

**Punyashlok Ahilyadevi Holkar Solapur University, Solapur**



**Name of the Faculty: Science and Technology**

**CHOICE BASED CREDIT SYSTEM**

**Syllabus: BOTANY**

**Name of the Course: B.Sc. I (Sem-I&II)**

**(Syllabus to be implemented from w.e.f. June 2019)**

Subject/ Core Course	Name and Type of the Paper		No. of papers/ Practical	Hrs/week			Total Marks Per Paper	UA	CA	Credits
	Type	Name		L	T	P				
Class :	B.Sc.- I Semester – I									
Ability Enhancement Course(AECC)	English(communication skill)		Paper- I	4.0			100	80	20	4.0
Core (*Students can opt any Four Subjects from the Twelve Subjects Listed below. Out of these Four Subjects One Subject will be CORE and other Three will be ELECTIVE Subjects.)	DSC 1A Microbiology, Phycology		Paper-I	2.5	--	--	50	40	10	4.0
	Fungi, Archegoniate		Paper-II	2.5	--	--	50	40	10	
	DSC 2A		Paper-I	2.5	--	--	50	40	10	4.0
			Paper-II	2.5	--	--	50	40	10	
	DSC 3A		Paper-I	2.5	--	--	50	40	10	4.0
			Paper-II	2.5	--	--	50	40	10	
	DSC 4A		Paper-I	2.5	--	--	50	40	10	4.0
			Paper-II	2.5	--	--	50	40	10	
Total				24	--	--	500	400	100	20
Class :	B.Sc.- I Semester – II									
Ability Enhancement Course(AECC)	English (communication skill)		Paper- II	4.0			100	80	20	4.0
Core (*Students can opt any Four Subjects from the Twelve Subjects Listed below. Out of these Four Subjects One Subject will be CORE and other Three will beELECTIVE Subjects.)	DSC1B Plant Ecology		Paper-III	2.5	--	--	50	40	10	4.0
	Taxonomy of Angiosperms		Paper-IV	2.5	--	--	50	40	10	
	DSC 2B		Paper-III	2.5	--	--	50	40	10	4.0
			Paper-IV	2.5	--	--	50	40	10	
	DSC 3B		Paper-III	2.5	--	--	50	40	10	4.0
			Paper-IV	2.5	--	--	50	40	10	
	DSC 4B		Paper-III	2.5	--	--	50	40	10	4.0
			Paper-IV	2.5	--	--	50	40	10	
Democracy, Elections and Good Governance			3.0			50	40	10	NC	
Total (Theory)				27	--	--	550	440	110	20
Core	DSC 1 A & 1B		Practical I and II	--	--	4	100	80	20	4.0
	DSC 2 A & 2B		Practical I and II	--	--	4	100	80	20	4.0
	DSC 3A & 3B		Practical I and II	--	--	4	100	80	20	4.0
	DSC 4A & 4B		Practical I and II	--	--	4	100	80	20	4.0
Total (Practical)						16	400	320	80	16
Grand Total				51		16	1450	1160	290	56

