) Food forage and fodder crops (ii) fibre crops (iii) medicinal and aromatic plants and (iv) vegetable oil-yielding crops.

**Ethnobotany**

Important fire-wood and timber – yielding plants and non-wood forest products (NWFPs) such as bamboos, rattans, raw materials for paper-making, gums, tannins, dyes, resins and fruits.

**Green revolution**: Benefits and adverse consequences.

**Plants used as avenue trees** for shade, pollution control and aesthetics.

**Principles of conservation; extinctions; environmental status of plants based on International Union for Conservation of Nature.**

**Strategies for conservation – in situ conservation**: International efforts and Indian initiatives; protected areas in India – sanctuaries, national parks, biosphere reserves, wetlands, mangroves and coral reefs for conservation of wild biodiversity.

**Strategies for conservation – ex situ conservation**: Principles and practices; botanical gardens, field gene banks, seed banks, in vitro repositories, cryobanks; general account of the activities of Botanical Survey of India (BSI), National Bureau of Plant Genetic Resources (NBPGR), Indian Council of Agricultural Research (ICAR), Council of Scientific and Industrial Research (CSIR) and the Department of Biotechnology (DBT) for conservation, non-formal conservation efforts.

**BIOTECHNOLOGY AND GENETIC ENGINEERING OF PLANTS AND MICROBES**

**Plant Biotechnology** – Principles, scope and applications.

**Plant cell and tissue culture**: General introduction, scope, cellular differentiation, and totipotency.

**Organogenesis and adventives embryogenesis**: Morphogenesis; somatic embryogenesis.

**Somatic hybridization**: Protoplast isolation, fusion and culture.
Applications of plant tissue culture: Clonal propagation, artificial seed, production of hybrids and soma clones, production of secondary metabolites/natural products, cryopreservation and germplasm storage.

Recombinant DNA technology: Gene cloning principles and techniques, genomic/cDNA libraries, vectors, DNA synthesis and sequencing, polymerase chain reaction, DNA finger printing and DNA markers.

Genetic engineering of plants: Transgenic plants, Methods of gene transfer – Agrobacterium medicated and microprojectile, chloroplast transformation, intellectual property rights, ecological risks and ethical concerns.

Microbial genetic manipulation: Bacterial transformation, selection of recombinants and transformants, genetic improvement of industrial microbes.

Genomics and proteomics: High throughput sequencing, genome projects, bioinformatics, functional genomics, microarrays.

14. ZOOLOGY

General Concepts:


2. Acoelomata, Pseudocoelomata, Coelomata, Proterostomia and Deuterostomia.


Non-Chordata:

1. General characteristics and classification of invertebrates up to class level.


6. Annelida: Excretory system, Coelom formation, coelom and coelomoducts.


8. Mollusca: Respiritation, Torsion and De-torsion, pearl formation and Pearl industry.


CHORDATA:

1. General Characters and classification of chordates up to class, Origin of Chordates, phylogeny and affinities of Hemichordata, Retrogressive metamorphosis.

2. Vertebrate integument and derivatives, Comparative account of Digestive, Respiratory, Circulatory, Excretory and Reproductive systems of Vertebrates.

3. Pisciculture in India, Common edible fishes of Andhra Pradesh.


5. Important Snakes of India, Dinosaurs.
7. Adaptive radiation and Dentition in Mammals.

CELL BIOLOGY:
1. Prokaryotic and Eukaryotic cell, Plasma Membrane-Ultrastructure, Permeability, intercellular communication, Endocytosis, Exocytosis, Phagocytosis, Active transport, membrane pumps.
2. Structure & function of Intracellular organelles – Nucleus, Mitochondria, Golgi bodies, lysosomes, endoplasmic reticulum, peroxisomes, plastids, vacuoles, Cell wall, Cytoskeleton and its role in motility.
3. Organization of genes and chromosomes - Operon, unique and repetitive DNA, structure of chromatin and chromosomes, heterochromatin, euchromatin, transposons.
5. DNA replication, repair and recombination - Unit of replication, replication origin and replication fork, Recombinant technology, Transgenic and cloned animals, DNA damage and repair mechanisms.
6. Protein synthesis - initiation, elongation and termination of Genetic code.
7. Regulation of gene expression - Lac operon, Lambda operon.

