



TAMIL NADU GOVERNMENT GAZETTE

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Part II—Section 2

Notifications or Orders of interest to a section of the public
issued by Secretariat Departments.

NOTIFICATIONS BY GOVERNMENT

பள்ளிக் கல்வி துறை

SYLLABUS FOR COMPETITIVE EXAMINATIONS FOR DIRECT RECRUITMENT OF SENIOR LECTURERS /
LECTURERS FOR STATE COUNCIL OF EDUCATIONAL RESEARCH AND TRAINING (SCERT) / DISTRICT
INSTITUTE OF EDUCATION AND TRAINING (DIET) AND JUNIOR LECTURERS FOR GOVERNMENT TEACHER
TRAINING INSTITUTIONS (GTTI)

[அரசாணை (நிலை) எண்.181, பள்ளிக் கல்வி (ERT)த் துறை, 02 நவம்பர் 2015, ஐப்பசி 16, மன்மத,
திருவள்ளூர் ஆண்டு-2046.]

No. II(2)/SE/637(b)/2015.

தமிழ்

அலகு 1 : சங்க இலக்கியங்கள்

பாட்டும் தொகையும் - தொல்காப்பிய அகம் - புறம் கோட்பாடுகள் - சங்க இலக்கியங்கள் திணை நிலை இலக்கியங்கள் - அகக் கோட்பாடுகள் - புறக் கோட்பாடுகள் - பண்பாட்டு நாகரிகச் சிறப்புகள் - இலக்கியச் சிறப்புகள் - வரலாற்றுக் குறிப்புகள் - இயற்கைப் புனைவு - அறக் கருத்துகள் - வாழ்வியல் நாடகப் பாங்கு - பழக்க வழக்கங்கள் - புலவரும் புரவலரும் - விழுமியங்கள் - ஆற்றுப்படை இலக்கியங்கள் - பொற்காலம் - தமிழின் செம்மொழித் தகுதிக்குச் சங்க இலக்கியப் பங்களிப்பு.

அலகு 2 : அற இலக்கியங்கள்

பதினெண்கீழ்க் கணக்கு நூல்களுள் அற இலக்கியங்கள் - தோற்றப் பின்னணி - திருக்குறளின் தனித் தன்மைகள் - திருக்குறள் - நாலடியார் ஒப்பீடு - பிந்தைய அற இலக்கியங்களில் திருக்குறளின் தாக்கம் - பிற்கால அற இலக்கியங்கள் - சதகங்கள் - ஔவையார் நூல்கள் - நீதி நெறி விளக்கம் - வேதநாயகரின் நூல்கள் - ஆத்தி சூடிகள் - ஔவையார் - பாரதியார்.

அலகு 3: காப்பியங்கள்

பெருங்காப்பியங்கள் - சிறு காப்பியங்கள் - வரையறை - இரட்டைக் காப்பியங்கள் - சீவக சிந்தாமணி - கம்பராமாயணம் - பெரியபுராணம் - பெருங்கதை - சீராப் புராணம் - தேம்பாவணி - உதயணகுமார காவியம் - நாககுமார காவியம் - யசோதர காவியம் - சூளாமணி - நீலகேசி - இக்காலக் காப்பியங்கள் : பாஞ்சாலி சபதம் - அவனும் அவளும் - ஆசியஜோதி - பாண்டியன் பரிசு - மாங்கனி.

அலகு 4 : சமய இலக்கியங்கள்

பக்தி இயக்கம் - பக்தி இலக்கியங்கள் - ஆழ்வார்கள் - நாயன்மார்கள் - சித்தர்கள் - சமண இலக்கியங்கள் - பௌத்த இலக்கியங்கள் - குமர குருபரர் - பட்டினத்தார் - அருணகிரிநாதர் - தாயுமானவர் - வள்ளலார் - இசுலாமிய இலக்கியங்கள் - கிறித்தவ இலக்கியங்கள்

அலகு 5 : இலக்கணங்களும் உரைகளும்

இலக்கணப் பொருட் பாகுபாடு : எழுத்து - சொல் - பொருள் - யாப்பு - அணி - பாட்டு - தொல்காப்பியம் - நன்னூல் - புறப்பொருள் வெண்பாமாலை - நம்பியகப் பொருள் - யாப்பருங்கலக் காரிகை - தண்டியலங்காரம் - பன்னிரு பாட்டியல் - பிற இலக்கண நூல்கள்.

உரைகள் : இறையனார் களவியல் - இளம்பூரணர் - பேராசிரியர் - சேனாவரையர் - தெய்வச் சிலையார் - நச்சினார்க்கினியர் - மயிலைநாதர் - பரிமேலழகர் - சிவஞான முனிவர் - ஆறுமுக நாவலர்.

அலகு 6 : சிற்றிலக்கியங்கள்

வகைப்பாடு - கோவை : திருக்கோவையார் - பரணி : கலிங்கத்துப்பரணி - பிள்ளைத் தமிழ் : மீனாட்சியம்மைப் பிள்ளைத் தமிழ் - தூது : தமிழ் விடு தூது - பள்ளு : முக்கூடற் பள்ளு - குறவஞ்சி : திருக்குற்றாலக் குறவஞ்சி - கலம்பகம் : நந்திக் கலம்பகம் - உலா : மூவருலா.

அலகு 7 : இக்கால இலக்கியங்கள்

கவிதை : மரபுக் கவிதை : பாரதியார் - கவிமணி - நாமக்கல்லார் - பாரதிதாசன் - கண்ணதாசன் - சுரதா
 புதுக்கவிதை : ந. பிச்சமூர்த்தி - நா. காமராசன் - மீரா - அப்துல் ரகுமான் - சிற்பி - மு. மேத்தா - வைரமுத்து
 ஐக்கூ - சென்றியூ - லிமரிக் - லிமரைக்கூ : தமிழன்பன்
 புதினம் : மாயூரம் வேதநாயகம் பிள்ளை - கல்கி - ஆர். சண்முக சுந்தரம் - மு. வரதராசன் - தி. ஜானகிராமன் - ராஜம் கிருஷ்ணன் - சுந்தர ராமசாமி - கி. ராஜநாராயணன் - சிவகாமி - இமயம்
 சிறுகதை : வ.வே.சு. அய்யர் - புதுமைப்பித்தன் - கு.ப. இராஜகோபாலன் - கு. அழகிரிசாமி - ஜெயகாந்தன் - அசோகமித்திரன் - வண்ணதாசன் - மேலாண்மை பொன்னுசாமி - அம்பை.
 நாடகம் : மனோன்மணியம் சுந்தரம் பிள்ளை - சங்கரதாஸ் சுவாமிகள் - பம்மல் சம்பந்த முதலியார் - ஆ. பழனி - அண்ணா - பி.எஸ். இராமையா - கலைஞர் மு. கருணாநிதி - இந்திரா பார்த்தசாரதி - ந. முத்துசாமி - சே. இராமானுஜம் - மு. இராமசாமி - இன்குலாப்.
 பயணம் : ஏ.கே. செட்டியார் - சோமலெ - சி. சுப்பிரமணியம் - மணியன்
 கட்டுரை : மறைமலையடிகள் - வ.ரா. - திரு. வி.க. - ரா.பி.சேதுப்பிள்ளை - மயிலை சீனி. வேங்கடசாமி - வெ. சாமிநாத சர்மா - வா.செ. குழந்தைசாமி
 வாழ்க்கை வரலாறு : மகாகவி பாரதியார் (வ.ரா.) - புதுமைப்பித்தன் வரலாறு (ரகுநாதன்) - பொன்னியின் செல்வன் (சுந்தா) - இராமானுசர் வரலாறு (சிற்பி) - குன்றக்குடி அடிகளார் (பொன்னீலன்)
 தன் வரலாறு : வ.உ.சி. - உ.வே.சா. - திரு.வி.க. - நாமக்கல் கவிஞர் - நெ.து. சுந்தரவடிவேலு - அப்துல் கலாம்

அலகு 8 : நாட்டுப்புற இலக்கியங்கள்

வகைப்பாடு - தாலாட்டு - ஓப்பாரி - தொழிற் பாடல்கள் - கதைப் பாடல்கள் - கதைகள் - பழமொழிகள் - விடுகதைகள் - நம்பிக்கைகள் - கற்பனை - நயம் - உளவியல் - வாழ்வியல் - பழக்க வழக்கங்கள் - பேணிப் பாதுகாக்கப்பட வேண்டியதன் இன்றியமையாமை.

அலகு 9 : தமிழர் கலைகளும் பண்பாடும்

கலை - பண்பாடு - விளக்கம் - இசை - ஆடல் - ஓவியம் - சிற்பம் - கட்டடம் - நாட்டுப் புறக் கலைகள் - பழக்க வழக்கங்கள் - நம்பிக்கைகள் - விழாக்கள் - விளையாட்டுகள் - வழிபாட்டு நெறிகள்

அலகு 10 : இலக்கியத் திறனாய்வியல்

இலக்கியப் படைப்பும் படைப்பாளியும் - இலக்கிய வகைமைக் கோட்பாடுகள் - இலக்கிய உருவம் - உள்ளடக்கம் - உத்தி - திறனாய்வு அணுகுமுறைகள் - இலக்கியக் கொள்கைகள் - பெண்ணியம் - தலித்தியம்

ஆ. முத்து சிவன் - எஸ். வையாபுரிப் பிள்ளை - தெ.பொ.மீ. - மு.வ. - அ.ச.ஞானசம்பந்தன் - நா. வானமாமலை - க. கைலாசபதி - கா. சிவத்தம்பி - க.நா. சுப்பிரமணியன் - சி.சு. செல்லப்பா - வ.சுப. மாணிக்கம் - இவர்களது திறனாய்வுகள்..

அலகு 11 : மொழி பெயர்ப்பிலக்கியங்கள்

தமிழிலிருந்து பிற மொழிகளுக்குப் பெயர்க்கப்பட்ட இலக்கியங்கள் - ஏ.கே. இராமானுஜன் - கா.செல்லப்பன் இவர்களது மொழி பெயர்ப்புப் பணிகள்

பிற இந்திய மொழிகளிலிருந்து தமிழுக்குப் பெயர்க்கப்பட்ட இலக்கியங்கள் - சுத்தானந்த பாரதி - கா. ஸ்ரீஸ்ரீ. - த.நா. குமாரசாமி - சி.ஏ. பாலன் - சரஸ்வதி ராமநாத் -

தி.ப. சித்தலிங்கையா - மு.கு. ஜகந்நாத ராஜா- இவர்களது மொழி பெயர்ப்புப் பணிகள்.

ஆங்கிலம் முதலிய உலக மொழிகளிலிருந்து தமிழுக்குப் பெயர்க்கப்பட்ட இலக்கியங்கள் - சேக்சுபியர் - மில்டன் - கார்க்கி.

அலகு 12 : மக்கள் தொடர்பியல் ஊடகங்கள்

அச்சு ஊடகங்கள் : இதழ்கள் - நாள் - வார - திங்கள் - பருவ இதழ்கள் தோற்றம் - வளர்ச்சி.