# Core Subject : Botany

**PUNYASHLOK AHILYADEVI HOLKAR**

**Solapur University, Solapur**

**Faculty of Science**

**Choice Based Credit System (CBCS) (w.e.f.2020-21)**

Subject/ Core Course	Name and Type of the Paper		No. of papers/ Practical	Hrs/week			Total Marks Per Paper	UA	CA	Credits
	Type	Name		L	T	P				
<b>Class :</b>	<b>B.Sc.- II Semester – III</b>									
<b>Core</b> (*Students can opt any Three subjects among the Four Subjects offered at B.Sc.I. Out of Three Subjects offered One Subject will be the Core Subject <b>OR</b> Subject will be the Core Subject	DSC 1C	Paper-V	3.0	--	--	50	40	10	4.0	
		Paper-VI	3.0	--	--	50	40	10		
Subjects offered at B.Sc.I. Out of Three Subjects offered One Subject will be the Core Subject <b>OR</b> Subject will be the Core Subject	DSC 2C	Paper-V	3.0	--	--	50	40	10	4.0	
		Paper-VI	3.0	--	--	50	40	10		
Subject will be the Core Subject <b>OR</b> Subject will be the Core Subject	DSC 3C	Paper-V	3.0	--	--	50	40	10	4.0	
		Paper-VI	3.0	--	--	50	40	10		
	AECC - Environmental Studies SEC-1		3.0	--	--	-	-	-	NC	
			2.5			50	40	10	2.0	
<b>Grand Total</b>				<b>23.5</b>	<b>--</b>	<b>--</b>	<b>350</b>	<b>280</b>	<b>70</b>	<b>14</b>
<b>Class :</b>	<b>B.Sc.- II Semester – IV</b>									
<b>Core</b> (*Students can opt any Three subjects among the Four Subjects offered at B.Sc.I. Out of Three Subjects offered One Subject will be the Core Subject <b>OR</b> Students can opt any Two subjects among the Four Subjects offered at B.Sc.I. Out of Two Subjects One Subject will be the Core Subject and any One Subject among the other will be Elective Subject	DSC 1D	Paper-VII	3.0	--	--	50	40	10	4.0	
		Paper-VIII	3.0	--	--	50	40	10		
	DSC 2D	Paper-VII	3.0	--	--	50	40	10	4.0	
		Paper-VIII	3.0	--	--	50	40	10		
	DSC 3D	Paper-VII	3.0	--	--	50	40	10	4.0	
		Paper-VIII	3.0	--	--	50	40	10		
	SEC-2		2.5			50	40	10	2.0	
<b>Total (Theory)</b>				<b>20.5</b>	<b>--</b>	<b>--</b>	<b>350</b>	<b>280</b>	<b>70</b>	<b>14</b>
<b>DSE (Practical)</b>	DSC 1C & 1D	Pr. III&IV	--	--	8	100	80	20	4.0	
	DSC 2C & 2D	Pr. III&IV	--	--	8	100	80	20	4.0	
	DSC 3C & 3D	Pr. III&IV	--	--	8	100	80	20	4.0	
<b>Total (Practical)</b>					<b>24</b>	<b>300</b>	<b>240</b>	<b>60</b>	<b>12</b>	

Grand Total			43.5		24	1000	800	200	40
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**Draft Structure for B. Sc-II**

**Core Subject : Botany**

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**Choice Based Credit System (CBCS)**

(w.e.f.2021-22)

**Draft Structure for B. Sc-III**

Subject/ Core Course	Name and Type of the Paper		No. of papers/ Practical	Hrs/week			Total Marks Per Paper	UA	CA	Credits	
	Type	Name		L	T	P					
<b>Class :</b>	<b>B.Sc.- III Semester – V</b>										
<b>Ability Enhancement Course(AECC)</b>	English (Business English)		Paper- III	4.0	--	--	100	80	20	4.0	
<b>Discipline Specific Elective (DSE)</b>			DSE-1A	Paper- IX	3	--	--	100	80	20	4.0
(Students can opt any one subjects among the three											
Subjects excluding interdisciplinary offered at B.Sc II.											
	DSE- 2 A	Paper -X	3	--	--	100	80	20	4.0		
	DSE- 3 A	Paper- XI	3	--	--	100	80	20	4.0		
	DSE- 4 A	Paper- XII	3	--	--	100	80	20	4.0		
	SEC- 3		2.5	--	--	50	40	10	2.0		
<b>Grand Total</b>				<b>18.5</b>	<b>--</b>	<b>--</b>	<b>550</b>	<b>440</b>	<b>110</b>	<b>22</b>	
<b>Class :</b>	<b>B.Sc.- III Semester –VI</b>										
<b>Ability Enhancement Course(AECC)</b>	English (Business English)		Paper IV	4.0	--	--	100	80	20	4.0	
<b>DSE</b>	DSE- 1B		Paper -XIII	3.0	--	--	100	80	20	4.0	
(Students can opt any one	DSE- 2B		Paper- XIV	3.0	--	--	100	80	20	4.0	

subjects among the three									
Subjects excluding interdisciplinary offered at B.Sc. II.									
	DSE- 3 B	Paper- XV	3.0	--	--	100	80	20	4.0
	DSE- 4 B	Paper- XVI	3.0	--	--	100	80	20	4.0
<b>SEC</b>	SEC- 4		2.5	--	--	50	40	10	2.0
<b>Total (Theory)</b>			<b>18.5</b>	--	--	<b>550</b>	<b>440</b>	<b>110</b>	<b>22</b>
<b>DSE ( Practical Annual Exam)</b>	DSE- 1 A&B	Practical- IX & XIII	--	--	4	100	80	20	4.0
	DSE -2 A&B	Practical- X&XIV	--	--	4	100	80	20	4.0
	DSE- 3 A&B	Practical- XI&XV			4	100	80	20	4.0
	DSE- 4 A& B	Practical- XII & XVI			4	100	80	20	4.0
	<b>Total (Practicals)</b>					<b>24</b>	<b>400</b>	<b>320</b>	<b>80</b>
<b>Grand Total</b>			<b>37.5</b>		<b>24</b>	<b>1500</b>	<b>1200</b>	<b>300</b>	<b>56</b>