GENETICS:
1. Mendel's law of inheritance - Critical review and Linkage.
2. Gene mapping methods : Linkage-complete and Incomplete linkage; Linkage maps, Recombination, mapping with molecular markers, somatic cell hybrids.
3. Crossing over : Types (Somatic or mitotic crossing over and Germinal or meiotic crossing over), theories about the mechanism of crossing over, tetrad analysis, and cytological detection of crossing over.
4. Mutations : Types (Spontaneous and Induced), causes and detection, mutant types (lethal, conditional, biochemical, loss of function, gain of function, germinal versus somatic mutants), Molecular basis of mutations.
5. Chromosomal aberrations (deletion, duplication, inversion and translocation, ploidy and their genetic implications); Autosomal abnormalities (Down's syndrome, Trisomy-13, -18); Sex anomalies (Turner's syndrome, Klinefelter's syndrome, Hermaphroditism).
6. Human genetics : Human karyotyping, Genetic disorders due to mutant genes (Huntington's chorea), Inborn errors of metabolism-Pheynylketonuria, alkaptonuria, Sickle cell anemia.

SYSTEM AND CELL PHYSIOLOGY:
1. Blood and circulation - Blood corpuscles, haemopoiesis, plasma function, blood groups, haemoglobin, haemostasis.
2. Cardiovascular System : Neurogenic, myogenic hearts, cardiac cycle, heart as a pump, neural and chemical regulation of all above.
7. Excretory system - Comparative physiology of excretion, urine formation, micturition.
9. Digestive system - Digestion, absorption, assimilation and egestion.
10. Endocrinology and reproduction - Endocrine glands, basic mechanism of hormone action, hormones and diseases, reproduction in mammals.
11. Chemical bonds (Covalent, Hydrogen and Ionic bonds, Van der waals interactions).
13. Order of protein structure, primary, secondary, tertiary and quaternary; Ramachandran plot.

EVOLUTION :
2. Isolation, Speciation, Natural Selection.
3. Hardy weinberg' Law.
5. Evolution of Man.

DEVELOPMENTAL BIOLOGY :
1. Speamatogenesis, oogenesis.
2. Fertilization, cleavage, gastrulation formation of germ layers, parthenogenesis.
3. Embryogenesis in vertebrates.
4. Formation and function of foetal membranes.
5. Types of Placenta.
6. Regulation, genetic control of development.
7. Development of Frog and chick.

HISTOLOGY :
1. Histology of Mammalian tissues and organs - Epithelial, connective, blood, bone, cartilage, skin, stomach, intestine, liver, pancreas, kidney, Testis and Ovary.

ECOLOGY :
1. Concept of Ecosystem.
2. Biogeochemical cycles (Carbon, Nitrogen and Phosphorous).
3. Influence of environmental factors on animals, energy flow in Ecosystem, food chains, food web and trophic levels.
7. Biodiversity-Economic significance, conservation, hot spots of India.

IMMUNOLOGY :
1. Cells of the immune system : Lymphoid cells, Mononuclear cells, granulocytic cells, Mast cells.
2. Organs of the immune system - primary and secondary lymphoid organs, lymphatic system.
3. Antigens: Antigenic determinants or epitopes, immunogenicity, Haptens.
5. Humoral immunity: Immunoglobulins (fine structure of immunoglobulins and immunoglobulin classes); the complement system, Classical and alternate pathway, inflammation.
6. Cell mediated immunity : Mechanism of cell mediated immunity; Brief account on Antigen presentation, Major histocompatibility complex.
7. Antigen-Antibody interactions : Affinity, Avidity, Cross-reactivity, precipitation reactions, and Agglutination reactions and ELISA.
8. Brief account on immunological Hypersensitivity disorders :
a) Tolerance and Autoimmunity
b) Transplantation.
c) Immunodeficiency diseases - HIV.
d) Immunization (Active and passive immunity).

