



## **ANDHRA PRADESH STATE COUNCIL OF HIGHER EDUCATION**

(A Statutory body of the Government of Andhra Pradesh)

3<sup>rd</sup>, 4<sup>th</sup> and 5<sup>th</sup> floors, Neeladri Towers, Sri Ram Nagar, 6<sup>th</sup> Battalion Road,  
Atmakur (V), Mangalagiri (M), Guntur-522 503, Andhra Pradesh  
**Web:** [www.apsche.org](http://www.apsche.org) **Email:** [acapsche@gmail.com](mailto:acapsche@gmail.com)

**REVISED SYLLABUS OF ENGLISH under (Part – I)  
UNDER CBCS FRAMEWORK WITH EFFECT FROM 2020-21**

**PROGRAMME: THREE-YEAR B.A. /B.Sc./B.Com/BCA/BBM/BHM & CT, etc.**

**Andhra Pradesh State Council of Higher Education, Mangalagiri,  
Guntur District**

**Revised English Syllabus from 2020-21 Onwards  
Under Choice Based Credit System**

**Introduction**

The turn of the twenty first century has made the English Language skills a passport to the job market to all job seekers. Ability to communicate well in English has become a hallmark of good educational foundation and a prerequisite for all graduates. The students are expected to possess a measurable knowledge and a set of skills in using English language in personal and professional life. The present course **English Praxis** in three parts offers suitable context to teach, learn and practise target language skills. Each part of the course aims at certain specified skills which are taught through various text-based classroom activities and the English Language Laboratory activities. The syllabus of the course offers an open platform to the teacher to facilitate active participatory learning to the students. Hence the whole course is offered in three semesters. The first part of the course offers fundamentals of the English language in five units: Listening, Speaking, Grammar, Writing and Soft Skills. These introductory units are developed into full length courses in the subsequent semesters in addition to Reading Skills so as to prepare the learner into a fully equipped individual.

In addition to the classroom interaction, the course also aims at language enhancement through various ICT based online and offline activities in the English Language Laboratory. Each Unit is reinforced with Laboratory activities. The College administration will bestow special attention to make the **English Praxis** course an activity oriented one. The innovative methods and creativity of the English faculty will enhance the learners' participation in teaching and learning.

**Semester-I** English Praxis Course-I : **A Course in Communication and Soft Skills**

**Semester-II** English Praxis Course -II : **A Course in Reading & Writing Skills**

**Semester-III** English Praxis Course -III: **A Course in Conversational Skills**

# English Syllabus-Semester-I

## English Praxis Course-I

### A Course in Communication and Soft Skills

#### Learning Outcomes

*By the end of the course the learner will be able to :*

- Use grammar effectively in writing and speaking.
- Demonstrate the use of good vocabulary
- Demonstrate an understating of writing skills
- Acquire ability to use Soft Skills in professional and daily life.
- Confidently use the tools of communication skills

#### **I. UNIT: Listening Skills**

- i. Importance of Listening
- ii. Types of Listening
- iii. Barriers to Listening
- iv. Effective Listening

#### **II. UNIT: Speaking Skills**

- a. Sounds of English: Vowels and Consonants
- b. Word Accent
- c. Intonation

#### **III. UNIT: Grammar**

- a) Concord
- b) Modals
- c) Tenses (Present/Past/Future)
- d) Articles
- e) Prepositions
- f) Question Tags
- g) Sentence Transformation (Voice, Reported Speech & Degrees of Comparison)
- h) Error Correction

#### **IV. UNIT: Writing**

- i. Punctuation
- ii. Spelling
- iii. Paragraph Writing

#### **V. UNIT: Soft Skills**

- a. SWOC
- b. Attitude
- c. Emotional Intelligence
- d. Telephone Etiquette
- e. Interpersonal Skills

# English Syllabus-Semester-II

## English Praxis Course-II

### A Course in Reading & Writing Skills

#### Learning Outcomes

*By the end of the course the learner will be able to :*

- Use reading skills effectively
- Comprehend different texts
- Interpret different types of texts
- Analyse what is being read
- Build up a repository of active vocabulary
- Use good writing strategies
- Write well for any purpose
- Improve writing skills independently for future needs

#### I. UNIT

<b>Prose</b>	: 1. How to Avoid Foolish Opinions	Bertrand Russell
<b>Skills</b>	: 2. Vocabulary: Conversion of Words	
	: 3. One Word Substitutes	
	: 4. Collocations	

#### II. UNIT

<b>Prose</b>	: 1. The Doll's House	Katherine Mansfield
<b>Poetry</b>	: 2. Ode to the West Wind	P B Shelley
<b>Non-Detailed Text</b>	: 3. Florence Nightingale	Abrar Mohsin
<b>Skills</b>	: 4. Skimming and Scanning	

#### III. UNIT

<b>Prose</b>	: 1. The Night Train at Deoli	Ruskin Bond
<b>Poetry</b>	: 2. Upagupta	Rabindranath Tagore
<b>Skills</b>	: 3. Reading Comprehension	
	: 4. Note Making/Taking	

#### IV. UNIT

<b>Poetry</b>	: 1. Coromandel Fishers	Sarojini Naidu
<b>Skills</b>	: 2. Expansion of Ideas	
	: 3. Notices, Agendas and Minutes	

#### V. UNIT

<b>Non-Detailed Text</b>	: 1. An Astrologer's Day	R K Narayan
<b>Skills</b>	: 2. Curriculum Vitae and Resume	
	: 3. Letters	
	: 4. E-Correspondence	



## **SUBJECT EXPERTS**

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## **SYLLABUS VETTED BY**

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**REVISED SYLLABUS OF TELUGU under (Part – I)  
UNDER CBCS FRAMEWORK WITH EFFECT FROM 2020-2021**

**PROGRAMME: THREE-YEAR B.A. /B.Sc./B.Com/BCA/BBM/BHM & CT**

*(With Learning Outcomes, Unit-wise Syllabus, References, Co-curricular Activities & Model  
Q.P.)*

*For Fifteen Courses of 1, 2, 3 Semesters)*

**(To be Implemented from 2020-21 Academic Year)**

**TELUGU**

**Andhra Pradesh State Council of Higher Education**  
**B.A., B.Com., & B.Sc., etc., Programmes**

Revised Syllabus under CBCS Pattern  
w.e.f. 2020-21

**Language Subjects - TELUGU**  
Revised Syllabus of  
**GENERAL TELUGU**

ఆంధ్ర ప్రదేశ్ రాష్ట్ర ఉన్నత విద్యామండలి  
బి.ఎ., బి.కాం., బి.యస్.సి., తదితర ప్రోగ్రాములు  
సి.బి.సి.ఎస్.పద్ధతిలో సవరించబడిన పాఠ్యప్రణాళిక  
**2020-21 విద్యా సంవత్సరం నుంచి**  
జనరల్ తెలుగు - పాఠ్య ప్రణాళిక

**Subject Curricular Framework**

Sem	Course	Title	Hrs/Wk	Credits	Max. Marks			Total
					IA	SE		
I	I	Pracheena Telugu Kavithvam	04	03	25	75	100	
II	II	Aadhunika Telugu Sahithyam	04	03	25	75	100	
III	III	Srujanaathmaka Rachana	04	03	25	75	100	

పాఠ్యప్రణాళిక (3 కోర్సులు)

సెమి.	కోర్సు	శీర్షిక	పీరియడ్లు/వారానికి	క్రెడిట్లు	మొత్తం మార్కులు		
I	I	ప్రాచీన తెలుగు కవిత్వం	04	03	25	75	100
II	II	ఆధునిక తెలుగు సాహిత్యం	04	03	25	75	100
III	III	సృజనాత్మక రచన	04	03	25	75	100



బి.ఏ., బి.కా., బి.యస్.సి., తదితర ప్రోగ్రాములు

అంశం: జనరల్ తెలుగు

సెమిస్టర్-1

కోర్సు-1 : ప్రాచీన తెలుగు కవిత్వం

యూనిట్ల సంఖ్య: 5

పీరియడ్ల సంఖ్య: 60

◆ అభ్యసన ఫలితాలు: -

ఈ కోర్సు విజయవంతంగా ముగించాక, విద్యార్థులు క్రింది అభ్యసన ఫలితాలను పొందగలరు.

1. ప్రాచీన తెలుగుసాహిత్యం యొక్క ప్రాచీనతను, విశిష్టతను గుర్తిస్తారు. తెలుగుసాహిత్యంలో ఆదికవినన్నయ కాలనాటి భాషాసంస్కృతులను, ఇతిహాసకాలం నాటి రాజనీతి విషయాలపట్ల పరిజ్ఞానాన్ని సంపాదించగలరు.
2. శివకవుల కాలనాటి మతపరిస్థితులను, భాషావిశేషాలను గ్రహిస్తారు. తెలుగు నుడికారం, సామెతలు, లోకోక్తులు మొదలైన భాషాంశాల పట్ల పరిజ్ఞానాన్ని పొందగలరు.
3. తిక్కన భారతనాటి మత, ధార్మిక పరిస్థితులను, తిక్కన కవితాశిల్పాన్ని, నాటకీయతను అవగాహన చేసుకోగలరు.
4. ఎఱ్ఱన సూక్తివైచిత్రిని, ఇతిహాస కవిత్వంలోని విభిన్న రీతులపట్ల అభిరుచిని పొందగలరు. శ్రీనాథుని కాలం నాటి కవితావిశేషాలను, మొల్ల కవితా విశిష్టతను గుర్తించగలరు.
5. తెలుగు పద్యం స్వరూప-స్వభావాలను, సాహిత్యాభిరుచిని పెంపొందించుకుంటారు. ప్రాచీన కావ్యభాషలోని వ్యాకరణాంశాలను అధ్యయనం చేయడం ద్వారా భాషాసామర్థ్యాన్ని, రచనల మెళకువలను గ్రహించగలరు.

## పాఠ్య ప్రణాళిక

యూనిట్-I

రాజనీతి - నన్నయ  
మహాభారతం-సభాపర్వం-ప్రథమాశ్వాసం-(26-57 పద్యాలు)

యూనిట్-II

దక్షయజ్ఞం - నన్నెచోడుడు  
కుమారసంభవం-ద్వితీయాశ్వాసం-(49-86 పద్యాలు)

యూనిట్-III

ధౌమ్య ధర్మోపదేశము - తిక్కన  
మహాభారతం-విరాటపర్వం-ప్రథమాశ్వాసం-(116-146) పద్యాలు

యూనిట్-IV

పలనాటి బెబ్బులి - శ్రీనాథుడు (పలనాటి వీరచరిత్ర-ద్విపద కావ్యం పుట 108-112  
'బాలచంద్రుడు భీమంబగు సంగ్రామం బొనర్చుట.. (108)..  
..... వెఱగంది కుంది' (112) సం. అక్కిరాజు ఉమాకాంతం  
ముద్రణ.వి.కె.స్వామి, బెజవాడ 1911.

యూనిట్-V

సీతారావణ సంవాదం - మొల్ల  
రామాయణము-సుందరకాండము-(40-87 పద్యాలు)

### ◆వ్యాకరణం

సంధులు: ఉత్ప, త్రిక, ద్రుతప్రకృతిక, నుగాగమ,ద్విరుక్తటకారాదేశ, యణాదేశ, వృద్ధి, శ్చుత్వ, జశ్చ, అనునాసిక సంధులు.

సమాసాలు: అవ్యయిభావ, తత్పురుష, కర్మధారయ, ద్వంద్వ, ద్విగు, బహువ్రీహి.

అలంకారాలు:

అర్థాలంకారాలు : ఉపమ, ఉత్పేక్ష, రూపక, స్వభావోక్తి, అర్థాంతరవ్యాస, అతిశయోక్తి.

శబ్దాలంకారాలు : అనుప్రాస (వృత్త్యనుప్రాస, ఛేకామప్రాస లాటానుప్రాస, అంత్యానుప్రాస)

ఛందస్సు

వృత్తాలు: ఉత్పలమాల, చంపకమాల, శార్దూలము, మత్తేభము;

జాతులు : కందం, ద్విపద; ఉపజాతులు : ఆటవెలది, తేటగీతి, సీసం మరియు ముత్యాలసరాలు

**ఆధార గ్రంథాలు:**

1. శ్రీమదాంధ్ర మహాభారతము : సభాపర్వము-తిరుమల తిరుపతి దేవస్థానం ప్రచురణ
2. శ్రీమదాంధ్ర మహాభారతము : విరాటపర్వము-తిరుమల తిరుపతి దేవస్థానం ప్రచురణ
3. కుమార సంభవం - నన్నెచోడుడు
4. పలనాటి వీరచరిత్ర - శ్రీనాథుడు
5. రామాయణము - మొల్ల

**◆ సూచించబడిన సహపాఠ్య కార్యక్రమాలు:**

1. నన్నయ్య, తిక్కన, ఎఱ్ఱన మొదలైన ప్రసిద్ధ కవుల పాఠ్యాంశేతర పద్యాలను ఇచ్చి, విద్యార్థులచేత సమీక్షలు రాయించడం; ఆయా పద్యాల్లోని యతిప్రాసాది ఛందోవిశేషాలను గుర్తింపజేయడం.
2. విద్యార్థులచేత పాఠ్యాంశాలకు సంబంధించిన వ్యాసాలు రాయించడం (సెమినార్/అసైన్ మెంట్)
3. ప్రాచీన పాఠ్యాంశాలలోని సమకాలీనతను గూర్చిన బృంద చర్చ, ప్రాచీన సాహిత్యాన్ని నేటి సామాజిక దృష్టితో పునర్మూల్యాంకనం చేయించడం.
4. చారిత్రక, సాంస్కృతిక అంశాలకు సంబంధించిన పర్యాటక ప్రదేశాలను సందర్శించడం.
5. వ్యక్తిగత/బృంద ప్రాజెక్టులు చేయించడం. ప్రశ్నాపత్ర నిర్మాతలకు సూచనలు ప్రతిపదార్థ పద్యాలు, కంఠస్థ పద్యాలు “రాజనీతి, దక్షయజ్ఞం, ధౌమ్య ధర్మోపదేశం, సీతారావణ సంవాదం” అనే నాలుగు పాఠ్యాంశాల నుండి మాత్రమే ఇవ్వాలి.

**ప్రశ్నాపత్ర నమూనా**

అ. ప్రతిపదార్థ పద్యాలు-(అంతర్గత ఛాయెస్) (2-1)	1×8=8	మా
ఆ. కంఠస్థ పద్యం-(అంతర్గత ఛాయెస్) (2-1)	1×3=3	మా
ఇ. సందర్భ వాక్యాలు-	(6-4)	4×3=12 మా
ఈ. సంగ్రహ సమాధాన ప్రశ్నలు	(6-4)	4×3=12 మా
ఉ. వ్యాస ప్రశ్నలు (అంతర్గత ఛాయెస్)	(6-3)	3×8=24 మా
ఊ. వ్యాకరణం-సంధులు	(6-4)	4×1=4 మా
సమాసాలు	(6-4)	4×1=4 మా
అలంకారాలు	(2-1)	1×4=4 మా
ఛందస్సు	(2-1)	1×4=4 మా

బి.ఏ., బి.కాం., బి.యస్.సి., తదితర ప్రోగ్రాములు

అంశం: జనరల్ తెలుగు

సెమిస్టర్-2

కోర్సు-2 : ఆధునిక తెలుగు సాహిత్యం

యూనిట్ల సంఖ్య:5

పీరియడ్ల సంఖ్య:60

◆ అభ్యసన ఫలితాలు:-

ఈ కోర్సు విజయవంతంగా ముగించాక, విద్యార్థులు క్రింది అభ్యసన ఫలితాలను పొందగలరు.

1. ఆంగ్లభాష ప్రభావం కారణంగా తెలుగులో వచ్చిన ఆధునిక సాహిత్యాన్ని, దాని విశిష్టతను గుర్తిస్తారు.
2. సమకాలీన ఆధునిక సాహిత్య ప్రక్రియలైన “వచన కవిత్వం, కథ, నవల, నాటకం, విమర్శ”లపై అవగాహన పొందుతారు.
3. భావకవిత, అభ్యుదయ కవితాలక్ష్యాలను గూర్చిన జ్ఞానాన్ని పొందుతారు. అస్తిత్వవాద ఉద్యమాలపుట్టుకను, ఆవశ్యకతను గుర్తిస్తారు.
4. కథాసాహిత్యం ద్వారా సామాజిక చైతన్యాన్ని పొందుతారు. సిద్ధాంతాల ద్వారా కాకుండా, వాస్తవ పరిస్థితులను తెలుసుకోవడం ద్వారా సిద్ధాంతాన్ని సమీక్షించగలరు.
5. ఆధునిక తెలుగు కల్పనాసాహిత్యం ద్వారా సామాజిక, సాంస్కృతిక, రాజకీయ చైతన్యాన్ని పొందుతారు.

## పాఠ్య ప్రణాళిక

### యూనిట్-I : ఆధునిక కవిత్వం

1. ఆధునిక కవిత్వం- పరిచయం
2. కొండవీడు - దువ్వూరి రామిరెడ్డి  
(‘కవికోకిల’ గ్రంథావళి-ఖండకావ్యాలు-నక్షత్రమాల సంపుటి నుండి)
3. మాతృసంగీతం - అనిసెట్టి సుబ్బారావు (‘అగ్నివీణ’ కవితాసంపుటి నుండి)
4. ‘తాతకో నూలుపోగు’ - బండారు ప్రసాదమూర్తి (‘కలనేత’ కవితాసంపుటి నుండి)

### యూనిట్-II: కథానిక

5. తెలుగు కథానిక - పరిచయం
6. భయం (కథ) - కాళీపట్నం రామారావు
7. స్వేదం ఖరీదు....? - (కథ) - రెంటాల నాగేశ్వరరావు

### యూనిట్-III: నవల

8. తెలుగు ‘నవల’ - పరిచయం
9. రథచక్రాలు (నవల) - మహీధర రామ్మోహన రావు (సంక్షిప్త ఇతివృత్తం మాత్రం)
10. రథచక్రాలు (సమీక్షా వ్యాసం) - డా॥ యల్లాప్రగడ మల్లికార్జునరావు

### యూనిట్-IV: నాటకం

11. తెలుగు ‘నాటకం’ - పరిచయం
12. యక్షగానము (నాటిక) - ఎం.వి.ఎస్. హరనాథరావు.
13. “అపురూప కళారూపాల విధ్వంసదృశ్యం ‘యక్షగానము’ (సమీక్షా వ్యాసం)”  
-డా॥కందిమళ్ళసాంబశివరావు

### యూనిట్-V: విమర్శ

14. తెలుగు సాహిత్య విమర్శ - పరిచయం
15. విమర్శ-స్వరూప స్వభావాలు; ఉత్తమ విమర్శకుడు-లక్షణాలు

**ఆధార గ్రంథాలు/వ్యాసాలు:**

1. ఆధునిక కవిత్వం-పరిచయం : చూ. 'దృక్పథాలు' పుట 1-22, ఆచార్య ఎస్సీ. సత్యనారాయణ
2. తెలుగు కథానిక-పరిచయం : చూ. మన నవలలు-మన కథానికలు, పుట 118-130,  
ఆచార్య రాచపాళెం చంద్రశేఖర రెడ్డి
3. తెలుగు నవల-పరిచయం : చూ. నవలాశిల్పం, పుట 1-17, వల్లంపాటి వెంకటసుబ్బయ్య
4. తెలుగు నాటకం-పరిచయం : చూ. తెలుగు నాటకరంగం, పుట 17-25 ఆచార్య ఎస్.గంగప్ప
5. తెలుగుసాహిత్య విమర్శ-పరిచయం: చూ.తెలుగుసాహిత్య విమర్శ-నాడు,నేడు పుట 213-217  
తెలుగువాణి, అయిదవ అఖిలభారత తెలుగు మహాసభల ప్రత్యేక సంచిక  
ఆచార్య జి.వి.సుబ్రహ్మణ్యం
6. నూరేళ్ళ తెలుగు నాటక రంగం - ఆచార్య మొదలి నాగభూషణశర్మ
7. నాటకశిల్పం - ఆచార్య మొదలి నాగభూషణశర్మ
8. సాంఘిక నవల-కథన శిల్పం - ఆచార్య సి.మృణాలిని.

**◆ సూచించబడిన సహపాఠ్య కార్యక్రమాలు:**

1. ఆధునిక కవిత్వానికి సంబంధించిన కొత్త కవితలను/అంశాలను ఇచ్చి, విద్యార్థులచేత వాటిమీద అసైన్మెంట్లు రాయించడం
2. పాఠ్యాంశాలకు సంబంధించిన విషయాలపై వ్యాసాలు రాయించడం (సెమినార్/అసైన్మెంట్)
3. తెలుగు సాహిత్యంలోని ప్రసిద్ధ కథలపై, కవితలపై సమీక్షలు రాయించడం.
4. ఆధునిక పద్యనిర్మాణ రచన చేయించడం.
5. విద్యార్థులను బృందాలుగా విభజించి, నాటకలపై/నవలలపై సమీక్షలు రాయించడం.
6. సాహిత్యవ్యాసాలు సేకరించడం, బృందచర్చ నిర్వహించడం, క్షేత్రపర్యటనలు.
7. ప్రసిద్ధుల విమర్శావ్యాసాలు చదివించి, వాటిని విద్యార్థుల సొంత మాటల్లో రాయించడం.
8. పాఠ్యాంశాలపై స్వీయ విమర్శావ్యాసాలు రాయించడం.

**◆ ప్రశ్నాపత్ర నమూనా ◆**

**అ-విభాగము**

సంక్షిప్త సమాధాన ప్రశ్నలు - ప్రతి యూనిట్ నుంచి తప్పనిసరిగా ఒక ప్రశ్న ఇస్తూ, మొత్తం ఎనిమిది ప్రశ్నలు ఇచ్చి, ఐదింటికి సమాధానం రాయమనాలి.  $5 \times 5 = 25$  మా.

**ఆ-విభాగము**

వ్యాసరూప సమాధాన ప్రశ్నలు-ప్రతి యూనిట్ నుంచి తప్పనిసరిగా రెండు ప్రశ్నలు ఇచ్చి ఒక ప్రశ్నకు సమాధానం రాయమనాలి. మొత్తం ప్రశ్నలు 5.  $5 \times 10 = 50$  మా.

◆ మాదిరి ప్రశ్నాపత్రం ◆

అ-విభాగము

క్రింది వానిలో ఐదింటికి సంక్షిప్త సమాధానాలు రాయండి.

ప్రతి సమాధానానికి 5 మార్కులు.

5×5=25 మా.

1. కొండవీడు
2. తెలుగు నవల
3. తెలుగు నాటకం
4. ఆధునిక కవిత్వం
5. కథానిక
6. విమర్శ
7. అనిసెట్టి సుబ్బారావు
8. కాళీపట్నం రామారావు

ఆ-విభాగము

క్రింది వానిలో అన్ని ప్రశ్నలకు సమాధానాలు రాయండి.

ప్రతి సమాధానానికి 10 మార్కులు.

5×10=50 మా.

9. ఆధునిక కవిత్వ ఆవిర్భావ వికాసాలను వివరించండి.

(లేదా)

కొండవీడులో దువ్వూరి రామిరెడ్డి గారి సందేశాన్ని వివరించండి.

10. తెలుగు కథానికను పరిచయం చేయండి.

(లేదా)

భయం కథలోని రచయిత సందేశాన్ని రాయండి.

11. సాహిత్య ప్రక్రియగా నవల స్థానాన్ని విమర్శించండి.

(లేదా)

రథచక్రాలు నవలలోని ఇతివృత్తాన్ని విశ్లేషించండి.

12. తెలుగు నాటక పరిణామాన్ని గూర్చి రాయండి.

(లేదా)

యక్షగానం నాటికపై సమీక్షా వ్యాసం రాయండి.

13. తెలుగు సాహిత్య విమర్శను పరిచయం చేయండి

(లేదా)

విమర్శ స్వరూప స్వభావాలను వివరిస్తూ, ఉత్తమ విమర్శకుని లక్షణాలను రాయండి.