Summary of the Structure of B.Sc. Programme  
as per CBCS pattern

Class	Semester	Marks-Theory	Credits-Theory	Marks-Practical	Credits-Practicals	Total – credits
B.Sc.-I	I	500	20	--	--	20
	II	550	20	400	16	36
B.Sc.-II	III	350	14	--	--	14
	IV	350	14	300	12	26
B.Sc.-III	V	550	22	--	--	22
	VI	550	22	400	16	38
<b>Total</b>		<b>2850</b>	<b>112</b>	<b>1100</b>	<b>44</b>	<b>156</b>

B.Sc. Programme:

Total Marks : Theory + Practical's = 2850 + 1100 = 3950

Credits : Theory + Practical's = 112 + 44 = 156

Numbers of Papers Theory: Ability Enhancement Course (AECC) : 05

Theory: Discipline Specific Elective Paper (DSE) : 08

Theory: DSC : 14

Skill Enhancement Courses : 04

Total : Theory Papers : 31

**Abbreviations:**

L: Lectures

T: Tutorials

P: Practicals

UA: University Assessment

CA: College Assessment

DSC / CC: Core Course

AEC: Ability Enhancement Course

DSE: Discipline Specific Elective Paper

SEC: Skill Enhancement Course

GE: Generic Elective

CA: Continuous Assessment

ESE: End Semester Examination

**PUNYASHLOK AHILYADEVJI HOLKAR**  
**Solapur University, Solapur**  
**Faculty of Science**  
**Choice Based Credit System (CBCS), (w.e.f June.2019-20)**  
**Structure for B. Sc-I**  
**\*Core Subjects: Botany**

**Objective and Outcome of the Course**  
**Syllabus of B. Sc.-I, CBCS Pattern**  
**Botany, w.e.f. June-2019**  
**DSC -1-A**

**Semester- I**

**Paper No-I: Microbiology and Phycology**

**Unit 1: Introduction of Microbiology**

**Objective:** To get the knowledge about the basic concepts in microbiology

**Outcome:** The student can understand the basic concept of microbiology

**Unit 2: Microbes**

**Objective:** To get the knowledge about the characters, structure and economic importance of viruses. Knowledge about the forms, size and diversity of bacteria and about the Mycoplasma

**Outcome:** The student can understand in detail about the viruses, diversity of bacteria and about the Mycoplasma

**Unit 3: Phycology**

**Objective:** To get the knowledge about the characters, classification and economic importance of algae

**Outcome:** The student can understand importance of algae

**Unit:4: Cyanophyta**

**Objective:** To get the knowledge about the general Characters, occurrence, classification, Thallus organization & reproduction of Cyanophyta division along with the example *Nostoc*

**Outcome:** The student can understand in detail about the division Cyanophyta along with its one detailed example of *Nostoc*

**Unit 5: Chlorophyta**

**Objective:** To get the knowledge about the general Characters, occurrence, classification, Thallus organization & reproduction of chlorophyta division along with the example *Nostoc*

**Outcome:** The student can understand in detail about the division chlorophyta along with its one detailed example of *Spirogyra*

## **Paper -II**

### **Fungi and Archegoniate**

#### **Unit 1: Fungi**

**Objective:** To get the knowledge about characters, mode of nutrition & classification of the True fungi.

**Outcome:** The student can understand about the general introduction of true fungi.

#### **Zygomycotina**

**Objective:** To get the knowledge about the fungal division Zygomycotina

**Outcome:** The student can understand about division of Zygomycotina.

#### **Ascomycotena**

**Objective:** To get the knowledge about the fungal division Ascomycotina.

**Outcome:** The student can understand about the division of Ascomycotina

#### **Unit 2: Archegoniate**

**Objective:** To get Knowledge about Introduction & general characters of Archegoniate

**Outcome:** The student get an detailed idea about Archegoniate

#### **Unit 3: Bryophytes**

**Objective:** To get the knowledge about the Bryophytes with suitable example

**Outcome:** The student can understand about the Bryophytes and life cycle of *Riccia* with its economic importance.

#### **Unit 4: Pteridophyta**

**Objective:** To get the knowledge about the Pteridophytes with suitable example.

**Outcome:** The student can understand about the Pteridophytes and life cycle of *Selaginella* with its economic importance..