15. STATISTICS

Probability Theory:
- Random experiment, Random event, Sample Space, Classes of sets, fields, sigma-fields, minimal sigma-fields, Borel sigma fields in R, Measure, Lebesque mesure, Lebesque-Stieltjes measures, Measurable functions, Borel function, induced sigma field, Probability Measure, Basic Properties of a Measure, conditional probability and Bayes Theorem. Caratheodory extension theorem (Statement only), measurable function, random variables, distribution function and its properties, expectation, statements and applications of monotone convergence theorem, Fatou’s lemma, dominated convergence theorem.
- Expectations of functions of rv’s, conditional expectation and conditional variance, their applications. Characteristic function of a random variable and its properties. Inversion theorem, uniqueness theorem (Functions which cannot be Characteristic functions). Levy’s continuity theorem (Statement only). Chebychev, Markov, Cauchy-Schwart, Jenson, Liapunov, Holder’s and Minkowsky’s inequalities.
- Sequence of Random variables, convergence in Probability, convergence in distribution, almost sure convergence, convergence in quadratic mean and their interrelationships, Slutsky’s theorem, Borel-Cantelli lemma Borel 0-1 law, Kolmogorov 0-1 law (Glevenko – Cantelli Lemma Statement only).
- Law of large numbers, Weak law of large numbers, Bernoulli and Khintchen’s WLLN’s, Kolomogorov Inequality, Kolmogorov SLLN for independent random variables and statement only for i.i.d. case and their applications, statements of three series theorem. Central Limit theorem : Demoviere – Laplace CLT, Lindberg-Levy CLT, Liapounou’ CLT, Statement of Lindberg-Feller CLT, simple applications.
- Introduction to stochastic processes; classification of stochastic process according to state-space and time-domain. Finite and countable state Markov chains; time-homogeneity; Chapman-Kolmogorov equations; marginal distribution and finite – dimensional distribution; classification of states of a Markov chain – recurrent, positive recurrent, null-recurrent and transient states.

Distribution Theory:
- Families of Distributions : Power series distributions, Exponential families of distributions. Functions of Random variables and their distributions (including transformation of rv’s). Bivariate Normal, Bivariate Exponential (Marshall and Olkins form), Compounding distributions using Binomial and Poisson. Truncated (Binomial, Poisson, Normal and Lognormal) and mixture distributions – Definition and examples.
- Distributions of quadratic forms under normality and related distribution theory.
Statistical Inference:


- Fundamental notions of hypothesis testing: Statistical hypothesis, statistical test, Critical region, types of errors, test function, randomized and non-randomized tests, level of significance, power function, Most powerful test. Neyman-Pearson fundamental lemma. MLR families and Uniformly most powerful tests for one parameter exponential families.

- Concepts of consistency, unbiased and invariance of tests. Likelihood Ratio tests, statement of the asymptotic properties of LR statistics with applications (including homogeneity of means and variances). Relation between confidence interval estimation and testing of hypothesis. Concept of robustness in estimation and testing with example.

- Concept of sequential estimation, sequential estimation of a normal population. Notions of sequential versus fixed sample size techniques. Wald's sequential probability Ratio test (SPRT) procedure for testing simple null hypothesis against simple alternative. Termination property of SPRT. SPRT procedures for Binomial, Poisson, Normal and Exponential distributions and associate OC and ASN functions. Statement of optimality of SPRT.

- Concepts of loss, risk and decision functions, admissible and optimal decision functions. Estimation and testing viewed as decision problems.


- Asymptotic Relative Efficiently (ARE) and Pitman's theorem. ARE of one sample, paired sample and two sample locations tests.

Sampling Techniques:


- SRSWR / WOR, Stratified random sampling and Systematic Sampling.

- Unequal probability Sampling: ppswr / wor methods (including Lahiri's scheme) and related estimators of a finite population mean. Horowitz – Thompson, Hansen – Horowitz and Yates and Grundy estimators for population mean / total and their variances.
• Ratio Method Estimation: Concept of ratio estimators, Ratio estimators in SRS, their bias, variance / MSE. Ratio estimator in Stratified random sampling – Separate and combined estimators, their variances / MSE.

• Regression method of estimation : Concept, Regression estimators in SRS with pre-assigned value of regression coefficient (Difference Estimator) and estimated value of regression coefficient, their bias, variance / MSE, Regression estimators in Stratified Random sampling – Separate and combined regression estimators, their variance / MSE.

• Cluster Sampling : Cluster sampling with clusters of equal sizes, estimator of mean per unit, its variance in terms of intracluster correlation, and determination of optimum sample and cluster sizes for a given cost. Cluster sampling with clusters of unequal sizes, estimator – population mean its variance / MSE.