బి.ఏ., బి.కా., బి.యస్.సి., తదితర ప్రోగ్రాములు  
అంశం: జనరల్ తెలుగు సెమిస్టర్-3  
కోర్సు-3 : సృజనాత్మక రచన

యూనిట్ల సంఖ్య:5

పీరియడ్ల సంఖ్య:60

◆ అభ్యసన ఫలితాలు: -

- ఈ కోర్సు విజయవంతంగా ముగించాక, విద్యార్థులు క్రింది అభ్యసన ఫలితాలను పొందగలరు.
1. తెలుగు సాహిత్య అభ్యసన ద్వారా నేర్చుకున్న నైపుణ్యాలను, సృజనాత్మక నైపుణ్యాలుగా మార్చుకోగలరు.
  2. విద్యార్థులు భాషాతత్వాన్ని, భాష యొక్క ఆవశ్యకతను, భాష యొక్క ప్రాధాన్యాన్ని గుర్తిస్తారు. మనిషి వ్యక్తిగత జీవనానికి, సామాజికవ్యవస్థ పటిష్టతకు భాష ప్రధానమని తెలుసుకుంటారు. తెలుగుభాషలోని కీలకాంశాలైన 'వర్ణం-పదం-వాక్యాల' ప్రాధాన్యాన్ని గుర్తిస్తూ, వాగ్రూప- లిఖితరూప వ్యక్తీకరణ ద్వారా భాషానైపుణ్యాలను మెరుగుపరచుకోగలరు.
  3. భాషానైపుణ్యాలను అలవరచుకోవడంతోపాటు వినియోగించడం నేర్చుకుంటారు. రచనా, భాషానైపుణ్యాలను సృజనాత్మక రూపంలో వ్యక్తీకరించగలరు.
  4. ప్రాచీన పద్యరచనతో పాటు ఆధునిక కవిత, కథ, వ్యాసం, మొదలైన సాహిత్యప్రక్రియల నిర్మాణాలకు సంబంధించిన సిద్ధాంతవిషయాలను నేర్పడంతో పాటు వారిలో రచనా నైపుణ్యాలను పెంపొందించుకోగలరు.
  5. సృజన రంగం, ప్రసారమాధ్యమ రంగాల్లో ఉపాధి అవకాశాలను అందిపుచ్చుకోగలరు.
  6. అనువాద రంగంలో నైపుణ్యం సంపాదించగలరు.



## పాఠ్య ప్రణాళిక

### యూనిట్-I: వ్యక్తికరణ నైపుణ్యాలు

1. భాష-ప్రాథమికాంశాలు: భాష-నిర్వచనం, లక్షణాలు, ఆవశ్యకత, ప్రయోజనాలు
2. వర్ణం-పదం-వాక్యం', వాక్య లక్షణాలు, సామాన్య-సంయుక్త-సంశ్లిష్టవాక్యాలు
3. భాషా నిర్మాణంలో 'వర్ణం-పదం-వాక్యం' ప్రాధాన్యత

### యూనిట్-II సృజనాత్మక రచన

4. కవితా రచన : ఉత్తమ కవిత - లక్షణాలు
5. కథారచన : ఉత్తమ కథ - లక్షణాలు
6. వ్యాస రచన : ఉత్తమ వ్యాసం-లక్షణాలు

### యూనిట్-III: అనువాద రచన

7. అనువాదం-నిర్వచనం, అనువాద పద్ధతులు,
8. అనువాద సమస్యలు-భౌగోళిక,భాషా,సాంస్కృతిక సమస్యలు, పరిష్కారాలు
9. అభ్యాసము : ఆంగ్లం నుండి తెలుగుకు,తెలుగు నుండి ఆంగ్లానికి ఒక పేరానుఅనువదించడం

### యూనిట్ IV మాధ్యమాలకు రచన-1 (ముద్రణామాధ్యమం/ప్రింట్ మీడియా)

10. ముద్రణామాధ్యమం (అచ్చుమాధ్యమం) : పరిచయం, పరిధి, వికాసం
11. వివిధ రకాల పత్రికలు-పరిశీలన, పత్రికాభాష, శైలి, వైవిధ్యం
12. పత్రికా రచన : వార్తా రచన, సంపాదకీయాలు, సమీక్షలు-అవగాహన

### యూనిట్ V మాధ్యమాలకు రచన-2 (ప్రసార మాధ్యమం/ఎలక్ట్రానిక్ మీడియా)

13. ప్రసారమాధ్యమాలు : నిర్వచనం, రకాలు, విస్తృతి, ప్రయోజనాలు
14. శ్రవణ మాధ్యమాలు - రచన: రేడియో రచన, ప్రసంగాలు, నాటికలు, ప్రసార సమాచారం
15. దృశ్యమాధ్యమాలు - రచన: వ్యాఖ్యానం (యాంకరింగ్), టెలివిజన్ రచన

## ఆధార గ్రంథాలు/వ్యాసాలు:

1. వ్యక్తికరణ నైపుణ్యాలు - చూ. 1. ఆధునిక భాషాశాస్త్ర సిద్ధాంతాలు-ఆచార్య పి.ఎస్.సుబ్రహ్మణ్యం  
2. తెలుగు భాషా చరిత్ర - సం.ఆచార్య భద్రరాజు కృష్ణమూర్తి  
3. తెలుగు వాక్యం - డా. చేకూరి రామారావు
2. ఉత్తమ కవిత-లక్షణాలు - చూ. నవ్యకవిత్వ లక్షణములు- ఆచార్య సి.నారాయణరెడ్డి  
ఆధునికాంధ్ర కవిత్వము-సంప్రదాయములు, ప్రయోగములు: చతుర్థ ప్రకరణము.
3. ఉత్తమ కథ-లక్షణాలు - చూ.కథాశిల్పం-వల్లంపాటి వెంకటసుబ్బయ్య, పుటలు 11-17
4. ఉత్తమ వ్యాసం-లక్షణాలు- చూ.చదువు-సంస్కృతి (వ్యాసం) - కొడవటిగంటి కుటుంబరావు
5. అనువాద రచన - చూ.1. అనువాద సమస్యలు - రాచమల్లు రామచంద్రారెడ్డి  
పుటలు 61-75, 85-94  
2. అనువాదన పద్ధతులు ఆచరణ సమస్యలు-చేకూరి రామారావు  
“భాషాంతరంగం”, పుటలు 130-146, తెలుగు విశ్వవిద్యాలయం ప్రచురణ
6. ముద్రణా మాధ్యమం - చూ. మాధ్యమాలకు రచన, పుటలు 9-12  
- డా॥ బి.ఆర్.అంబేద్కర్ విశ్వవిద్యాలయ ప్రచురణ
7. పత్రికా భాష - చూ. మాధ్యమాలకు రచన, పుటలు 67-74  
- డా॥ బి.ఆర్.అంబేద్కర్ విశ్వవిద్యాలయ ప్రచురణ
8. పత్రికా రచన - చూ. తెలుగు- మౌలికాంశాలు, పుటలు 59-69  
- డా॥ బి.ఆర్.అంబేద్కర్ విశ్వవిద్యాలయ ప్రచురణ
9. ప్రసార మాధ్యమాలు - చూ. మాధ్యమాలకు రచన, పుటలు 3-10  
- డా॥ బి.ఆర్.అంబేద్కర్ విశ్వవిద్యాలయ ప్రచురణ
10. రేడియో రచన - చూ.మాధ్యమాలకు రచన, పుటలు 141-148  
- డా॥ బి.ఆర్.అంబేద్కర్ విశ్వవిద్యాలయ ప్రచురణ
11. వ్యాఖ్యానం (యాంకరింగ్) - చూ.మాధ్యమాలకు రచన, పుటలు 178-181  
- డా॥ బి.ఆర్.అంబేద్కర్ విశ్వవిద్యాలయ ప్రచురణ
12. టెలివిజన్ రచన - చూ.మాధ్యమాలకు రచన, పుటలు 153-160  
- డా॥ బి.ఆర్.అంబేద్కర్ విశ్వవిద్యాలయ ప్రచురణ
13. తెలుగు జర్నలిజం - డా॥ బూదరాజు రాధాకృష్ణ

## సూచించబడిన సహపాఠ్య కార్యక్రమాలు

1. భాషాంశాలపై, వాక్య నిర్మాణంపై అసైన్మెంట్లు రాయించడం, పత్రికల్లోని సాహిత్య/భాషాంశాలను సేకరింపజేయడం.
2. విద్యార్థులచేత తెలుగుభాషా సాహిత్యాలపై ప్రసంగవ్యాసం ఇప్పించడం (సెమినార్/ అసైన్మెంట్)
3. వ్యాసరచన, లేఖారచన, స్వీయకవితలు రాయించి, తరగతిలో చదివింపజేయడం మొదలైనవి.
4. వివిధ కార్యక్రమాల్లో విద్యార్థులచేత సదస్సు నిర్వహణ, వ్యాఖ్యానం (యాంకరింగ్) చేయించడం.
5. సమకాలీన భాషాసమస్యలపై / ఉద్యమాలపై/సాంఘిక సమస్యలపై 'బృందచర్చ' (Group Discussion) నిర్వహింపజేయడం.
6. తెలుగుభాషా దినోత్సవం/అంతర్జాతీయ మాతృభాషా దినోత్సవం మొదలైన రోజుల్లో జరిగే సాంస్కృతిక కార్యక్రమాలు విద్యార్థులచేత నిర్వహింపజేయడం, వాటిపై సమీక్షలు/పత్రికా ప్రకటనలు రాయించడం.
7. సమకాలీన సంఘటనలపై సామాజిక మాధ్యమాల్లో/ టి.వి.ల్లో జరిగే చర్చలను నమోదు చేయించి సంకలనం చేయడం.
8. సాంస్కృతిక / చారిత్రక ప్రాశస్త్యం కలిగిన కట్టడాలు , దేవాలయాలు, కళానిలయాలను 'బృందపర్యటన/ క్షేత్ర పర్యటన' ద్వారా విద్యార్థులచేత సందర్శింపజేయడం.

### ◆ప్రశ్నాపత్ర నమూనా ◆

#### అ-విభాగము

సంక్షిప్త సమాధాన ప్రశ్నలు - ప్రతి యూనిట్ నుంచి తప్పనిసరిగా ఒక ప్రశ్న ఇస్తూ, మొత్తం ఎనిమిది ప్రశ్నలు ఇచ్చి, ఐదింటికి సమాధానం రాయమనాలి.  $5 \times 5 = 25$  మా.

#### ఆ-విభాగము

వ్యాసరూప సమాధాన ప్రశ్నలు-ప్రతి యూనిట్ నుంచి తప్పనిసరిగా రెండు ప్రశ్నలు ఇచ్చి ఒక ప్రశ్నకు సమాధానం రాయమనాలి. మొత్తం ప్రశ్నలు 5.  $5 \times 10 = 50$  మా.

◆ మాదిరి ప్రశ్నాపత్రం ◆

అ-విభాగము

క్రింది వానిలో ఐదింటికి సంక్షిప్త సమాధానాలు రాయండి. 8వ ప్రశ్నకు తప్పనిసరిగా సమాధానం రాయాలి. ప్రతి సమాధానానికి 5 మార్కులు.  $5 \times 5 = 25$  మా.

1. భాష-ప్రయోజనాలు
2. వాక్యం-లక్షణాలు
3. టెలివిజన్ రచన
4. రేడియో రచన
5. ఉత్తమ వ్యాసం-లక్షణాలు
6. సంశ్లిష్ట వాక్యం
7. సంపాదకీయాలు
8. క్రింది అంశాన్ని తెలుగులోకి అనువదించి రాయండి.

To many, Indian thought, Indian manners, Indian customs, Indian Philoshophy, Indian Literature are repulsive at the first sight; but let them preservere, let them read, let them become familiar with the great principles underlying these ideas, and it is ninety-nine to one that the charm will come over them, and fascination will be the result. Slow and silent, as the gentle dew that falls in the morning, unseen and unheard yet producing, a most tremendous result, has been the work of the calm, patient, all-suffering spiritual race upon the World of thought.

ఆ-విభాగము

క్రింది వానిలో అన్ని ప్రశ్నలకు సమాధానాలు రాయండి.

ప్రతి సమాధానానికి 10 మార్కులు.

$5 \times 10 = 50$  మా.

9. భాషానిర్మాణంలో 'వర్ణం-పదం-వాక్యా'ల ప్రాధాన్యతను వివరించండి. (లేదా)

భాషను నిర్వచించి, లక్షణాలు రాసి, ప్రామాణిక భాషను పరిచయం చేయండి.

10. ఉత్తమ కవితా లక్షణాలను విశ్లేషించండి.

(లేదా)

ఉత్తమ కథా లక్షణాలను వివరించండి.

11. అనువాద సమస్యలను, వాటి పరిష్కారాలను గూర్చి రాయండి.

(లేదా)

అనువాద లక్షణాలను వివరిస్తూ, అనువాద పద్ధతులను గురించి రాయండి.

12. ముద్రణా మాధ్యమాన్ని పరిచయం చేస్తూ; దాని పరిధి, వికాసాలను వివరించండి.

(లేదా)

పత్రికా రచనను గురించి విశ్లేషణాత్మక వ్యాసం రాయండి.

13. ప్రసార మాధ్యమాల విస్తృతి, ప్రయోజనాలను సమీక్షించండి.

(లేదా)

యాంకరింగ్ నిర్వహణ, తీరుతెన్నులను వివరించండి.

**SUBJECT EXPERTS**

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**SYLLABUS VETTED BY**

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# ANDHA UNIVERSITY

I B.A./B.Com./B.Sc., SEMESTER – I : GENERAL HINDI PAPER – I

w.e.f. 2020-21

(Prose, Short Stories and Grammar)

Credits : 03

Teaching Hrs/Week : 04

## SYLLABUS

### गद्य संदेश (PROSE)

१. भारतीय साहित्य की एकता - नन्द दुलारे वाजपायी
२. आत्मनिर्भरता - पं. बालकृष्ण भट्ट
३. अन्दर की पवित्रता - डॉ. हजारी प्रसाद द्विवेदी

### कथा लोक (SHORT STORIES)

४. ठाकुर का कुआँ - प्रेमचंद
१. वापसी - उषा प्रियंवदा
२. सदाचार का तावीज - हरिशंकर परसाई

### व्याकरण (GRAMMAR)

लिंग, वचन,

काल

विलोम शब्द

कार्यालयीन शब्दावली - अंग्रेजी से हिन्दी, हिन्दी से अंग्रेजी

पत्र लेखन - व्यक्तिगत पत्र (छुट्टी पत्र , पिता, मित्र के नाम पत्र, पुस्तक विक्रेता के नाम पत्र )

**ANDHRA UNIVERSITY**

I B.A./B.Com./B.Sc., SEMESTER – I : GENERAL HINDI PAPER – I

**w.e.f. 2020-21**

**(Prose, Short Stories and Grammar)**

Time : 3hrs

Max Marks :75

**MODEL QUESTION PAPER**

PART - A

- I. किन्ही पाँच प्रश्नों के उत्तर दीजिए | 5 X 5 = 25  
Short Q & ANS
1. Annotation - Prose
  2. Annotation - Prose
  3. Short Question - Prose
  4. Short Question - Short Stories(Non-detailed)
  5. Short Question - Short Stories(Non-detailed)
  6. Short Question - Short Stories(Non-detailed)
  7. Short Question – Grammar
  8. Short Question - Grammar

PART - B

- II. निम्न लिखित सभी प्रश्नों के उत्तर दीजिए | 5 X10 = 50
1. PROSE  
(अथवा)  
PROSE
  2. PROSE  
(अथवा)  
Short Stories(Non-detailed)
  3. Short Stories(Non-detailed)  
(अथवा)  
Short Stories(Non-detailed)

4. LETTER WRITING पत्र लेखन

(अथवा)

LETTER WRITING पत्र लेखन

5. a ) निम्न लिखित शब्दों के विलोम शब्द लिखिए ।

1. 2. 3. 4. 5. 6. 7. 8. 9. 10

b ) काल

(अथवा)

निम्न लिखित अंग्रेजी शब्दों का हिन्दी में अनुवाद कीजिए ।

(a ) 1. Part time 2. Memorandum 3. Conference 4. Certificate 5. Circular

(b ) निम्न लिखित हिन्दी शब्दों का अंग्रेजी में अनुवाद कीजिए

6. चुनाव 7. सचिव 8. लेखाकार 9. राज्यपाल 10. नगर निगम



## **ANDHRA UNIVERSITY**

II B.A./B.Com./B.Sc., SEMESTER – II : GENERAL HINDI PAPER – I

**2020-21**

(Prose, Short Stories, Grammar and Letter writing)

Credits : 03

Teaching Hrs/Week : 4

### **SYLLABUS**

#### **गद्य संदेश (PROSE)**

१. भारत में संस्कृति संगम - रामधारी सिंह दिनकर
३. समय पर मिलाने वाले - हरिशंकर परसाई
२. HIV /AIDS

#### **कथा लोक (SHORT STORIES)**

३. हार की जीत - सुदर्शन

४. पुरस्कार - जयशंकर प्रसाद

५. सेवा - ममता कालिया

### व्याकरण (GRAMMAR)

कार्यालयीन हिन्दी शब्दावली - अंग्रेजी से हिन्दी, हिन्दी से अंग्रेजी

पदनाम

कारक,

पत्र लेखन (आवेदन पत्र, शिकायती पत्र )

**ANDHRA UNIVERSITY**  
II B.A./B.Com./B.Sc., SEMESTER – II : GENERAL HINDI PAPER – I  
**w.e.f.2020-21**

(Prose, Short Stories, Grammar and Letter writing)

Time : 3hrs

Max Marks :75

**MODEL QUESTION PAPER**

**PART - A**

- I. किन्ही पाँच प्रश्नों के उत्तर दीजिए | 5 X 5 = 25  
Short Q & ANS
9. Annotation - Prose  
10. Annotation - Prose  
11. Short Question - Prose  
12. Short Question - Short Stories(Non-detailed)  
13. Short Question - Short Stories(Non-detailed)  
14. Short Question - Short Stories(Non-detailed)  
15. Short Question - Grammar  
16. Short Question - Grammar

**PART - B**

- II. निम्न लिखित सभी प्रश्नों के उत्तर दीजिए | 5 X10 = 50
17. PROSE  
(अथवा)  
PROSE
18. PROSE  
(अथवा)  
Short Stories(Non-detailed)
19. Short Stories(Non-detailed)  
(अथवा)  
Short Stories(Non-detailed)
20. LETTER WRITING पत्र लेखन ( आवेदन पत्र, शिकायती पत्र )  
(अथवा)  
LETTER WRITING पत्र लेखन
21. कारक कितने प्रकार के हैं ? समझाइए |

(अथवा)

a) निम्न लिखित हिन्दी शब्दों का अंग्रेजी में अनुवाद कीजिए ।

1.            2.            3.            4.            5.

b) निम्न लिखित हिन्दी पदनामों का अंग्रेजी में अनुवाद कीजिए ।

1.            2.            3.            4.            5.

**Signature of the members**

# ANDHRA UNIVERSITY

II B.A./B.Com./B.Sc., SEMESTER – III : GENERAL HINDI PAPER – II

w.e.f. 2022-23

(Old & Modern Poetry, History of Hindi Literature, Essays, Translation and Official Letters)

Credits : 03

Teaching Hrs/Week : 4

## SYLLABUS

### 1. काव्यदीप : साखी - १-१०

सूरदास - बाल वर्णन

आगे बढ़, आगे - मैथिलीशरण गुप्त

भिक्षुक - निराला

चरण चले, ईमान अचल हो ! - माखनलाल चतुर्वेदी

### 2. हिन्दी साहित्य का इतिहास :

भक्तिकाल : स्वर्ण युग

जानाश्रयी शाखा - कबीर, प्रेमाश्रयी शाखा - जायसी

### 3. साधारण निबंध :

नारी शिक्षा का महत्त्व

प्रदूषण का खतरा

विश्व भाषा के रूप में हिन्दी

भारत की वर्तमान समस्याएँ

स्वच्छ भारत

### 4. अनुवाद : अंग्रेजी से हिन्दी ( 3-4 lines)

तेलुगु से हिन्दी

### 5. प्रयोजन मूलक हिन्दी : सरकारी पत्र (Official letters )

ज्ञापन, परिपत्र, सूचना

**ANDHRA UNIVERSITY**

II B.A./B.Com./B.Sc., SEMESTER – III : GENERAL HINDI PAPER – II

**w.e.f. 2022-23**

(Old & Modern Poetry, History of Hindi Literature, Essays, Translation and Official Letters)

Time : 3hrs

Max Marks :75

**MODEL QUESTION PAPER**

PART - A

II. किन्ही पाँच प्रश्नों के उत्तर दीजिए | 5 X 5 = 25  
Short Q & ANS

1. .Annotation – Old Poetry
2. Annotation - Old Poetry
3. Annotation - Modern Poetry
4. Annotation - Modern Poetry
5. Short Question – Old Poetry
6. Short Question - Modern Poetry
7. Short Question - Official Letter ( Functional Hindi )
8. Short Question – History of Hindi Literature

PART - B

II. निम्न लिखित सभी प्रश्नों के उत्तर दीजिए | 5 X10 = 50

9. Modern Poetry – Summary

(अथवा)

Modern Poetry – Summary

10. History of Hindi Literature

(अथवा)

History of Hindi Literature

11. Translation ( English to Hindi)

(अथवा)

Translation ( Telugu to Hindi)

12. General Essay

(अथवा)

General Essay

13. Official Letter ( Functional Hindi )

(अथवा)

Official Letter ( Functional Hindi )

**Signature of the members**

## **ANDHRA UNIVERSITY**

II B.A./B.Com./B.Sc., SEMESTER-IV : GENERAL HINDI PAPER – II

**w.e.f. 2022-23**

(Old & Modern Poetry, History of Hindi Literature, Essays, Translation and Official Letters)

Credits : 03

Teaching Hrs/Week : 4

### **SYLLABUS**

1. काव्यदीप : तुलसी दास के दोहे (१-१०)

रहीम के दोहे (१-१०)

सुख - दुःख - सुमित्रानंदन पंत

कलम और तलवार - रामधारी सिंह दिनकर

भारत - जयशंकर प्रसाद

2. हिन्दी साहित्य का इतिहास :

भक्तिकाल : रामभक्ति शाखा - तुलसी दास,

कृष्ण भक्ति शाखा - सूर दास

3. साधारण निबंध : समाज में नारी का स्थान,

भाषा की समस्या,

मेरा प्रिय कवि/ साहित्यकार



विज्ञान से हानि - लाभ,

राष्ट्र - निर्माण में विद्यार्थियों का योगदान

4. अनुवाद : अंग्रेजी से हिन्दी ( 3-4 lines)

तेलुगु से हिन्दी

5. प्रयोजन मूलक हिन्दी : सरकारी पत्र (Official letters )

अधि सूचना, अर्ध सरकारी पत्र, नीलाम

### ANDHRA UNIVERSITY

II B.A./B.Com./B.Sc., SEMESTER-IV : GENERAL HINDI PAPER – II  
w.e.f.2022-23

(Old & Modern Poetry, History of Hindi Literature, Essays, Translation and Official Letters)

Time : 3hrs

Max Marks :75

### MODEL QUESTION PAPER

#### PART - A

III. किन्ही पाँच प्रश्नों के उत्तर दीजिए |

5 X 5 = 25

Short Q & ANS

14. .Annotation – Old Poetry

15. Annotation - Old Poetry

16. Annotation - Modern Poetry

17. Annotation - Modern Poetry

18. Short Question – Old Poetry

19. Short Question - Modern Poetry

20. Short Question - Official Letter ( Functional Hindi )

21. Short Question – History of Hindi Literature

#### PART - B

II. निम्न लिखित सभी प्रश्नों के उत्तर दीजिए |

5 X10 = 50

22. Modern Poetry – Summary

(अथवा)

Modern Poetry – Summary

23. History of Hindi Literature

(अथवा)

History of Hindi Literature

24. Translation ( English to Hindi)

(अथवा)

Translation ( Telugu to Hindi)

25. General Essay

(अथवा)

General Essay

26. Official Letter ( Functional Hindi )

(अथवा)

Official Letter ( Functional Hindi )

**Signature of the Members**



## **ANDHRA PRADESH STATE COUNCIL OF HIGHER EDUCATION**

(A Statutory body of the Government of Andhra Pradesh)

3<sup>rd</sup>, 4<sup>th</sup> and 5<sup>th</sup> floors, Neeladri Towers, Sri Ram Nagar, 6<sup>th</sup> Battalion Road,  
Atmakur (V), Mangalagiri (M), Guntur-522 503, Andhra Pradesh  
**Web:** www.apsche.org **Email:** acapsche@gmail.com

### **REVISED SYLLABUS OF B.Sc (Chemistry) UNDER CBCS FRAMEWORK WITH EFFECT FROM 2020-2021**

#### **PROGRAMME: THREE-YEAR B.Sc. (B.Sc Chemistry)**

*(With Learning Outcomes, Unit-wise Syllabus, References, Co-curricular Activities &  
Model Q.P.)*

*For Fifteen Courses of 1, 2, 3 & 4 Semesters)*

**(To be Implemented from 2020-21 Academic Year)**

**Andhra Pradesh State Council of Higher Education**

## B.Sc. Chemistry Revised Syllabus under CBCS

w.e.f. 2020-21

### Structure of Chemistry Core Syllabus under CBCS

YEAR	SEMESTER	COURSE	TITLE	MARKS	CREDITS
I	I	I	Inorganic and Physical Chemistry	100	03
			Practical – I Analysis of SALT MIXTURE	50	02
	II	II	Organic and General Chemistry	100	03
			Practical – II Volumetric Analysis	50	02
II	III	III	Organic Chemistry and Spectroscopy	100	03
			Practical – III Organic preparations and IR Spectral Analysis	50	02
	IV	IV	Inorganic, Organic and Physical Chemistry	100	03
			Practical – IV Organic Qualitative analysis	50	02
		V	Inorganic and Physical Chemistry	100	02
			Practical-V Course Conductometric and Potentiometric Titrimetry	50	02

## SEMESTER – I

**Course I (Inorganic & Physical Chemistry)**

**60 hrs. (4h/w)**

### **Course outcomes:**

At the end of the course, the student will be able to;

1. Understand the basic concepts of p-block elements
2. Explain the difference between solid, liquid and gases in terms of intermolecular interactions.
3. Apply the concepts of gas equations, pH and electrolytes while studying other chemistry courses.