மின் ஊடகங்கள் : வானொலி - திரைப்படம் - தொலைக்காட்சி - கணினி - தோற்றம் வளர்ச்சி - இணையம் - இணைய இதழ்கள் - வளர்ச்சி

ஊடகங்களும் தமிழ் வளர்ச்சியும் - விளம்பரங்களும் தமிழ் வளர்ச்சியும், கலைச் சொல்லாக்கம் - புதிய சொல்லாக்கம் - கருத்துப் பரப்பல் முறை

Syllabus – Telugu Pandit

Paper – 1

Unit – I : Classical and Contemporary Poetry

(a) Classical Poetry

- Kumarastra Vidya Pradarsanam-Nannaya. Andhra Mahabharatham - Adipervamu
- Govyagra Samvadamu – Ananthamathya, Bhajarajeeyamu
- Trijata vrittantamu – Anguleeyaka Pradanamu (328 lines) Ranganatha Ramayanamu – Sundara kanda

(b) Contemporary Poetry

Book Prescribed :

Telugu kavyamala, Edited by Katuri, Published by Central Sahitya Academy

Selections :

- Jandhyala Papaiah Sastri – Karunamayi (Pages 327-328)
- Tilak – Advitiamu (Pages 332-333)

Unit – II : Drama

Text : Uttaramacharilamu Translated by M.Nageswara Rao, A.C. College, Guntur.

Unit – III : History of Telugu Literature

I. Division of Yugas :

II. Poets :

Nannaya
Tikkana
Errana
Bammera Pothana
Allasani Peddana
Dhurjati
Pingali Surana
Tenali Ramakrishnudu

Tirupathi Venkatakavulu Royaprolu
Veerasingalingam Panthulu Sri Sri
Gurazada Dasurathi
Tilak Narayana Reddi
Pingali – katuri

III. Trends : Puranam, Ithihasamu, Kavyamu, Natakamu, Prabandhamu, Achcha Tenugu – Janu Tenugu – Marga. Desikavithalu. Sathakamu, Yaksha ganamu, Navala, Kathanika, Natika

Books recommended for reference:

- Andhra Sahitya Charita by Pingali Lakshmikantham
- Samagrاندhra Sahithyam by Arudra

Unit – IV : Telugu Novel

Text Books :

Mana Navala – OKA Pariseelanamu
Published by Yuvabharathi, Hyderabad.

Unit - V : History of Telugu Language and Dravidian Philogy

Books Prescribed :

1. History of Telugu Language, Edited by Bh. Krishnamurthy
2. Dravida Bhashalu – P.S.Subrahmanyam
3. Andhra Bhashavikasamu – C.J.Somayaji

Unit – VI : Grammar and Prosody

Grammar – Balavyakaranamu
Prosody – Appakaviyamu – Canto III

Books prescribed :

1. Ramaneeyamu – by Duvvuri Venkatrama Sastri
2. Commentary on Balavyakaranam – by Bulusu Venkataramanayya
3. Appakaviya bhava prakasika by Ravoori Dorasami Sarma

Unit – VII : Translation and General Essay :

Translation from English to Telugu

Unit – VIII : Outlines of Linguistics

1. The general Characteristics of Language and its definition
2. Phonetics
3. Phonemics
4. Morphology
5. Sentence and its parts

Books Prescribed :

Adhunika Bhashasastra Siddhanthalu – By P.S. Subrahmanyam.

Note : Medium of Examination only in Telugu.

SYLLABUS – MALAYALAM PANDIT

Unit – I : Poetry (Ancient, Medieval and Modern)

1. Kannassa Ramayanam – Balakandam First 41 songs
2. Kaliya mardanam – Krishna Gadha
3. Sthree Parvam – Ezhuthachan
4. Kalyanasauganthikam – Kunchan Nambiar
5. Anveshnam – G.Sankarakurup
6. Sargasangeetham – Vayalar Ramavarma
7. Chinthavishtayaya Seetha – Kumaran Asan

Unit – II : Novel & Short Stories

- | | | |
|-----------------|---|----------------------------|
| 1. Marappavakal | - | Karoor Neelakantha Pillai |
| 2. Mail Carrier | - | S.K.Pottekkad |
| 3. Vastuhara | - | C.V.Sreeraman |
| 4. Dharmaraja | - | C.V.Raman Pillai |
| 5. Chemmeen | - | Thakazhi Sivasankarapillai |
| 6. Mathilukal | - | Vaikom Mohd. Basheer |

Unit – III : Prose – non – Fiction

- | | | |
|--------------------------------|---|---------------|
| 1. Isangalkkappuram | - | S.Guptam Nair |
| 2. Pourasthyasahithya Darshnam | - | M.S.Menon |
| 3. Balidweep | - | S.K.Pottekkad |

Unit – IV : History of Language & Literature

1. Keralapanineeyam Peedhika excluding Aksharamala and Varnavilkaram
2. Kairaliyude Kadha – N.Krishna Pillai (Chapters 2 to 11)

Unit – V : Grammar and Elements of Sanskrit Grammar

1. Vibhakthi
2. Sandhivibhagam
3. Samasaprakaranam
4. Sree Ramodantham First 75 slokas
5. Kamadhenu – E.R.Bharatha Pisharodi
6. General Essay

Unit – VI : Drama and Attakkatha

- | | | |
|------------------------------------|---|-------------------------|
| 1. Nivatha kavacha Kalakeya Vadham | - | Kottayathu Thampuram |
| 2. Malavikagnirnithram | - | Tr. A.R.Raja Raja Varma |
| 3. Bhagna Bhavanam | - | N.Krishnapillai |

Unit – VII : Prosody & Alankarasastram

1. Vritamanjari – A.R.Rajarajavarma
(Indravajra, Upendravajra, Upajathi, Vasantha Thilakam, Sragdhara, Sardoolavikreditam, Kakali, Kalakanchi, Keka, Annanada, Manjari, Tharangini, Nathonnatha, Pushpitagra)
2. Bhasha Bhooshanam – A.R.Rajarajavarma
(Upama, Utpreksha, Roopakam, Depakam, Ullekham, Roopakathisayokthi, Arthantharanyasam, Kavyalingam, Slesham, Yamakam, Dristhantham, Udaatham, Samasokthi, Prathivasthoopama)

Unit – VIII : Kerala History & Kerala Culture

1. Kerala Charithram – A.Sreedhara Menon
Chapters – 2, 4, 10, 15, 17, 18, 22, 23, 27 & 28
2. Kerala Samskaram – A.Sreedhara Menon
Excluding Chapters (4, 5, 14)

Note : Medium of Examination only in Malayalam

ENGLISH**Unit 1: Chaucer to Shakespeare**

- | | |
|-------------------|---|
| Geoffrey Chaucer: | The Prologue to the Canterbury Tales |
| Edmund Spenser: | Prothalamion |
| Shakespeare : | Sonnets (12,18,29,30,33,53,54,60,65,73,90,94,107,116,144) |
| John Donne : | A Valediction : Forbidding Mourning |
| Andrew Marvell : | To His Coy Mistress |
| Francis Bacon : | Of Truth
Of Death |

	Of Revenge
	Of Marriage and Single Life
	Of Ambition
	Of Nobility
Christopher Marlowe	: Dr.Faustus
Thomas Middleton	: The Changeling
John Webster	: The Duchess of Malfi
William Shakespeare	: Twelfth Night
	Henry IV Part I
	Macbeth
	The Tempest
	Antony and Cleopatra

Unit 2: Jacobean to Augustan Age

John Milton	: Paradise Lost - Book IX
John Dryden	: Mac Flecnoe
Alexander Pope	: An Epistle to Dr.Arbutnot
Thomas Gray	: Elegy Written in a Country Churchyard
Thompson	: Spring
	Autumn
	Winter
William Collins	: Ode to Evening
William Blake	: A Poison Tree
	The Tiger
	The Lamb
John Dryden	: Preface to the Fables
Jonathan Swift	: The Battle of the Books
Daniel Defoe	: Robinson Crusoe
Addison and Steele	: The Spectator and the Coverly Papers (Essays 1-10 Macmillan Edn.)
Samuel Johnson	: Preface to Shakespeare
William Congreve	: The Way of the World
R.B.Sheridan	: The Rivals
Goldsmith	: She Stoops to Conquer
Henry Fielding	: Tom Jones

Unit 3: Romantic Period

Wordsworth	: Intimation Ode
	Tintern Abbey
Coleridge	: Kubla Khan
	The Rime of the Ancient Mariner
P.B.Shelley	: To a Skylark
John Keats	: Ode to a Nightingale
	Ode on a Grecian Urn
Byron	: Vision of Judgement
Charles Lamb	: Essays of Elia
	1. The South-Sea House
	2. Dream Children : A Reverie
	3. Christ Hospital Five and Thirty Years Ago
	4. Oxford in the Vacation
	5. All Fools' Day
Wordsworth	: Preface to the Lyrical Ballads
Walter Scott	: The Heart of Midlothian

Jane Austen	:	Pride and Prejudice
Emily Bronte	:	Wuthering Heights

Unit 4: Victorian Period

Tennyson	:	Ulysses The Lotus Eaters
Robert Browning	:	My Last Duchess Andrea Del Sarto
Matthew Arnold	:	The Scholar Gipsy Dover Beach
D.G.Rossetti	:	The Blessed Damozel
G.M.Hopkins	:	The Wreck of the Deutschland
Matthew Arnold	:	The Study of Poetry
Oscar Wilde	:	The Importance of Being Earnest
Charles Dickens	:	Great Expectations
Thomas Hardy	:	The Woodlanders

Unit 5: Modern and Contemporary Periods

W.B.Yeats	:	Sailing to Byzantium
T.S.Eliot	:	The Waste Land
W.H.Auden	:	The Unknown Citizen
Philip Larkin	:	Church Going
C.B.Lewis	:	Fern Hill
T.S.Eliot	:	Tradition and the Individual Talent
E.M.Forster	:	(Selections from E.M.Forster. Edited by R.Krishnamoorthy & Published by Macmillan). 1. Notes on the English Character 2. My Wood 3. Hymn Before Action 4. Tolerance 5. What I Believe
G.B.Shaw	:	Arms and the Man
John Osborne	:	Look Back in Anger
T.S.Eliot	:	Murder in the Cathedral
D.H.Lawrence	:	The Rainbow
William Golding	:	Lord of the Flies
Joseph Conrad	:	Lord Jim

Unit 6: American Literature

Emerson	:	Brahma
Poe	:	The Raven
Whitman	:	When Lilacs Last in the Dooryard Bloom'd
Emily Dickinson	:	Success is Counted Sweetest I Tasted a Liquor Never Brewed Because I Could not Stop for Death
		A Narrow Fellow in the Grass
Robert Frost	:	Mending Wall Stopping by Woods on a Snowy Evening
Wallace Stevens	:	The Emperor of Ice-cream
Emerson	:	The American Scholar