• Sub sampling (Two – Stage only) : Equal first stage units – Estimator of population mean, variance / MSE, estimator of variance. Determination of optimal sample size for a given cost. Unequal first stage units – estimator of the population mean and its variance / MSE.

Design of Experiments


• Simple linear regression, examining the regression equation, Lack of fit and pure error. Analysis of Multiple regression models. Estimation and testing of regression parameters, sub-hypothesis. Introduction of residuals, overall plot, time sequence plot, plot against Yi, Predictor variables \( X_{ij} \), Serial correlation among the residual outliers. The use of dummy variables in multiple regression, Polynomial regressions – use of orthogonal polynomials. Derivation of Multiple and Partial correlations, tests of hypothesis on correlation parameters.

• Analysis of Covariance : One-way and Two-way classifications. Factorial experiments : Estimation of Main effects, interaction and analysis of \( 2^k \), factorial experiment in general with particular reference to \( k = 2, 3 \) and \( 3^2 \) factorial experiment. Multiple Comparisons : Fishers least significance difference (LSD) and Duncan’s Multiple Range test (DMR test).

• Total and Partial Confounding in case of \( 2^3 \), \( 2^4 \) and \( 3^2 \) factorial designs. Concept of balanced partial confounding. Fractional replications of factorial designs : One half replications of \( 2^3 \) and \( 2^5 \) factorial designs, one-quarter replications of \( 2^5 \) and \( 2^6 \) factorial designs. Resolutions of a design. Split – Plot design.

• Youdin design, intra block analysis. B.I.B.D., P.B.I.B.D., their analysis, estimation of parameters, testing of hypothesis.

16. BIOTECHNOLOGY

mutations in cancer cells. Biotic and abiotic stress in plants. Signal transduction:
types of receptors, second messengers (calcium, phosphoinositides and Nitric oxide).
Meiosis, Gametogenesis, fertilization and Development of chick embryo.

BIOMOLECULES AND ANALYTICAL TECHNIQUES: - Chemical foundations of
Biology water, pH, pK, acids, bases, buffers, weak bonds, covalent bonds. Principles of
thermodynamics. Classification, structure and functions of carbohydrates, amino
acids, proteins, nucleic acids and lipids. Chromatography Methods; partition, ion
exchange, and affinity methods, criteria for purity, proteins and nucleic acids
 sequencing methods, Hormones, vitamins and minerals.

Analytical techniques: Principle, instrumentation and applications of VIS/UV, IR,
NMR, LASER Raman Spectroscopy MASS Spectroscopy, Fluorescence
Spectroscopy, Differential colorimetry, X-ray Crystallography, Ultra centrifugation,
Electron Cryomicroscopy and Scanning Tunneling microscopy. Methods of cell
study; confocal microscopy, Flowcytometry and FACS (fluorescence activated cell
sorter) and atomic force microscopy. Radiochemical methods; Stable and
radioactive isotopes, measurement of radioactivity by Liquid scintillation counting,
GM counters and autoradiography. Specific activity and precursor-product
relationship. Tracer studies and Effect of radiation on cells.

MOLECULAR BIOLOGY: - DNA Structure, replication, repair and
recombination, Transcription, regulation and post transcripitional modifications in
Prokaryotes and Eukaryotes. Transcriptional and post-transcriptional gene silencing.
Translation and regulation in Prokaryotes and eukaryotes, co-translation and post-
translational modifications of proteins. Protein Localization-Synthesis of secretory
and membrane proteins, import into nucleus, mitochondria, chloroplast and
peroxisomes, Biology of Cancer-Oncogenes and Tumour Suppressor genes,
Structure, function and mechanism of action of pRB and p53 tumor suppressor
proteins.

Antisense oligonucelotides, molecular targets of drug action and Ribozyme
Technology. Homologous Recombination-Holliday model gene targeting, gene
disruption, FLP/FRT and Cre/Lox recombination RecA and other recombinases.
Molecular Mapping of Genome, Genes, mutation and mutagenesis, site directed
mutagenesis and Human genome project, Transposons

BIOSTATISTICS: - Frequency distribution, Distribution of data bionomial,
poiisson and normal. Measures of central tendency-mean, median, mode and
standard deviation-probability distribution-regression-correlation- Analysis of
variance-tests of significance- T-test, F-test, Chi-square test.