### **INORGANIC CHEMISTRY**

**24 h**

#### **UNIT –I**

#### **Chemistry of p-block elements**

**8h**

**Group 13:** Preparation & structure of Diborane, Borazine

**Group 14:** Preparation, classification and uses of silicones

**Group 15:** Preparation & structures of Phosphonitrilic halides  $\{(\text{PNCl}_2)_n\}$  where  $n=3, 4$

**Group 16:** Oxides and Oxoacids of Sulphur (structures only)

**Group 17:** Pseudohalogens, Structures of Interhalogen compounds.

#### **UNIT-II**

#### **1. Chemistry of d-block elements:**

**6h**

Characteristics of d-block elements with special reference to electronic configuration, variable valence, magnetic properties, catalytic properties and ability to form complexes. Stability of various oxidation states.

#### **2. Chemistry of f-block elements:**

**6h**

Chemistry of lanthanides - electronic structure, oxidation states, lanthanide contraction, consequences of lanthanide contraction, magnetic properties. Chemistry of actinides - electronic configuration, oxidation states, actinide contraction, comparison of lanthanides and actinides.

#### **3. Theories of bonding in metals:**

**4h**

Valence bond theory and Free electron theory, explanation of thermal and electrical conductivity of metals based on these theories, Band theory- formation of bands, explanation of conductors, semiconductors and insulators.

## **PHYSICAL CHEMISTRY**

**36h**

### **UNIT-III**

#### **Solidstate**

**10h**

Symmetry in crystals. Law of constancy of interfacial angles. The law of rationality of indices. The law of symmetry. Miller indices, Definition of lattice point, space lattice, unit cell. Bravais lattices and crystal systems. X-ray diffraction and crystal structure. Bragg's law. Powder method. Defects in crystals. Stoichiometric and non-stoichiometric defects.

### **UNIT-IV**

#### **1. Gaseous state**

**6h**

van der Waal's equation of state. Andrew's isotherms of carbon dioxide, continuity of state. Critical phenomena. Relationship between critical constants and vander Waal's constants. Law of corresponding states. Joule- Thomson effect. Inversion temperature.

#### **2. Liquid state**

**4h**

Liquid crystals, mesomorphic state. Differences between liquid crystal and solid/liquid. Classification of liquid crystals into Smectic and Nematic. Application of liquid crystals as LCD devices.

### **UNIT-V**

#### **Solutions, Ionic equilibrium & dilute solutions**

#### **1. Solutions**

**6h**

Azeotropes-HCl-H<sub>2</sub>O system and ethanol-water system. Partially miscible liquids-phenol-water system. Critical solution temperature (CST), Effect of impurity on consolute temperature. Immiscible liquids and steam distillation. Nernst distribution law. Calculation of the partition coefficient. Applications of distribution law.

#### **2. Ionic equilibrium**

**3h**

Ionic product, common ion effect, solubility and solubility product. Calculations based on solubility product.

#### **3. Dilute solutions**

**7h**

Colligative properties- RLVP, Osmotic pressure, Elevation in boiling point and depression in freezing point. Experimental methods for the determination of molar mass of a non-volatile

solute using osmotic pressure, Elevation in boiling point and depression in freezing point. Abnormal colligative properties. Van't Hoff factor.

### **Co-curricular activities and Assessment Methods**

1. Continuous Evaluation: Monitoring the progress of student's learning
2. Class Tests, Worksheets and Quizzes
3. Presentations, Projects and Assignments and Group Discussions: Enhances critical thinking skills and personality
4. Semester-end Examination: critical indicator of student's learning and teaching methods adopted by teacher throughout the semester.

### **List of Reference Books**

1. Principles of physical chemistry by Prutton and Marron
2. Solid State Chemistry and its applications by Anthony R. West
3. Text book of physical chemistry by K L Kapoor
4. Text book of physical chemistry by S Glasstone
5. Advanced physical chemistry by Bahl and Tuli
6. Inorganic Chemistry by J.E. Huheey
7. Basic Inorganic Chemistry by Cotton and Wilkinson
8. A textbook of qualitative inorganic analysis by A.I. Vogel
9. Atkins, P. W. & Paula, J. de Atkin's Physical Chemistry Ed., Oxford University Press  
10th Ed (2014).
10. Castellan, G. W. Physical Chemistry 4th Ed. Narosa (2004).
11. Mortimer, R. G. Physical Chemistry 3rd Ed. Elsevier: NOIDA, UP (2009).
12. Barrow, G. M. Physical Chemistry

**LABORATORY COURSE -I**

**30hrs (2 h / w)**

**Practical-I Analysis of SALT MIXTURE**

(At the end of Semester-I)

**Qualitative inorganic analysis (Minimum of Six mixtures should be analysed)**

**50 M**

**Course outcomes:**

At the end of the course, the student will be able to;

1. Understand the basic concepts of qualitative analysis of inorganic mixture
2. Use glassware, equipment and chemicals and follow experimental procedures in the laboratory
3. Apply the concepts of common ion effect, solubility product and concepts related to qualitative analysis

**Analysis of SALT MIXTURE**

**50 M**

Analysis of mixture salt containing two anions and two cations (From two different groups) from the following:

**Anions:** Carbonate, Sulphate, Chloride, Bromide, Acetate, Nitrate, Borate, Phosphate.

**Cations:** Lead, Copper, Iron, Aluminium, Zinc, Nickel, Manganese, Calcium, Strontium, Barium, Potassium and Ammonium.

**MODEL PAPER**

**FIRST YEAR B.Sc., DEGREE EXAMINATION**

**SEMESTER-I**

**CHEMISTRY Course-I: INORGANIC & PHYSICAL CHEMISTRY**

Time: 3 hours

Maximum Marks: 75

**PART- A5 X 5 = 25 Marks**

Answer any **FIVE** of the following questions. Each carries **FIVE** marks

1. Explain the preparation & structures of Phosphonitrilic compounds.
2. Explain in brief, catalytic properties & stability of various oxidation states of d-block elements.
3. Write short note on Bravais lattices and crystal systems.
4. What are Smectic&Nematic liquid Crystals? Explain.



5. Write account on Common ion effect & Solubility product.
6. Describe Andrew's isotherms of carbon dioxide.
7. Explain Actinide Contraction.
8. Explain the structure of Borazine.

**PART- B5 X 10 = 50 Marks**

Answer **ALL** the questions. Each carries **TEN** marks

- 9 (a). Explain Classification, Preparations & uses of Silicones

(or)

- (b). (i) What are Pseudohalogens.  
(ii) Explain the Structures of any one  $AX_3$  &  $AX_5$  interhalogen compounds.

- 10 (a). What is Lanthanide Contraction? Explain the Consequences of Lanthanide Contraction.

(or)

- (b). (i) Explain the magnetic properties of d- block elements.  
(ii) Explain about Conductors, Semi-Conductors & Insulators using Band Theory.

- 11.(a). Write an essay on Crystal defects.

(or)

- (b). What is Bragg's Law. Explain the determination of structure of a crystal by powder method.

- 12.(a). Derive the relationship between Critical constants & Vanderwaal constants

(or)

- (b).(i) Write any 5 differences between liquid crystals & liquids, solids  
(ii) Write the applications of Liquid crystals.

- 13.(a). Explain Nernst distribution Law. Explain its applications

(or)

- (b). What are colligative properties. Write experimental methods for determination of molar mass of a non-volatile solute by using Elevation in boiling point & depression in freezing point.

\*\*\*

## SEMESTER – II

### Course II – (Organic & General Chemistry) 60 hrs (4h/w)

#### Course outcomes:

At the end of the course, the student will be able to;

1. Understand and explain the differential behavior of organic compounds based on fundamental concepts learnt.
2. Formulate the mechanism of organic reactions by recalling and correlating the fundamental properties of the reactants involved.
3. Learn and identify many organic reaction mechanisms including Free Radical Substitution, Electrophilic Addition and Electrophilic Aromatic Substitution.
4. Correlate and describe the stereochemical properties of organic compounds and reactions.

#### **ORGANIC CHEMISTRY**

**36h**

##### **UNIT-I**

##### **Recapitulation of Basics of Organic Chemistry**

##### **Carbon-Carbon sigma bonds (Alkanes and Cycloalkanes)**

**12h**

General methods of preparation of alkanes- Wurtz and Wurtz Fittig reaction, Corey House synthesis, physical and chemical properties of alkanes, Isomerism and its effect on properties, Free radical substitutions; Halogenation, concept of relative reactivity v/s selectivity. Conformational analysis of alkanes (Conformations, relative stability and energy diagrams of Ethane, Propane and butane). General molecular formulae of cycloalkanes and relative stability, Baeyer strain theory, Cyclohexane conformations with energy diagram, Conformations of monosubstituted cyclohexane.

##### **UNIT-II**

##### **Carbon-Carbon pi Bonds (Alkenes and Alkynes)**

**12h**

General methods of preparation, physical and chemical properties. Mechanism of E1, E2, E1cB reactions, Saytzeff and Hoffmann eliminations, Electrophilic Additions, mechanism (Markownikoff/Antimarkownikoff addition) with suitable examples, *syn* and *anti*- addition; addition of H<sub>2</sub>, X<sub>2</sub>, HX. oxymercuration-

demercuration, hydroboration-oxidation, ozonolysis, hydroxylation, Diels Alder reaction, 1,2- and 1,4-addition reactions in conjugated dienes.

Reactions of alkynes; acidity, electrophilic and nucleophilic additions, hydration to form carbonyl compounds, Alkylation of terminal alkynes.

### **UNIT-III**

#### **Benzene and its reactivity**

**12h**

Concept of aromaticity, Huckel's rule - application to Benzenoid (Benzene, Naphthalene) and Non - Benzenoid compounds (cyclopropenyl cation, cyclopentadienyl anion and tropylium cation)

Reactions - General mechanism of electrophilic aromatic substitution, mechanism of nitration, Friedel-Craft's alkylation and acylation. Orientation of aromatic substitution - ortho, para and meta directing groups. Ring activating and deactivating groups with examples (Electronic interpretation of various groups like  $\text{NO}_2$  and Phenolic). Orientation of (i) Amino, methoxy and methyl groups (ii) Carboxy, nitro, nitrile, carbonyl and sulphonic acid groups (iii) Halogens

(Explanation by taking minimum of one example from each type)

### **GENERAL CHEMISTRY**

**24 h**

#### **UNIT-IV**

##### **1. Surface chemistry and chemical bonding**

###### **Surface chemistry**

**6h**

**Colloids**- Coagulation of colloids- Hardy-Schulze rule. Stability of colloids, Protection of Colloids, Gold number.

**Adsorption**- Physical and chemical adsorption, Langmuir adsorption isotherm, applications of adsorption.

###### **2. Chemical Bonding**

**6h**

Valence bond theory, hybridization, VB theory as applied to  $\text{ClF}_3$ ,  $\text{Ni}(\text{CO})_4$ , Molecular orbital theory - LCAO method, construction of M.O. diagrams for homo-nuclear and hetero-nuclear diatomic molecules ( $\text{N}_2$ ,  $\text{O}_2$ ,  $\text{CO}$  and  $\text{NO}$ ).

### **3. HSAB**

**2h**

Pearson's concept, HSAB principle & its importance, bonding in Hard-Hard and Soft-Soft combinations.

### **UNIT-V**

#### **Stereochemistry of carbon compounds**

**10h**

Molecular representations- Wedge, Fischer, Newman and Saw-Horse formulae.

Optical isomerism: Optical activity- wave nature of light, plane polarised light, optical rotation and specific rotation.

Chiral molecules- definition and criteria(Symmetry elements)- Definition of enantiomers and diastereomers – Explanation of optical isomerism with examples- Glyceraldehyde, Lactic acid, Alanine, Tartaric acid, 2,3-dibromopentane.

D,L, R,S and E,Z- configuration with examples.

Definition of Racemic mixture – Resolution of racemic mixtures (any 3 techniques)

#### **Co-curricular activities and Assessment Methods**

Continuous Evaluation: Monitoring the progress of student's learning

Class Tests, Worksheets and Quizzes

Presentations, Projects and Assignments and Group Discussions: Enhance critical thinking skills and personality

Semester-end Examination: critical indicator of student's learning and teaching methods adopted by teachers throughout the semester.

#### **List of Reference Books**

##### **Theory:**

Morrison, R. N. & Boyd, R. N. Organic Chemistry, Dorling Kindersley (India) Pvt. Ltd. (Pearson Education).

Finar, I. L. Organic Chemistry (Volume 1), Dorling Kindersley (India) Pvt. Ltd. (Pearson Education).

Finar, I. L. Organic Chemistry (Volume 2: Stereochemistry and the Chemistry of Natural Products), Dorling Kindersley (India) Pvt. Ltd. (Pearson Education).

Eliel, E. L. & Wilen, S. H. Stereochemistry of Organic Compounds; Wiley: London, 1994.

Kalsi, P. S. Stereochemistry Conformation and Mechanism; New Age International, 2005.

##### **Practical:**

Ahluwalia, V.K. & Aggarwal, R. Comprehensive Practical Organic Chemistry: Preparation and Quantitative Analysis, University Press (2000).

Ahluwalia, V.K. & Dhingra, S. Comprehensive Practical Organic Chemistry: Qualitative Analysis, University Press (2000).

Furniss, B.S.; Hannaford, A.J.; Smith, P.W.G.; Tatchell, A.R. Practical Organic Chemistry, 5th Ed., Pearson (2012)

#### **Additional Resources:**

Solomons, T. W. G.; Fryhle, C. B. & Snyder, S. A. Organic Chemistry, 12th Edition, Wiley.

Bruice, P. Y. Organic Chemistry, Eighth Edition, Pearson.

Clayden, J.; Greeves, N. & Warren, S. Organic Chemistry, Oxford.

Nasipuri, D. Stereochemistry of Organic Compounds: Principles and Applications, Third Edition, NewAge International.

Gunstone, F. D. Guidebook to Stereochemistry, Prentice Hall Press, 1975.

### **LABORATORY COURSE-II**

**30hrs (2 h / w)**

#### **Practical-II Volumetric Analysis**

(At the end of Semester-II)

#### **Course outcomes:**

At the end of the course, the student will be able to;

1. Use glassware, equipment and chemicals and follow experimental procedures in the laboratory
2. Understand and explain the volumetric analysis based on fundamental concepts learnt in ionic equilibria
3. Learn and identify the concepts of a standard solutions, primary and secondary standards
4. Facilitate the learner to make solutions of various molar concentrations. This may include: The concept of the mole; Converting moles to grams; Converting grams to moles; Defining concentration; Dilution of Solutions; Making different molar concentrations.

#### **Volumetric analysis**

**50 M**

1. Estimation of sodium carbonate and sodium hydrogen carbonate present in a mixture.
2. Determination of Fe (II) using  $\text{KMnO}_4$  with oxalic acid as primary standard.

3. Determination of Cu (II) using  $\text{Na}_2\text{S}_2\text{O}_3$  with  $\text{K}_2\text{Cr}_2\text{O}_7$  as primary standard.
4. Estimation of water of crystallization in Mohr's salt by titrating with  $\text{KMnO}_4$

**MODEL PAPER**  
**FIRST YEAR B.Sc., DEGREE EXAMINATION**  
**SEMESTER-II**  
**CHEMISTRY COURSE -II: ORGANIC & GENERAL CHEMISTRY**

Time: 3 hours

Maximum Marks: 75

**PART- A**

5 X 5 = 25 Marks

Answer any **FIVE** of the following questions. Each carries **FIVE** marks

1. Write different conformations of n-butane. Explain their relative stability..
2. Explain 1,2- & 1,4- addition reactions of conjugated dienes.
3. Explain the orientation effect of halogens on mono substituted benzene.
4. Explain the mechanism of  $\text{E1}^{\text{CB}}$  elimination reaction.
5. Explain the structure of  $\text{ClF}_3$  by Valency Bond theory.
6. What are Hard & soft acids & bases? Explain with examples.
7. Draw the Wedge, Fischer, Newmann & saw-Horse representations for Tartaric acid.
8. Define Enantiomers and Diastereomers and give two examples for each.

**PART- B**

5 X 10 = 50 Marks

Answer **ALL** the questions. Each carries **TEN** marks

- 9 (a). (i) Write the preparation of alkanes by Wurtz and Corey-House reaction.  
(ii) Explain Halogenation of alkanes. Explain the reactivity and selectivity in free radical substitutions.  
(or)
  - (b). (i) Explain Baeyer Strain Theory  
(ii) Draw the conformations of Cyclohexane and explain their stability by drawing energy profile diagram.
- 10 (a). (i) Write any two methods of preparation of alkenes.  
(ii) Explain the mechanism of Markownikoff and Anti-Markownikoff addition of  $\text{HBr}$  to alkene.  
(or)

- (b). (i) Explain the acidity of 1-alkynes  
(ii) How will you prepare acetaldehyde and acetone from alkynes?  
(iii) Write alkylation reaction of terminal alkene.
- 11.(a). Define Huckel rule of aromatic compounds. What are benzenoid and non-benzenoid aromatic compounds? Give examples.  
(or)
- (b). Explain the mechanisms of Nitration and Friedel-Craft's alkylation of Benzene.
- 12.(a). (i) Define Hardy-Schulze rule & Gold number.  
(ii) Differentiate Physisorption & Chemisorption. Explain Langmuir adsorption isotherm.  
(or)
- (b). Construct the Molecular Orbital diagram for O<sub>2</sub> and NO and explain their bond order and magnetic property.
- 13.(a). Define racemic mixture. Explain any two techniques for resolution of racemic mixture.  
(or)
- (b). (i) Define Optical activity and Specific rotation.  
(ii) Draw the R- & S- isomers of Alanine, Glyceraldehyde.  
(iii) Write the E- & Z- isomers of 2-butene.

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### SEMESTER - III

#### Course III (ORGANIC CHEMISTRY & SPECTROSCOPY) 60hrs (4 h / w)

#### Course outcomes:

At the end of the course, the student will be able to;

1. Understand preparation, properties and reactions of haloalkanes, haloarenes and oxygen containing functional groups.
2. Use the synthetic chemistry learnt in this course to do functional group transformations.
3. To propose plausible mechanisms for any relevant reaction

## ORGANIC CHEMISTRY

34h

### UNIT – I

#### 1. Chemistry of Halogenated Hydrocarbons:

6h

Alkyl halides: Methods of preparation and properties, nucleophilic substitution reactions –  $S_N1$ ,  $S_N2$  and  $S_Ni$  mechanisms with stereochemical aspects and effect of solvent etc.; nucleophilic substitution vs. elimination, Williamson's synthesis.

Aryl halides: Preparation (including preparation from diazonium salts) and properties, nucleophilic aromatic substitution;  $S_NAr$ , Benzyl mechanism.

Relative reactivity of alkyl, allyl, benzyl, vinyl and aryl halides towards nucleophilic substitution reactions.

#### 2. Alcohols & Phenols

6h

Alcohols: preparation, properties and relative reactivity of  $1^\circ$ ,  $2^\circ$ ,  $3^\circ$  alcohols, Bouvaelt Blanc Reduction; Oxidation of diols by periodic acid and lead tetra acetate, Pinacol-Pinacolone rearrangement;

Phenols: Preparation and properties; Acidity and factors affecting it, Ring substitution reactions, Reimer-Tiemann and Kolbe's-Schmidt Reactions, Fries and Claisen rearrangements with mechanism;

### UNIT-II

#### Carbonyl Compounds

10h

Structure, reactivity, preparation and properties;

Nucleophilic additions, Nucleophilic addition-elimination reactions with ammonium derivatives

Mechanisms of Aldol and Benzoin condensation, Claisen-Schmidt, Perkin, Cannizzaro and Wittig reaction, Beckmann haloform reaction and Baeyer-Villiger oxidation,  $\alpha$ -substitution reactions, oxidations and reductions (Clemmensen, Wolff-Kishner, with  $LiAlH_4$  &  $NaBH_4$ ).

Addition reactions of  $\alpha, \beta$ -unsaturated carbonyl compounds: Michael addition.

Active methylene compounds:

Keto-

enol tautomerism. Preparation and synthetic applications of diethyl malonate and ethyl acetoacetate.

### UNIT-III

#### Carboxylic Acids and their Derivatives

12h



General methods of preparation, physical properties and reactions of monocarboxylic acids, effect of substituent on acidic strength. Typical reactions of dicarboxylic acids, hydroxy acids and unsaturated acids.

Preparation and reactions of acid chlorides, anhydrides, esters and amides;

Comparative study of nucleophilic substitution at acyl group - Mechanism

of acidic and alkaline hydrolysis of esters, Claisen condensation, Reformatsky reactions and Curtius rearrangement

Reactions involving H, OH and COOH groups - salt formation, anhydride formation, acid chloride formation, amide formation and esterification (mechanism). Degradation of carboxylic acids by Hunsdiecker reaction, decarboxylation by Schmidt reaction, Arndt-Eistert synthesis, halogenation by Hell-Volhard-Zelinsky reaction.

## **SPECTROSCOPY**

**26 h**

### **UNIT-IV**

#### **Molecular Spectroscopy:**

**18h**

Interaction of electromagnetic radiation with molecules and various types of spectra;

**Rotation spectroscopy:** Selection rules, intensities of spectral lines, determination of bond lengths of diatomic and linear triatomic molecules, isotopic substitution.

**Vibrational spectroscopy:** Classical equation of vibration, computation of force constant, Harmonic and anharmonic oscillator, Morse potential curve, vibrational degrees of freedom for polyatomic molecules, modes of vibration. Selection rules for vibrational transitions, Fundamental frequencies, overtones and hot bands.

**Electronic spectroscopy:** Energy levels of molecular orbitals ( $\sigma$ ,  $\pi$ ,  $n$ ). Selection rules for electronic spectra. Types of electronic transitions in molecules, effect of conjugation. Concept of chromophore. bathochromic and hypsochromic shifts. Beer-Lambert's law and its limitations.

**Nuclear Magnetic Resonance (NMR) spectroscopy:** Principles of nuclear magnetic resonance, equivalent and non-equivalent protons, position of signals. Chemical shift, NMR splitting of signals - spin-spin coupling, coupling constants. Applications of NMR with suitable examples - ethyl bromide, ethanol, acetaldehyde, 1,1,2-tribromo ethane, ethyl acetate, toluene and acetophenone.

**Application of Spectroscopy to Simple Organic Molecules****Application of visible, ultraviolet and Infrared spectroscopy in organic molecules.**

Application of electronic spectroscopy and Woodward rules for calculating  $\lambda_{\max}$  of conjugated dienes and  $\alpha, \beta$  – unsaturated compounds.

Infrared radiation and types of molecular vibrations, functional group and fingerprint region. IR spectra of alkanes, alkenes and simple alcohols (inter and intramolecular hydrogen bonding), aldehydes, ketones, carboxylic acids and their derivatives (effect of substitution on  $>C=O$  stretching absorptions).

**Co-curricular activities and Assessment Methods**

Continuous Evaluation: Monitoring the progress of student's learning

Class Tests, Worksheets and Quizzes

Presentations, Projects and Assignments and Group Discussions: Enhance critical thinking skills and personality

Semester-end Examination: critical indicator of student's learning and teaching methods adopted by teacher throughout the semester.

**List of Reference Books**

1. A Text Book of Organic Chemistry by Bahl and Arunbahl
2. A Text Book of Organic chemistry by I L Finar Vol I
3. Organic chemistry by Bruice
4. Organic chemistry by Clayden
5. Spectroscopy by William Kemp
6. Spectroscopy by Pavia
7. Organic Spectroscopy by J. R. Dyer
8. Elementary organic spectroscopy by Y.R. Sharma
9. Spectroscopy by P.S. Kalsi
10. Spectrometric Identification of Organic Compounds by Robert M Silverstein, Francis X Webster
11. Mann, F.G. & Saunders, B.C. Practical Organic Chemistry, Pearson Education (2009)
12. Furniss, B.S., Hannaford, A.J., Smith, P.W.G. & Tatchell, A.R. Practical Organic Chemistry, 5th Ed. Pearson (2012)

13. Ahluwalia, V.K. & Aggarwal, R. Comprehensive Practical Organic Chemistry: Preparation and Quantitative Analysis, University Press (2000).

**LABORATORY COURSE -III**

**30hrs (2 h / w)**

**Practical Course-III Organic preparations and IR Spectral Analysis**

(At the end of Semester- III)

**Course outcomes:**

On the completion of the course, the student will be able to do the following:

1. how to use glassware, equipment and chemicals and follow experimental procedures in the laboratory
2. how to calculate limiting reagent, theoretical yield, and percent yield
3. how to engage in safe laboratory practices by handling laboratory glassware, equipment, and chemical reagents appropriately
4. how to dispose of chemicals in a safe and responsible manner
5. how to perform common laboratory techniques including reflux, distillation, recrystallization, vacuum filtration.
6. how to create and carry out work up and separation procedures
7. how to critically evaluate data collected to determine the identity, purity, and percent yield of products and to summarize findings in writing in a clear and concise manner

**Organic preparations:**

**40M**

i. Acetylation of one of the following compounds:

amines (aniline, o-, m-, p-toluidines and o-, m-, p-anisidine) and phenols ( $\beta$ -naphthol, vanillin, salicylic acid) by any one method:

- a. Using conventional method.
- b. Using green approach

ii. Benzoylation of one of the following amines

(aniline, o-, m-, p-toluidines and o-, m-, p-anisidine)

iii. Nitration of any one of the following:

- a. Acetanilide/nitrobenzene by conventional method
- b. Salicylic acid by green approach (using ceric ammonium nitrate).