#### **Unit 5: Gymnosperms**

**Objective:** To get the knowledge about the Gymnosperms with suitable example

**Outcome:** The student can understand about the Gymnosperms and life cycle of *Cycas* with its economic importance.



## **Paper No. III**

### **Plant Ecology**

#### **Unit 1: Introduction**

**Objective:** To get the knowledge about the climatic and Edaphic factors of environment

**Outcome:** The student can understand about the Climatic and Edaphic factors of environment.

#### **Unit 2: Ecological Adaptations**

**Objective:** To get the knowledge about the Ecological adaptations.

**Outcome:** The student can understand about the Ecological adaptations in plants.

#### **Unit 3: Plant communities**

**Objective:** To get the knowledge about the Forms & structure of community along with Qualitative and quantitative characters of community

**Outcome:** The student can understand about the Plant communities

#### **Unit 4: Ecology**

**Objective:** To get the knowledge about Introduction, Components of ecosystem, Ecological pyramids with Food chain and food webs.

**Outcome:** The student can understand about the concepts of ecology

#### **Unit 5: Ecological succession**

**Objective:** To get the knowledge about the Ecological succession

**Outcome:** The student can understand about the Ecological succession

## **Taxonomy of Angiosperms**

### **Unit 1: Introduction**

**Objective:** To get knowledge about different concepts in taxonomy

**Outcome:** The student can understand about importance of taxonomy

### **Unit 2: Classification**

**Objective:** To understand different classification systems and its merit & demerits

**Outcome:** The student can understand about classification systems in taxonomy

### **Unit 3: Identification and nomenclature**

**Objective:** To understand Identification methods, Nomenclature, Principles and Rules of ICBN

**Outcome:** The student can understand different methods of classification and rules of nomenclature

### **Unit 4: Herbarium and Botanical Garden**

**Objective:** To understand technique of herbarium preparation and significance

**Outcome:** The student can understand technique and botanical gardens in India

### **Unit 5: Study of Angiosperm families**

**Objective:** To study morphological & reproductive characters of 4 families

**Outcome:** The student can understand detailed identifying characters of family

# Botany, w.e.f. June-2019

## DSC -1-A

### Semester- I

#### Paper No-I: Microbiology & Phycology

#### Microbiology & Phycology (Lecture 35)

- Unit-1** : Introduction of microbiology (02 lecture)
- Unit-2** **Microbes** (09 lectures)
- 2.1** **Viruses:** General characters, structure, classification (plant viruses) and economic importance of viruses.
- 2.2** **Bacteria:** General characters of bacteria, structure and Economic importance.
- 2.3** **Mycoplasma:** General characters, Structure, classification and significance.
- Unit-3** **Phycology** (09 lectures)
- 3.1** Introduction, general characters and classification of algae (As per Smith-1955) up to class.
- 3.2** Economic importance of Algae
- Unit-4** **Cyanophyta** (07 lectures)
- 4.1** General Characters
- 4.2** Study of *Nostoc* – Occurrence, Classification, thallus structure and reproduction. (excluding developmental stages)
- Unit-5** **Chlorophyta** (08 lectures)
- 5.1** General Characters
- 5.2** Study of *Spirogyra* - Occurrence, Classification, thallus structure and reproduction (excluding developmental stages)

#### References Book

1. Lee, R.E. (2008). Phycology, Cambridge University Press, Cambridge. 4<sup>th</sup> edition.
2. Prescott, L.M., Harley J.P., Klein D. A. (2005). Microbiology, Mc Graw Hill, India. 6th edition.
3. Kumar, H.D. (1999). Introductory Phycology. Affiliated East-West Press, Delhi.
4. Sahoo, D. (2000). Farming the ocean: seaweeds cultivation and utilization. Aravali International, New Delhi.
5. Campbell, N.A., Reece J.B., Urry L.A., Cain M.L., Wasserman S.A. Minorsky P.V., Jackson R.B. (2008). Biology, Pearson Benjamin Cummings, USA. 8th edition.
6. Pelczar, M.J. (2001) Microbiology, 5th edition, Tata Mc Graw-Hill Co, New Delhi.