MICROBIOLOGY: - Discovery of the microbial world; Distinguishing features of
prokaryotes and eukaryotes; general role of microorganisms in transformation of
organic matter and in the causation of diseases; Microbial taxonomy; Classification,
Nomenclature and new approaches to microbial taxonomy; Pure culture techniques;
sterilization methods; Principles of microbrial nutrition and composition of culture
media; culture enrichment techniques; Growth and its mathematical expression;
synchronized cultures, Culture collection and maintenance of cultures; Purple and
green bacteria Ricketssias; Chlamydia and Mycoplasma. Archea; Viruses: structure
and replication of viruses; DNA viruses and RNA viruses; Viroids and Prions; Viruse
and their Genetic System; Bacteriophages; RNA phages; Retroviruses, Biomass and Bioenergy.

**IMMUNOLOGY:**
- Phylogeny of immune System; Innate and acquired immunity; Hematopoietic and differentiation, cells and organs of the immune system; Lymphocyte trafficking; Antigenicity and super antigens; Immunoglobulin types, structure and function, Antigen-antibody interactions; Blood groups, Cell migration and Homing, Immunoglobulin and gene organization. Major histocompatibility complex, BCR and TCR and generation of diversity; Complement system, Antigen processing and presentation, generation of humeral and cell mediated immune responses; Activation of B-and T- lymphocytes, Cytokines and their role in immune regulation; Cell mediated cytotoxic, Hypersensitivity, Autoimmunity, Transplantation, Tumor Immunology, AIDS and other Immunodeficiency; Hybridoma Technology, Psychoneuro-immunology.

- Single chain antibodies, theories of antibody diversity, Vaccines – Concept of immunization, routes of vaccination. Types of vaccines – Whole organism (attenuated and inactivated) and component vaccines (synthetic peptides, DNA vaccines, recombinant vaccines, subunit vaccines, conjugate vaccines. Vaccine delivery systems.

**BIOPROCESS ENGINEERING:**

**ENZYME TECHNOLOGY:**

**ENVIRONMENTAL BIOTECHNOLOGY:**
- Ecological balance, resiliency of ecosystem and sustainable development, environmental pollution and global problems, water, air, soil pollution and their impacts on environment and biotechnological approaches for management, waste water treatment: aerobic and anaerobic processes, bioremediation of contaminated soils and waste land, biotechnological treatment for industrial effluents and solid wastes. GM microbes

**GENETIC ENGINEERING:**
- Discovery, properties and application of Restriction enzymes, Cloning and expression vectors, Purification of plasmids, genomic DNA and mRNA. Genomic and cDNA Library construction and screening of recombinants by hybridization methods, Reporter assays, protein engineering- site directed mutagenesis, adding disulfide bonds – changing asparagines to other amino acids modification of metal cofactor requirements. Increasing of specific activity Stability to thermal and salinity conditions, Phage Display library and yeast two hybrid
system. Gene transfer methods Tagging. Role of gene tagging analysis; Gene Therapy, Gene silencing methods, Biochips.

**BIOINFORMATICS**: Biological databases, ORF finding, EST analysis, gene identification, microsatellite repeat patterns, Blast all flavours, Mutation matrix, global Vs local alignments, Dot plots, PAM and BLOSUM matrices, Multiple sequence modeling, alignments dendrograms, phylograms, protein structure prediction methods, molecular modeling, Primer design, QSAR, Drug designing


**17. MICROBIOLOGY**

**General Microbiology and Microbial Physiology**


**Cell and Molecular Biology, Virology**


Biochemistry and Techniques

Immunology


Industrial Microbiology

Medical Microbiology

Food, Environment and Agriculture Microbiology
18. Computer Applications

1. Mathematical Foundations:
   Mathematical Logic – Propositional Logic, First Order Logic;
   Probability: Conditional Probability, Mean, Median, Mode and Standard deviation;
   Random Variables; Distributions - Uniform, Normal, Exponential, Poisson, Binomial.
   Set Theory and Algebra: Sets, Relations, Functions, Groups, Partial Orders,
   Lattices, Boolean Algebra.
   Combinatorics: Permutations, Combinations, Counting, Summation, Generating
   Functions, Recurrence Relations.

2. Programming:
   Programming in C, C++ and Java: Object Oriented Programming Concepts
   including Classes; Polymorphism; Inheritance and Programming in C, C++ and
   Java.