**IR Spectral Analysis**

**10M**

IR Spectral Analysis of the following functional groups with examples

- a) Hydroxyl groups
- b) Carbonyl groups
- c) Amino groups
- d) Aromatic groups

**MODEL PAPER**  
SECOND YEAR B.Sc., DEGREE EXAMINATION  
**SEMESTER-III**  
**CHEMISTRY COURSE-III: ORGANIC CHEMISTRY &**  
**SPECTROSCOPY**

Time: 3 hours

Maximum Marks: 75

**PART- A**

5 X 5 = 25 Marks

Answer any **FIVE** of the following questions. Each carries **FIVE** marks

1. Discuss two methods for preparation of aryl halides.
2. Explain the mechanism for Pinacol-Pinacolone rearrangement.
3. Discuss the mechanism for Bayer-villiger oxidation reaction.
4. Explain the effect of substituents on acidic strength of mono-carboxylic acids.
5. Write the mechanism for Claisen Condensation reaction.
6. Write the selection rules in rotational spectroscopy.
7. Explain Spin – Spin coupling and Coupling Constant.
8. Explain types of electronic transitions in UV spectroscopy.

**PART- B**

5 X 10 = 50 Marks

Answer **ALL** the questions. Each carries **TEN** marks

- 9 (a). Give the mechanism & stereochemistry of  $SN^1$  &  $SN^2$  reactions of alkyl halides with suitable example.

(or)

- (b). Explain the following reactions with mechanism.  
(i) Reimer-Tiemann reaction (ii) Fries rearrangement.

- 10 (a). Discuss the mechanism for following reactions.  
(i) Perkin reaction. (ii) Cannizzaro reaction

(or)

(b). Write the preparation and any three synthetic applications of diethyl malonate.

11.(a). Explain acid and base hydrolysis reaction of esters with mechanism.

(or)

(b). Explain the mechanisms of Curtius rearrangement & Arndt –Eistert reaction.

12.(a). (i) Write a note on vibrational degrees of freedom for polyatomic molecules.  
(ii) Explain different modes of vibrations & selection rules in IR spectroscopy.

(or)

(b).(i) Define Bathochromic shift. Explain the effect of conjugation in U.V. spectroscopy.

(ii) Discuss the principle of NMR spectroscopy.

13.(a). Write Woodward-Fieser rules for calculating  $\lambda_{\max}$  for conjugated dienes and  $\alpha,\beta$  – unsaturated carbonyl compounds, and apply them for one example each.

(or)

(b).(i) What is Fingerprint region. Explain its significance with an example.(ii)  
Write IR spectral data for any one alcohol, aldehyde and ketone

## SEMESTER - IV

**Course IV (INORGANIC, ORGANIC AND PHYSICAL CHEMISTRY) 60hrs (4 h / w)**

### Course outcomes:

At the end of the course, the student will be able to;

1. To learn about the laws of absorption of light energy by molecules and the subsequent photochemical reactions.
2. To understand the concept of quantum efficiency and mechanisms of photochemical reactions.

### UNIT - I

**Organometallic Compounds**

**8h**

Definition and classification of organometallic compounds on the basis of bond type, Concept of hapticity of organic ligands. Metal carbonyls: 18 electron rule, electron count of mononuclear, polynuclear and substituted metal carbonyls of 3d series. General methods of preparation of mono and binuclear carbonyls of 3d series. P-acceptor behaviour of carbon monoxide. Synergic effects (VB approach) - (MO diagram of CO can be referred to for synergic effect to IR frequencies).

## **UNIT – II**

### **Carbohydrates 8h**

Occurrence, classification and their biological importance, Monosaccharides: Constitution and absolute configuration of glucose and fructose, epimers and anomers, mutarotation, determination of ring size of glucose and fructose, Haworth projections and conformational structures; Interconversions of aldoses and ketoses; Killiani-Fischer synthesis and Ruff degradation; Disaccharides – Elementary treatment of maltose, lactose and sucrose. Polysaccharides – Elementary treatment of starch.

## **UNIT- III**

### **Amino acids and proteins 6h**

Introduction: Definition of Amino acids, classification of Amino acids into alpha, beta, and gamma amino acids. Natural and essential amino acids - definition and examples, classification of alpha amino acids into acidic, basic and neutral amino acids with examples. Methods of synthesis: General methods of synthesis of alpha amino acids (specific examples - Glycine, Alanine, valine and leucine) by following methods: a) from halogenated carboxylic acid b) Gabriel Phthalimide synthesis c) strecker's synthesis.

Physical properties: Zwitter ion structure - salt like character - solubility, melting points, amphoteric character, definition of isoelectric point.

Chemical properties: General reactions due to amino and carboxyl groups - lactams from gamma and delta amino acids by heating- peptide bond (amide linkage). Structure and nomenclature of peptides and proteins.

### **Heterocyclic Compounds 7h**

Introduction and definition: Simple five membered ring compounds with one hetero atom Ex. Furan. Thiophene and pyrrole - Aromatic character – Preparation from 1, 4, -dicarbonyl compounds, Paul-Knorr synthesis.

Properties: Acidic character of pyrrole - electrophilic substitution at 2 or 5 position, Halogenation, Nitration and Sulphonation under mild conditions - Diels Alder reaction in furan.

Pyridine – Structure - Basicity - Aromaticity- Comparison with pyrrole- one method of preparation and properties - Reactivity towards Nucleophilic substitution reaction.

#### **UNIT- IV**

#### **Nitrogen Containing Functional Groups**

Preparation, properties and important reactions of nitro compounds, amines and diazonium salts.

##### **1. Nitro hydrocarbons**

**3h**

Nomenclature and classification-nitro hydrocarbons, structure -Tautomerism of nitroalkanes leading to aci and keto form, Preparation of Nitroalkanes, reactivity -halogenation, reaction with HONO (Nitrous acid), Nef reaction and Mannich reaction leading to Michael addition and reduction.

##### **2. Amines:**

**11h**

Introduction, classification, chirality in amines (pyramidal inversion), importance and general methods of preparation.

Properties : Physical properties, Basicity of amines: Effect of substituent, solvent and steric effects.

Distinction between Primary, secondary and tertiary amines using Hinsberg's method and nitrous acid. Discussion of the following reactions with emphasis on the mechanistic pathway: Gabriel Phthalimide synthesis, Hoffmann-

Bromamide reaction, Carbylamine reaction, Mannich reaction, Hoffmann's exhaustive methylation, Hoffmann-elimination reaction and Cope elimination.

##### **Diazonium**

**Salts:** Preparation and

synthetic applications of diazonium salts including preparation of arenes, haloarenes, phenols, cyano and nitro compounds. Coupling reactions of diazonium salts (preparation of azo dyes).

#### **UNIT- V**

##### **Photochemistry**

**5h**

Difference between thermal and photochemical processes, Laws of photochemistry- Grothus-Draper's law and Stark-Einstein's law of photochemical equivalence, Quantum yield- Photochemical reaction mechanism- hydrogen- chlorine and hydrogen- bromine reaction. Qualitative description of fluorescence, phosphorescence, Jablonski diagram, Photosensitized reactions- energy transfer processes (simple example).

## **Thermodynamics**

**12 h**

The first law of thermodynamics-statement, definition of internal energy and enthalpy, Heat capacities and their relationship, Joule-Thomson effect- coefficient, Calculation of work for the expansion of perfect gas under isothermal and adiabatic conditions for reversible processes, State function. Temperature dependence of enthalpy of formation- Kirchoff's equation, Second law of thermodynamics Different Statements of the law, Carnot cycle and its efficiency, Carnot theorem, Concept of entropy, entropy as a state function, entropy changes in reversible and irreversible processes. Entropy changes in spontaneous and equilibrium processes. Third law of thermodynamics, Nernst heat theorem, Spontaneous and non-spontaneous processes, Helmholtz and Gibbs energies-Criteria for spontaneity.

## **Co-curricular activities and Assessment Methods**

Continuous Evaluation: Monitoring the progress of student's learning

Class Tests, Worksheets and Quizzes

Presentations, Projects and Assignments and Group Discussions: Enhance critical thinking skills and personality

Semester-end Examination: critical indicator of student's learning and teaching methods adopted by teacher throughout the semester.

## **List of Reference Books**

1. Concise coordination chemistry by Gopalan and Ramalingam
2. Coordination Chemistry by Basalo and Johnson
3. Organic Chemistry by G. Mareloudan, Purdue Univ
4. Text book of physical chemistry by S Glasstone
6. Concise Inorganic Chemistry by J.D. Lee
7. Advanced Inorganic Chemistry Vol-I by Satyaprakash, Tuli, Basu and Madan
8. A Text Book of Organic Chemistry by Bahl and Arunbahl
9. A Text Book of Organic chemistry by I L Finar Vol I
10. A Text Book of Organic chemistry by I L Finar Vol II
11. Advanced physical chemistry by Gurudeep Raj

**LABORATORY COURSE -IV    30hrs(2 h / w)**

**Practical Course-IV Organic Qualitative analysis**

**50 M**

(At the end of Semester- IV)



**Course outcomes:**

At the end of the course, the student will be able to;

1. Use glassware, equipment and chemicals and follow experimental procedures in the laboratory
2. Determine melting and boiling points of organic compounds
3. Understand the application of concepts of different organic reactions studied in theory part of organic chemistry

**Organic Qualitative analysis****50 M**

Analysis of an organic compound through systematic qualitative procedure for functional group identification including the determination of melting point and boiling point with suitable derivatives.

Alcohols, Phenols, Aldehydes, Ketones, Carboxylic acids, Aromatic primary amines, amides and simple sugars

**MODEL PAPER**  
**SECOND YEAR B.Sc., DEGREE EXAMINATION**  
**SEMESTER-IV**  
**CHEMISTRY COURSE -IV: INORGANIC, ORGANIC & PHYSICAL**  
**CHEMISTRY**

Time: 3 hours

Maximum Marks: 75

**PART- A**

5 X 5 = 25 Marks

Answer any **FIVE** of the following questions. Each carries **FIVE** marks

1. Describe the 18 electron rule of mono nuclear and polynuclear metal carbonyls with suitable examples.
2. What are epimers and anomers. Give examples.
3. Discuss about iso electric point and zwitter ion.
4. Discuss the Paul-Knorr synthesis of five membered heterocyclic compounds.
5. Explain Tautomerism shown by nitro alkanes
6. Discuss the basic nature of amines.
7. Write the differences between thermal and photochemical reactions.
8. Derive heat capacities and derive  $C_p - C_v = R$

**PART- B**

5 X 10 = 50 Marks

Answer **ALL** the questions. Each carries **TEN** marks

- 9 (a). What are organometallic compounds? Discuss their Classification on the basis of type of bonds with examples.  
(or)
- (b). Discuss the general methods of preparations of mono & bi-nuclear carbonyls of 3d series.
- 10 (a). Discuss the constitution, configuration and ring size of glucose. Draw the Haworth and Conformational structure of glucose.  
(or)
- (b). (i) Explain Ruff's degradation.  
(ii) Explain Kiliani- Fischer synthesis.
- 11.(a). What are amino acids? Write any three general methods of preparation of amino acids.  
(or)
- (b). Discuss the aromatic character of Furan, Thiophene and Pyrrole.
- 12.(a). Write the mechanism for the following.  
(i) Nef reaction                      (ii) Mannich reaction  
(or)
- (b).(i) Explain Hinsberg separation of amines.  
(ii) Discuss any three synthetic applications of diazonium salts.
- 13.(a). What is quantum yield? Explain the photochemical combination of Hydrogen-Chlorine and Hydrogen - Bromine.  
(or)
- (b). Define entropy. Describe entropy changes in the reversible and irreversible process.

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## SEMESTER - IV

Course V (INORGANIC & PHYSICAL CHEMISTRY) 60 hrs (4 h / w)

### Course outcomes:

At the end of the course, the student will be able to;

1. Understand concepts of boundary conditions and quantization, probability distribution, most probable values, uncertainty and expectation values
2. Application of quantization to spectroscopy.
3. Various types of spectra and their use in structure determination.

## INORGANIC CHEMISTRY

26 h

### UNIT –I

#### Coordination Chemistry

12 h

IUPAC nomenclature of coordination compounds, Structural and stereoisomerism in complexes with coordination numbers 4 and 6. Valence Bond Theory (VBT): Inner and outer orbital complexes. Limitations of VBT, Crystal field effect, octahedral symmetry. Crystal field stabilization energy (CFSE), Crystal field effects for weak and strong fields. Tetrahedral symmetry, Factors affecting the magnitude of crystal field splitting energy, Spectrochemical series, Comparison of CFSE for Octahedral and Tetrahedral complexes, Tetragonal distortion of octahedral geometry, Jahn-Teller distortion, square planar coordination.

### UNIT –II

#### 1. Inorganic Reaction Mechanism:

4h

Introduction to inorganic reaction mechanisms. Concept of reaction pathways, transition state, intermediate and activated complex. Labile and inert complexes, ligand substitution reactions -  $SN^1$  and  $SN^2$ , Substitution reactions in square planar complexes, Trans-effect, theories of trans effect and its applications

#### 2. Stability of metal complexes:

2h

Thermodynamic stability and kinetic stability, factors affecting the stability of metal complexes, chelate effect, determination of composition of complex by Job's method and mole ratio method.

#### Bioinorganic Chemistry:

8h

Metal ions present in biological systems, classification of elements according to their action in biological system. Geochemical effect on the distribution of metals, Sodium/K-pump, carbonic anhydrase and carboxypeptidase.

Excess and deficiency of some trace metals. Toxicity of metal ions (Hg, Pb, Cd and As), reasons for toxicity, Use of chelating agents in medicine, Cisplatin as an anti-cancer drug. Iron and its application in bio-systems, Haemoglobin, Myoglobin. Storage and transfer of iron.

## **PHYSICAL CHEMISTRY**

**34 h**

### **UNIT-III**

#### **1 .Phase rule**

**6h** Concept of phase, components, degrees of freedom. Thermodynamic derivation of Gibbs phase rule. Phase diagram of one component system - water system, Study of Phase diagrams of Simple eutectic systems i) Pb-Ag system, desilverisation of lead ii) NaCl-Water system, Congruent and incongruent melting point- Definition and examples for systems having congruent and incongruent melting point , freezing mixtures.

### **UNIT-IV**

#### **Electrochemistry**

**14h**

Specific conductance, equivalent conductance and molar conductance- Definition and effect of dilution. Cell constant. Strong and weak electrolytes, Kohlrausch's law and its applications, Definition of transport number, determination of transport number by Hittorf's method. Debye-Huckel-Onsager's equation for strong electrolytes (elementary treatment only), Application of conductivity measurements- conductometric titrations.

Electrochemical Cells- Single electrode potential, Types of electrodes with examples: Metal-metal ion, Gas electrode, Inert electrode, Redox electrode, Metal-metal insoluble salt- salt anion. Determination of EMF of a cell, Nernst equation, Applications of EMF measurements - Potentiometric titrations.

Fuel cells- Basic concepts, examples and applications

### **UNIT-V**

#### **Chemical Kinetics:**

**14 h**

The concept of reaction rates. Effect of temperature, pressure, catalyst and other factors on reaction rates. Order and molecularity of a reaction, Derivation of integrated rate equations for zero, first and second order reactions (both for equal and unequal concentrations of reactants). Half-life of a reaction. General methods for determination of order of a reaction. Concept of activation energy and its calculation from Arrhenius equation. Theories of Reaction Rates: Collision theory and Activated Complex theory of bimolecular reactions. Comparison of the two theories (qualitative treatment only). Enzyme catalysis- Specificity,

factors affecting enzyme catalysis, Inhibitors and Lock & key model. Michaels- Menten equation- derivation, significance of Michaelis-Menten constant.

#### **Co-curricular activities and Assessment Methods**

Continuous Evaluation: Monitoring the progress of student's learning

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Semester-end Examination: critical indicator of student's learning and teaching methods adopted by teacher throughout the semester.

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2. Concise Inorganic Chemistry by J.D.Lee
3. Advanced Inorganic Chemistry Vol-I by Satyaprakash, Tuli, Basu and Madan
4. Advanced physical chemistry by Gurudeep Raj
5. Principles of physical chemistry by Prutton and Marron
6. Advanced physical chemistry by Bahl and Tuli
7. Inorganic Chemistry by J.E.Huheey
8. Basic Inorganic Chemistry by Cotton and Wilkinson
9. A textbook of qualitative inorganic analysis by A.I. Vogel
10. Atkins, P. W. & Paula, J. de Atkin's Physical Chemistry Ed., Oxford University Press  
10th Ed (2014).
11. Castellan, G. W. Physical Chemistry 4th Ed. Narosa (2004).
12. Mortimer, R. G. Physical Chemistry 3rd Ed. Elsevier: NOIDA, UP (2009).
13. Barrow, G. M. Physical Chemistry

#### **SEMESTER - IV**

<b>Course V</b>	<b>LABORATORY COURSE</b>	<b>30 hrs (2 h / w)</b>
<b>Practical-Course -V</b>	<b>Conductometric and Potentiometric Titrimetry</b>	<b>50 M</b>

**Course outcomes:**

At the end of the course, the student will be able to;

1. Use glassware, equipment and chemicals and follow experimental procedures in the laboratory
2. Apply concepts of electrochemistry in experiments
3. Be familiar with electroanalytical methods and techniques in analytical chemistry which study an analyte by measuring the potential (volts) and/or current (amperes) in an electrochemical cell containing the analyte

**Conductometric and Potentiometric Titrimetry****50 M**

1. **Conductometric titration**- Determination of concentration of HCl solution using standard NaOH solution.
2. **Conductometric titration**- Determination of concentration of CH<sub>3</sub>COOH Solution using standard NaOH solution.
3. **Conductometric titration**- Determination of concentration of CH<sub>3</sub>COOH and HCl in a mixture using standard NaOH solution.
4. **Potentiometric titration**- Determination of Fe (II) using standard K<sub>2</sub>Cr<sub>2</sub>O<sub>7</sub> solution.
5. Determination of rate constant for acid catalyzed ester hydrolysis.

**MODEL PAPER**

SECOND YEAR B.Sc., DEGREE EXAMINATION

**SEMESTER-IV****CHEMISTRY COURSE V: INORGANIC & PHYSICAL CHEMISTRY**

Time: 3 hours

Maximum Marks: 75

**PART- A5 X 5 = 25 Marks**

Answer any **FIVE** of the following questions. Each carries **FIVE** marks

1. Write note on Jahn-Teller distortion.
2. Explain Labile & inert complexes.
3. Explain Job's method for determination of composition of complex.
4. Explain Thermodynamic derivation of Gibb's phase rule.
5. Explain any two conductometric titrations.
6. Write note on Fuel Cells with examples and applications.
7. What is enzyme catalysis? Write any three factors effecting enzyme catalysis.

8. Derive Michaels- Menten equation.

**PART- B**  
Marks

5 X 10 = 50

Answer **ALL** the questions. Each carries **TEN** marks

9 (a). Explain Valence Bond theory with Inner and Outer orbital complexes. Write limitations of VBT.

(or)

(b). Define CFSE. Explain the factors effecting the magnitude of crystal field splitting energy.

10 (a). Explain Trans effect. Explain the theories of trans effect and write any two applications of trans effect.

(or)

(b). (i) Write the biological functions of Haemoglobin and Myoglobin.  
(ii) Write note on use of chelating agents in medicines.

11.(a). Define Phase rule and terms involved in it. Explain phase diagram of Pb-Ag system.

(or)

(b). (i) Explain phase diagram for NaCl-water system.  
(ii) Explain briefly about Freezing mixtures.

12.(a). Define Transport number. Write experimental method for the determination of transport number by Hittorf method.

(or)

(b).(i) Define single electrode potential.  
(ii) Explain four types of electrodes with examples.

13.(a). Explain general methods for determination of order of a reaction.

(or)

(b).Explain Collision theory and Activated complex theory of bimolecular reactions.

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### **SUBJECT EXPERTS**

*Prof. C. Suresh Reddy*  
Professor, Department of Chemistry  
S.V. University  
Tirupati.

*Dr. M. Mahaboob Pacha*  
Lecturer in Chemistry  
Government Degree College  
Ramachandrapuram – 533255

### **SYLLABUS VETTED BY**

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## **ANDHRA PRADESH STATE COUNCIL OF HIGHER EDUCATION**

(A Statutory body of the Government of Andhra Pradesh)

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### **REVISED SYLLABUS OF BOTANY UNDER CBCS FRAMEWORK WITH EFFECT FROM 2020-2021**

#### **PROGRAMME: THREE-YEAR BOTANY**

*(With Learning Outcomes, Unit-wise Syllabus, References, Co-curricular Activities &  
Model Q.P.)*

*For Fifteen Courses of 1, 2, 3 & 4 Semesters)*

**(To be Implemented from 2020-21 Academic Year)**

**APSCHE/ REVISION OF C.B.C.S – BOTANY COURSE W.E.F.2020-21**

<b>S. No.</b>	<b>Semester</b>	<b>Title of the Course (Paper)</b>	<b>Hours /week</b>	<b>Max. Marks (SEE)</b>	<b>Marks in CIA</b>	<b>Credits</b>
1.	Sem.-I/ Course-1	Fundamentals of Microbes and Non-vascular Plants	04	75	25	03
	Course-1 Practical	Fundamentals of Microbes and Non-vascular Plants	03	Max. Marks-50 Internal assessment at Semester end		02
2.	Sem.-II/ Course-2	Basics of Vascular plants and Phytogeography	04	75	25	03
	Course-2 Practical	Basics of Vascular plants and Phytogeography	03	Max. Marks-50 External assessment at Semester end		02
3.	Sem.-III/ Course-3	Anatomy and Embryology of Angiosperms, Plant Ecology and Biodiversity	04	75	25	03
	Course-3 Practical	Anatomy and Embryology of Angiosperms, Plant Ecology and Biodiversity	03	Max. Marks-50 Internal assessment at Semester end		02
4.	Sem.-IV Course-4	Plant Physiology and Metabolism	03	75	25	03
	Course-4 Practical	Plant Physiology and Metabolism	03	Max. Marks-50 External assessment at Semester end		02
5.	Sem.- IV Course- 5	Cell Biology, Genetics and Plant Breeding	04	75	25	03
	Course-5 Practical	Cell Biology, Genetics and Plant Breeding	03	Max. Marks-50 External assessment at Semester end		02
6.	Sem.- V  Course – 6 & 7	Domain related Skill Enhancement Courses (02)	03	75	25	03
		- Three (3) pairs of courses (each pair has 2 related courses) will be offered, student has to choose a pair of courses.	03	Max. Marks-50 Internal assessment at Semester end		02
			03	75	25	03
			03	Max. Marks-50 Internal assessment at Semester end		02

**CBCS / Semester System (w.e.f. 2020-'21 Admitted Batch)**

**I Semester /Botany Core Course - 1**

**Fundamentals of Microbes and Non-vascular Plants**

**(Viruses, Bacteria, Fungi, Lichens, Algae and Bryophytes)**

(Total hours of teaching – 60 @ 04 Hrs./Week)

**Theory:**

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**Learning Outcomes:**

On successful completion of this course, the students will be able to:

- Explain origin of life on the earth.
  - Illustrate diversity among the viruses and prokaryotic organisms and can categorize them.
  - Classify fungi, lichens, algae and bryophytes based on their structure, reproduction and life cycles.
  - Analyze and ascertain the plant disease symptoms due to viruses, bacteria and fungi.
  - Recall and explain the evolutionary trends among amphibians of plant kingdom for their shift to land habitat.
  - Evaluate the ecological and economic value of microbes, thallophytes and bryophytes.
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**Unit – 1: Origin of life and Viruses**

**12Hrs.**

1. Origin of life, concept of primary Abiogenesis; Miller and Urey experiment. Five kingdom classification of R.H. Whittaker
2. Discovery of microorganisms, Pasteur experiments, germ theory of diseases.
3. Shape and symmetry of viruses; structure of TMV and Gemini virus; multiplication of TMV; A brief account of Prions and Viroids.
4. A general account on symptoms of plant diseases caused by Viruses. Transmission of plant viruses and their control.
5. Significance of viruses in vaccine production, bio-pesticides and as cloning vectors.

**Unit – 2: Special groups of Bacteria and Eubacteria**

**12Hrs.**

1. Brief account of Archaeobacteria, Actinomycetes and Cyanobacteria.
2. Cell structure and nutrition of Eubacteria.

3. Reproduction- Asexual (Binary fission and endospores) and bacterial recombination (Conjugation, Transformation, Transduction).
4. Economic importance of Bacteria with reference to their role in Agriculture and industry (fermentation and medicine).
5. A general account on symptoms of plant diseases caused by Bacteria; Citrus canker.