#### Paper-II: Fungi & Archegoniate

## Fungi & Archegoniate

(Lecture 35)

<b>Unit-1</b>	<b>Fungi</b>	(08lecture)
1.1	General characters, Nutrition and classification of fungi up to class (as per Ainsworth).	
1.2	Economic importance of Fungi	
1.3	Study of <i>Mucor</i> - Occurrence, Thallus organisation, classification and Life cycle. (excluding developmental stages)	
1.4	Study of Yeast-Occurrence, Thallus organization, classification and life cycle. (excluding developmental stages)	
<b>Unit 2</b>	<b>Archegoniate</b>	(04 Lectures)
2.1	Introduction	
2.2	General characters.	
<b>Unit 3</b>	<b>Bryophytes</b>	(07 Lectures)
3.1	General characters, and Classification (as per G. M. Smith)	
3.2	Study of <i>Riccia</i> - Occurrence, classification, thallus structure (External and Internal) and reproduction (Excluding development).	
3.3	Economic importance of Bryophytes	
<b>Unit 4</b>	<b>Pteridophytes</b>	(8 Lectures)
4.1	General characters and classification up to class (as per G. M. Smith)	
4.2	Study of <i>Sellaginella</i> - Occurrence, classification, morphology of sporophyte, anatomy (stem) and reproduction (Excluding development).	
4.3	Economic importance of Pteridophyte	
<b>Unit 5</b>	<b>Gymnosperms</b>	(08 Lectures)
5.1	General characters and classification (As per Sporne)	
5.2	Study of <i>Cycas</i> - Occurrence, classification, morphology (Sporophyte, Corolloid root), anatomy of leaflet and reproduction of <i>Cycas</i> (Structure of male and female reproductive structures excluding development).	
5.3	Economical importance of Gymnosperms	

## References Book

1. Vashistha, P.C., Sinha, A.K., Kumar, A. (2010). Pteridophyta. S. Chand. Delhi, India.
2. Bhatnagar, S.P. & Moitra, A. (1996). Gymnosperms. New Age International (P) Ltd Publishers, New Delhi, India.
3. Parihar, N.S. (1991). An introduction to Embryophyta: Vol. I. Bryophyta. Central Book Depot. Allahabad.
4. Raven, P.H., Johnson, G.B., Losos, J.B., Singer, S.R. (2005). Biology. Tata McGraw Hill, Delhi.
5. Vander-Poorteri 2009 Introduction to Bryophytes. COP.
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9. Sethi, I.K. and Walia, S.K. (2011). Text book of Fungi and Their Allies, Macmillan Publishers India Ltd.
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12. Prescott, L.M., Harley J.P., Klein D. A. (2005). Microbiology, McGraw Hill, India. 6<sup>th</sup> edition.
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14. Sahoo, D. (2000). Farming the ocean: seaweeds cultivation and utilization. Aravali International, New Delhi.
15. Campbell, N.A., Reece J.B., Urry L.A., Cain M.L., Wasserman S.A. Minorsky P.V., Jackson R.B. (2008). Biology, Pearson Benjamin Cummings, USA. 8th edition.
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**Syllabus of B. Sc.-I, CBCS Pattern**  
**Botany, w.e.f. June-2019**  
**DSC -1-A**  
**Semester- II**

**Paper No-III: Plant Ecology**

**Plant Ecology** **(Lecture 35)**

**Unit 1: Introduction** (05 Lectures)

- 1.1. Climatic factor- Light, Temperature, Humidity, Wind & Rainfall.
- 1.2. Edaphic factor- Soil formation, Soil profile, Classification & Chemical properties of soil.

**Unit 2: Ecological Adaptation** (8 Lectures)

- 2.1. Introduction.
- 2.2. Hydric Adaptation.
- 2.3. Xeric Adaptation.

**Unit 3: Plant communities** (8 Lectures)

- 3.1. Introduction.
- 3.2. Forms & structure of community.
- 3.3. Classification.
- 3.4. Qualitative and quantitative characters of community

**Unit 4: Ecosystem** (8 Lectures)

- 4.1. Introduction.
- 4.2. Concept & type.
- 4.3. Components of ecosystem.
- 4.4. Ecological pyramids.
- 4.5. Food chain and food webs.

**Unit 5: Ecological succession** (6 Lectures)

- 5.1. Introduction.
- 5.2. Concept & process.
- 5.3. Hydrosere and Xerosere.