3. Data and File Structures:
   Data structure – Definition, Arrays, stacks, queues, linked lists, trees, graphs,
   priority queues and heaps.
   File Structures - Fields, records and files, Sequential, direct, index-sequential and
   relative files, Hashing, inverted lists and multi-lists B trees and B+ trees.

4. Design and Analysis of Algorithms:
   Asymptotic notation, Notations of Space and Time complexities, Worst and Average
   case analysis; Design: Greedy Approach, Dynamic Programming, Divide and
   Conquer; Tree and Graph traversals, connected components, spanning trees,
   shortest paths; Hashing, Sorting, Searching. Asymptotic analysis (best, worst and
   average cases) of time and space, upper and lower bounds.

5. Computer Organization:
   Machine instructions and addressing modes, Main Memory Organization, CPU
   Organization, I/O Organization, Micro-programmed Control, Cache Memory,
   Secondary Storage.

6. Operating Systems and Unix:
   Processes, Threads, Inter-process communication, Concurrency, Synchronization,
   Deadlock, CPU scheduling, Memory management and virtual memory, File
   systems, I/O systems, Protection and security.
   Unix System - File system, process management, bourne shell, Shell variables,
   command line programming.
   Filters and Commands - Pr, head, tail, cut, paste, sort, uniq, tr, join, etc., grep,
   egrep, fgrep, etc., sed, awk, etc.
   System Calls (like) - Creat, open, close, read, write, isseek, link, unlink, stat, fstat,
   umask, chmod, exec, fork, wait, system.

7. Relational Database Design and SQL
   E R diagrams and their transformation to relational design, normalization - 1NF,
   2NF, 3NF, BCNF and 4NF, Limitations of 4NF and BCNF.
   SQL - Data Definition language (DDL), Data Manipulation Language (DML), Data
   Control language (DCL) commands. Database objects like-Views, indexes,
   sequences, synonyms, data dictionary.
   Transaction Management, concurrency control and system recovery.

8. Software Engineering:
   Software Characteristics, Software Process Models, Analysis, Design, Coding,

9. Computer Graphics:
   Line Drawing, Graphic Primitives and Polygons, 2D Transformations, Windowing
   and Clipping, 3-D Graphics, Curves and Surfaces.

10. Computer Networks:
    ISO/OSI stack, LAN technologies, (Ethernet and Token ring), Flow and error control
    techniques, Routing algorithms, Congestion control, TCP/UDP and Sockets, IP
    (v4), Application layer protocols (icmp, dns, smtp, pop, ftp, http).

11. Data Warehousing and Mining: Data Warehousing Concepts and Architectures,
    OLAP, Data Pre-processing, Data Cube Technology, Data mining Functionalities,
Primitives, Data Characterization, Association Mining, Classification and regression, Clustering and Outlier Analysis.

12 Web Technologies:
HTML, XML, Basic Concepts of Client Server computing, Static, Dynamic and Active Web pages, Client and Server Side Scripting.

13 E Commerce and Security:
Electronic Payment Systems - Digital Token, Smart Cards, Credit Cards, Risks in Electronic Payment System, Designing Electronic Payment Systems.
Electronic Data Interchange (EDI) - Concepts, Applications, (Legal, Security and Privacy) issues, EDI and Electronic Commerce, Standardization and EDI, EDI Software Implementation, EDI Envelope for Message Transport, Internet-Based EDI.

14 Management Information Systems:
Concepts of system and Organizations, Business process re-engineering, Applications of Strategic, Tactical and Operational Information Systems. Information Systems Planning and Development.

15 Artificial Intelligence:

19. Computer Science

1. Mathematical Foundations:
Mathematical Logic – Propositional Logic, First Order Logic;
Probability: Conditional Probability, Mean, Median, Mode and Standard deviation; Random Variables; Distributions - Uniform, Normal, Exponential, Poisson, Binomial.
Set Theory and Algebra: Sets, Relations, Functions, Groups, Partial Orders, Lattices, Boolean Algebra.
Combinatorics: Permutations, Combinations, Counting, Summation, Generating Functions, Recurrence Relations.

2. Programming :

3. Data and File Structures:
Data structure – Definition; Arrays, stacks, queues, linked lists, trees, graphs, priority queues and heaps.
File Structures - Fields, records and files, Sequential, direct, index-sequential and relative files, Hashing, inverted lists and multi-lists B trees and B+ trees.