### **Unit – 3: Fungi & Lichens**

**12 Hrs.**

1. General characteristics of fungi and Ainsworth classification (upto classes).
2. Structure, reproduction and life history of (a) *Rhizopus* (Zygomycota) and (b) *Puccinia* (Basidiomycota).
3. Economic uses of fungi in food industry, pharmacy and agriculture.
4. A general account on symptoms of plant diseases caused by Fungi; Blast of Rice.
5. Lichens- structure and reproduction; ecological and economic importance.

### **Unit – 4: Algae**

**12 Hrs.**

1. General characteristics of Algae (pigments, flagella and reserve food material); Fritsch classification (upto classes).
2. Thallus organization and life cycles in Algae.
3. Occurrence, structure, reproduction and life cycle of (a) *Spirogyra* (Chlorophyceae) and (b) *Polysiphonia* (Rhodophyceae).
4. Economic importance of Algae.

### **Unit – 5: Bryophytes**

**12 Hrs.**

1. General characteristics of Bryophytes; classification upto classes.
2. Occurrence, morphology, anatomy, reproduction (developmental details are not needed) and life cycle of (a) *Marchantia* (Hepaticopsida) and (b) *Funaria* (Bryopsida).
3. General account on evolution of sporophytes in Bryophyta.

**Text books:**

- Botany – I (Vrukshasastram-I) : Telugu Akademi, Hyderabad
- Pandey, B.P. (2013) *College Botany, Volume-I*, S. Chand Publishing, New Delhi
- Hait,G., K.Bhattacharya&A.K.Ghosh (2011) *A Text Book of Botany, Volume-I*, New Central Book Agency Pvt. Ltd., Kolkata
- Bhattacharjee, R.N., (2017) *Introduction to Microbiology and Microbial Diversity*, Kalyani Publishers, New Delhi.

**Books for Reference:**

- Dubey, R.C. &D.K.Maheswari (2013) *A Text Book of Microbiology*,S.Chand& Company Ltd., New Delhi
- Pelczar Jr., M.J., E.C.N. Chan &N.R.Krieg (2001)*Microbiology*, Tata McGraw-Hill Co, New Delhi
- Prescott, L. Harley, J. and Klein, D. (2005)*Microbiology, 6th edition*, Tata McGraw –Hill Co. New Delhi.
- Alexopoulos, C.J., C.W.Mims&M.Blackwell (2007) *Introductory Mycology*,Wiley& Sons, Inc., New York
- Mehrotra, R.S. & K. R. Aneja (1990)*An Introduction to Mycology*. New Age International Publishers, New Delhi
- Kevin Kavanagh (2005) *Fungi ; Biology and Applications* John Wiley & Sons, Ltd.,West Sussex, England
- John Webster & R. W. S. Weber (2007) *Introduction to Fungi*,Cambridge University Press, New York
- Fritsch, F.E. (1945)*The Structure & Reproduction of Algae (Vol. I & Vol. II)*Cambridge UniversityPress Cambridge, U.K..
- Bold, H.C. & M. J. Wynne (1984)*Introduction to the Algae*, Prentice-Hall Inc., New Jersey
- Robert Edward Lee (2008)*Phycology*. Cambridge University Press, New York
- Van Den Hoek, C., D.G.Mann&H.M.Jahns (1996)*Algae : An Introduction to Phycology*. Cambridge University Press, New York
- Shaw, A.J.&B.Goffinet (2000)*Bryophyte Biology*.Cambridge University Press, New York.

## **Practical syllabus of Botany Core Course – 1/ Semester – I**

### **Fundamentals of Microbes and Non-vascular Plants**

(Viruses, Bacteria, Fungi, Lichens, Algae and Bryophytes)

(Total hours of laboratory exercises 30 Hrs. @ 02 Hrs./Week)

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**Course Outcomes:** On successful completion of this practical course, student shall be able to;

1. Demonstrate the techniques of use of lab equipment, preparing slides and identify the material and draw diagrams exactly as it appears.
2. Observe and identify microbes and lower groups of plants on their own.
3. Demonstrate the techniques of inoculation, preparation of media etc.
4. Identify the material in the permanent slides etc.

#### **Practical Syllabus:**

1. Knowledge of Microbiology laboratory practices and safety rules.
2. Knowledge of different equipment for Microbiology laboratory (Spirit lamp, Inoculation loop, Hot-air oven, Autoclave/Pressure cooker, Laminar air flow chamber and Incubator) and their working principles. (In case of the non-availability of the laboratory equipment the students can be taken to the local college/clinical lab. with required infrastructural facilities or they can enter a linkage with the college/lab for future developments and it will fetch credits during the accreditation by NAAC).
3. Demonstration of Gram's staining technique for Bacteria.
4. Study of Viruses (Corona, Gemini and TMV) using electron micrographs/ models.
5. Study of Archaeobacteria and Actinomycetes using permanent slides/ electron micrographs/diagrams.
6. Study of *Anabaena* and *Oscillatoria* using permanent/temporary slides.
7. Study of different bacteria (Cocci, Bacillus, Vibrio and Spirillum) using permanent or temporary slides/ electron micrographs/ diagrams.
8. Study/ microscopic observation of vegetative, sectional/anatomical and reproductive structures of the following using temporary or permanent slides/ specimens/ mounts :
  - a. Fungi : *Rhizopus*, *Penicillium* and *Puccinia*

- b. Lichens: Crustose, foliose and fruticose
  - c. Algae : *Volvox*, *Spirogyra*, *Ectocarpus* and *Polysiphonia*
  - d. Bryophyta : *Marchantia* and *Funaria*
9. Study of specimens of Tobacco mosaic disease, Citrus canker and Blast of Rice.

## Model Question Paper for Practical Examination

Semester – I/ Botany Core Course – 1

### Fundamentals of Microbes and Non-vascular Plants

(Viruses, Bacteria, Fungi, Lichens, Algae and Bryophytes)

Max. Time: 3 Hrs.

Max. Marks: 50

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1. Take the T.S. of material 'A' (Fungi), make a temporary mount and make comments about identification. 10 M
2. Identify any 2 algae from the mixture (material 'B') given with specific comments about identification. 10 M
3. Take the T.S. of material 'C' (Bryophyta), make a temporary mount and make comments about identification. 10 M
4. Identify the following with specific reasons. 4x 3 = 12 M  
D. A laboratory equipment of Microbiology  
E. Virus  
F. Archaeobacteria /Ascomycete /Cyanobacteria/ Eu-Bacteria  
G. Lichen
5. Record + Viva-voce 5+3 = 8 M

### Suggested co-curricular activities for Botany Core Course-1 in Semester-I:

#### A. Measurable :

##### a. Student seminars :

1. Baltimore classification of Viruses.
2. Lytic and lysogenic cycle of T- even Bacteriophages.
3. Viral diseases of humans and animals.
4. Retroviruses
5. Bacterial diseases of humans and animals.
6. Significance of Bacteria in Biotechnology and Genetic engineering.
7. Fungi responsible for major famines in the world.
8. Poisonous mushrooms (Toad stools).
9. Algae as Single Cell Proteins (SCPs)
10. Parasitic algae



11. Origin of Bryophytes through : Algae vsPteridophytes
12. Fossil Bryophytes
13. Evolution of gametophytes in Bryophyta.
14. Ecological and economic importance of Bryophytes.

**b. Student Study Projects :**

1. Isolation and identification of microbes from soil, water and air.
2. Collection and identification of algae from fresh /estuarine /marine water.
3. Collection and identification of fruiting bodies of Basidiomycetes and Ascomycetes.
4. Collection and identification of Lichens from their native localities.
5. Collection of diseased plants/parts and identification of symptoms.
6. Collection and identification of Bryophytes from their native localities.

- c. Assignments:** Written assignment at home / during '0' hour at college; preparation of charts with drawings, making models etc., on topics included in syllabus.

**B. General :**

1. Visit to Agriculture and/or Horticulture University/College/Research station to learn about microbial diseases of plants.
2. Visit to industries working on microbial, fungal and algal products.
3. Group Discussion (GD)/ Quiz/ Just A Minute (JAM) on different modules in syllabus of the course.

**II Semester /Botany Core Course – 2**  
**Basics of Vascular plants and Phytogeography**  
**(Pteridophytes, Gymnosperms, Taxonomy of Angiosperms and Phytogeography)**  
(Total hours of teaching – 60 @ 02 Hrs./Week)

**Theory:**

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**Learning Outcomes:**

On successful completion of this course, the students will be able to:

- Classify and compare Pteridophytes and Gymnosperms based on their morphology, anatomy, reproduction and life cycles.
  - Justify evolutionary trends in tracheophytes to adapt for land habitat.
  - Explain the process of fossilization and compare the characteristics of extinct and extant plants.
  - Critically understand various taxonomical aids for identification of Angiosperms.
  - Analyze the morphology of the most common Angiosperm plants of their localities and recognize their families.
  - Evaluate the ecological, ethnic and economic value of different tracheophytes and summarize their goods and services for human welfare.
  - Locate different phytogeographical regions of the world and India and can analyze their floristic wealth.
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**Unit – 1: Pteridophytes**

**12 Hrs.**

1. General characteristics of Pteridophyta; classification of Smith (1955) into divisions.
2. Occurrence, morphology, anatomy, reproduction (developmental details are not needed) and life history of (a) *Lycopodium* (Lycopsida) and (b) *Marsilea* (Filicopsida).
3. Stellar evolution in Pteridophytes;
4. Heterospory and seed habit.

**Unit – 2:Gymnosperms** **14 Hrs.**

1. General characteristics of Gymnosperms; Sporneclassification upto classes.
2. Occurrence, morphology, anatomy, reproduction (developmental details are not needed) and life history of (a) *Cycas*(Cycadopsida) and (b) *Gnetum* (Gnetopsida).
3. Outlines of geological time scale.
4. A brief account on *Cycadeoidea*.

**Unit – 3:Basic aspects of Taxonomy** **13Hrs.**

1. Aim and scope of taxonomy; Species concept: Taxonomic hierarchy, species, genus and family.
2. Plant nomenclature: Binomial system, ICBN- rules for nomenclature.
3. Herbarium and its techniques,BSI herbarium and Kew herbarium; concept of digital herbaria.
4. Bentham and Hooker system of classification;
5. Systematic description and economic importance of the following families:  
(a) Annonaceae (b) Curcubitaceae

**Unit – 4: Systematic Taxonomy** **13 Hrs.**

1. Systematic description and economic importance of the following families:  
(a) Asteraceae (b) Asclepiadaceae (c)Amaranthaceae(d) Euphorbiaceae  
(e) Arecaceaeand (f) Poaceae
2. Outlines of Angiosperm Phylogeny Group (APG IV).

**Unit – 5:Phytogeography** **08 Hrs.**

1. Principles of Phytogeography, Distribution (wides, endemic, discontinuous species)
2. Endemism – types and causes.
3. Phytogeographic regions of World.
4. Phytogeographic regions of India.
5. Vegetation types in Andhra Pradesh.

**Text books:**

- Botany – I (Vrukshasastram-I) : Telugu Akademi, Hyderabad
- Botany – II (Vrukshasastram-II) : Telugu Akademi, Hyderabad
- Acharya, B.C., (2019) *Archhegoniates*, Kalyani Publishers, New Delhi
- Bhattacharya, K., G. Hait&Ghosh, A. K., (2011) *A Text Book of Botany, Volume-II*, New Central Book Agency Pvt. Ltd., Kolkata
- Hait,G., K.Bhattacharya&A.K.Ghosh (2011) *A Text Book of Botany, Volume-I*, New Central Book Agency Pvt. Ltd., Kolkata
- Pandey, B.P. (2013)*College Botany, Volume-I*, S. Chand Publishing, New Delhi
- Pandey, B.P. (2013)*College Botany, Volume-II*, S. Chand Publishing, New Delhi

**Books for Reference:**

- Smith, G.M. (1971)*Cryptogamic Botany Vol. II.*, Tata McGraw Hill, New Delhi
- Sharma,O.P.(2012)*Pteridophyta*. Tata McGraw-Hill, New Delhi
- Kramer, K.U.&P. S. Green (1990) *The Families and Genera of Vascular Plants, Volume –I: Pteridophytes and Gymnosperms*(Ed.K.Kubitzki) Sprunge-Verlag, New York
- Bhatnagar, S.P. &AlokMoitra (1996)*Gymnosperms*. New Age International, New Delhi
- Coulter, J.M. &C.J.Chamberlain(1910) *Morphology of Gymnosperms*,The University of Chicago Press, Chicago, Illinois
- Govil, C.M. (2007)*Gymnosperms : Extinct and Extant*. KRISHNA Prakashan Media (P) Ltd.Meerut& Delhi
- Sporne, K.R.(1971)*The Morphology of Gymnosperms*.Hutchinsons Co. Ltd., London
- Arnold, C.A., (1947) *An introduction to Paleobotany*McGraw –Hill Book Company,INC, New York
- Stewart,W.N., and G.W.Rothwell (2005) *Paleobotany and the evolution of plants* Cambridge University Press, New York
- Lawrence, George H.M. (1951) *Taxonomy of Vascular Plants*. The McMillan Co., New York
- Heywood, V. H. and D. M. Moore (1984)*Current Concepts in Plant Taxonomy*. Academic Press, London.

- Jeffrey, C. (1982)*An Introduction to Plant Taxonomy*. Cambridge University Press, Cambridge. London.
- Sambamurty, A.V.S.S. (2005)*Taxonomy of Angiosperms I*. K .International Pvt. Ltd., New Delhi
- Singh, G. (2012). *Plant Systematics: Theory and Practice*.Oxford & IBH Pvt. Ltd., NewDelhi.
- Simpson, M.G. (2006). *Plant Systematics*. Elsevier Academic Press, San Diego, CA,U.S.A.
- Cain, S.A . (1944)*Foundations of Plant Geography*Harper & Brothers, N.Y.
- Good, R. (1997)*The Geography of flowering Plants (2nd Edn.)*Longmans, Green & Co., Inc., London & Allied Science Publishers, New Delhi
- Mani, M.S (1974)*Ecology & Biogeography of India*Dr. W. Junk Publishers, The Haque

## Practical syllabus of Botany Core Course – 2/ Semester – II

### Basics of Vascular plants and Phytogeography

(Pteridophytes, Gymnosperms, Taxonomy of Angiosperms and Phytogeography) (Total hours of laboratory exercises 30 Hrs. @ 02 Hrs. /Week)

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#### Course Outcomes:

On successful completion of this course students shall be able to:

1. Demonstrate the techniques of section cutting, preparing slides, identifying of the material and drawing exact figures.
2. Compare and contrast the morphological, anatomical and reproductive features of vascular plants.
3. Identify the local angiosperms of the families prescribed to their genus and species level and prepare herbarium.
4. Exhibit skills of preparing slides, identifying the given twigs in the lab and drawing figures of plant twigs, flowers and floral diagrams as they are.
5. Prepare and preserve specimens of local wild plants using herbarium techniques.

#### Practical Syllabus:

1. Study/ microscopic observation of vegetative, sectional/anatomical and reproductive structures of the following using temporary or permanent slides/ specimens/ mounts :
  - a. Pteridophyta : *Lycopodium* and *Marselia*
  - b. Gymnosperms : *Cycas* and *Gnetum*
2. Study of fossil specimens of *Cycadeoidea* and *Pentoxylon* (photographs /diagrams can be shown if specimens are not available).
3. Demonstration of herbarium techniques.
4. Systematic / taxonomic study of locally available plants belonging to the families prescribed in theory syllabus. (Submission of 30 number of Herbarium sheets of wild plants with the standard system is mandatory).
5. Mapping of phytogeographical regions of the globe and India.

## Model Question Paper for Practical Examination

Semester – II/ Botany Core Course – 2

### Basics of Vascular plants and Phytogeography

(Pteridophytes, Gymnosperms, Taxonomy of Angiosperms and Phytogeography)

Max. Time: 3 Hrs.

Max. Marks: 50

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1. Take T.S. of the material 'A' (Pteridophyta), make a temporary slide and justify the identification with apt points. 10 M
2. Take T.S. of the material 'B' (Gymnosperms), make a temporary slide and justify the identification with apt points. 10 M
3. Describe the vegetative and floral characters of the material 'C' (Taxonomy of Angiosperms) and derive its systematic position. 10 M
4. Identify the specimen 'D' (Fossil Gymnosperm) and give specific reasons. 5 M
5. Locate the specified phytogeographical regions (2x2M) in the world / India (E) map supplied to you. 4 M
6. Record + Herbarium & Field note book + Viva-voce 5 +4+3 = 12 M

### Suggested co-curricular activities for Botany Core Course-2 in Semester-II:

#### A. Measurable :

##### a. Student seminars :

1. Fossil Pteridophytes.
2. Aquatic ferns and tree ferns
3. Ecological and economic importance of Pteridophytes
4. Evolution of male and female gametophytes in Gymnosperms.
5. Endemic and endangered Gymnosperms.
6. Ecological and economic importance of Gymnosperms.
7. Floras and their importance: Flora of British India and Flora of Madras Presidency.
8. Botanical gardens and their importance: National Botanic garden and Royal Botanic garden.
9. Artificial, Natural and Phylogenetic classification systems.
10. Molecular markers used in APG system of classification.
11. Vessel less angiosperms.

12. Insectivorous plants.
13. Parasitic angiosperms.
14. Continental drift theory and species isolation.

**b. Student Study Projects :**

1. Collection and identification of Pteridophytes from their native locality/ making an album by collecting photographs of Pteridophytes.
  2. Collection and identification of Gymnosperms from their native locality/ making an album by collecting photographs of Gymnosperms.
  4. Collection of information on famous herbaria in the world and preparation of a report.
  5. Collection of information on famous botanic gardens in the world and preparation of a report.
  6. Collection of data on vegetables (leafy and fruity) plants in the market and preparation of a report on their taxonomy.
  7. Collection and identification of fresh and dry fruits plants in the market and preparation of a report on their taxonomy.
  7. Collection of data on plants of ethnic and ethnobotanical importance from their native locality.
  9. Preparation of a local flora by enlisting the plants of their native place.
- c. Assignments:** Written assignment at home / during '0' hour at college; preparation of charts with drawings, making models etc., on topics included in syllabus.

**B. General :**

1. Visit to Botanic garden in a Research institute/University to see the live plants.
2. Virtual tour in websites for digital herbaria and botanic gardens.
3. Acquaint with standard floras like – Flora of Madras Presidency, Flora of their respective district in Andhra Pradesh.
4. Looking into vegetation of different phytogeographical regions using web resources.
5. Group Discussion (GD)/ Quiz/ Just A Minute (JAM) on different modules in syllabus of the course.



### III Semester /Botany Core Course - 3

#### Anatomy and Embryology of Angiosperms, Plant Ecology and Biodiversity

(Total hours of teaching – 60 @ 04 Hrs./Week)

#### Theory:

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#### Learning outcomes:

On successful completion of this course, the students will be able to;

- Understand on the organization of tissues and tissue systems in plants.
  - Illustrate and interpret various aspects of embryology.
  - Discuss the basic concepts of plant ecology, and evaluate the effects of environmental and biotic factors on plant communities.
  - Appraise various qualitative and quantitative parameters to study the population and community ecology.
  - Correlate the importance of biodiversity and consequences due to its loss.
  - Enlist the endemic/endangered flora and fauna from two biodiversity hot spots in India and assess strategies for their conservation.
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#### Unit – 1: Anatomy of Angiosperms

12 Hrs.

1. Organization of apical meristems: Tunica-carpus theory and Histogen theory.
2. Tissue systems—Epidermal, ground and vascular.
3. Anomalous secondary growth in *Boerhaavia* and *Dracaena*.
4. Study of timbers of economic importance - Teak, Red sanders and Rosewood.

#### Unit – 2: Embryology of Angiosperms

12 Hrs.

1. Structure of anther, anther wall, types of tapetum. Microsporogenesis and development of male gametophyte.
2. Structure of ovule, megasporogenesis; monosporic (*Polygonum*), bisporic (*Allium*) and tetrasporic (*Peperomia*) types of embryo sacs.
3. Outlines of pollination, pollen – pistil interaction and fertilization.
4. Endosperm - Types and biological importance - Free nuclear, cellular, helobial and ruminant.
5. Development of Dicot (*Capsella bursa-pastoris*) embryo.

**Unit – 3: Basics of Ecology****12 Hrs.**

1. Ecology: definition, branches and significance of ecology.
2. Ecosystem: Concept and components, energy flow, food chain, food web, ecological pyramids.
4. Plants and environment: Climatic (light and temperature), edaphic and biotic factors.
5. Ecological succession: Hydrosere and Xerosere.

**Unit – 4: Population, Community and Production Ecology****12 Hrs.**

1. Population ecology: Natality, mortality, growth curves, ecotypes, ecads
2. Community ecology: Frequency, density, cover, life forms, biological spectrum
3. Concepts of productivity: GPP, NPP and Community Respiration
4. Secondary production, P/R ratio and Ecosystems.

**Unit – 5: Basics of Biodiversity****12 Hrs.**

1. Biodiversity: Basic concepts, Convention on Biodiversity - Earth Summit.
  2. Value of Biodiversity; types and levels of biodiversity and Threats to biodiversity
  3. Biodiversity Hot spots in India. Biodiversity in North Eastern Himalayas and Western Ghats.
  4. Principles of conservation: IUCN threat-categories, RED data book
  5. Role of NBPGR and NBA in the conservation of Biodiversity.
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**Text books:**

- Botany – III (Vrukshasastram-I) : Telugu Akademi, Hyderabad
- Botany – IV (Vrukshasastram-II) : Telugu Akademi, Hyderabad
- Pandey, B.P. (2013) *College Botany, Volume-II*, S. Chand Publishing, New Delhi
- Pandey, B.P. (2013) *College Botany, Volume-III*, S. Chand Publishing, New Delhi
- Bhattacharya, K., G. Hait & Ghosh, A. K., (2011) *A Text Book of Botany, Volume-II*, New Central Book Agency Pvt. Ltd., Kolkata

**Books for Reference:**

- Esau, K. (1971) *Anatomy of Seed Plants*. John Wiley and Son, USA.
- Fahn, A. (1990) *Plant Anatomy*, Pergamon Press, Oxford.
- Cutler, D.F., T. Botha & D. Wm. Stevenson (2008) *Plant Anatomy: An Applied Approach*, Wiley, USA.
- Paula Rudall (1987) *Anatomy of Flowering Plants: An Introduction to Structure and Development*. Cambridge University Press, London
- Bhojwani, S. S. and S. P. Bhatnagar (2000) *The Embryology of Angiosperms (4<sup>th</sup> Ed.)*, Vikas Publishing House, Delhi.
- Pandey, A. K. (2000) *Introduction to Embryology of Angiosperms*. CBS Publishers & Distributors Pvt. Ltd. , New Delhi
- Maheswari, P. (1971) *An Introduction to Embryology of Angiosperms*. McGraw Hill Book Co., London.
- Johri, B.M. (2011) *Embryology of Angiosperms*. Springer-Verlag, Berlin
- Pandey, B.P. (2013) *College Botany, Volume-III*, S. Chand Publishing, New Delhi
- Bhattacharya, K., A. K. Ghosh, & G. Hait (2011) *A Text Book of Botany, Volume-IV*, New Central Book Agency Pvt. Ltd., Kolkata
- Kormondy, Edward J. (1996) *Concepts of Ecology*, Prentice-Hall of India Private Limited, New Delhi
- Begon, M., J.L. Harper & C.R. Townsend (2003) *Ecology*, Blackwell Science Ltd., U.S.A.
- Eugene P. Odum (1996) *Fundamentals of Ecology*, Natraj Publishers, Dehradun
- Sharma, P.D. (2012) *Ecology and Environment*. Rastogi Publications, Meerut, India.
- N.S. Subrahmanyam & A.V.S.S. Sambamurty (2008) *Ecology* Narosa Publishing House, New Delhi

- A. K. Agrawal & P.P. Deo (2010) *Plant Ecology*, Agrobios (India), Jodhpur
- Kumar, H.D. (1992) *Modern Concepts of Ecology (7th Edn.,)* Vikas Publishing Co.,  
New Delhi.
- Newman, E.I. (2000): *Applied Ecology* Blackwell Scientific Publisher, U.K.
- Chapman, J.L. & M.J. Reiss (1992): *Ecology - Principles & Applications*. Cambridge University Press, U.K.
- Kumar H.D. (2000) *Biodiversity & Sustainable Conservation* Oxford & IBH Publishing Co Ltd. New Delhi.
- U. Kumar (2007) *Biodiversity : Principles & Conservation*, Agrobios (India), Jodhpur

**Practical syllabus of Botany Core Course – 3 /Semester – III**  
**Anatomy and Embryology of Angiosperms, Plant Ecology and Biodiversity**

(Total hours of laboratory exercises 30 Hrs. @ 02 Hrs./Week)

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**Course Outcomes:**

On successful completion of this practical course students shall be able to:

1. Get familiarized with techniques of section making, staining and microscopic study of vegetative, anatomical and reproductive structure of plants.
2. Observe externally and under microscope, identify and draw exact diagrams of the material in the lab.
3. Demonstrate application of methods in plant ecology and conservation of biodiversity and qualitative and quantitative aspects related to populations and communities of plants.