**References;**

1. Kormondy, E.J. (1996). Concepts of Ecology. Prentice Hall, U.S.A. 4th edition.
2. Sharma, P.D. (2010) Ecology and Environment. Rastogi Publications, Meerut, India. 8<sup>th</sup> edition.
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6. Hill, M.K. 1997. Understanding Environmental Pollution. Cambridge University Press.
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9. Prof. M.A. Khan – Environment, Biodiversity and Conservation S-B Nangia, A.P.H. Publishing Corporation, 5, Ansari Road, Daryaganj New Delhi – 110002.
10. B.P. Pandey – Modern Practical Botany Vol – I / II Chand & Company Ltd. Ramnagar New Delhi – 110055.
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## Paper- IV: Taxonomy of Angiosperms

### Taxonomy of Angiosperms

(Lecture 35)

<b>Unit 1:</b>	<b>1.1.</b> Introduction	<b>(4 Lectures)</b>
	<b>1.2.</b> Aims and Principles of Taxonomy	
<b>Unit 2:</b>	<b>Classification</b>	<b>(8 Lectures)</b>
	<b>2.1.</b> Types of classification: Artificial, Natural and Phyllogenetic.	
	<b>2.2</b> Bentham and Hooker system of classification	
	<b>2.3</b> Merits and demerits	
<b>Unit 3:</b>	<b>Identification and nomenclature</b>	<b>(8 Lectures)</b>
	<b>3.1</b> Identification of plants	
	<b>3.2</b> Nomenclature, Binomial nomenclature of plants	
	<b>3.3</b> Principles of ICBN.	
<b>Unit 4:</b>	<b>Herbarium and Botanical Garden</b>	<b>(5 Lectures)</b>
	<b>4.1</b> Herbarium- Steps in preparation and significance.	
	<b>4.2</b> Botanical gardens of India- Sir J. C. Bose Botanical Garden, Calcutta & Lead Botanical Garden of Shivaji University Kolhapur.	
<b>Unit 5:</b>	<b>Study of Angiosperms families</b>	<b>(10 Lectures)</b>
	<b>5.1</b> Systematic position, Morphological & distinguishing characters with economic importance of following families:	
	a) Caesalpiniaceae                      b) Solanaceae	
	c) Nyctaginaceae                        d) Liliaceae	

### References:

1. Morphology of Angiosperms, J M Coulter and C J Chamberlain, Pointer Publishers, Jaipur.
2. Taxonomy of Angiosperm R Pandey, S Chand and Co. Ltd, Ramnagar New Delhi.110055
3. An Introduction to Taxonomy of Angiosperms- Pritish Shukla, Shital P Mishra, Vikas Publishing House, Pvt. Ltd. Gaziabad, UP.
4. A Text Book of Angiosperms-B P Pandey, S Chand and Co Ltd. Ramnagar, New Delhi.110055
5. A Text Book of Botany -'Angiosperm,V Singh C Pande, D K Jain, Rastogi Publication, Shivaji Road Meerut.250002
6. Taxonomy of Angiosperm, Neeru Mathur, Sonali Publications, New Delhi, 110002.
7. Angiosperms-G L Chopra, Pradeep Publications, Jalandhar, 144008.
8. Simpson, M.G. (2006). *Plant Systematics*. Elsevier Academic Press, San Diego, CA, U.S.A.
9. Singh, G. (2012). *Plant Systematics: Theory and Practice*. Oxford & IBH Pvt. Ltd., New Delhi. 3<sup>rd</sup> edition.
10. Jeffrey, C. (1982). An introduction to plant Taxonomy, Cambridge University Press, Cambridge.
11. Judd, W.S., Campbell, C.S., Kellog, E.A., Steven, P.F. (2002). *Plant Systematics-A Phyllogenetic approach*. Sinauer Associates Inc., U.S.A. 2nd edition.



12. Maheshwari j.k. (1963). Flora of Delhi. CSIR, New Delhi.
13. Simpson, M.G. (2006). Plant Systematics. Elsevier Academic Press, San Diego, CA, U.S.A.
14. Singh, G. (2012). Plant Systematics: Theory and Practice. Oxford & IBH Pvt. Ltd., New Delhi. 3<sup>rd</sup> edition.
15. Gaikwad, S. P. & Garad, K. U. (2015). *Flora of Solapur District*, Laxmi Book Publication Solapur.