Henry James	:	The Art of Fiction
O'Neill	:	The Hairy Ape
Edward Albe	:	Who's Afraid of Virginia Woolfe
Hawthorne	:	The Scarlet Letter
Mark Twain	:	Huckleberry Finn
Ernest Hemingway	:	The Old Man and the Sea
Faulkner	:	The Sound and the Fury
Alice Walker	:	Color Purple

Unit 7: Indian English Literature

Toru Dutt	:	The Lotus Our Casuarina Tree
R.Parthasarathy	:	Under Another Sky A River Once
Sarojini Naidu	:	Indian Weavers
Kamala Das	:	Introduction My Grandmother's House
Nissim Ezekiel	:	Enterprise Night of the Scorpion
A.K.Ramanujan	:	Small Scale Reflections on a Great House Obituary
Sri Aurobindho	:	The Renaissance in India
Tagore	:	Post Office
Girish Karnard	:	Tughlaq
R.K.Narayan	:	The Guide
Chaman Nahal	:	Azadi
Deshpande	:	The Dark Holds No Terror
Arundathi Roy	:	God of Small Things

Unit 8: Language and Linguistics

Family of Indo-European Languages

Foreign Influences

Word Making

Change of Meaning

Spelling Reforms

Standard English

Morphology

Basic Sentence Patterns

IC Analysis

Structural Linguistics

T.G. Grammar

English Language Teaching

Translation

Semantics, Pragmatics and Discourse

Descriptions and classification of Consonants and Vowels

Accent

Intonation

Phonetic Transcription

Writing a research paper: Bibliography, abstract, documentation etc

Mechanics of thesis writing

Unit 9: Criticism and Literary Theories

Aristotle	:	Poetics
Dr Johnson	:	Life of Milton
T.S.Eliot	:	The Function of Criticism
I.A.Richards	:	Four Types of Meaning
Northrop Frye	:	The Archetypes of Literature
Lionel Trillin	:	The Meaning of a Literary Idea
Rolland Barthes	:	The Death of the Author
Wayne Booth	:	Telling and Showing
Edward Wilson	:	A Historical Interpretation of Literature
Derrida	:	Structure, Sign and Play in the Discourse of Human Sciences
Terry Eagleton	:	Capitalism, Modernism and Post Modernism
Elaine Showalter	:	Towards a Feminist Poetics
Gayatri Spivak	:	Imperialism and Sexual Difference

Unit 10: Post Colonial Literature and European Literature in Translation

A.G.Smith	:	Ode on the Death of William Butler Yeats Like an Old Proud King in a Parable.
Margaret at Wood	:	Journey to the Interior.
P.K.Page	:	Adolescence
Wilfered Campbell	:	The Winter Lakes
George Ryga	:	The Ecstasy of Rita Joe
Margaret Lawrence	:	The Stone Angel
Ondaatje	:	Running in the Family
Sir Thomas More	:	Utopia
Moliere	:	The Misanthropist
Ibsen	:	A Doll's House
Wole Soyinka	:	The Lion and the Jewel
Chinua Achebe	:	Things Fall Apart

MATHEMATICS**Unit 1: Real Analysis**

Finite-countable and uncountable sets-Bounded and unbounded sets,-Archimedean Property-Ordered field-Completeness of \mathbf{R} -Extended real number system-Sequences and series-limsup and liminf of a sequence- convergence of sequences and series-uniform convergence-continuity of a function-types of discontinuities-uniform continuity- differentiability- Roll's theorem- mean value theorem -monotone functions, functions of bounded variations, -Riemann Integral and its properties- Improper integrals and their convergence and uniform convergence- sequence of functions and series of functions- point wise convergence and uniform convergence- Bolzano-Weierstrass Theorem- Compact subsets of \mathbf{R}^n - Heine-Borel Theorem- Riemann-Stieltjes integral and its properties- partial, directional and total derivatives in \mathbf{R}^n .

Unit 2: Complex Analysis

Algebra of complex numbers, Riemann Sphere, Stereographic projection, lines, circles, cross ratio, Mobius transformation, Analytic functions, Cauchy-Riemann equations, line integrals, Cauchy's theorem for convex regions, Morera's theorem, Liouville's theorem, Fundamental Theorem of Algebra, Cauchy's Integral formula, power series representation, classification of singularities, Riemann theorem for removable singularities, Taylor's and Laurent's series expansions, maximum modulus principle. Schwarz lemma, Open mapping theorem, Contour integration, Conformal mapping, Entire functions, Harmonic functions, Elliptic functions, Analytic continuation.

3. Algebra

Groups, subgroups, normal subgroups, quotient groups, homomorphisms, cyclic groups, permutation groups, symmetric groups, alternating groups, simple groups, Sylow's theorem, Finite abelian groups, Rings, ideals, integral domains, polynomial rings, Euclidean ring, Principal ideal domains, Unique factorisation domains, Finite fields, Extension fields, Splitting fields, Galois Theorem.

Vector spaces, linear independence, bases, dimension, subspaces, quotient spaces, algebra of linear transformations, kernel, range, isomorphism, matrix representation of a linear transformation, change of bases, Dual bases, dual space, projection, transpose, trace, determinant, Hermitian, Unitary and normal transformations, eigen values and eigen vectors, Cayley-Hamilton theorem, Invariant subspaces, canonical forms: triangular form, Jordan form, rational canonical form.

4. Topology

Topological spaces – Basis for a topology – The product topology – The subspace topology – Closed sets and limit points, Continuous functions – the product topology – The metric topology. Connected spaces- connected subspaces of the Real line – Components and local connectedness, Compact spaces – compact subspaces of the Real line – Limit Point Compactness – Local Compactness. The Countability Axioms – The separation Axioms – Normal spaces – The Urysohn Lemma – The Tietze extension theorem.

5. Measure Theory and Functional Analysis

Measure Theory: Lebesgue Outer Measure - Measurable sets - Regularity - Measurable Functions - Borel and Lebesgue Measurability - Integration of Non- negative functions - The General Integral - Riemann and Lebesgue Integrals, Field of sets, sigma-field of sets, finitely additive set function and countably additive set function, measure, Measurable and measure spaces, Extension of measures, signed measures, Jordan, Hahn decomposition theorem, Monotone convergence Theorem, Fatou's lemma, Dominated convergence theorem, absolute continuity, L^p spaces- Convex functions, Jensen's inequality, Holder's and Minkowski's inequalities, Radon-Nikodym derivative, Fubini's Theorem.

Functional Analysis : Normed Linear space- Continuous Linear Transformations – Banach spaces- The Hahn-Banach Theorem – The natural embedding of N in N^{**} - Open mapping theorem-Closed graph Theorem – Uniform boundedness theorem – conjugate of an operator – Inner product space – Orthogonalisation process - Hilbert Space– Orthonormal sets- Orthogonal complements – Conjugate space H^* - Adjoint of an operator – Self-adjoint operator – Normal and Unitary Operators – Projections.

6. Differential Equations

Ordinary Differential Equations : Second order homogeneous equations-Initial value problems-Linear dependence and independence-Wronskian and a formula for Wronskian-Non-homogeneous equation of order two. Homogeneous and non-homogeneous equation of order n –Initial value problems- Annihilator method to solve non-homogeneous equation- Algebra of constant coefficient operators. Initial value problems -Existence and uniqueness theorems – Solutions to solve a non-homogeneous equation – Wronskian and linear dependence – reduction of the order of a homogeneous equation – homogeneous equation with analytic coefficients-The Legendre equation. Euler equation – Second order equations with regular singular points –Exceptional cases – Bessel Function. Equation with variable separated – Exact equation – method of successive approximations – the Lipschitz condition – convergence of the successive approximations and the existence theorem.

Partial Differential Equations : Linear and non-linear first order partial differential equations - Second order equations in two independent variables – canonical forms – equations with constant coefficients – general solution . The Cauchy problem – Homogeneous wave equation – Initial Boundary value problem- Non-homogeneous boundary conditions – Non-homogeneous wave equation – Riemann method – Goursat problem – spherical wave equation – cylindrical wave equation. Separation of variable- Vibrating string problem – Existence and uniqueness of solution of vibrating string problem.- Heat conduction problem – Existence and uniqueness of solution of heat conduction problem – Laplace and beam equations. Boundary value problems – Maximum and minimum principles – Uniqueness and continuity theorem – Dirichlet Problem for a circle , a circular annulus, a rectangle – Dirichlet problem involving Poisson equation – Neumann problem for a circle and a rectangle. The Delta function – Green's function – Method of Green's function – Dirichlet Problem for the Laplace and Helmholtz operators.

7. Mechanics and Numerical Methods

Mechanics: Generalised coordinates – Constraints - Virtual work - Energy and Momentum , Derivation of Lagrange's equations- Examples- Integrals of motion. Hamilton's Principle - Hamilton's Equation - Other variational principle. Hamilton Principle function – Hamilton-Jacobi Equation - Separability , Differential forms and generating functions – Special Transformations– Lagrange and Poisson brackets.

Numerical Methods: Representation of numbers (binary, octal, decimal, hexadecimal) – Errors – Difference Table – Difference formula – Solution of non-linear equations: Bisection, secant, regula-falsi, Newton-Raphson, Fixed iteration. Solution of system of equations: Gauss Elimination, Jacobi, Gauss-Jordan, Gauss-Seidal, LU decomposition. Solution of ordinary differential equations: Taylor Series, Euler and modified Euler, Runge-Kutta method of order two and four, Milne-Simpson, Adams-Badsforth method.

8. Probability and Mathematical Statistics

Probability : Random events – Probability axioms – Combinatorial formulae – conditional probability – Bayes Theorem – Independent events – Random Variables – Distribution Function – Joint Distribution – Marginal Distribution – Conditional Distribution – Independent random variables – Functions of random variables. Expectation- Moments – The Chebyshev Inequality – Absolute moments .Cumulant Generating Function, Moment Generating Function and Probability Generating function- Properties of characteristic functions – Characteristic functions and moments – characteristic function of the sum of the independent random variables – Determination of distribution function by the Characteristic function – Probability generating functions. One point , two point , Binomial – Poisson distributions – Uniform(discrete and continuous) – normal -gamma distributions. Weak law of large numbers – Central limit theorem (Lindberg Theorem and Lapunov Theroem) Borel-Cantelli Lemma - Kolmogorov Strong Law of large numbers.

Mathematical Statistics : Sampling : Sample mean, sample variance and their independence- Moments of sample mean and sample variance, t distribution, F distribution. Point Estimation : Unbiasedness, consistency, sufficiency, efficient and asymptotically most efficient- Method of moments: One parameter and two parameters cases- Maximum likelihood Estimation: One parameter and two parameter cases, unbiasedness, mean square error, CR bound. Interval Estimation: Derivation of confidence interval:-The pivotal method, confidence limits, sample size, confidence interval for the normal distribution(mean, variance)-Confidence interval for Binomial and Poisson-Confidence interval for two sample problems(Two normal means, two population variances, two population propositions, two Poisson parameters, paired data) . Hypotheses, test statistics, decision and errors: Hypotheses(Null, alternative, simple and composite) , one sided and two sided tests, test statistics, errors(Type-I and II errors), Best Test (smallest type-II error), p-values. Best Tests: Testing the value of a population mean, of population variance, of population proposition. Of the mean of Poisson. Best Tests: Testing the value of the difference between two population means, ratio of two population variances, difference between population propositions, difference between two Poisson means, paired data. Tests and confidence intervals: chi-square test, goodness of fit, contingency table for independence. ANOVA : One way and two way classifications.