**Practical Syllabus**

1. Tissue organization in root and shoot apices using permanent slides.
2. Anomalous secondary growth in stems of *Boerhavia* and *Dracaena*.
3. Study of anther and ovule using permanent slides/photographs.
4. Study of pollen germination and pollen viability.
5. Dissection and observation of Embryo sac haustoria in *Santalum* or *Argemone*.
6. Structure of endosperm (nuclear and cellular) using permanent slides / Photographs.
7. Dissection and observation of Endosperm haustoria in *Crotalaria* or *Coccinia*.
8. Developmental stages of dicot and monocot embryos using permanent slides / photographs.
9. Study of instruments used to measure microclimatic variables; soil thermometer, maximum and minimum thermometer, anemometer, rain gauge, and lux meter. (visit to the nearest/local meteorology station where the data is being collected regularly and record the field visit summary for the submission in the practical).
10. Study of morphological and anatomical adaptations of hydrophytes and xerophytes (02 each).
11. Quantitative analysis of herbaceous vegetation in the college campus for frequency, density and abundance.

12. Identification of vegetation/various plants in college campus and comparison with Raunkiaer's frequency distribution law.
13. Find out the alpha-diversity of plants in the area
14. Mapping of biodiversity hotspots of the world and India.

## Model paper for Practical Examination

Semester – III/ Botany Core Course – 3

### Anatomy and Embryology of Angiosperms, Plant Ecology and Biodiversity

Max. Time: 3 Hrs.

Max. Marks: 50

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1. Take T.S. of the material 'A' (Anatomy), prepare a temporary slide and justify the identification with specific reasons. 10 M
2. Write the procedure for the experiment 'B' (Embryology) and demonstrate the same. 10 M
3. Take T.S. of the material 'C', prepare a temporary slide and justify the identification with specific reasons. 10 M
4. Identify the following with specific reasons. 4 x 3 = 12 M
  - D. Anatomy/Embryology
  - E. Ecology instrument
  - F. Mapping of Biodiversity hot spot
  - G. Endemic/endangered plant/animal
5. Record + Viva-voce 5 + 3 = 8 M

## **Suggested co-curricular activities for Botany Core Course-3 in Semester-III:**

### **A. Measurable :**

#### **a. Student seminars :**

1. Anatomy in relation to taxonomy of Angiosperms.
2. Nodal anatomy
3. Floral anatomy
4. Embryology in relation to taxonomy of Angiosperms.
5. Apomictics and polyembryony.
6. Biogeochemical cycles- Carbon, Nitrogen and Phosphorous.
7. Deforestation and Afforestation.
8. Green house effect and ocean acidification.
9. The Montreal protocol and the Kyoto protocol.
10. Productivity of aquatic ecosystems.
11. Mangrove ecosystems in India.
12. Kollerulake – Ramsar site.
13. Biodiversity hotspots of the world.
14. Origin of Crop plants - Vavilov centers
15. Agrobiodiversity
16. International organizations working on conservation of Biodiversity
17. Nagoya protocol – ABS system.
18. Endemic and endangered plants in Andhra Pradesh.

#### **b. Student Study Projects :**

1. Stomata structure in plants from college campus/ their native place.
2. Report on xylem elements in plants using maceration technique.
3. Collection of information on famous herbaria in the world and preparation of a report.
4. Microscopic observations on pollen morphology from plants in college Campus/ their native locality.
5. Study report on germination and viability of pollen in different plants.
6. Observation of anthesis time in different plants and their pollinators.
7. A report on autecology and synecology of some plants in college campus or their native place.
8. Collection of photos of endemic/endangered plant and animal species to Make an album.



9. Biodiversity of the college or their own residential/ native area.
10. Collection of seeds/vegetative organs of rare plant species from their localities and to raise/grow in college garden

**c. Assignments:** Written assignment at home / during '0' hour at college; preparation of charts with drawings, making models etc., on topics included in syllabus.

**B. General :**

1. Visit to an arboretum/silviculture station/Forest research institute to see the live timber yielding plants or to visit a local timber depot. to observe various woods.
2. Field visit to a nearby ecosystem to observe the abiotic-biotic relationships.
3. Visit to National park/Sanctuary/Biosphere reserve etc., to observe in-situ conservation of plants and animals.
4. Visit to a Botanical garden or Zoo to learn about ex-situ conservation of rare plants or animals.
5. Group Discussion (GD)/ Quiz/ Just A Minute (JAM) on different modules in syllabus of the course.

## IV Semester/ Botany Core Course – 4

### Plant Physiology and Metabolism

(Total hours of teaching – 60 @ 04 Hrs./Week)

#### Theory:

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#### Learning outcomes:

On successful completion of this course, the students will be able to;

- Comprehend the importance of water in plant life and mechanisms for transport of water and solutes in plants.
  - Evaluate the role of minerals in plant nutrition and their deficiency symptoms.
  - Interpret the role of enzymes in plant metabolism.
  - Critically understand the light reactions and carbon assimilation processes responsible for synthesis of food in plants.
  - Analyze the biochemical reactions in relation to Nitrogen and lipid metabolisms.
  - Evaluate the physiological factors that regulate growth and development in plants.
  - Examine the role of light on flowering and explain physiology of plants under stress conditions.
- 

#### Unit – 1: Plant-Water relations

10 Hrs.

1. Importance of water to plant life, physical properties of water, diffusion, imbibition, osmosis. water potential, osmotic potential, pressure potential.
2. Absorption and lateral transport of water; Ascent of sap
3. Transpiration: stomata structure and mechanism of stomatal movements ( $K^+$  ion flux).
4. Mechanism of phloem transport; source-sink relationships.

#### Unit – 2: Mineral nutrition, Enzymes and Respiration

14 Hrs.

1. Essential macro and micro mineral nutrients and their role in plants; symptoms of mineral deficiency
2. Absorption of mineral ions; passive and active processes.
3. Characteristics, nomenclature and classification of Enzymes. Mechanism of enzyme action, enzyme kinetics.

4. Respiration: Aerobic and Anaerobic; Glycolysis, Krebs cycle; electron transport system, mechanism of oxidative phosphorylation, Pentose Phosphate Pathway (HMP shunt).

**Unit – 3: Photosynthesis and Photorespiration**

**12 Hrs.**

1. Photosynthesis: Photosynthetic pigments, absorption and action spectra; Red drop and Emerson enhancement effect
2. Concept of two photosystems; mechanism of photosynthetic electron transport and evolution of oxygen; photophosphorylation
3. Carbon assimilation pathways (C<sub>3</sub>, C<sub>4</sub> and CAM);
4. Photorespiration - C<sub>2</sub> pathway

**Unit – 4: Nitrogen and lipid metabolism**

**12 Hrs.**

1. Nitrogen metabolism: Biological nitrogen fixation – asymbiotic and symbiotic nitrogen fixing organisms. Nitrogenase enzyme system.
2. Lipid metabolism: Classification of Plant lipids, saturated and unsaturated fatty acids.
3. Anabolism of triglycerides,  $\beta$ -oxidation of fatty acids, Glyoxylate cycle.

**Unit – 5: Plant growth - development and stress physiology**

**12 Hrs.**

1. Growth and Development: Definition, phases and kinetics of growth.
  2. Physiological effects of Plant Growth Regulators (PGRs) - auxins, gibberellins, cytokinins, ABA, ethylene and brassinosteroids.
  3. Physiology of flowering: Photoperiodism, role of phytochrome in flowering.
  4. Seed germination and senescence; physiological changes.
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**Text books:**

- Botany – IV (Vrukshasastram-II) : Telugu Akademi, Hyderabad
- Pandey, B.P. (2013) *College Botany, Volume-III*, S. Chand Publishing, New Delhi
- Ghosh, A. K., K. Bhattacharya & G. Hait (2011) *A Text Book of Botany, Volume-III*, New Central Book Agency Pvt. Ltd., Kolkata

**Books for Reference:**

- Aravind Kumar & S.S. Purohit (1998) *Plant Physiology – Fundamentals and Applications*, AgroBotanica, Bikaner
- Datta, S.C. (2007) *Plant Physiology*, New Age International (P) Ltd., Publishers, New Delhi
- Hans Mohr & P. Schopfer (2006) *Plant Physiology*, Springer (India) Pvt. Ltd., New Delhi
- Hans-Walter Heldt (2005) *Plant Biochemistry*, Academic Press, U.S.A.
- Hopkins, W.G. & N.P.A. Huner (2014) *Introduction to Plant Physiology*, Wiley India Pvt. Ltd., New Delhi
- Noggle Ray & J. Fritz (2013) *Introductory Plant Physiology*, Prentice Hall (India), New Delhi
- Pandey, S.M. & B.K. Sinha (2006) *Plant Physiology*, Vikas Publishing House, New Delhi
- Salisbury, Frank B. & Cleon W. Ross (2007) *Plant Physiology*, Thomsen & Wadsworth, Australia & U.S.A
- Sinha, R.K. (2014) *Modern Plant Physiology*, Narosa Publishing House, New Delhi
- Taiz, L. & E. Zeiger (2003) *Plant Physiology*, Panima Publishers, New Delhi
- Verma, V. (2007) *Text Book of Plant Physiology*, Ane Books India, New Delhi

## **Practical Syllabus of Botany Core Course – 4 / Semester – IV**

### **Plant Physiology and Metabolism**

(Total hours of laboratory exercises 30 Hrs. @ 02 Hrs. /Week)

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**Course outcomes:** On successful completion of this practical course, students shall be able to:

1. Conduct lab and field experiments pertaining to Plant Physiology, that is, biophysical and biochemical processes using related glassware, equipment, chemicals and plant material.
2. Estimate the quantities and qualitative expressions using experimental results and calculations
3. Demonstrate the factors responsible for growth and development in plants.

### **Practical Syllabus**

1. Determination of osmotic potential of plant cell sap by plasmolytic method using *Rhoeo/ Tradescantia* leaves.
2. Calculation of stomatal index and stomatal frequency of a mesophyte and a xerophyte.
3. Determination of rate of transpiration using Cobalt chloride method / Ganong's potometer (at least for a dicot and a monocot).
4. Effect of Temperature on membrane permeability by colorimetric method.
5. Study of mineral deficiency symptoms using plant material/photographs.
6. Demonstration of amylase enzyme activity and study the effect of substrate and Enzyme concentration.
7. Separation of chloroplast pigments using paper chromatography technique.
8. Demonstration of Polyphenol oxidase enzyme activity (Potato tuber or Apple fruit)
9. Anatomy of C<sub>3</sub>, C<sub>4</sub> and CAM leaves

10. Estimation of protein by biuret method/Lowry method

11. Minor experiments – Osmosis, Arc-auxonometer, ascent of sap through xylem, cytoplasmic streaming.

## Model Question Paper for Practical Examination

Semester – IV/ Botany Core Course – 4

### Plant Physiology and Metabolism

Max. Time: 3 Hrs.

Max. Marks: 50

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1. Conduct the experiment 'A' (Major experiment), write aim, principle, material and apparatus/equipment, procedure, tabulate results and make conclusion. 20 M
2. Demonstrate the experiment 'B' (Minor experiment), write the principle, procedure and give inference. 10 M
3. Identify the following with apt reasons. 3 x 4 = 12 M
  - C. Plant water relations / Mineral nutrition
  - D. Plant metabolism
  - E. Plant growth and development
4. Record + Viva-voce 5 + 3 = 8 M

#### Suggested co-curricular activities for Botany Core Course-4 in Semester-IV:

##### A. Measurable :

###### a. Student seminars :

1. Antitranspirants and their significance in crop physiology and horticulture.
2. Natural chelating agents in plants.
3. Criteria of essentiality of elements and beneficial elements.
4. Hydroponics, aquaponics and aeroponics.
5. Mycorrhizal association and mineral nutrition in plants.
6. Non-proteinaceous enzymes.
7. Respiratory inhibitors.
8. Structure of ATPase and Chemiosmotic hypothesis.
9. Transpiration and photosynthesis – a compromise.
10. Amphibolic pathways and bypass pathways in plants.
11. Non-biological nitrogen fixation.
12. Role of Hydrogenase in nitrogen fixation.
13. Plant lectins – their role in plants and use in medicine and medical research.

**b. Student Study Projects :**

1. Stomatal densities among different groups of plants.
2. Various treatments (salt, cold, high temperature, heavy metals) and their effects on seed germination.
3. Effects of plant hormones (IAA, Gibberellin and Kinetin) on Seed Germination.
4. Diurnal variation of stomatal behavior in CAM and C3 plants found in local area.
5. Effects of nitrogen fertilizer on plant growth.
6. Enumeration of C3, C4 and CAM plants in the local area.
7. Effect of different light wavelengths (red light, green light, blue light) on apparent photosynthesis in terms of growth.
8. Light effects on leaf growth and leaf orientation.
9. Artificial Fruit Ripening Process by various treatments (carbide and ethylene).
10. Study of relative water content and water retention by leaves under different environments.
11. Study of soil nutrients in local agricultural fields.
12. Study of mineral deficiency symptoms of various crops of local area.
13. Study of local weeds in crop fields.
14. Studies on seed storage proteins, oils and starch in local millets and pulse crops.
15. Making a report on LDPs, SDPs and DNPs in their locality.

- c. Assignments:** Written assignment at home / during '0' hour at college; preparation of charts with drawings, making models etc., on topics included in syllabus.

**B. General :**

1. Group Discussion (GD)/ Quiz/ Just A Minute (JAM) on different modules in syllabus of the course.
2. Visit to a Plant Physiology laboratory in a University or Physiology division in a Agriculture/Horticulture University/Research station.



**IV Semester / Botany Core Course –5**  
**Cell Biology, Genetics and Plant Breeding**  
(Total hours of teaching – 60 @ 04 Hrs./Week)

**Theory:**

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**Learning outcomes:**

On successful completion of this course, the students will be able to:

- Distinguish prokaryotic and eukaryotic cells and design the model of a cell.
  - Explain the organization of a eukaryotic chromosome and the structure of genetic material.
  - Demonstrate techniques to observe the cell and its components under a microscope.
  - Discuss the basics of Mendelian genetics, its variations and interpret inheritance of traits in living beings.
  - Elucidate the role of extra-chromosomal genetic material for inheritance of characters.
  - Evaluate the structure, function and regulation of genetic material.
  - Understand the application of principles and modern techniques in plant breeding.
  - Explain the procedures of selection and hybridization for improvement of crops.
- 

**Unit – 1: The Cell**

**12 Hrs.**

1. Cell theory; prokaryotic vs eukaryotic cell; animal vs plant cell; a brief account on ultra-structure of a plant cell.
2. Ultra-structure of cell wall.
3. Ultra-structure of plasma membrane and various theories on its organization.
4. Polymorphic cell organelles (Plastids); ultrastructure of chloroplast. Plastid DNA.

**Unit – 2: Chromosomes**

**12 Hrs.**

1. Prokaryotic vs eukaryotic chromosome. Morphology of a eukaryotic chromosome.
2. Euchromatin and Heterochromatin; Karyotype and ideogram.
3. Brief account of chromosomal aberrations - structural and numerical changes
4. Organization of DNA in a chromosome (solenoid and nucleosome models).

**Unit – 3: Mendelian and Non-Mendelian genetics****14Hrs.**

1. Mendel's laws of inheritance. Incomplete dominance and co-dominance; Multiple allelism.
2. Complementary, supplementary and duplicate gene interactions (plant based examples are to be dealt).
3. A brief account of linkage and crossing over; Chromosomal mapping - 2 point and 3 point test cross.
4. Concept of maternal inheritance (Corren's experiment on *Mirabilis jalapa*); Mitochondrial DNA.

**Unit – 4: Structure and functions of DNA****12 Hrs.**

1. Watson and Crick model of DNA. Brief account on DNA Replication (Semi-conservative method).
2. Brief account on Transcription, types and functions of RNA. Gene concept and genetic code and Translation.
3. Regulation of gene expression in prokaryotes - Lac Operon.

**Unit – 5: Plant Breeding****12 Hrs.**

1. Plant Breeding and its scope; Genetic basis for plant breeding. Plant Introduction and acclimatization.
  2. Definition, procedure; applications and uses; advantages and limitations of : (a) Mass selection, (b) Pure line selection and (c) Clonal selection.
  3. Hybridization – schemes, and technique; Heterosis (hybrid vigour).
  4. A brief account on Molecular breeding – DNA markers in plant breeding. RAPD, RFLP.
-

**Text books :**

- Botany – III (Vrukshasastram-I) : Telugu Akademi, Hyderabad
- Pandey, B.P. (2013) *College Botany, Volume-III*, S. Chand Publishing, New Delhi
- Ghosh, A.K., K.Bhattacharya & G. Hait (2011) *A Text Book of Botany, Volume-III*, New Central Book Agency Pvt. Ltd., Kolkata
- Chaudhary, R. C. (1996) *Introduction to Plant Breeding*, Oxford & IBH Publishing Co. Pvt. Ltd., New Delhi

**Books for Reference:**

- S. C. Rastogi (2008) *Cell Biology*, New Age International (P) Ltd. Publishers, New Delhi
- P. K. Gupta (2002) *Cell and Molecular biology*, Rastogi Publications, New Delhi
- B. D. Singh (2008) *Genetics*, Kalyani Publishers, Ludhiana
- A.V.S.S. Sambamurty (2007) *Molecular Genetics*, Narosa Publishing House, New Delhi
- Cooper, G.M. & R.E. Hausman (2009) *The Cell – A Molecular Approach*, A.S.M. Press, Washington
- Becker, W.M., L.J. Kleinsmith & J. Hardin (2007) *The World of Cell*, Pearson Education, Inc., New York
- De Robertis, E.D.P. & E.M.F. De Robertis Jr. (2002) *Cell and Molecular Biology*, Lippincott Williams & Wilkins Publ., Philadelphia
- Robert H. Tamarin (2002) *Principles of Genetics*, Tata McGraw –Hill Publishing Company Limited, New Delhi.
- Gardner, E.J., M. J. Simmons & D.P. Snustad (2004) *Principles of Genetics*, John Wiley & Sons Inc., New York
- Micklos, D.A., G.A. Freyer & D.A. Cotty (2005) *DNA Science: A First Course*, I.K. International Pvt. Ltd., New Delhi
- Chaudhari, H.K. (1983) *Elementary Principles of Plant Breeding*, TMH publishers Co., New Delhi
- Sharma, J.R. (1994) *Principles and Practice of Plant Breeding*, Tata McGraw- Hill Publishers, New Delhi
- Singh, B.D. (2001) *Plant Breeding : Principles and Methods*, Kalyani Publishers, Ludhiana

- Pundhan Singh (2015) *Plant Breeding for Undergraduate Students*, Kalyani Publishers, Ludhiana
- Gupta, S.K. (2010) *Plant Breeding : Theory and Techniques*, Agrobios (India), Jodhpur
- Hayes, H.K., F.R. Immer & D.C. Smith (2009) *Methods of Plant Breeding*, Biotech Books, Delhi

## Practical Syllabus of Botany Core Course – 5/IVSemester

### Cell Biology, Genetics and Plant Breeding

(Total hours of laboratory exercises 30 Hrs. @ 02 Hrs. /Week)

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**Course Outcomes:** After successful completion of this practical course the student shall be able to:

1. Show the understanding of techniques of demonstrating Mitosis and Meiosis in the laboratory and identify different stages of cell division.
2. Identify and explain with diagram the cellular parts of a cell from a model or picture and prepare models
3. Solve the problems related to crosses and gene interactions.
4. Demonstrate plant breeding techniques such as emasculation and bagging

#### Practical Syllabus:

1. Study of ultra structure of plant cell and its organelles using Electron microscopic Photographs/models.
2. Demonstration of Mitosis in *Allium cepa*/*Aloe vera* roots using squash technique; observation of various stages of mitosis in permanent slides.
4. Demonstration of Meiosis in P.M.C.s of *Allium cepa* flower buds using squash technique; observation of various stages of meiosis in permanent slides.
4. Study of structure of DNA and RNA molecules using models.
5. Solving problems monohybrid, dihybrid, back and test crosses.
6. Solving problems on gene interactions (at least one problem for each of the gene interactions in the syllabus).
7. Chromosome mapping using 3- point test cross data.
8. Demonstration of emasculation, bagging, artificial pollination techniques for hybridization.

**Model paper for Practical Examination**

Semester-IV / Botany Core Course – 5

**Cell Biology, Genetics and Plant Breeding**

Max. Time: 3 Hrs.

Max. Marks: 50

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1. Make a cytological preparation of given material 'A' (mitosis or meiosis in Onion) by squash technique, report any two stages, draw labeled diagrams and write the reasons.

15 M

2. Solve the given Genetic problem (Dihybrid cross/ Interaction of genes/ 3-point test cross) 'B' and write the conclusions.

15 M

3. Identify the following and justify with apt reasons.

3 x 4 = 12 M

C. Cell Biology (Cell organelle)

D. Genetics (DNA/RNA)

E. Plant Breeding

4. Record + Viva-voce

5 + 3 = 8 M

**Suggested co-curricular activities for Botany Core Course- 5 in Semester-IV:**

**A. Measurable :**

**a. Student seminars :**

1. Light microscopy : bright field and dark field microscopy.
2. Scanning Electron Microscopy (SEM).
3. Transmission Electron Microscopy (TEM).
4. Mitosis and Meiosis
5. Cell cycle and its regulation.
6. Cell organelles bounded by single membrane.
7. Prokaryotic chromosomes
8. Special types of chromosomes :Polytene, Lampbrush and B-chromosomes.
9. Different forms of DNA.
10. Gene mutations.
11. DNA damage and repair mechanisms.
12. Reverse transcription.
13. Protein structure.

14. Modes of reproduction in plants.

15. Modes of pollination in plants

**b. Student Study Projects :**

1. Study of mitotic cell cycle in roots of *Allium cepa*

2. Study of mitotic cell cycle in roots of *Aloe vera*

3. Observation of chromosomal aberrations in *Allium cepa* root cells exposed to industrial effluent(s).

4. Observation of chromosomal aberrations in *Allium cepa* root cells exposed to heavy metal(s).

5. Observation of polyembryony in *Citrus* spp. and *Mangifera indica*.

**c. Assignments:** Written assignment at home / during '0' hour at college; preparation of charts with drawings, making models etc., on topics included in syllabus.

**B. General :**

1. Field visit to Agriculture/Horticulture University/ Research station to observe Plant breeding methods.

2. Group Discussion (GD)/ Quiz/ Just A Minute (JAM) on different modules in syllabus of the course.

## RECOMMENDED ASSESSMENT OF STUDENTS:

### **Recommended continuous assessment methods for all courses:**

Some of the following suggested assessment methodologies could be adopted. Formal assessment for awarding marks for Internal Assessment in theory.

#### **(a) Formal:**

1. The oral and written examinations (Scheduled and surprise tests),
2. Simple, medium and Critical Assignments and Problem-solving exercises,
3. Practical assignments and laboratory reports,
4. Assessment of practical skills,
5. Individual and group project reports,
6. Seminar presentations,
7. Viva voce interviews.

#### **(b) Informal:**

1. Computerized adaptive testing, literature surveys and evaluations,
2. Peers and self-assessment, outputs from individual and collaborative work
3. Closed-book and open-book tests,



**Common pattern for Question Paper for Theory Examination(s) at Semester end**

Max. Time: 3 Hrs.

Max. Marks: 75 M

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**Section – A**

**Answer all the following questions.**

**5 x 2 = 10 M**

- ✓ One question should be given from each Unit in the syllabus.

**Section – B**

**Answer any three of the following questions. Draw a labeled diagram wherever necessary**

**3 x 5 = 15 M**

- ✓ One question should be given from each Unit in the syllabus.

**Section – C**

**Answer any five of the following questions. Draw a labeled diagram wherever necessary**

**5 x 10 = 50 M**

- ✓ Two questions (a & b) are to be given from each Unit in the syllabus (internal choice in each unit). Student has to answer 5 questions by choosing one from a set of questions given from a Unit.

**Note:** Questions should be framed in such a way to test the understanding, analytical and creative skills of the students. All the questions should be given within the frame work of the syllabus prescribed.

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## *Annexure*

### **Objectives and General Outcomes of Programme and Domain Subject**

**Programme(B.Sc.) Objectives:** The objectives of bachelor's degree programme with Botany are:

1. To provide a comprehensive knowledge on various aspects related to microbes and plants.
2. To deliver knowledge on latest developments in the field of Plant sciences with a practical approach.
3. To produce a student who thinks independently, critically and discuss various aspects of plant life.
4. To enable the graduate to prepare and pass through national and international examinations related to Botany.
5. To empower the student to become an employee or an entrepreneur in the field of Botany /Biology and to serve the nation.

### **Programme Outcomes:**

1. Understand the basic concepts of Botany in relation to its allied core courses.
2. Perceive the significance of microbes and plants for human welfare, and structural and functional aspects of plants.
3. Demonstrate simple experiments related to plant sciences, analyze data, and interpret them with the theoretical knowledge.
4. Work in teams with enhanced inter-personal skills.
5. Develop the critical thinking with scientific temper.
6. Effectively communicate scientific ideas both orally and in writing.