4. Design and Analysis of Algorithms:
Asymptotic notation, Notations of Space and Time complexities, Worst and Average case analysis; Design: Greedy Approach, Dynamic Programming, Divide and Conquer; Tree and Graph traversals, connected components, spanning trees, shortest paths; Hashing, Sorting, Searching. Asymptotic analysis (best, worst and average cases) of time and space, upper and lower bounds.

6. **Theory of Computation and Compiler Design:**

7. **Digital Logic Design and Computer Organization:**
Logic functions, Minimization, Design and synthesis of combinational and sequential circuits; Number representation and computer arithmetic (fixed and floating point). Machine instructions and addressing modes, Main Memory Organization, CPU Organization, I/O Organization, Micro-programmed Control, Cache Memory, Secondary Storage.

8. **Operating Systems and Unix:**
Processes, Threads, Inter-process communication, Concurrency, Synchronization, Deadlock, CPU scheduling, Memory management and virtual memory, File systems, I/O systems, Protection and security.
Unix System - File system, process management, bourne shell, Shell variables, command line programming. Filters and Commands - Pr, head, tail, cut, paste, sort, uniq, tr, join, etc., grep, egrep, fgrep, etc., sed, awk, etc. System Calls (like) - Creat, open, close, read, write, isseek, link, unlink, stat, fstat, umask, chmod, exec, fork, wait, system.

9. **Relational Database Design and SQL**
ER diagrams and their transformation to relational design, normalization - 1NF, 2NF, 3NF, BCNF and 4NF, Limitations of 4NF and BCNF.
SQL - Data Definition language (DDL), Data Manipulation Language (DML), Data Control language (DCL) commands. Database objects like-Views, indexes, sequences, synonyms, data dictionary, Transaction Management, concurrency control and system recovery.

10. **Computer Networks:**

11. **Software Engineering:**

12. **Cryptography and Network Security:**
Data Encryption and Decryption, Symmetric Key algorithms like DES, IDEA and AES, Public Key Cryptography, RSA algorithm, Digital Signatures & Authentication, Firewalls and VPN.

13. **Data Warehousing and Mining:**
Data Warehousing Concepts and Architectures, OLAP, Data Pre-processing, Data Cube Technology, Data mining functionalities, Primitives, Data Characterization, Association Mining, Classification and regression, Clustering and Outlier Analysis.

14. **Distributed Operating Systems:**
Goals, Client-Server Model, Synchronization in distributed systems, Distributed Process Management and File Systems, Distributed Shared Memory.

15. **Web Technologies:**
HTML, XML, Basic Concepts of Client Server computing, Static, Dynamic and Active Web pages, Client and Server Side Scripting.

**20. GEOLOGY**

1. **Geomorphology and Remote Sensing**
Basic principles, weathering and soils, mass wasting, influence of climate on processes. Concept of erosion cycles. Geomorphology of fluvial tracts, arid zones, coastal regions, karst landscapes and glaciated ranges. Applications of Geomorphology in mineral prospecting, civil engineering, hydrology and environmental studies, topographical maps and geomorphology of India.


2. **Structural geology and Geotectonics**
Principles of geological mapping and map reading, projection diagrams, stress-strain relationship of elastic, plastic and viscous materials. Behavior of minerals and rocks under deformation conditions. Structural analysis of folds, cleavages, lineation’s, joints,


3. Stratigraphy

4. Paleontology
Fossil records, morphology and time ranges fossil groups. Evolutionary changes in Mollusks and mammals in geological time. Principles of evolution. Use of species and genera of foraminifera and echinodermata in biostratigraphic correlation. Siwalik vertebrate fauna and flora, different microfossil groups and their distribution in India.

5. Crystallography and Mineralogy


6. Igneous and Metamorphic petrology


7. Sedimentology

8. Geochemistry

9. Environmental geology
Environmental protection-legislative measures in India. Factors for groundwater subsidence.

10. Indian mineral deposits and mineral economics

11. Ore genesis

12. Mineral exploration

13. Fuels

14. Engineering geology

15. Hydrogeology
Surface geophysical methods - seismic, gravity, geoelectrical and magnetic. Subsurface geophysical methods - well logging for delineation of aquifers and estimation of water quality.

Sd/-
Secretary