9. Differential Geometry and Graph Theory

Space curve – Arc length – tangent – normal and binormal – curvature and torsion – contact between curves and surfaces-tangent surface- involutes and evolutes- Intrinsic equations – Fundamental Existence Theorem for space curves- Helics. Surface – curves on a surface – Surface of revolution – Helicoids – Metric- Direction coefficients – families of curves- Isometric correspondence- Intrinsic properties. Geodesics – Canonical geodesic equations – Normal property of geodesics- Existence Theorems – Geodesic parallels – Geodesics curvature- Gauss- Bonnet Theorem – Gaussian curvature- surface of constant curvature. The second fundamental form- Principle curvature – Lines of curvature – Developable - Developable associated with space curves and with curves on surface - Minimal surfaces – Ruled surfaces. Compact surfaces whose points are umblics- Hilbert's lemma – Compact surface of constant curvature – Complete surface and their characterization – Hilbert's Theorem – Conjugate points on geodesics.

Graph Theory : Graphs and simple graphs – Graph Isomorphism – The Incidence and Adjacency Matrices – Subgraphs – Vertex Degrees – Paths and Connection – Cycles – Trees – Cut Edges ana Bonds – Cut Vertices. Connectivity – Blocks – Euler tours – Hamilton Cycles. Matchings – Matchings and Coverings in Bipartite Graphs – Edge Chromatic Number – Vizing's Theorem. Independent sets – Ramsey's Theorem – Chromatic Number – Brooks' Theorem – Chromatic Polynomials. Plane and planar Graphs – Dual graphs – Euler's Formula – The Five- Colour Theorem and the Four-Colour Conjecture- Directed graphs.

10. Mathematical Programming and Fluid Dynamics

Convex sets- Hyperplane- Open and closed half spaces- Formulation of Linear Programming problem - Graphical solution – Types of solutions- Simplex procedure - method of penalty - Two - phase technique- special cases in simplex method applications - Duality - Economic Interpretation of duality - Dual Simplex method- Generalised simplex Tableau in Matrix Form – Efficient Computational algorithm – Transportation and Assignment problems as linear programming problems.

Fluid Dynamics: Real fluids and Ideal fluids- Velocity of a fluid at a point, Stream lines , path lines , steady and unsteady flows- Velocity potential - The vorticity vector- Local and particle rates of changes - Equations of continuity - Acceleration of a fluid - Conditions at a rigid boundary. Pressure at a point in a fluid at rest.- Pressure at a point in a moving fluid - Conditions at a boundary of two inviscid immiscible fluids- Euler's equation of motion - Steady motion under conservative body forces. Sources, sinks and doublets - Images in a rigid infinite plane - Axis symmetric flows - Stokes stream function - Two dimensional flow - The stream function - The complex potential for two dimensional , irrotational in compressible flow - Complex velocity potentials for standard two dimensional flows - Two dimensional Image systems - The Milne Thomson circle Theorem. Stress components in a real fluid. - Relations between Cartesian components of stress- Translational motion of fluid elements - The rate of strain quadric and principle stresses - Some further properties of the rate of strain quadric - Stress analysis in fluid motion - Relation between stress and rate of strain- The coefficient of viscosity and Laminar flow - The Navier – Stokes equations of motion of a Viscous fluid.

PHYSICS**Unit 1: Mathematical Methods**

Vector fields: Orthogonal curvilinear co-ordinate systems – Expressions for gradient, divergence, curl and Laplacian – Linear vector spaces: Linear independence, basis, dimension, inner product – Schwartz inequality – Orthonormal basis – Gram – Schmidt orthogonalization process – Linear operators – Representation of vectors and operators in a basis – Matrix theory – Cayley-Hamilton theorem – Inverse of a matrix – Diagonalisation of matrices – Operational methods: Laplace transforms – Solution of linear differential equations with constant coefficients – Fourier integral – Fourier transforms – Convolution theorems – Applications – Complex variables: Analytic function – Cauchy-Riemann conditions – Singular points – Multivalued function and branch points – Cauchy's integral theorem and formula – Taylor's and Laurentz's expansions – Residue theorem and its applications.

Unit 2: Classical Mechanics and Relativity

Lagrangian and Hamiltonian formulations – Newton's equations and conservation laws for a system of particles – D'Alembert's principle and Lagrange's equations of motion – Hamiltonian and Hamilton's equation of motion – Application: Two-body central force problem – Scattering by central potential, two particle scattering – Cross section in Lab system - Small oscillations – Transformation to normal coordinates and frequencies of normal modes – Mechanics of rigid bodies: Angular momentum and kinetic energy – Moment of inertia tensor – Euler angles – Euler's equation of motion – Torque free motion – Symmetric top - Wave motion – Phase velocity – Group velocity – Dispersion - Relativity: Special theory of relativity – Lorentz transformation – Addition of velocities – Mass-energy equivalence.

Unit 3: Quantum Theory and its Applications

Basic principles: Wave - particle duality – Heisenberg's uncertainty principle – Postulates of quantum mechanics – Interpretation of wave function – Schrodinger's wave equation and its application to particle in a box – Harmonic oscillator – tunneling through a barrier – Motion in central field potential: Hydrogen atom – angular momentum and spherical harmonics – Addition of two angular momenta – Approximate methods: Time independent perturbation theory for non-degenerate case – application to anharmonic oscillator – time dependent perturbation theory – Fermi's golden rule – Scattering theory: Scattering amplitude – cross section – Born approximation – Partial wave analysis – Identical particles and spin – Symmetric and antisymmetric wave functions – Representation theory – Coordinate and momentum representations.

Unit 4: Electromagnetic Theory

Electrostatics – Laplace and Poisson equations – Boundary value problems – Magnetostatics – Ampere's theorem - Biot-Savart law – Electromagnetic induction - Maxwell's equations in free space and in linear isotropic media – Boundary conditions on the fields at interfaces – Scalar and vector potentials – Gauge invariance – Electromagnetic waves – Reflection, refraction, dispersion, interference, diffraction and polarization – Electrodynamics of a charged particle in electric and magnetic fields – Radiation from moving charges and from a dipole – Retarded potential.

Unit – 5 Thermodynamics and Statistical Mechanics

Laws of thermodynamics and their consequences – Thermodynamic potentials and Maxwell's relations – Chemical potential and phase equilibria – Phase space, microstates and macrostates – Partition function – Free energy and its connection with thermodynamic quantities – Classical and quantum statistics – Degenerate electron gas – Black body radiation and Planck's distribution law – Bose – Einstein condensation – Einstein and Debye models for lattice specific heat.

Unit 6: Atomic and Molecular Physics

Quantum states of an electron in an atom - Hydrogen atom spectrum – Electron spin - Stern-Gerlach experiment - Spin-orbit coupling – Fine structure – Relativistic correction – Spectroscopic terms and selection rules – Hyperfine structure – Exchange symmetry of wave functions – Pauli's exclusion principle – Periodic table – Alkali-type spectra – LS and JJ coupling – Zeeman, Paschen-Back and Stark effects – X-rays and Auger transitions – Compton effect – Principles of ESR, NMR – Molecular Physics: Covalent, ionic and Vander Waal's interactions – Rotation/vibration spectra – Raman spectra – Selection rules – Nuclear spin and intensity alternation – Isotopic effects – Electronic states of diatomic molecules – Frank-Condon principle – Lasers: Spontaneous and stimulated emission – Optical pumping – Population inversion – Coherence (temporal and spatial) – Simple description of ammonia maser - CO₂ and He-Ne lasers.

Unit 7: Condensed Matter Physics

Crystal classes and systems – 2d and 3d lattices – Bonding in common crystal structures – Reciprocal lattice – Diffraction and structure factor – Elementary ideas about point defects and dislocations – Lattice vibrations – Phonons – Specific heat of solids – Free electron theory – Fermi statistics – Heat capacity – Electron motion in periodic potential – Energy bands in metals, insulators and semiconductors – Tight binding approximation – Impurity level in doped semiconductors – Electronic transport from classical kinetic theory – Electrical and thermal conductivities – Hall effect and thermoelectric power -transport in semiconductors – Dielectrics – Polarization mechanism – Clausius-Mossotti equation – Piezo, pyro and ferroelectricity – Dia and paramagnetism – Exchange interactions – Magnetic ordering: ferro, antiferro and ferrimagnetism – Superconductivity: Basic phenomenology – Meissner effect – Type 1 and Type 2 superconductors – BCS pairing mechanism.

Unit 8: Nuclear and Particle Physics

Basic nuclear properties – Size, shape, charge distribution, spin and parity - binding energy - empirical mass formula - liquid drop model – Nuclear forces – Elements of two-body problem – Charge independence and charge symmetry of nuclear forces – Evidence of nuclear shell structure – Single particle shell model – Its validity and limitations – Collective model – Interactions of charged particles and e. m. rays with matter – Basic principles of particle detectors – Ionization chamber – Proportional counter – GM counter – Scintillation and semiconductor detectors – Radioactive decays: Basic theoretical understanding - Nuclear reactions – Elementary ideas of reaction mechanism – Compound nucleus and direct reactions – Elementary ideas of fission and fusion – Particle Physics: Symmetries and Conservation laws – Classification of fundamental forces and elementary particles – Iso-spin – Strangeness – Gell-Mann Nishijima formula – Quark model – C. P. T invariance in different interactions – Parity nonconservation in weak interaction.

Unit – 9 Electronics

Physics of p-n junction – Diode as a circuit element – Clipping – Clamping – Rectification – Zener regulated power supply – Transistor as a circuit element – CC, CB and CE configuration – Transistor as a switch, OR, AND, NOT gates – Feedback amplifiers – Operational amplifier and its applications - Inverting, non-inverting amplifier – Adder – Subtractor – Integrator - Differentiator – Waveform generator – Comparator – Schmidt trigger – Digital integrated circuits – NAND and NOR gates as building blocks – X - OR gate – Simple combinational circuits – Half and full adder – Flip-flop – Shift register – Counters – Basic principles of A/D and D/A converters – Simple applications of A/D and D/A converters – Microprocessor 8085: Architecture – Addressing modes – Instruction sets – Simple programming.

Unit - 10 Experimental Physics

Measurement of fundamental constants: e, h, c – Measurement of high and low resistances, L and C – Detection of X – rays, gamma rays, charged particles, neutrons etc – Ionization chamber - proportional counter – GM counter – Scintillation detectors – Solid state detectors – Emission and absorption spectroscopy – Measurement of magnetic field – Hall effect – Magnetoresistance – X – ray and neutron diffraction – Vacuum techniques – Basic idea of conductance – Pumping speed etc – Pumps: Mechanical pump – Diffusion pump – Gauges: Thermocouple – Penning – Pirani – Hot cathode – Low temperature: Cooling a sample over a range upto 4 K and measurement of temperature – Error analysis and hypothesis testing – Propagation of errors – Plotting of graph - Distributions - Least squares fitting - Criteria for goodness of fits – Chi square test.