## List of Practicals (based on paper no I to IV):

1. Study of dissecting and compound microscope.
  2. Electron micrographs/Models of viruses - T-Phage and TMV (photographs/models).
  3. Gram staining (demonstration) and forms of Bacteria (permanent slides/photographs).
  4. Identification of Algae (*Volvox*, *Sargassum*, *Gracillaria*,)
  5. Study of *Nostoc*.
  6. Study of *Spirogyra*.
  7. Identification of Fungi (*Albugo*, *Penicilium*, *Agaricus*,)
  8. Study of *Mucor*.
  9. Study of Yeast
  10. Identification of Archegoniates (*Marchantia*, *Adantium*, *Pinus*)
  11. Study of *Riccia*.
  12. Study of *Selaginella*- Morphology of sporophyte and anatomy of stem, Strobilus.
  13. Study of *Cycas*- Morphology of sporophyte and anatomy of leaflet.
  14. Study of *Cycas*- Reproductive structure: male cone, microsporophyll, microspore and megasporophyll, L. S. of ovule (permanent slide).
  15. - 18. Study of plant families:
    - a) Caesalpiniaceae
    - b) Solanaceae.
    - c) Nyctaginaceae
    - d) Liliaceae
  19. Study of soil P<sup>H</sup> by Universal indicator/pH paper/pH meter.
  20. Study of Water holding capacity of different soil.
  21. Study of meteorological instruments (any three).
  22. Determination of Density and Frequency of plants by quadrat method.
  23. Ecological adaptations of Hydrophytes (*Hydrilla*, *Eichhornia* and *Typha*).
  24. Ecological adaptations of Xerophytes (*Nerium* and *Aloe*).
  25. Excursion report.
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## **PUNYASHLOK AHILYADEVJI HOLKAR**

### **SOLAPUR UNIVERSITY, SOLAPUR**

Practicals of B.Sc. Part– I Botany (Semester System) (With effect from June 2019) Botanical Excursion: One teacher along with a batch not more than 20 students be taken for Botanical Excursion to places of Botanical interest, one in each term. If there are female students in a batch of twenty students, one additional lady teacher is permissible for excursion. T.A. and D.A. for teacher and non-teaching staff participating in excursions should be paid as per University rules. Tour report duly certified by teacher concerned and Head of the Department should be submitted at the time of practical examination. Practical Course: B.Sc. Part – I Botany practical course is to be covered in twenty five practicals. These practicals are to be performed by the students. Each practical is to be supplemented by permanent slides, preserved / fresh specimens, materials, charts, herbarium sheets, meteorological instruments where ever necessary.

#### **Details of Practical Examination:**

A) Every candidate must produce a certificate from Head of Department of his / her college, saying that he / she has completed practical course in satisfactory manner as per terms laid down by Academic council on the recommendations of Board of Studies in Botany. The student should record his / her observation and report of each experiment in the journal. The journal is to be signed periodically by teacher Incharge and certified by the Head of Department at the end of year. Candidates have to produce their certified journal and tour report at the time of practical examination. Candidate is not allowed to appear for the practical examination without a certified journal / loss certificate from Head of Botany Department regarding the same.

B) Practical Examination should be of five hours duration and shall test a candidate in the following respect. 1. Practical study of external and internal structures of different plant types and their classification. 2. Making temporary stained preparations and identification. 3. Identification and setting of biochemical experiments. 4. Study of plant families as per syllabus. 5. Spotting of the specimens as per syllabus.

### **1. Structure of the courses:-**

A) Each paper of every subject for Arts, Social Sciences & Commerce Faculty shall be of 50 marks as resolved by the respective faculties and Academic Council.

B) For Science Faculty subjects each paper shall be of 100 marks and practical for every subject shall be of 100 Marks as resolved in the faculty and Academic Council.

C) For B. Pharmacy also the paper shall be of 50 marks for University examination. Internal marks will be given in the form of grades.

D) For courses which were in semester pattern will have their original distribution already of marks for each paper.

E) For the faculties of Education, Law, Engineering the course structure shall be as per the resolutions of the respective faculties and Academic Council.

2. Practical Examination for B. Sc. I. will be conducted at the end of second semester.

3. Examination fees for semester Examination will be decided in the Board of Examinations. The structures of all courses in all Faculties were approved and placed before the Academic Council. After considered deliberations and discussion it was decided not to convene a meeting of the Academic Council for the same matter as there is no deviation from any decision taken by Faculties and Academic Council. Nature of Question Paper approved by Hon. Vice Chancellor on behalf of the Academic Council.