### **Domain Subject(Botany) Objectives :**

1. To impart knowledge on origin, evolution, structure, reproduction and interrelationships of microbes and early plant groups.
2. To provide knowledge on biology and taxonomy of true land plants within a phylogenetic framework.
3. To teach aspects related to anatomy, embryology and ecology of plants, and importance of Biodiversity.
4. To explain the structural and functional aspects of plants with respect to the cell organelles, chromosomes and genes, and methods of plant breeding.

5. To develop a critical understanding on SPAC, metabolism and growth and development in plants.
6. To enable the students proficient in experimental techniques and methods of analysis appropriate for various sub-courses in Botany.

**Domain Subject(Botany) Outcomes:**

1. Students will be able to identify, compare and distinguish various groups of microbes and primitive plants based on their characteristics.
2. Students will be able to explain the evolution of trachaeophytes and also distribution of plants on globe.
3. Students will be able to discuss on internal structure, embryology and ecological adaptations of plants, and want of conserving Biodiversity.
4. Students will be able to interpret life processes in plants in relation to physiology and metabolism.
5. Students will be able to describe ultrastructure of plant cells, inheritance and crop improvement methods.
6. Students will independently design and conduct simple experiments based on the knowledge acquired in theory and practicals of the different sub-courses in Botany.

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**SUBJECT EXPERTS**

*Prof. C.Sudhakar*  
Dept of Botany,  
Sri Krishnadevaraya University,  
Anantapur

*Dr.A.Srinivasa Rao*  
Lecturer in Botany,  
Govt Degree College,  
Mandapeta

**SYLLABUS VETTED BY**

*Prof.M.Vijaya Lakshmi,*  
Dept of Botany and Microbiology,  
Acharya Nagarjuna University,  
Nagarjuna Nagar



## **ANDHRA PRADESH STATE COUNCIL OF HIGHER EDUCATION**

(A Statutory body of the Government of Andhra Pradesh)

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### **REVISED SYLLABUS OF B.Sc. (ZOOLOGY) UNDER CBCS FRAMEWORK WITH EFFECT FROM 2020-21**

#### **PROGRAMME: THREE-YEAR B.Sc.**

(Zoology)

*(With Learning Outcomes, Unit-wise Syllabus, References, Co-curricular Activities &  
Model Q.P.)*

*For Fifteen Courses of 1, 2, 3 & 4 Semesters)*

**(To be Implemented from 2020-21 Academic Year)**

## Structure of ZOOLOGY Syllabus

(Under CBCS for 3-year B.Sc. Programme)

(With domain subject covered during the first 4 Semesters with 5 Courses)

YEAR	SEM	PAPER	TITLE	MARKS (100)		CREDITS
				MID SEMESTER	END SEMESTER	
I	I	I	Animal Diversity – I Biology of Non-Chordates	25	75	04
			Practical - I	25	75	01
	II	II	Animal Diversity – II Biology of Chordates	25	75	04
			Practical - II	25	75	01
II	III	III	Cell biology, Genetics, Molecular Biology & Evolution	25	75	04
			Practical - III	25	75	01
	IV	IV	Physiology, Cellular Metabolism & Embryology	25	75	04
			Practical - IV	25	75	01
		V	Immunology & Animal Biotechnology	25	75	04
			Practical - V	25	75	01

## **PROGRAMME: THREE-YEAR B.Sc.**

**(With Chemistry, Botany and Zoology Disciplines)**

As per the **National Education Policy, 2019** the **outcomes of Higher Education** include increased critical thinking abilities, higher order thinking and deeper learning, mastery of content, problem solving, team work and communication skills besides general engagement and enjoyment of learning including systematic research in India.

The overall objectives of the learning outcomes-based curriculum framework are to:

- Help formulate graduate attributes, qualification descriptors, programme learning outcomes and course learning outcomes that are expected to be demonstrated by the holder of a qualification;
- Enable prospective students, parents, employers and others to understand the nature and level of learning outcomes (knowledge, skills, attitudes and values) or attributes a graduate of a programme should be capable of demonstrating on successful completion of the programme of study.

### **Programme Educational Objectives (PEOs):**

**PEO1 Higher Education:** Empower students to pursue higher studies in various fields of Biology and Chemistry.

**PEO2 Career:** Enable students to pursue careers in Chemical, Biological and related fields as demonstrated by professional success at positions within industry, government, or academia.

**PEO3 Social responsibility:** Enable students to exhibit professionalism, ethical attitude, communication skills and team work in their profession.

### **Program Outcomes (POs):**

The Learning Outcomes of the programme could be in consonance with the Bloom's Taxonomy, which includes –

1. Remember (Lower order)
2. Understand (Lower Order)
3. Apply (Lower Order)
4. Analyze (Higher Order)

5. Evaluate & Problem Solving (Higher Order)
6. Create (Higher Order)

**PO1 Critical thinking:** Able to understand and utilize the principles of scientific enquiry, think analytically, clearly and evaluate critically while solving problems and making decisions during biological study.

**PO2 Effective communication:** Able to formally communicate Scientific ideas and investigations of the biology discipline to others using both oral and written communication skills.

**PO3 Social interaction:** Able to develop individual behaviour and influence society and social structure.

**PO4 Effective citizenship:** Able to work with a sense of responsibility towards social awareness and follow the ethical standards in the society.

**PO5 Ethics:** Ability to demonstrate and discuss ethical conduct in scientific activities.

**PO6 Environment and Sustainability:** Able to understand the impact of biological science in societal and environmental contexts and demonstrate the knowledge for sustainable development.

**PO7 Self-directed and life-long learning:** Able to recognize the need of life-long learning and engage in research and self-education.



**Domain Subject: ZOOLOGY**

*(Syllabus with Outcomes, Co-curricular Activities, References & Model Q.P  
for Five Courses of 1, 2, 3, 4 & 5 Semesters)*

“The domain subject “Zoology”, embracing the fields of Animal diversity, Cell biology, Genetics, evolution, Animal physiology, Biochemistry, Embryology, Immunology, Molecular biology and Ecology gives the student a broad understanding of faunal diversity, various life processes involved in the development of an animal, its functioning, its response to environmental stimuli, molecular basis of life, new technological approach towards life, an insight for the lecturer into research and responsibility of the student towards environment”.

## GENERAL CURRICULAR ACTIVITIES

### ➤ **Lecturer-based:**

- 1) **Class-room activities:** Organization of Group discussions, question-answer sessions, scientific observations, use of audio-visual aids, guidance programmes, examination and evaluation work (scheduled and surprise tests), quizzes, preparation of question banks, student study material, material for PG entrance examinations etc.
- 2) **Library activities:** Reading books and magazines taking notes from prescribed and reference books and preparation of notes on lessons as per the syllabus; Reading journals and periodicals pertaining to different subjects of study; Making files of news-paper cuttings etc.
- 3) **Lab activities:** Organization of practicals, maintenance of lab attendance registers/log registers, maintenance of glassware and chemicals
- 4) **Activities in the Seminars, workshops and conferences:** Organization of at least one seminar/workshop/conference per academic year either on academic/research aspects and inculcate research spirit among students
- 5) **Research activities:** Student study projects (General / RBPT model), Minor or Major research projects, Research guidance to research scholars, Publication of research articles/papers (at least one in 2 years) in UGC-recognized journals, Registration in Vidwan/Orcid/Scopus/Web of Science
- 6) **Smart Classroom Activities:** Organization of Departmental WhatsApp groups, Edmodo groups/Google Class Rooms/Adobe Spark groups for quick delivery of the subject; Preparation of Moocs content & presentation tube lessons by trained lecturers; Using smart/digital/e- class rooms (mandatory) wherever present; Utilization of youtube videos (subject to copy rights) etc.

➤ **Student-based:**

- 1) **Class-room activities:** Power point presentations, seminars, assignments
- 2) **Library activities:** Visit to library during library hour and preparation of notes
- 3) **Lab activities:** Maintenance of observation note book and record, keeping lab clean and tidy
- 4) **Activities in the Seminars, workshops and conferences:** Participation/presentation in seminar/workshop/conference

### **CO-CURRICULAR ACTIVITIES**

**OBJECTIVES:**

The co-curricular activities are aimed at strengthening the theoretical knowledge with an activity related to the content taught in the class room. The aesthetic development, character building, spiritual growth, physical growth, moral values, creativity of the student.

The different types of co-curricular activities relevant to Zoology domain are listed below:

➤ **Academic - based**

- Preparation of Charts/Clay or Thermocol Models
- Debates, Essay Writing Competitions
- Group Discussions
- Departmental (Zoology) magazine
- Formation of Book clubs
- Animal album-making
- Viva-Voce

➤ **Lab/Research –based**

- Digital dissections
- Field Visit/Excursions/Zoological Tours and submission of report
- Training at research centres (aquaculture/apiculture/sericulture etc.)
- Exposure to scientific instruments and hands-on experience

➤ **Value - based**

- Organization of first-aid camp, swachhbharat, cleanliness week, girl-child importance, Nutrition and health awareness etc.

➤ **Observation of Days of National/International Importance**

World Cancer Day (February 4 <sup>th</sup> )	International Biological Diversity Day (May 22 <sup>nd</sup> )
Darwin Day (February 12 <sup>th</sup> )	World Turtle Day (May 23 <sup>rd</sup> )
National Science Day (Feb 28 <sup>th</sup> )	World blood Donor Day (June 14 <sup>th</sup> )
World Wildlife day (March 3 <sup>rd</sup> )	World Zoonoses Day (July 6 <sup>th</sup> )
National Vaccination Day (March 16 <sup>th</sup> )	World Mosquito Day (August 20 <sup>th</sup> )
World Health Day (April 7 <sup>th</sup> )	World Turtle Day (May 23 <sup>rd</sup> )
Earth Day (April 22 <sup>nd</sup> )	World Mosquito Day (August 20 <sup>th</sup> )
Malaria Day (April 25 <sup>th</sup> )	World Animal day (October 4 <sup>th</sup> )
World Hepatitis Day (May 19 <sup>th</sup> )	World Immunization Day (November 10 <sup>th</sup> )

**AP STATE COUNCIL OF HIGHER EDUCATION**

w.e.f. 2020-21 (Revised in April, 2020)

**ZOOLOGY – SEMESTER I**

**PAPER – I: ANIMAL DIVERSITY – BIOLOGY OF NONCHORDATES**

**HOURS: 60 (5X12)**

**Max. Marks: 100**

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**Course Outcomes:** By the completion of the course the graduate should be able to –

- CO1** Describe general taxonomic rules on animal classification
- CO2** Classify Protozoa to Coelenterata with taxonomic keys
- CO3** Classify Phylum Platyhelminthes to Annelida phylum using examples from parasitic adaptation and vermin composting
- CO4** Describe Phylum Arthropoda to Mollusca using examples and importance of insects and Molluscs
- CO5** Describe Echinodermata to Hemichordata with suitable examples and larval stages in relation to the phylogeny

**Learning objectives**

1. To understand the taxonomic position of protozoa to helminthes.
2. To understand the general characteristics of animals belonging to protozoa to hemichordata.
3. To understand the structural organization of animals phylum from protozoa to hemichordata.
4. To understand the origin and evolutionary relationship of different phyla from protozoa to hemichordata.
5. To understand the origin and evolutionary relationship of different phylum from annelids to hemichordates.

## ZOOLOGY SYLLABUS FOR I SEMESTER

### PAPER – I: ANIMAL DIVERSITY – BIOLOGY OF NONCHORDATES

HOURS:60 (5X12)

Max. Marks: 100

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#### UNIT I

- 1.1 Principles of Taxonomy – Binomial nomenclature – Rules of nomenclature
- 1.2 Whittaker's five kingdom concept and classification of Animal Kingdom.

#### Phylum Protozoa

- 1.3 General Characters and classification of protozoa up to classes with suitable examples
- 1.4 Locomotion, nutrition and reproduction in Protozoans
- 1.5 *Elphidium* (type study)

#### UNIT –II

#### Phylum Porifera

- 2.1 General characters and classification up to classes with suitable examples
- 2.2 Skeleton in Sponges
- 2.3 Canal system in sponges

#### Phylum Coelenterata

- 2.4 General characters and classification up to classes with suitable examples
- 2.5 Metagenesis in *Obelia*
- 2.6 Polymorphism in coelenterates
- 2.7 Corals and coral reefs

#### Phylum Ctenophora :

- 2.8 General Characters and Evolutionary significance (affinities)

#### Unit – III

#### Phylum Platyhelminthes

- 3.1 General characters and classification up to classes with suitable examples
- 3.2 Life cycle and pathogenicity of *Fasciola hepatica*

3.3 Parasitic Adaptations in helminthes

**Phylum Nemathelminthes**

3.4 General characters and classification up to classes with suitable examples

3.5. Life cycle and pathogenicity of *Ascarislumbricoides*

**Unit – IV**

**Phylum Annelida**

4.1 General characters and classification up to classes with suitable examples

4.2 Evolution of Coelom and Coelomoducts

4.3 Vermiculture - Scope, significance, earthworm species, processing,  
Vermicompost, economic importance of vermicompost

**Phylum Arthropoda**

4.4 General characters and classification up to classes with suitable examples

4.5 Vision and respiration in Arthropoda

4.6 Metamorphosis in Insects

4.7 *Peripatus* - Structure and affinities

4.8 Social Life in Bees and Termites

**Unit – V**

**Phylum Mollusca**

5.1 General characters and classification up to classes with suitable examples

5.2 Pearl formation in Pelecypoda

5.3 Sense organs in Mollusca

**Phylum Echinodermata**

5.4 General characters and classification up to classes with suitable examples

5.5 Water vascular system in star fish

5.6 Larval forms of Echinodermata

**Phylum Hemichordata**

5.7 General characters and classification up to classes with suitable examples

## 5.8 *Balanoglossus* - Structure and affinities

### **Co-curricular activities (suggested)**

- Preparation of chart/model of phylogenic tree of life, 5-kingdom classification, *Elphidium* life cycle etc.
- Visit to Zoology museum or Coral island as part of Zoological tour
- Charts on life cycle of *Obelia*, polymorphism, sponge spicules
- Clay models of canal system in sponges
- Preparation of charts on life cycles of *Fasciola* and *Ascaris*
- Visit to adopted village and conducting awareness campaign on diseases, to people as part of Social Responsibility.
- Plaster-of-paris or Thermocol model of *Peripatus*
- Construction of a vermicompost in each college, manufacture of manure by students and donating to local farmers
- Models of compound eye, bee hive and termitarium (termitaria) by students
- Visit to apiculture centre and short-term training as part of apprenticeship programme of the govt. Of Andhra Pradesh
- Chart on pearl forming layers using clay or Thermocol
- Visit to a pearl culture rearing industry/institute
- Live model of water vascular system
- Phylogeny chart on echinoderm larvae and their evolutionary significance
- Preparation of charts depicting the feeding mechanism, 3 coeloms, tornaria larva etc., of *Balanoglossus*



## REFERENCE BOOKS

1. **L.H. Hyman** '*The Invertebrates*' Vol I, II and V. – M.C. Graw Hill Company Ltd.
2. **Kotpal, R.L. 1988 - 1992** Protozoa, Porifera, Coelenterata, Helminthes, Arthropoda, Mollusca, Echinodermata. Rastogi Publications, Meerut.
3. **E.L. Jordan and P.S. Verma** '*Invertebrate Zoology*' S. Chand and Company.
4. **R.D. Barnes** '*Invertebrate Zoology*' by: W.B. Saunders CO., 1986.
5. **Barrington. E.J.W.**, '*Invertebrate structure and Function*' by ELBS.
- 6 **P.S. Dhama and J.K. Dhama**. Invertebrate Zoology. S. Chand and Co. New Delhi.
7. **Parker, T.J. and Haswell**'*A text book of Zoology*' by, W.A., Mac Millan Co. London.
8. **Barnes, R.D. (1982)**. *Invertebrate Zoology*, V Edition"

**ZOOLOGY MODEL PAPER FOR I SEMESTER**

**ZOOLOGY - PAPER - I**

**ANIMAL DIVERSITY – BIOLOGY OF NONCHORDATES**

**Time : 3 hrs**

**Max. Marks : 75**

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**I. Answer any FIVE of the following :**

**5x5=25**

**Draw labeled diagrams wherever necessary**

- 1.
- 2.
- 3.
- 4.
- 5.
- 6.
- 7.
- 8.

**II. Answer any FIVE of the following:**

**5x10=50**

**Draw labeled diagrams wherever necessary**

9.

OR

10.

OR

11.

OR

12.

OR

13.

OR

□□□□□

**ZOOLOGY PRACTICAL SYLLABUS FOR I SEMESTER**

**ZOOLOGY - PAPER - I**

**ANIMAL DIVERSITY - BIOLOGY OF NONCHORDATES**

**Periods: 24**

**Max. Marks: 50**

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**Learning Outcomes:**

- To understand the importance of preservation of museum specimens
- To identify animals based on special identifying characters
- To understand different organ systems through demo or virtual dissections
- To maintain a neat, labeled record of identified museum specimens

**Syllabus :**

**1. Study of museum slides / specimens / models (Classification of animals up to orders)**

**Protozoa:** *Amoeba, Paramoecium, Paramoecium Binary fission and Conjugation, Vorticella, Entamoebahistoltytica, Plasmodium vivax*

**Porifera:** *Sycon, Spongilla, Euspongia, Sycon- T.S & L.S, Spicules, Gemmule*

**Coelenterata:** *Obelia – Colony & Medusa, Aurelia, Physalia, Velella, Corallium, Gorgonia, Pennatulav.*

**Platyhelminthes:** *Planaria, Fasciola hepatica, Fasciolalarval forms – Miracidium, Redia, Cercaria, Echinococcusgranulosus, Taeniasolium, Schistosomahaematobiumvii.*

**Nemathelminthes:** *Ascaris(Male & Female), Drancunculus, Ancylostoma, Wuchereria*

**Annelida:** *Nereis, Aphrodite, Chaetopteurs, Hirudinaria, Trochophore larva*

**Arthropoda:** *Cancer, Palaemon, Scorpion, Scolopendra, Sacculina, Limulus, Peripatus, Larvae - Nauplius, Mysis, Zoea, Mouth parts of male &female Anopheles and Culex, Mouthparts of Housefly and Butterfly. xiii.*

**Mollusca:** *Chiton, Pila, Unio, Pteredo, Murex, Sepia, Loligo, Octopus, Nautilus, Glochidium larva*

**Echinodermata:** *Asterias, Ophiothrix, Echinus, Clypeaster, Cucumaria, Antedon,*  
Bipinnaria larva

**Hemichordata:** *Balanoglossus,* Tornaria larva

**2. Dissections:**

**1. Prawn:** Appendages, Digestive system, Nervous system, Mounting of Statocyst

**2. Insect Mouth Parts**

**3. Laboratory Record work shall be submitted at the time of practical examination**

4. An “**Animal album**” containing photographs, cut outs, with appropriate write up about the above mentioned taxa. Different taxa/ topics may be given to different sets of students for this purpose

**5. Computer - aided techniques should be adopted or show virtual dissections**

**REFERENCE MANUALS:**

1. Practical Zoology- Invertebrates S.S. Lal

2. Practical Zoology - Invertebrates P.S. Verma

3. Practical Zoology - Invertebrates K.P. Kurl

4. Ruppert and Barnes (2006) Invertebrate Zoology, 8<sup>th</sup> Edition, Holt Saunders  
International Edition

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w.e.f. 2020-21 (Revised in April, 2020)

**ZOOLOGY –SEMESTER II**

**PAPER – II: ANIMAL DIVERSITY – BIOLOGY OF CHORDATES**

**HOURS :60 (5X12)**

**Max. Marks:100**

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**Course Outcomes:**

By the completion of the course the graduate should able to -

- CO1** Describe general taxonomic rules on animal classification of chordates
- CO2** Classify Protochordata to Mammalia with taxonomic keys
- CO3** Understand Mammals with specific structural adaptations
- CO4** Understand the significance of dentition and evolutionary significance
- CO5** Understand the origin and evolutionary relationship of different phyla from Prochordata to mammalia.

**Learning objectives**

1. To understand the animal kingdom .
2. To understand the taxonomic position of Protochordata to Mammalia.
3. To understand the general characteristics of animals belonging to Fishes to Reptilians.
4. To understand the body organization of Chordata.
5. To understand the taxonomic position of Protherian mammals.

## ZOOLOGY SYLLABUS FOR II SEMESTER

### PAPER – II: ANIMAL DIVERSITY – BIOLOGY OF CHORDATES

HOURS: 60 (5X12)

Max. Marks: 100

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#### Unit - I

- 1.1 General characters and classification of Chordata upto classes
- 1.2 Protochordata- Salient features of Cephalochordata , Affinities of Cephalochordata.
- 1.3 Salient features of Urochordata
- 1.4 Structure and life history of *Herdmania*
- 1.5 Retrogressive metamorphosis –Process and Significance

#### Unit - II

- 2.1 Cyclostomata, General characters, Comparison of *Petromyzon* and *Myxine*
- 2.2 Pisces : General characters of Fishes
- 2.3 *Scoliodon*: External features, Digestive system, Respiratory system, Structure and function of Heart, Structure and functions of the Brain.
- 2.4 Migration in Fishes
- 2.5 Types of Scales
- 2.6 Dipnoi

#### Unit - III

- 3.1 General characters of Amphibia
- 3.2 Classification of Amphibia up to orders with examples.
- 3.3 *Rana hexadactyla*: External features, Digestive system, Respiratory system, Structure and function of Heart, structure and functions of the Brain
- 3.4 Reptilia: General characters of Reptilia, Classification of Reptilia upto orders with examples
- 3.5 *Calotes*: External features, Digestive system, Respiratory system, Structure and function of Heart, structure and function of Brain
- 3.6 Identification of Poisonous snakes and Skull in reptiles

## **Unit - IV**

- 4.1 Aves General characters of Aves
- 4.2 *Columba livia*: External features, Digestive system, Respiratory system, Structure and function of Heart, structure and function of Brain
- 4.3 Migration in Birds
- 4.4 Flight adaptation in birds

## **Unit - V**

- 5.1 General characters of Mammalia
- 5.2 Classification of Mammalia upto sub - classes with examples
- 5.3 Comparison of Prototherians, Metatherians and Eutherians
- 5.4 Dentition in mammals

### ***Co-curricular activities (suggested)***

- Preparation of charts on Chordate classification (with representative animal photos) and retrogressive metamorphosis
- Thermocol or Clay models of Herdmania and Amphioxus
- Visit to local fish market and identification of local cartilaginous and bony fishes
- Maintaining of aquarium by students
- Thermocol model of fish heart and brain
- Preparation of slides of scales of fishes
- Visit to local/nearby river to identify migratory fishes and prepare study notes
- Preparation of Charts on above topics by students (Eg: comparative account of vertebrate heart/brain/lungs, identification of snakes etc.)
- Collecting and preparation of Museum specimens with dead frogs/snakes/lizards etc., and/or their skeletons
- Additional input on types of snake poisons and their antidotes (student activity).
- Collection of bird feathers and submission of report on Plumology
- Taxidermic preparation of dead birds for Zoology museum
- Map pointing of prototherian and metatherian mammals
- Chart preparation for dentition in mammals



## REFERENCE BOOKS

- J.Z. Young, 2006. The life of vertebrates. (The Oxford University Press, New Delhi). 646 pages. Reprinted
- Arumugam, N. Chordate Zoology, Vol. 2. SarasPlublication. 278 pages. 200 figs.
- A.J. Marshall, 1995. Textbook of zoology, Vertebrates. (The McMillan Press Ltd., UK). 852 pages. (Revised edition of Parker & Haswell, 1961).
- M. EkambaranathaAyyar, 1973. A manual of zoology. Part II. (S. ViswanathanPvt. Ltd., Madras).
- P.S. Dhama & J.K. Dhama, 1981. Chordate zoology. (R. Chand & Co.). 550 pages.
- Gurdarshan Singh & H. Bhaskar, 2002. Advanced Chordate Zoology. Campus Books, 6 Vols., 1573 pp., tables, figs.
- A.K. Sinha, S. Adhikari & B.B. Ganguly, 1978. Biology of animals. Vol. II. Chordates. (New Central Book Agency, Calcutta). 560 pages.
- R.L. Kotpal, 2000. Modern textbook of zoology, Vertebrates. (Rastogi Publ., Meerut). 632 pages.
- E.L. Jordan & P.S. Verma, 1998. Chordate zoology. (S. Chand & Co.). 1092 pages.
- G.S. Sandhu, 2005. Objective Chordate Zoology. Campus Books, vii, 169 pp.
- Sandhu, G.S. & H. Bhaskar, H. 2004. Textbook of Chordate Zoology. Campus Books, 2 vols., xx, 964 p., figs.
- Veena, 2008. Lower Chordata. (Sonali Publ.), 374 p., tables, 117 figs.