CHEMISTRY**Unit-1**

Analytical Chemistry: Classification of analytical Methods – classical and instrumental. Errors and Evaluation: Definition of terms in mean and median – Types of errors, propagation of errors, accuracy and precision, least squares analysis, average standard deviation.

Analytical techniques: Principle and applications of adsorption, partition, ion exchange and solvent extraction chromatographic methods – TLC, HPLC and GC. Applications of atomic, molecular and emission spectroscopy in quantitative analysis. Electroanalytical techniques – cyclic and stripping voltametry, polarography, TGA, DTA and DSC. Light scattering techniques including nepelometry and Raman spectroscopy.

Unit-2

Structure and Bonding: Atomic orbitals – Types of chemical Bonds (weak and strong) intermolecular forces – Theories of bonding (VB and MO)- Concept of hybridization – shapes of polyatomic molecules – VSEPR theory – Structure of simple ionic and covalent compounds – lattice energy – crystal defects – Insulators and semiconductors, superconductors, Band theory of solids – Solid state reactions.

Acids and Bases: Bronsted and Lewis acids and bases, pH and pKa, acid – base concept in nonaqueous media, HSAB concept, Buffer solution.

Redox Reactions: Oxidation numbers, Redox potential, electrochemical series, Redox indicators. Chemical principles involved in extractions and purification of Iron, Copper, Lead, Zinc and Aluminium.

Unit-3

Nuclear Chemistry: Radioactive decay and equilibrium, Nuclear reactions: Q value, cross sections, types of reactions, Nuclear transmutations, fission and fusion Radioactive techniques- tracer technique, neutron activation analysis. G.M, Ionization and proportional counters. Radiolysis of water – G value, dosimeters and Hydrated electron.

Chemistry of Non-transition elements: General properties and structure of their halides and oxides, Polymorphism of carbon, phosphorus and sulphur. Synthesis, properties and structure of boranes, carboranes and metallo carboranes – Wade's rule – preparation, properties and structure of borazines & phosphazenes.

Sulphur- nitrogen compounds- Oxides and oxyacids of nitrogen, phosphorous, sulphur and halogens. Interhalogen and noble gas compounds. Isopoly and heteropoly acids and salts.

Unit-4

Chemistry of Transition elements: Co-ordination Chemistry of transition metal ions – Werner's theory – nomenclature and stereo chemistry of co-ordination compounds – stability constants and their determinations – CFT, splitting of d orbitals, CFSE, Jahn Teller effect, charge transfer spectra – spectrochemical series – Term states for dⁿ ions, Orgel and Tanabe – Sugano diagram, calculation of D_q, B and b parameters.

Inorganic reaction mechanism: Inert and labile complexes – substitution reactions – trans effect – redox and electron transfer reactions. Photochemistry of chromium, ruthenium and cobalt complexes, Chemistry of lanthanides and actinides. Metal carbonyls and metal clusters, Organometallic reagents in organic synthesis - Catalytic reactions – (hydrogenation, hydroformylation, isomerization and polymerization) pi-acid metal complexes.

Bio-inorganic Chemistry: Metal ions in Biology, Photosynthesis, PSL, PSH, Nitrogen fixation, Oxygen transport and storage, Hemeproteins haemoglobin, cytochrome and ferredoxins.

Spectroscopy: Applications of nmr, nqr and esr to inorganic compounds.

Unit-5

Chirality. Differentiation of asymmetric and dissymmetric molecules. Identification of prochiral carbons, enantio and diastereotopic hydrogens in a molecule. Stereochemistry of disubstituted four, five and six membered saturated alicyclic molecules. Conformational analysis of mono and disubstituted cyclohexanes and piperidines. E-Z nomenclature for isomeric olefins. Stereochemistry of aliphatic nucleophilic substitutions in acyclic and bicyclic systems. Stereochemistry (specific or selective) of dihydroxylations, halogen addition, hydroborations and Diels Alder reaction of suitably substituted olefinic double bonds. Sterospecific E-2 eliminations in erythro-threo isomers. Reduction of ring substituted cyclohexanones to cyclohexanols.

Unit-6

Mechanism of SN-1, reactions in substrates with various types of NGP. Methods of generation and mechanisms of reactions proceeding via carbenes and nitrenes. Concerted reactions: Mechanism of electrocyclic and chelotropic reactions and sigmatropic rearrangements. Photochemical reactions: Mechanisms of Norrish-I and II types, Paterno Buchi and Barton reactions, di-δ-methane rearrangements. Rearrangements: Mechanisms of rearrangements proceeding via carbonium ions (Wagner Meerwin pinacol – pinacolone and Demjanov type) and electrophilic heteroatoms (Baeyer Villiger and Curtius type).

Mechanism of nucleophilic substitution in activated aryl halides. Regiochemistry of aryne generation and subsequent additions of o, m and p – substituted aryl halides.

Unit-7

Organic synthesis: Synthesis of any di and trisubstituted benzene derivatives from any mono substituted benzene or benzene itself. Synthesis of simple compounds using C-C bond forming reactions involving Wittig, Wittig Honner, Gilman Reagents, organolithiums, Grignards, Robinson annulation, Dickmann condensation, Knoevenagel, Mannich, Stork enamine, and Vilsmeier reactions and Umpolung. (1,3 – dithiane). Synthetic transformations involving Swern oxidation, Birch Wolf Kishner and metal hydride reductions, catalytic hydrogenations and reagents like tributyltin hydride, trimethylsilyl iodide, LDA, n-BuLi, Raney nickel, NBS Chromium reagents, DCC and Pd. Application of protective group concept (aldehydes, ketones and carboxylic acids) during multistep synthesis. Spectral identification of organic intermediates by IR (functional group) PMR and CMR and mass spectra. (simple molecules only).

Unit-8

Numbering and synthesis of unsubstituted (parent) and alkyl, aryl or acyl (wherever methods are available) substituted furans, pyrroles, thiophene, quinoline, isoquinoline and indoles. Reactivity of these compounds towards electrophiles or nucleophiles. A study of other non benzenoid aromatics (ferrocenes, azulenes, annulenes and fulvenes)

Unit-9

Quantum Chemistry: Planck's quantum theory, Compton effect, wave particle duality, uncertainty principle, operators: linear and Hermitian, Schrodinger wave equation, postulates of quantum mechanics. Application of Schrodinger equation to particle in a box, harmonic oscillator, rigid rotator and hydrogen atom. Angular momentum: commutation relation, spin orbit interaction Approximation methods : variation theorem, application of variation method to harmonic oscillator, hydrogen and helium atoms. Perturbation theory – application to helium atom. Born – Oppenheimer approximations : LCAO – MO and VB treatments of H₂ molecule. Huckel theory: application to ethylene, butadiene and benzene. Calculation of electron density and bond order. Semi empirical methods : Slater orbital and HF-SCF methods.

Macromolecules: Techniques, mechanism and kinetics of polymerisation, Kinetics of copolymerisation – Molecular weights and their determination. Properties of polymers: glass transition temp. crystallinity of polymers – polymer processing techniques.

Unit-10

Chemical Kinetics: Theories of reaction rate, collision theory, ARRT, comparison – potential energy surfaces – treatment of unimolecular reaction.

Complex reactions : simultaneous, parallel and consecutive reactions. Chain reactions : H_2-Cl_2 , H_2-Br_2 reactions, branching reaction – explosion limit.

Reactions in solution : factors determining reaction rate in solution, dielectric constant and ionic strength, Kinetic isotopic effect, Linear free energy relations, Hammett and Taft equations.

Homogenous Catalysis: acid base catalysis, enzyme catalysis Heterogeneous catalysis: Adsorption, Langmuir and BET adsorption isotherms – mechanism of heterogeneous catalysis.

Thermodynamics: First and second Laws of thermodynamics – relation between c_p and c_v in terms of coefficients of expansion and compressibility. Maxwell relations – partial molar properties – Gibbs' Duhem equation – variation of chemical potential with temperature and pressure – fugacity – Third law and calculation of entropy.

Statistical thermodynamics: Maxwell Boltzmann, Bose-Einstein and Fermi-Dirac distribution – Partition function, translational, rotational and vibrational partition function, calculation of thermodynamic functions, equilibrium constant and heat capacity from partition functions. Einstein and Debye theories of heat capacity of solids., concept of negative absolute temperature.

Nonequilibrium, thermodynamics: Phenomenological laws – Onsagers' reciprocity relation – application to Diffusion potential, electrokinetic phenomena – entropy production.

Unit-11

Group theory: Symmetry elements and symmetry operations, point groups, reducible and irreducible representations – Direct product representation. Orthogonality theorem and its consequences – construction of Character Table (C_{2v} , C_{3v} and C_{2h}) Applications: Selection rules for IR, Raman and electronic spectra. Determining Symmetries of normal vibrational modes of non linear molecules, construction of hybrid orbitals, application to electronic spectra of ethylene and formaldehyde.

Spectroscopy: Rotational Spectra of rigid and non-rigid diatomic rotors, simple polyatomic molecules.

Vibrational Spectra: harmonic and anharmonic oscillator, overtones, Fermi resonance – Raman Spectra. Vibration – rotation Spectra – PQR branches, parallel and perpendicular vibrations.

Electronic Spectroscopy: Spectra of diatomic molecules – Frank condon principle – Morse function. Polyatomic molecules, types of transition, solvent effects.

Spin resonance Spectroscopy: NMR: Origin of nmr signal, Chemical Shift, factors affecting chemical shift and spin spin coupling. NMR Spectra of simple AX and ABX type molecules. ^{13}C and ^{19}F nmr.

ESR: Origin, g-factor, hyperfine structure – Mc Connel equations, Theory and simple applications of Mossbauer and Photoelectron Spectroscopy.

Unit-12

Electrochemistry: Ion-solvent interaction – Born treatment – solvation number and its determination. Ion-ion interaction: activity co-efficient, Debye-Huckel equation for activity coeff – limitations and extension to concentrated solutions. Ion transport: Debye Huckel Orsager equation for conductance – experimental validity. Ion association: its effect on conductance and activity coefficient.

Electrode-electrolyte interface: Structure of double layer – electrode kinetics – overvoltage, Butler – Volmer equation for one electron transfer. Corrosion and Stability of metals: construction and use of Pourbaix and Evans' diagram – Prevention of corrosion, Primary and Secondary cells – various fuel cells.

Photochemistry: Photophysical processes – Theory of radiationless transition – fluorescence, phosphorescence, fluorescence quenching – Stern-Volmer equation, excimer, exciplexes, Quantum yield measurement, Kinetics of Photochemical reac.

BOTANY**Unit I: Plant diversity 1**

Algae – General account and classification – structure – reproduction – life history – salient features of major classes (Prochlorophyta, Chlorophyta, Xanthophyta, Bacillariophyta, Phaeophyta, Rhodophyta) – economic importance.

Fungi – General account and classification – structure – reproduction – life histories – General characters of major classes – economic importance.

Bacteria – classification – General account – Ultrastructure – Reproduction – economic importance

Viruses – General properties – multiplication – purification – infection – replication – classification of plant viruses.

Lichens – Habit and Habitat – Classification – vegetative and sexual reproduction and economic importance.

Unit 2: Plant diversity 2

Bryophytes – General features – structural organization, of gametophytes, Origin and evolution of sporophytes – reproduction (including \ vegetative) – economic importance.

Pteridophytes – General features and classification – structure of gametophytes and sporophytes – stelar evolution – reproduction and life history – soral and sporangial evolution – heterospory and seed habit – economic importance. Gymnosperms – General characters and classification – structure – anatomy – reproduction – life history – economic importance.

Palaeobotany: Geological time scale – types of fossils and fossilization – economic importance of fossils.

Unit 3: Taxonomy of Angiosperms

Historical account – systems of classification (Bentham and Hooker, Hutchinson and Takhtajan) – Modern tools of classification (numerical taxonomy, chemotaxonomy, Biosystematics and Cytotaxonomy) – ICBN – importance and principles of nomenclature – familiarity with botanical literature – general account of the following families: (1) Ranunculaceae, (2) Menispermaceae, (3) Rhamnaceae, (4) Vitaceae, (5) Sapindaceae, (6) Onagraceae, (7) Sapotaceae, (8) Gentianaceae, (9) Boraginaceae, (10) Polygonaceae, (11) Loranthaceae, (12) Casuarinaceae, (13) Orchidaceae, (14) Amaryllidaceae, (15) Poaceae.

Economic Botany – cultivation and utilization of food crops, spices, condiment and commercial crops.

Evolutionary Biology – Origin of life – biological diversity and concepts of evolution – modern synthetic theories of evolution – speciation.

Unit 4: Angiosperm Anatomy

Organization and theories regarding shoot, root and reproductive Meristems – structure of cell wall – Vascular cambium – cambial activity – Xylem – phloem – nodal anatomy – leaf anatomy.

Embryology: Microsporogenesis – pollen- stigma compatibility – megasporogenesis – female gametophyte – nutrition of embryosac – endosperm types – polyembryony – apomixes, agamospermy, apospory and parthenogenesis.

Developmental Botany: Definition – theories – morphogenetic factors – morphogenetic dynamics and processes – molecular basis of morphogenesis – cytosol – cytoskeleton – classical concepts of flower.

Unit 5: Environmental Botany

Ecosystem – concepts – types – dynamics – energy flow – biogeocycles – major types of biomes – autecology – synecology – ecological succession – Environmental pollution (air, water, soil, noise) – effects and control measures – green house effect – conservation *in situ* (afforestation, social forestry, agroforestry, botanical gardens, biosphere reserves, National parks, sanctuaries, sacred groves) *ex situ* (cryopreservation, gene banks, seed banks, pollen banks, DNA banks, tissue cultural and biotechnological strategies).

Phytogeography : Principles and importance of plant geography - patterns of distribution - continuous and discontinuous distribution - endemism - continental drift, - remote sensing and its application

Unit 6: Cell Biology

Microscopy - basic techniques in Cell biology - Structural Organization of plant cell - cell wall, plasma membrane - plastids - mitochondria - ribosomes - endoplasmic reticulum - Golgi apparatus - Lysosomes - Glyoxysomes and peroxisomes - nucleus - nucleolus - cell division - cell cycle - chromosomes (types, numerical and structural changes)

Genetics : Basic account on Mendelian genetics and gene interactions - linkage and crossing over - gene mapping - sex linkage - cytoplasmic inheritance - polyploidy - mutation (causative agents, induction, types, inheritance of mutation) - population genetics - Hardy - Weinberg Law.

Plant Breeding : Breeding methods in self and cross pollinated crops - vegetative propagated and apomictic plants - heterosis and inbreeding depression - mutation breeding.

Biostatistics : Analysis of quantitative characters on the basis of mean, standard deviation and standard error - Tests of significance - Chi-square test for goodness of fit - "t" test - 'F' test.

Unit 7: Molecular Biology

An overview of molecular biology - Nucleic acids-DNA (A,B and Z forms) and RNA structure - DNA denaturation and renaturation - DNA replication - enzymology - DNA polymerase - termination of DNA replication - transcription - translation - gene regulation - recombinant DNA and genetic engineering - plasmids - Vector - Insertion of DNA - genomic library - production of gene products from cloned genes - application of genetic engineering - RFLP - RAPD - AFLP and PCR - DNA finger printing - basic systems of gene transfer techniques - Ti and Ri plasmids - genetic transformation - conjugation - electroporation - microinjection and microprojectile method.

Unit 8: Plant Biotechnology

Concepts and scope of biotechnology - microbial fermentation - plant cell culture and production of secondary metabolites - biotransformations - cryopreservation - Application of plant tissue culture in agriculture and forestry - biotechnology and transgenics - methodology to develop transgenics - herbicide resistance- resistance against pest and insects - *Bacillus thuringiensis* endotoxins - resistance against pathogens - production of biofertilizers - *Rhizobium* - nitrogen fixation - "nif" genes - mycorrhizae - phosphate solubilizing bacteria

Biotechnology and intellectual property : Intellectual property

rights (IPR) - PGR - GATT and Trade related intellectual property (TRIP) - patenting of biological material.

Unit 9: Plant Biochemistry

Carbohydrates : classification - structures of mono, di, oligo and polysaccharides - stereoisomer

Amino acids and proteins : Structure, characteristics and classification of amino acids, proteins and non protein amino acids - amino acid biosynthesis - peptide bond and polypeptide chain - primary, secondary, tertiary and quaternary structure of proteins. Enzymes : General aspects (classification and structure) - allosteric mechanism - regulatory and active sites - isozymes - kinetics - enzymatic catalysis - Michaelis-Menton equation and its significance. Lipids : classification and structure - biosynthesis of fatty acids - saturated and unsaturated fatty acids - oxidation of fatty acids. Nucleic acids : Composition of nucleic acids and synthesis of nucleotides. Biophysics: Bioenergetics - law of thermodynamics - Redox potential - Redox coupling - ATP bioenergetics - entropy and enthalpy. Photobiology : Dual nature of light characteristics of solar radiation - solar energy - efficiency of atoms - absorption spectra in molecules - energy stator - de-excitation.

Unit 10: Plant Physiology

Plant-water relations : water transport processes, diffusion-osmosis-water potential - chemical potential - absorption of water - water transport through tracheids and Xylem - transpiration and its significance- factors affecting transpiration - mechanism of stomatal movement - water stress on crop production.

Mineral nutrition: Nutrient uptake and transport mechanism - role of cell membrane - ion pump and carriers - salt stress on crop production.

Photosynthesis : ultrastructure of photosynthetic apparatus - photochemical reactions - electron transport pathway of chloroplast membranes - protophosphorylation - CA carbon cycle

Respiration : Glycolysis - TCA cycle - electron transport in mitochondria - Oxidative phosphorylation - pentose phosphate - Nitrogen metabolism : Biological nitrogen fixation - reduction of N_2 to ammonia - 'nif'genes - regulation of Nitrate reductase - ammonium assimilation.

Growth and development : Plant growth regulators - auxins - cytokinins, gibberellins, abscisic acid - ethylene. Physiology of flowering - physiology of seed dormancy and seed germination - senescence and fruit ripening.

ZOOLOGY**Unit 1:**

Broad classification of Animal Kingdom – Principles of taxonomy – Functional morphology of non-chordates, larval forms, origin and evolution of metazoan-theories; Structural peculiarities and affinities of minor phyla (Nemertinea, Gastrotricha, Rotifera, Kinorhynca, Nematomorpha, Acanthocephala, Pogonophora, Sipunculoidea, Echinoidea, Priapulida, Tardigrada, Pentastomida, Entoprocta, Phoronida, Ectoprocta, Brachiopoda and Lophophorates).

Unit 2:

Classification and comparative anatomy of Prochordates and Chordates- Origin and evolution of major classes of Chordata – Geologic time scale vertebrate fossils – evolution of man and horse. Origin of life – Theories of evolution – Mechanisms of speciation – Hardy-Weinberg law and genetic equilibrium.

Unit 3:

Important human and veterinary parasites (Protozoan and Helminths): Life cycle and biology of *Plasmodium*, *Leishmania*, *Entamoeba*, *Fasciola*, *Taenia*, *Schistosoma*, *Ascaris*, *Ancylostoma*, *Wuchereria bancrofti* (filarial worm), cellular and physiological basis of host-parasite interaction; Invertebrate vectors of human diseases (biological and mechanical vectors). Modes of transmission and pathogens. Vector control: Chemical and biological control methods. Insect pest management: Useful and harmful insects – silk worm, honey bees, lac insects, bed bug, mosquito.

Unit 4:

Physiological processes: Nutrition, digestion, respiration, circulation (types of hearts, physiology of cardiac muscle, heart beat and regulation, composition of blood, coagulation and functions). Osmoregulation, Theories and mechanism of muscular contraction, Nerve impulse transmission, reflex action, conditioned reflex, Chemical co-ordination, Sense organs, Excretion and Reproduction, parental care; Circadian rhythm, lunar periodicity and Bioluminescence.

Unit 5:

Gametogenesis: Molecular events during gametogenesis, fertilization, cleavage patterns and fate maps. Gastrulation and morphogenetic movement of cells. Early development of Echinoderms, Amphibians and Birds. Cell differentiation and differential gene activity. Organogenesis – Differentiation and development of heart, kidney. Stem cells: Characteristics, source, multipotent and totipotent cells, biomedical implications.

Unit 6:

Types of Ecosystem – Concept of habitat ecology and ecological niches. Natural and man made ecosystems. Energy flow, Trophic structure, Food chain and Food web, biogeochemical cycles, C, N, P, H₂O (hydrologic cycle) and S cycle. Renewable and non-renewable sources of energy. Conventional and non-conventional energy sources. Environmental pollution and its ecological effects.

Unit 7:

Structure and functions of cell and cell organelles: Plasma membrane- Composition, ultra- structure, theories of plasma membrane, membrane transport. Cell adhesion, cell-cell communication. Mitochondria, Golgi complex, Lysosomes, SER and RER, peroxysomes, Glyoxisomes, Chloroplasts and Ribosomes: Ultrastructure and functions. Cell-cycle. Nucleocytoplasmic interactions. Cell fusion technique- preparation of cytoplasm and karyoplast. Mitotic and meiotic cell divisions. – Mitotic apparatus and chromosome movements. Cancer cells - Characteristics and theories of Carcinogenesis.

Unit 8:

Principles of Mendelian inheritance; Chromosomes- structure and functions; Linkage and crossing over, gene mapping, extra chromosomal inheritance. Human genetics. Normal human karyotype – Variations in karyotypes. Syndromes in Man. Principles and methods of pedigree analysis. Genetic counseling: objectives, ethics and principles. Mutation – types and genetic disorders. Radiation genetics. Mutagens and mutagenesis – genetic changes in neoplasia in man.