**ZOOLOGY MODEL PAPER FOR II SEMESTER**

**ZOOLOGY - PAPER - II**

**ANIMAL DIVERSITY – BIOLOGY OF CHORDATES**

**Time: 3 hrs**

**Max. Marks: 75**

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**I. Answer any FIVE of the following:**

**5x5=25**

**Draw labeled diagrams wherever necessary**

1. *Amphioxus*
2. Placoid scale
3. Quill feather
4. Prototheria
5. Anadromous migration
6. *Draco*
7. Emu
8. Apoda

**II. Answer any FIVE of the following:**

**5x10=50**

**Draw labeled diagrams wherever necessary**

9. Explain the life history of *Herdmania*

OR

Explain the origin and general characters of chordates

10. Compare the characters of *Petromyzon* and *Myxine*

OR

Describe the structure of heart of *Scoliodon*

11. Describe the brain of *Rana hexadactyla*

OR

Explain the external features of *Calotes*

12. Write an essay on flight adaptations in birds

OR

Explain the respiratory system of *Columba livia*

13. Compare the characters of Metatheria and Eutheria

OR

Write an essay on dentition in mammals

□ □ □ □ □

## ZOOLOGY PRACTICAL SYLLABUS FOR II SEMESTER

### ZOOLOGY - PAPER - II

#### ANIMAL DIVERSITY - BIOLOGY OF CHORDATES

Periods: 24

Max. Marks: 50

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#### Learning Outcomes:

- To understand the taxidermic and other methods of preservation of chordates
- To identify chordates based on special identifying characters
- To understand internal anatomy of animals through demo or virtual dissections, thus directing the student for “empathy towards the fellow living beings”
- To maintain a neat, labeled record of identified museum specimens

#### OBSERVATION OF THE FOLLOWING SLIDES / SPOTTERS / MODELS

1. Protochordata :*Herdmania, Amphioxus, Amphioxus* T.S through pharynx.
2. Cyclostomata :*Petromyzon and Myxine*.
3. Pisces : *Pristis, Torpedo, Hippocoampus, Exocoetus, Echeneis, Labeo, Catla, Clarius, Channa, Anguilla*.
4. Amphibia :*Ichthyophis, Amblystoma, Axolotl larva, Hyla*,
5. Reptilia: *Draco, Chamaeleon, Uromastix, Testudo, Trionyx, Russels viper, Naja, Krait, Hydrophis, Crocodile*.
6. Aves : *Psittacula, Eudynamis, Bubo, Alcedo*.
7. Mammalia: *Ornithorhynchus, Pteropus, Funambulus*.

#### Dissections-

1. *Scoliodon* IX and X, Cranial nerves
2. *Scoliodon* Brain
3. Mounting of fish scales

Note: 1. Dissections are to be demonstrated only by the faculty or virtual.

2. Laboratory Record work shall be submitted at the time of practical examination.

**REFERENCE BOOKS:**

1. S.S.Lal, Practical Zoology – Vertebrata
2. P.S.Verma, A manual of Practical Zoology – Chordata

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w.e.f. 2020-21 (Revised in April, 2020)

**ZOOLOGY – SEMESTER III**

**PAPER – III: CELL BIOLOGY, GENETICS, MOLECULAR BIOLOGY AND  
EVOLUTION**

**HOURS:60 (5X12)**

**Max. Marks:100**

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**Course Outcomes:**

The overall course outcome is that the student shall develop deeper understanding of what life is and how it functions at cellular level. This course will provide students with a deep knowledge in Cell Biology, Animal Biotechnology and Evolution and by the completion of the course the graduate shall able to –

- CO1** To understand the basic unit of the living organisms and to differentiate the organisms by their cell structure.
- CO2** Describe fine structure and function of plasma membrane and different cell organelles of eukaryotic cell.
- CO3** To understand the history of origin of branch of genetics, gain knowledge on heredity, interaction of genes, various types of inheritance patterns existing in animals
- CO4** Acquiring in-depth knowledge on various aspects of genetics involved in sex determination, human karyotyping and mutations of chromosomes resulting in various disorders
- CO5** Understand the central dogma of molecular biology and flow of genetic information from DNA to proteins.
- CO6** Understand the principles and forces of evolution of life on earth, the process of evolution of new species and apply the same to develop new and advanced varieties of animals for the benefit of the society

## **Learning Objectives**

- To understand the origin of cell and distinguish between prokaryotic and eukaryotic cell
- To understand the role of different cell organelles in maintenance of life activities
- To provide the history and basic concepts of heredity, variations and gene interaction
- To enable the students distinguish between polygenic, sex-linked, and multiple allelic modes of inheritance.
- To acquaint student with basic concepts of molecular biology as to how characters are expressed with a coordinated functioning of replication, transcription and translation in all living beings
- To provide knowledge on origin of life, theories and forces of evolution
- To understand the role of variations and mutations in evolution of organisms

**ZOOLOGY SYLLABUS FOR III SEMESTER**  
**PAPER – III: CELL BIOLOGY, GENETICS, MOLECULAR BIOLOGY AND**  
**EVOLUTION**

**HOURS: 60 (5X12)**

**Max. Marks: 100**

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**Unit – I      Cell Biology**

- 1.1 Definition, history, prokaryotic and eukaryotic cells, virus, viroids, mycoplasma
- 1.2 Electron microscopic structure of animal cell.
- 1.3 Plasma membrane –Models and transport functions of plasma membrane.
- 1.4 Structure and functions of Golgi complex, Endoplasmic Reticulum and Lysosomes
- 1.5 Structure and functions of Ribosomes, Mitochondria, Nucleus, Chromosomes

**(Note: 1. General pattern of study of each cell organelle – Discovery, Occurrence, Number, Origin, Structure and Functions with suitable diagrams)**

**2. Need not study cellular respiration under mitochondrial functions)**

**Unit – II      Genetics - I**

2. 1 Mendel's work on transmission of traits
2. 2 Gene Interaction – Incomplete Dominance, Codominance, Lethal Genes
2. 3 Polygenes (General Characteristics & examples); Multiple Alleles (General Characteristics and Blood group inheritance)
2. 4 Sex determination (Chromosomal, Genic Balance, Hormonal, Environmental and Haplo-diploidy types of sex determination)
2. 5 Sex linked inheritance (X-linked, Y-linked & XY-linked inheritance)

**Unit – III      Genetics - II**

- 3.1 Mutations & Mutagenesis
- 3.2 Chromosomal Disorders (Autosomal and Allosomal)
- 3.3 Human Genetics – Karyotyping, Pedigree Analysis (basics)
- 3.4 Basics on Genomics and Proteomics

**UNIT IV:      Molecular Biology**

- 4.1 Central Dogma of Molecular Biology



#### 4.2 Basic concepts of -

- a. DNA replication – Overview (Semi-conservative mechanism, Semi-discontinuous mode, Origin & Propagation of replication fork)
- b. Transcription in prokaryotes – Initiation, Elongation and Termination, Post-transcriptional modifications (basics)
- c. Translation – Initiation, Elongation and Termination

#### 4.3 Gene Expression in prokaryotes (Lac Operon); Gene Expression in eukaryotes

### Unit - V

#### 5.1 Origin of life

#### 5.2 Theories of Evolution: Lamarckism, Darwinism, Germ Plasm Theory, Mutation Theory

#### 5.3 Neo-Darwinism: Modern Synthetic Theory of Evolution, Hardy-Weinberg Equilibrium

#### 5.4 Forces of Evolution: Isolating mechanisms, Genetic Drift, Natural Selection, Speciation

### Co-curricular activities (Suggested)

- Model of animal cell
- Working model of mitochondria to encourage creativity among students
- Photo album of scientists of cell biology
- Charts on plasma membrane models/cell organelles
- Observation of Mendelian / Non-Mendelian inheritance in the plants of college botanical garden or local village as a student study project activity
- Observation of blood group inheritance in students, from their parents and grand parents
- Karyotyping and preparation of pedigree charts for identifying diseases in family history
- Charts on chromosomal disorders
- Charts on central dogma/lac operon/genetic code
- Model of semi-conservative model of DNA replication
- Model of tRNA and translation mechanism
- Power point presentation of transcription or any other topic by students
- Draw geological time scale and highlight important events along the time line

- Chart on industrial melanism to teach directed selection, Darwin's finches to teach genetic drift, collection of data on weight of children born in primary health centres to teach stabilizing selection etc.

## **REFERENCES:**

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2. Cell Biology by De Robertis
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4. Rastogi, Cytology
5. Varma & Aggarwal, Cell Biology
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Genetic Analysis. IX Edition. W. H. Freeman and Co.
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**ZOOLOGY MODEL PAPER FOR III SEMESTER**

**ZOOLOGY - PAPER - III**

**CELL BIOLOGY, GENETICS, MOLECULAR BIOLOGY AND EVOLUTION**

**Time : 3 hrs**

**Max. Marks : 75**

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**I. Answer any FIVE of the following :**

**5x5=25**

**Draw labeled diagrams wherever necessary**

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**II. Answer any FIVE of the following:**

**5x10=50**

**Draw labeled diagrams wherever necessary**

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## **ZOOLOGY PRACTICAL SYLLABUS FOR III SEMESTER**

### **ZOOLOGY - PAPER - III**

#### **CELL BIOLOGY, GENETICS, MOLECULAR BIOLOGY AND EVOLUTION**

**Periods: 24**

**Max. Marks: 50**

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#### **Learning Objectives:**

- Acquainting and skill enhancement in the usage of laboratory microscope
- Hands-on experience of different phases of cell division by experimentation
- Develop skills on human karyotyping and identification of chromosomal disorders
- To apply the basic concept of inheritance for applied research
- To get familiar with phylogeny and geological history of origin & evolution of animals

#### **I. Cell Biology**

1. Preparation of temporary slides of Mitotic divisions with onion root tips
2. Observation of various stages of Mitosis and Meiosis with prepared slides
3. Mounting of salivary gland chromosomes of *Chironomus*

#### **II. Genetics**

1. Study of Mendelian inheritance using suitable examples and problems
2. Problems on blood group inheritance and sex linked inheritance
3. Study of human karyotypes (Down's syndrome, Edwards, syndrome, Patau syndrome, Turner's syndrome and Klinefelter syndrome)

#### **III. Evolution**

1. Study of fossil evidences
2. Study of homology and analogy from suitable specimens and pictures
3. Phylogeny of horse with pictures
4. Study of Genetic Drift by using examples of Darwin's finches (pictures)
5. Visit to Natural History Museum and submission of report

## REFERENCE BOOKS

1. Burns GW. 1972. *The Science of Genetics. An Introduction to Heredity*. Mac Millan Publ. Co.Inc.
2. Gardner EF. 1975. *Principles of Genetics*. John Wiley & Sons, Inc. New York.
3. Harth and Jones EW. 1998. *Genetics – Principles and Analysis*. Jones and BarHett Publ. Boston.
4. Levine L. 1969. *Biology of the Gene*. Toppan.
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8. Stahl FW. 1965. *Mechanics of Inheritance*. Prentice-Hall.
9. White MJD. 1973. *Animal Cytology and Evolution*. Cambridge Univ.Press.

**AP STATE COUNCIL OF HIGHER EDUCATION**

w.e.f. 2020-21 (Revised in April, 2020)

**ZOOLOGY – SEMESTER IV**

**PAPER – IV: ANIMAL PHYSIOLOGY, CELLULAR METABOLISM AND  
EMBRYOLOGY**

**HOURS : 60 (5X12)**

**Max. Marks: 100**

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**Course Outcomes:**

This course will provide students with a deep knowledge in Physiology, Cellular metabolism and Molecular Biology and by the completion of the course the graduate shall be able to –

**CO1** Understand the functions of important animal physiological systems including digestion, cardio-respiratory and renal systems.

**CO2** Understand the muscular system and the neuro-endocrine regulation of animal growth, development and metabolism with a special knowledge of hormonal control of human reproduction.

**CO3** Describe the structure, classification and chemistry of biomolecules and enzymes responsible for sustenance of life in living organisms

**CO4** Develop broad understanding the basic metabolic activities pertaining to the catabolism and anabolism of various biomolecules

**CO5** Describe the key events in early embryonic development starting from the formation of gametes upto gastrulation and formation of primary germ layers.



## **Learning Objectives**

- To achieve a thorough understanding of various aspects of physiological systems and their functioning in animals.
- To instil the concept of hormonal regulation of physiology, metabolism and reproduction in animals.
- To understand the disorders associated with the deficiency of hormones
- To demonstrate a thorough knowledge of the intersection between the disciplines of Biology and Chemistry.
- To provide insightful knowledge on the structure and classification of carbohydrates, proteins, lipids and enzymes
- To demonstrate an understanding of fundamental biochemical principles such as the function of biomolecules, metabolic pathways and the regulation of biochemical processes
- To make students gain proficiency in laboratory techniques in biochemistry and orient them to apply the scientific method to the processes of experimentation and hypothesis testing.

**ZOOLOGY SYLLABUS FOR IV SEMESTER**  
**PAPER – IV: ANIMAL PHYSIOLOGY, CELLULAR METABOLISM AND**  
**EMBRYOLOGY**

**HOURS: 60 (5X12)**

**Max. Marks: 100**

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**UNIT I      Animal Physiology - I**

1.1 Process of digestion and assimilation

1.2 Respiration - Pulmonary ventilation, transport of oxygen and CO<sub>2</sub>

(Note: Need not study cellular respiration here)

1.3 Circulation - Structure and functioning of heart, Cardiac cycle

1.4 Excretion - Structure and functions of kidney urine formation, counter current  
Mechanism

**UN IT II      Animal Physiology - II**

2.1 Nerve impulse transmission - Resting membrane potential, origin and propagation of action potentials along myelinated and non-myelinated nerve fibers

2.2 Muscle contraction - Ultra structure of muscle, molecular and chemical basis of muscle contraction

2.3 Endocrine glands - Structure, functions of hormones of pituitary, thyroid, parathyroid, adrenal glands and pancreas

2.4 Hormonal control of reproduction in a mammal

**UNIT III      Cellular Metabolism – I (Biomolecules)**

3.1 Carbohydrates - Classification of carbohydrates. Structure of glucose

3.2 Proteins - Classification of proteins. General properties of amino acids

3.3 Lipids - Classification of lipids

3.4 Enzymes: Classification and Mechanism of Action

**UNIT IV      Cellular Metabolism – II**

4.1 Carbohydrate Metabolism - Glycolysis, Krebs cycle, Electron Transport Chain, Glycogen metabolism, Gluconeogenesis

4.2 Lipid Metabolism –  $\beta$ -oxidation of palmitic acid

#### 4.3 Protein metabolism - Transamination, Deamination and Urea Cycle

### **Unit – V      Embryology**

- 5.1 Gametogenesis
- 5.2 Fertilization
- 5.3 Types of eggs
- 5.4 Types of cleavages
- 5.5 Development of Frog upto formation of primary germ layers

### **Co-curricular activities (Suggested)**

- Chart on cardiac cycle, human lung, kidney/nephron structure etc.
- Working model of human / any mammalian heart.
- Chart of sarcomere/location of endocrine glands in human body
- Chart affixing of photos of people suffering from hormonal disorders
- Student study projects such as identification of incidence of hormonal disorders in the local primary health centre, studying the reasons thereof and measures to curb or any other as the lecturer feels good in nurturing health awareness among students
- Chart on structures of biomolecules/types of amino acids (essential and non-essential)Chart preparation by students on Glycolysis / kreb's cycle/urea cycle etc.
- Model of electron transport chain
- Preparation of models of different types of eggs in animals
- Chart on frog embryonic development, fate map of frog blastula, cleavage etc.

## **REFERENCE BOOKS**

1. Eckert H. *Animal Physiology: Mechanisms and Adaptation*. W.H. Freeman & Company.
2. Flory E. *An Introduction to General and Comparative Animal Physiology*. W.B. Saunders Co., Philadelphia.
3. Goel KA and Satish KV. 1989. *A Text Book of Animal Physiology*, Rastogi Publications, Meerut, U.P.
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9. Chordate embryology by Varma and Agarwal
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15. Schatten H and Schatten G. 1989. *Molecular Biology of Fertilization*. Academic Press, New York.

**ZOOLOGY MODEL PAPER FOR IV SEMESTER**

**ZOOLOGY - PAPER - IV**

**ANIMAL PHYSIOLOGY, CELLULAR METABOLISM AND EMBRYOLOGY**

**Time : 3 hrs**

**Max. Marks : 75**

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**I. Answer any FIVE of the following :**

**5x5=25**

**Draw labeled diagrams wherever necessary**

- 1.
- 2.
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**II. Answer any FIVE of the following:**

**5x10=50**

**Draw labeled diagrams wherever necessary**

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## **ZOOLOGY PRACTICAL SYLLABUS FOR IV SEMESTER**

### **ZOOLOGY - PAPER - IV**

#### **ANIMAL PHYSIOLOGY, CELLULAR METABOLISM AND EMBRYOLOGY**

**Periods: 24**

**Max. Marks: 50**

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#### **Learning Objectives:**

- Identification of an organ system with histological structure
- Deducing human health based on the information of composition of blood cells
- Demonstration of enzyme activity *in vitro*
- Identification of various biomolecules of tissues by simple colorimetric methods and also quantitative methods
- Identification of different stages of early embryonic development in animals

#### **I. ANIMAL PHYSIOLOGY**

1. Qualitative tests for identification of carbohydrates, proteins and fats
2. Study of activity of salivary amylase under optimum conditions
3. T.S. of duodenum, liver, lung, kidney, spinal cord, bone and cartilage
4. Differential count of human blood

#### **II. CELLULAR METABOLISM**

1. Estimation of total proteins in given solutions by Lowry's method.
2. Estimation of total carbohydrate by Anthrone method.
3. Qualitative tests for identification of ammonia, urea and uric acid
4. Protocol for Isolation of DNA in animal cells

#### **III. EMBRYOLOGY**

1. Study of T.S. of testis, ovary of a mammal
2. Study of different stages of cleavages (2, 4, 8 cell stages)
3. Construction of fate map of frog blastula

#### **REFERENCE BOOKS:**

- Harper's Illustrated Biochemistry
- Cell and molecular biology: Concepts & experiments. VI Ed. John Wiley & sons. Inc.
- Lab Manual on Blood Analysis and Medical Diagnostics, S. Chand and Co. Ltd.
- Laboratory techniques by Plummer



**AP STATE COUNCIL OF HIGHER EDUCATION**

w.e.f. 2020-21 (Revised in April, 2020)

**ZOOLOGY – SEMESTER IV**

**COURSE – 5: IMMUNOLOGY AND ANIMAL BIOTECHNOLOGY**

**HOURS : 60 (5X12)**

**Max. Marks: 100**

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**Course Outcomes:**

This course will provide students with a deep knowledge in immunology, genetics, embryology and ecology and by the completion of the course the graduate shall able to –

- CO1** To get knowledge of the organs of Immune system, types of immunity, cells and organs of immunity.
- CO2** To describe immunological response as to how it is triggered (antigens) and regulated (antibodies)
- CO3** Understand the applications of Biotechnology in the fields of industry and agriculture including animal cell/tissue culture, stem cell technology and genetic engineering.
- CO4** Get familiar with the tools and techniques of animal biotechnology.

**Learning Objectives**

- To trace the history and development of immunology
- To provide students with a foundation in immunological processes
- To be able to compare and contrast the innate versus adaptive immune systems and humoral versus cell-mediated immune responses
- Understand the significance of the Major Histocompatibility Complex in terms of immune response and transplantation
- To provide knowledge on animal cell and tissue culture and their preservation
- To empower students with latest biotechnology techniques like stem cell technology, genetic engineering, hybridoma technology, transgenic technology and their application in medicine and industry for the benefit of living organisms
  - To explain *in vitro* fertilization, embryo transfer technology and other reproduction manipulation methodologies.
  - To get insight in applications or recombinant DNA technology in agriculture, production of therapeutic proteins.

- To understand principles of animal culture, media preparation.

**ZOOLOGY SYLLABUS FOR SEMESTER - IV**  
**COURSE – 5: IMMUNOLOGY AND ANIMAL BIOTECHNOLOGY**

**HOURS : 60 (5X12)**

**Max. Marks: 100**

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**Unit – I      Immunology – I (Overview of Immune system)**

- 1.1 Introduction to basic concepts in Immunology
- 1.2 Innate and adaptive immunity, Vaccines and Immunization programme
- 1.3 Cells of immune system
- 1.4 Organs of immune system

**Unit – II      Immunology – II (Antigens, Antibodies, MHC and Hypersensitivity)**

- 2.1 Antigens: Basic properties of antigens, B and T cell epitopes, haptens and adjuvants; Factors influencing immunogenicity
- 2.2 Antibodies: Structure of antibody, Classes and functions of antibodies
- 2.3 Structure and functions of major histocompatibility complexes
- 2.4 Exogenous and Endogenous pathways of antigen presentation and processing
- 2.5 Hypersensitivity – Classification and Types

**Unit – III      Techniques**

- 2.1 Animal Cell, Tissue and Organ culture media: Natural and Synthetic media,
- 2.2 Cell cultures: Establishment of cell culture (primary culture, secondary culture, types of cell lines; Protocols for Primary Cell Culture); Established Cell lines (common examples such as MRC, HeLa, CHO, BHK, Vero); Organ culture; Cryopreservation of cultures
- 2.3 Stem cells: Types of stem cells and applications
- 2.4 Hybridoma Technology: Production & applications of Monoclonal antibodies (mAb)

**Unit – IV      Applications of Animal Biotechnology**

- 3.1 Genetic Engineering: Basic concept, Vectors, Restriction Endonucleases and Recombinant DNA technology
- 3.2 Gene delivery: Microinjection, electroporation, biolistic method (gene gun), liposome and viral-mediated gene delivery
- 3.3 Transgenic Animals: Strategies of Gene transfer; Transgenic - sheep, - fish; applications
- 3.4 Manipulation of reproduction in animals: Artificial Insemination, *In vitro* fertilization, super ovulation, Embryo transfer, Embryo cloning

#### **Unit - V**

- 4.1. PCR: Basics of PCR.
- 4.2 DNA Sequencing: Sanger's method of DNA sequencing- traditional and automated sequencing (2 hrs)
- 4.3 Hybridization techniques: Southern, Northern and Western blotting
- 4.4 DNA fingerprinting: Procedure and applications
- 4.5 Applications in Industry and Agriculture: Fermentation: Different types of Fermentation and Downstream processing; Agriculture: Monoculture in fishes, polyploidy in fishes

#### **Co-curricular activities (suggested)**

- Organizing awareness on immunization importance in local village in association with NCC and NSS teams
- Charts on types of cells and organs of immune system
- Student study projects on aspects such as – identification of allergies among students (hypersensitivity), blood groups in the class (antigens and antibodies duly reported) etc., as per the creativity and vision of the lecturer and students
- Visit to research laboratory in any University as part of Zoological tour and exposure and/or hands-on training on animal cell culture.
- Visit to biotechnological laboratory in University or any central/state institutes and create awareness on PCR, DNA finger printing and blot techniques or Visit to a fermentation industry or Visit to a local culture pond and submit report on culture of fishes etc.

## **REFERENCE BOOKS**

1. Immunology by Ivan M. Riott
2. Immunology by Kubey
3. Sreekrishna V. 2005. *Biotechnology –I, Cell Biology and Genetics*. New Age International Publ. New Delhi, India.

**ZOOLOGY MODEL PAPER FOR V SEMESTER**

**COURSE – 5: IMMUNOLOGY AND ANIMAL BIOTECHNOLOGY**

**Time: 3 hrs**

**Max. Marks: 75**

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**I. Answer any FIVE of the following:**

**5x5=25**

**Draw labeled diagrams wherever necessary**

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**II. Answer any FIVE of the following:**

**5x10=50**

**Draw labeled diagrams wherever necessary**

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**ZOOLOGY PRACTICAL SYLLABUS FOR V SEMESTER**  
**COURSE – 5: IMMUNOLOGY AND ANIMAL BIOTECHNOLOGY**

**Periods: 24**

**Max. Marks: 50**

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**Learning Objectives:**

- Acquainting student with immunological techniques vis-à-vis theory taught in the class room
- Interconnect the theoretical and practical knowledge of immunity with the outer world for the development of a healthier life.
- Demonstrate basic laboratory skills necessary for Biotechnology research
- Promoting application of the lab techniques for taking up research in higher studies

**I. IMMUNOLOGY**

1. Demonstration of lymphoid organs (as per UGC guidelines)
2. Histological study of spleen, thymus and lymph nodes (through prepared slides)
3. Blood group determination
4. Demonstration of
  - a. ELISA
  - b. Immunoelectrophoresis

**II. Animal biotechnology**

1. DNA quantification using DPA Method.
2. Techniques: Western Blot, Southern Hybridization, DNA Fingerprinting
3. Separation, Purification of biological compounds by paper, Thin-layer and Column chromatography
4. Cleaning and sterilization of glass and plastic wares for cell culture.
5. Preparation of culture media.

**REFERENCE BOOKS**

1. Immunology Lab Biology 477 Lab Manual; Spring 2016 Dr. Julie Jameson



2. Practical Immunology A Laboratory Manual; **LAP LAMBERT Academic Publishing**

3. Manual of laboratory experiments in cell biology by Edward, G

4. Laboratory Techniques by Plummer

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