Unit 9:

Molecular structure of DNA and RNA – replication – identification of DNA and RNA as genetic material – Microbial genetics: conjugation, transformation, transduction and sexduction; Chemistry of DNA – polymorphism and DNA repair mechanisms; chemistry of RNA – different types of RNA and their functions. Information transfer in prokaryotes and eukaryotes (transcription, promoters, initiators and terminators, introns and exons). Regulation of gene action – Operon concepts – Gal and Lac Operon systems.

Unit 10:

Immune systems: Cells, tissues and organs of immune systems; lymphatic system; Antigens: types and classes; Antibodies: structure and biological functions; Complement system and its activation pathways; Lymphocytes: development, differentiation and cellular traffic; Immune responses against bacteria, virus, toxins and parasites; Transplantation immunity; Vaccines: principles and types.

Unit 11:

A) Biomolecules: Amino acids – structures, classification and functions. Proteins – structure and classification. Enzymes – general properties, classification and nomenclature; enzyme kinetics – K_m and V_{max} – factors affecting enzyme kinetics. Carbohydrates – structure, classification and metabolic pathways (glucogenolysis, glycogenesis, glycolysis, Embden-Meyerhof and Parnas pathway, HMP shunt); Lipids – structure and classification, biosynthesis and oxidation of fatty acids.

B) Thermodynamics and photobiophysics: Laws of thermodynamics, concepts of free energy and entropy; Diffusion – Fick's law, Osmotic gradient, Osmotic co-efficient, Gibb's-Donnan equilibrium; Radiation – types and effects of radiation on macromolecules; biophysical aspects of vision, muscle contraction and nerve co-ordination.

Unit 12:

A) Principles and applications, of microscopy: Bright-field, Phase contrast, Fluorescence and Transmission Electron microscopes. Chromatography- Paper, gel matrices (Gel filtration, ion-exchange and affinity) and Thin layer chromatography.

B) Principles and methods of Statistical analyses in biological research: Collection, classification and presentation of data; Measures of central tendency – mean, median, mode; Measures of dispersion - variance, standard deviation, standard error, co-efficient of variation. Probability and distribution (normal, binomial and poisson). Test of significance - Student *t*-test, ANOVA, correlation and regression analyses.

HISTORY**Unit 1:**

Sources - Archaeological sources – Exploration, excavation, epigraphy, numismatics, monuments - Literary Sources – Indigenous and Foreign Accounts. Greek, Chinese and Arab Writers.

Pre - history and Proto - history – Paleolithic and Mesolithic, Neolithic and Chalcolithic – Indus Valley civilization, origin, date, extent, characteristics and decline.

Unit 2:

Vedic culture. Early and Late – Social and Political Institutions – Economic conditions – Religious and Philosophical Ideas – Mahajanapadas – Republics – Economic growth – Rise of urban centres – Trade Routes – Emergence of Jainism and Buddhism – Rise of Magada and Nandas – Macedonian Invasions and their impact.

Unit 3:

Foundation of the Mauryan Empire – Chandra Gupta – Kautilya and Arthashastra, Asoka and his Dhamma – Mauryan Administration – Economy, Art and Architecture – External Contacts – Disintegration of the Empire.

Sangam Age – Sungas, Satavahanas and Kushanas: Administration, religion, society, economy, trade and commerce, culture – Art and architecture, Literature.

Unit 4:

Guptas and Vakatakas – Harsha – Administration – Economic condition – Coinage of the Guptas – Caste system – Position of Women – Educational Institutions, Nalanda, Vikramasila and Vallabhi – Contact with neighbouring states – Sanskrit Literature – Scientific literature – Art and architecture.

The Kadambas, Gangas, Pallavas and Chalukyas of Badami – Administration – Trade guilds - growth of Vaishnava and Saiva religions – Tamil Bhakthi Movements – Institutions of Temple and temple architecture.

Unit 5:

A brief survey of the history of the Palas and Senas, Rashtrakutas, Pratiharas, Paramarhas, Kalachuris, Gahatavalas and the Chauhans, Chalukyas of Gujarat – Arab conquest, Ghaznavi conquest, Alberuni.

The Chalukyas of Kalyani, Cholas, Cheras, Hoysalas, Pandyas – Administration and local government, growth of art and architecture, religious sects, Institution of temple and Mathas, Agraharas, education and literature, economy and society, conquest of Sri Lanka and South East Asia.

Unit 6:

Expansion and consolidation – The Ghorids, The Turks, The Khaljis, The Tughlaqs, The Sayyids and the Lodis, Vijayanagar and Bahmini kingdoms – State and Religion – Concept of sovereignty – Religious movements and Sufism – Economic Aspect – urban centres, Industries, Trade and Commerce, Land Revenue and Prices.

Mongol problem and its impact – Administrative structure – Art, Architecture and Literature.

Sources – Archaeological, Persian and non-Persian literatures, Foreign travellers' accounts.

Unit 7:

Sources of Mughal period. Mughal Expansion and consolidation – Babur's establishment of Mughal rule in India: Humayun and Surs – Akbar, Jahangir, Shahjahan and Aurangzeb. Mughal relations with the nobility and the Rajputs.

Jahangir – the period of stability and expansion 1611-1621; the period of crisis 1622-1627 – The Nurjahan Junta.

Administration: Sher Shah's administrative reforms, Mughal administration, land revenue and other sources of income, Mansabdari and Jagirdari.

Unit 8:

Decline of Mughal Empire: Political, administrative and economic causes. Later Mughals – The Maratha movement, the foundation of Swaraj by Shivaji: its expansion under the Peshwas; Maratha Confederacy – causes of decline.

Socio – economic and cultural life under the Mughals – village society and economy, Art, architecture and literature – Trade and Commerce – Religious policy from Akbar to Aurangzeb – Urban centres and Industries – currency – Position of Women.

Unit 9:

Rise of European powers – Expansion and consolidation of the British rule British relations with major Indian powers – Bengal, Oudh, Hyderabad, Mysore, Marathas and Sikhs.

Administration under the East India company and crown. Paramountcy, Civil Service, Judiciary, Police and Army - Local Self – Government, Constitutional Development from 1909 to 1935.

Unit 10:

Agrarian policy of the British, Land Revenue, Agriculture and Land Rights, Famine policy, Rural indebtedness. Policy towards trade and Industries, condition of Labour, Trade Union Movements- Factory Legislation – Banking – Transport – Drain Theory.

Indian Society in transition – Christian missions – Socio – religious reform movements – Status of women - New Educational Policy – English language, Modern Sciences, Journalism, Indian languages and literature.

Unit 11:

Rise of Nationalism – Revolt of 1857, Tribal and Peasant Movements – Ideologies and Programmes of Indian National Congress, Swadeshi Movement, Indian Revolutionary Movement in India and abroad.

Gandhian Mass Movements, Ideologies and Programmes of the Justice Party: Left wing politics – Movement of the depressed classes - Genesis of Pakistan – India towards Independence, and Partition.

Unit 12:

India after Independence, Rehabilitation after partition, Integration of Indian States, the Kashmir Question.

Making of the Indian Constitution, Structure of Bureaucracy and the Police – Economic policies and the Planning process – Linguistic reorganisation of the States – Foreign policy initiatives.

Unit 13:

World History – Concepts, Ideas and Terms – Athenian Democracy, Aristocracy, Feudalism, Humanism – Divine Right – Nation States – Renaissance, Reformation – Enlightenment – Rights of Man – Apartheid – Imperialism, Socialism – Nazism and Facizm – Parliamentary Democracy – Commonwealth – Efforts of World peace – Cold War – Post-modernism.

Unit 14:

Research in History – Scope and Importance of History – Objectivity and Bias in History – Causation in History – History and its auxiliary sciences – Significance of Regional History – Recent trends of Indian History.

Unit 15:

Research Methodology – Area of Proposed Research – Sources – Primary / Secondary in the proposed area of Research – Recent Historical writings in the proposed area of Research – Some Important Historians – D.D. Kosambi – V.A.Smith – R.C.Majumdar - J.N.Sarkar – K.A.Nilakanta Sastri – R. Sathianathaier –K.K.Pillai – Ranajit Guha.

GEOGRAPHY**Unit 1: Geomorphology**

Fundamental concepts - endogenetic and exogenetic forces - denudation processes: weathering and erosion - continental drift and plate tectonics - concept of geomorphic cycles – landforms associated with fluvial, glacial, arid, coastal and karst cycles.

Unit 2: Climatology

Composition and structure of the atmosphere – insolation - heat budget of the Earth - distribution of temperature - atmospheric pressure and general circulation of winds - monsoon - jet stream - air masses – tropical and temperate cyclones – types of precipitation – classification of world climates – Koppen's and Thornthwaite's schemes.

Unit 3: Oceanography

Bottom relief of Atlantic, Indian and Pacific Oceans – temperature and salinity of the oceans – density of sea water – tides and ocean currents - coral reefs - ocean deposits – sea level changes – ocean resources.

Unit 4: Biogeography

World distribution of plants and animals – forms and functions of ecosystems – biodiversity and its depletion – conservation and management of ecosystems – environmental hazards and problems of pollution – global warming.

Unit 5: Geographic Thought

General character of geographic knowledge during the ancient and medieval periods – foundations of modern geography – determinism and possibilism - aerial differentiation and spatial organization – quantitative revolution

Unit 6: Population Geography

Patterns of world distribution – growth and density of population – pattern and processes of migration – demographic transition.

Unit 7: 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 centers.

Unit 8: Economic Geography

Sectors of economy: primary, secondary, tertiary and quaternary – natural resources: renewable and non-renewable – measurement of agricultural productivity and efficiency – crop combination and diversification – Von Thunen's model – agricultural systems of the world – classification of industries – Weber's and Losch's approaches – models of transportation and transport cost – accessibility and connectivity.

Unit 9:

Political Geography: Heartland and Rimland theories – boundaries and frontiers – concept of state, nation and nation-state.

Cultural Geography: Culture-areas – cultural regions – human races – habitat economy and society of tribal groups.

Unit 10: Regional Planning

Regional concepts in Geography – concept of planning regions – types of regions – methods of regional delineation – regional hierarchy – regional planning in India – regional imbalances – fundamentals of town and country planning.

Unit 11: Geography of India

Physiography – drainage – climate – natural vegetation – soils – water resources – irrigation – agriculture – agro climatic regions – mineral and power resources – major industries and industrial regions – population distribution and growth – population problems.

Unit 12: Geography of Tamil Nadu

Physiography – drainage – climate – natural vegetation – soils – water resources – irrigation – agriculture – mineral and power resources – major industries and industrial regions – population distribution and growth.

Unit 13: Map making:

Types of maps – distribution maps – representation of weather and climatic data socio economic data - map symbolization – map design – map compilation.

Unit 14: Remote Sensing

Energy source and radiation principles – energy interaction with the atmosphere and Earth surface features - remote sensing platforms – resolutions – elements of image interpretation – remote sensing applications.

GIS: Components – data models: vector and raster data – data collection, capture and geoprocessing – analysis and display of vector and raster based point, line and area – output for spatial decisions.

Unit 15: Statistical Methods

Types of data – measures of central tendency – measures of dispersion and concentration – standard deviation – Lorenz curve – methods of measuring association among different attributes – simple and multiple correlation - regression - nearest neighbour analysis – scaling techniques: rank score – weighted score – sampling techniques for geographical analysis.\

PHYSICAL EDUCATION**Unit-I**

Meaning - definition - objectives of Physical Education. Relationship between Education and Physical Education. Growth and development - Unsynchronised growth - reciprocal innovation - athletic heart.

Unit-II

Functions of Sports Management - Levels of management - Finance management - Personnel management - Human resources and man power planning - Salaries and wages - Raising of funds - budget - accounting - records and register maintenance - Organisation of Sports meet and Tournaments - Fixtures - Physical Education professional training in Tamil Nadu. Expand: SAI - SDAT - AICS - CABPE - NIS - NCC - NDS - LNIPE - CIPE - RIPE - YMCA - IOA - IAAF.

Unit-III

Motivation: Meaning - types - techniques. Meaning of emotion - types of emotion - Stress management. Motor learning and performance. Mass versus distributed practices - Tension, frustration and depression. Traits of Sportsmen - Effect of sports participation on personality - Assessing intelligence - Testing special aptitude. Psychological skill training for superior players - autogenic training. Sports as a social institution - Relationship of sports with other social institutions - Sports participation - Career success and sports mobility - Sports and social stratification - sports and culture - Women's sports in India.

Unit-IV

Criteria of test selection - Classification of test - Physical fitness test: AAHPER youth fitness test and Rogers Physical Fitness index. Motor fitness test: Indiana Motor Fitness test and J.C.R. test. Motor ability test: Barrow Motor Ability test and McCloy's general motor ability test. Muscular strength: Rogers strength index and Kraus weber strength test. Skill tests: Johnson Basketball Ability test - McDonald Volleying Soccer test - Schmithal - French Field Hockey test - Russellange Volleyball test. Use of following equipment: Leg Dynamo meter - Grip Dynamo meter - Spiro meter - Peak flow meter - Bio monitor.

Unit-V

Classification of research: Basic, applied and action research. Formulation of hypothesis - research proposal - qualities of a good research - Tools for research - Experimental designs. Content of chapters - writing of research report. Measures of central tendency - Measures of variability. Types of statistics - Meaning of the terms: Population - sample - data - attributes - variables - parametric - non-parametric statistics. Scoring scales: Sigma scale - Z scale - T scale - Hull scale. Level of significance - degrees of freedom - properties of normal curve.

Unit-VI

Basic principles of training: Specificity - overload - reversibility. Periodical cycle: micro - meso - macro cycle - Periodisation and its types - Technique - tactics - offensive and defensive strategies. Training to develop motor components: Speed - strength - agility - cardio vascular endurance - flexibility. Circuit training - weight training - Interval training. High altitude training. Ergogenic aids - Effect of doping - drugs - alcohol - coffee - smoking on sports performance. Use of treadmill for training and research.

Unit-VII

Functions of supervision - Techniques of supervision: visitation - conference - workshop - survey - evaluation. Sources of curriculum materials: Curriculum activities - teaching method - curriculum design. Curriculum materials: Journals - dictionary - encyclopaedia - magazines. Integration of Physical Education with other sciences. Concept of movement education - Meaning of adapted physical education - adapted games for: blind - deaf - dumb - orthopaedically disabled.

Unit-VIII

Energy supply - accumulation of waste products - heat - stress - fatigue - second wind. Aerobic training: fibre composition - oxygen delivery - fuel storage. Anaerobic training: monitoring training changes. Adaptations in body build and composition with physical training. Effect of exercise on muscular - circulatory - respiratory systems. Exercise and aging: performance and aging - trainability of the older athlete. Female athlete: metabolic responses - physiological adaptations to chronic exercise.

Unit-IX

Skeletal system - Human movements and functions. Types of muscles - Role of muscles - Kinds of muscular action. Origin, insertion and action of: Trapezius - Deltoid - biceps - triceps - Pectoralis major - rectus abdominous - quadriceps group of muscles - Hamstring group of muscles. Sports biomechanics: Dynamic - kinematics - static - planes - axes - centre of gravity. Types of motion - units of force - Projectiles and equilibrium - meaning of: work - power - kinetic energy - potential energy - conservation of energy - fluid mechanics. Newton's Law of Motion - Lever function and sports performance. Movement analysis of: walking - running - throwing - catching - lifting. Analysis of techniques of games: Basketball - Cricket - Football - Hockey - Volleyball - Athletics.

Unit-X

Health objectives for the Nation - WHO. Sign - symptoms - preventions of communicable diseases. Sports nutrition: Dietary practices for team players and athletes. Nutritional aids: Importance of Carbohydrate during high load training - Need for protein and fat for superior performance - Changes of Protein and Fat metabolism during exercise - Fluid replacement before, during and after exercise. Recommended dietary allowance for players. Sports injury: safety in sports - muscle injury: partial and central muscle tear - cramp - stiffness - tendon injuries - physical rehabilitation. Exercise prescription for: heart disease - asthma - hypertension - diabetics - arthritis - obesity.

Unit-XI

Layout of standard 400 mts. track - marking of staggers for 200 mts, 400 mts, 800 mts and 1500 mts running events - Relay exchange zone marking for 4 x 100 mts and 4 x 400 mts - marking for 110 mts hurdles - Layout of sectors for: Javelin, Shot-put, Discus and hammer throw events. Equipment required for Jumping and throwing events. Duties of officials for track and field events.

Unit-XII

Dimension of playfield - duration of game - team composition - method of substitution - systems of officiating position of officials - duties of officials - equipment required for: Badminton - Ball badminton - Basketball - Cricket - Football - Handball - Hockey - Kabaddi - Kho-kho - Volleyball - Tennis.

Unit-XIII

Computer application: Input and output devices - Central Processing Unit - Memory - Sources of memory - hardware - software - working with Windows - MS Word - SPSS package - Electronic Mail - On-line searching - Internet and World Wide Web. Meaning and components of Information Technology - use of Sports Information Technology.

EDUCATION**Unit 1: Philosophical Foundation**

Idealism, Realism, Naturalism, Pragmatism, Existentialism, Rationalism, Humanism, Positivism, Vedanda, Buddhism, Jainism, Islamic traditions with special reference to the concepts of reality, knowledge and value - their educational implications. Values as enshrined in the Indian Constitution & their educational implications.

Unit 2: Sociological Foundation

Sociology and Education – Education - a Social sub-system – Education – an instrument of Social Change – Social Stratification & Social Mobility – Equalisation of Educational Opportunities in India – Constraints & Solutions – Impact of Globalisation and Liberalisation in Indian Education – Education for World Citizenship – Human Rights Education.

Unit 3: Psychological Foundation

Learning Theories – Guthrie, Hull, Lewin, Tollman, Piaget, Bruner, Gagne and Ausubel – Motivation Theories – Adler, Maslow and McGlelland – Intelligence – Theories and Measurement – Personality Measurement Techniques.

Unit 4: Educational Evaluation

Measurement – Concepts, Assumptions and Limitations – Evaluation – Formative, Summative, Illuminative, Goal-based, Goal-free – Intrinsic and Extrinsic. Tests – Norm-referenced and Criterion-referenced – Construction and Standardisation – Reliability - Split-half, Test-retest, Parallel Form and Rational Equivalence – Validity – Construct, Criterion, Predictive, Concurrent and Factorial. Norms – Standard Scores, Age Norm, Grade Norm and Percentiles.

Unit-5: Research Methodology & Statistics

Educational Research - Criteria and Sources for identification of Problem. Methods of research – Historical, Normative, Experimental, Case-study, Follow-up and Trend.

Designs – Exploratory, Explanatory, Causal – comparative and Descriptive.

Techniques – Survey, Interview, Observation and Sociometry.

Tools – Questionnaire, Inventory, Check-list, Score Card, Scale and Schedule.

Proposal – Steps and designing

Sampling – different methods

Descriptive & Inferential Statistics

Parametric and non-parametric.

Measures of Central Tendency & Dispersion.

Correlation – Rank & Product moment.

Regression, Prediction & Equations

Hypothesis Testing – t-test between Means and Percentages & Chi-square Test

Unit-6: Educational Technology

Educational Technology. - meaning and scope: Media technology, System technology, Concept technology and Artificial Intelligence.

Media Attributes – Sensory Modality, Symbol System, Design Cues & Codes, Locus of Control and Interactive Features.

Ware Approach – Hardware, Software, Useware, Heartware, Underware & Courseware.

Individualised Instruction – PLM & CAI.

Unit-7: Curriculum Development

Curriculum – Varied connotations –Foundations and Determinants

Curricular Models – Kerr, Johnson, McDonald, Zia & Taba.

Curricular Designs – Subject-centred, Learner-centred, Activity-centred, Problem-centred – Fused curriculum.

Curricular Organisation – Concentric, Spiral, Logical, Psychological, Correlated development of subjects & ABC of Curriculum.

Unit-8: Educational Planning & Administration

Management – Definition, concept, nature & universality of management. Management and Administration

Functions of Management - POSD CORB

Theories of Management – X, Y & Z

Kinds of Management – MBO, OBM, Participatory & Crisis.

Educational Planning – Nature and need.

Kinds of Planning - Institutional, Perspective, Sector & Annual

Types of Planning - Downward and Upward.

Unit-9: Guidance & Counselling

Guidance and Counselling – Concept, definitions and need.

Kinds of guidance – Personal, Familial, Academic and Vocational.

Types – Group and Individual

Importance of Aptitude test in Academic and Vocational guidance

Mental Health & Defence Mechanisms.

Unit-10: Teacher Education

Teaching – Meaning, relationship with Education and Instruction.

Teaching levels – Memory, Understanding & Reflective.

Models of teaching –Glaser and Stolurow's.

Instruction Designing - Resource unit and Lesson plan.

Teaching skills – Micro-teaching – Skill practice, link practice & macro teaching.

Flanter's Interaction Analysis & Category System.

Information Communication Technology in Teacher Education.

Unit-11: Education for Challenged

Mentally challenged – Categories and educational programmes

Visually challenged – Partial and total - Programmes

Hearing impaired – Degree of impairment and programmes

Orthopaedically crippled – Types, characteristics and programmes

Inclusive Education.

GENERAL KNOWLEDGE**Unit I: Indian History**

History of India – Vedic period 1526 AD to 1947 – Free India – Modern India

Unit II: Indian Constitution

Origin of Indian Constitution – Salient and special features – Fundamental rights - Legislature – Judiciary – Executive – Adult franchise – Human rights

Unit III: History of Tamil Nadu

Ancient period – Sangam age – Chera, Chola, Pandias – Economical, political, social conditions – Literature – Architecture – Fine arts – Geography of Tamil Nadu – Natural boundaries – Resources – Rivers and places.

Unit IV: Personalities

Books and authors – Discoveries

Unit V: Sports & Games

(confined to India)

Unit VI: Abbreviations**Unit VII: Every Day Science****Unit VIII: Current Affairs**

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