**PUNYASHLOK AHALYADEVJI HOLKAR  
SOLAPUR UNIVERSITY, SOLAPUR**

**B.Sc. Part- I: Practical Examination in Botany**

**March/April 2020**

**Centre:** .....

**Batch:** .....

**Date:** .....

**Total Marks -80**

- N. B.** 1. Draw neat and labeled diagrams wherever necessary.  
2. Do not write about points of theoretical information unless asked specifically.  
3. Perform the experiment as per instructions given by the examiners.
- 

**Q. 1.** Identify and show the important structures observed by you in the given specimen- A, B and C. leave your preparation for inspection. (No written answer) **24**

**Q. 2.** Determine Density/Frequency of plants of given quadrat. **08**

**Q. 3.** Set up the ecological experiment- D assigned to you and shows it to the examiner (No Written answer). **08**

**OR**

Show the ecological adaptation in the given specimen- E (No written answer).

**Q. 4.** Assign the specimen- 'F' to its respective family on the basis of characters observed by you in it. Give important vegetative and floral characters. Draw the floral diagram/floral formula of it. **10**

**Q. 5. Identifications** **10**

a. Identify and describe the slide/photograph- **G** (*Viruses/ Gram staining/ Types of bacteria*).

b. Identify and describe- **H** (*Algae/Fungi*).

c. Identify and describe- **I** (*Bryophyte/Pteridophyte/Gymnosperm*).

d. Identify and describe- **J** (*Vegetative character/Reproductive character*).

e. Identify and describe the specimen- **K** (*Meteorological instrument*).

**Q. 6.** a. Journal **10**

b. Excursion report. **10**

**Punyashlok Ahilyadevi Holkar Solapur University, Solapur**



**Name of the Faculty: Science & Technology**

**CHOICE BASED CREDIT SYSTEM**

**Syllabus: CHEMISTRY**

**Name of the Course: B.Sc. I ( Sem-I & II )**

**(Syllabus to be implemented from w.e.f. June 2019)**

## Punyashlok Ahilyadevi Holkar Solapur University, Solapur

### SYLLABUS FOR B. Sc – I (CHEMISTRY) CHOICE BASED CREDIT SYSTEM (CBCS) SYLLABUS

#### Structure of the Course:

- Structure of B.Sc. course in faculty of science has total of 06 semesters for 3 years.
- B.Sc.-I comprises of total two semesters. Each semester will have **two** theory papers of 80 marks for university external examination and 20 marks for internal examination for each paper.
- At the end of academic year i.e. semester II the practical examination will be conducted. The Weightage of practical is of 80 marks for university external practical examination and 20 marks for internal practical examination.
- The titles and marks distribution for each paper are as under.

Semester	Paper No.	Title of Paper	Total Lectures	Examination			Total Credit
				Univ. Exam	Internal Exam	Total Marks	
Semester I	I	Physical Chemistry	30	40	10	50	02
	II	Inorganic Chemistry	30	40	10	50	02
Semester II	III	Organic Chemistry	30	40	10	50	02
	IV	Analytical Chemistry	30	40	10	50	02
Practical	I	Chemistry		80	20	100	04

#### • University Examination

1. Theory Paper I : 40 Marks
2. Theory Paper II : 40 Marks
3. Theory Paper III : 40 Marks
4. Theory Paper IV : 40 Marks
5. Practical :80 Marks

Practical paper has 80 marks for external university practical examination. Duration of practical examination is **one day**. There will be three practicals, one from each sections physical, inorganic and organic chemistry. Out of 80 marks for external university practical examination, the mark distribution is as follows.

- Q. 1 Physical Chemistry experiment : 23 marks
- Q. 2 Inorganic Chemistry experiment : 24 marks
- Q. 3 Organic Chemistry experiment : 23 marks
- Q. 4 Oral : 05 marks
- Q. 5 Journal : 05 marks

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Total marks : 80 marks

#### • Continuous Internal Assessment for chemistry:

- 1) Each theory paper has 10 marks for internal examination. There will be 05 marks for unit test and 05 marks for home assignment.
- 2) Practical paper has 20 marks for internal examination.

**Total Credits: 4**  
**Marks: 100 (70+30)**

**SEMESTER-I**  
**PAPER –I (Physical Chemistry) (Total**  
**Credits: 2; Contact hrs: 30)**

**1. Chemical Kinetics (Contact hrs: 12)**

- 1.1 Chemical Kinetics and its scope, Rate of reaction, Definition and units of rate constant.  
Factors affecting rate of reaction. Concentration, pressure, temperature and catalyst.
- 1.2 Order and Molecularity of reaction.
- 1.3 First order reaction: Derivation of Rate constant. Characteristics of first order reaction.  
Examples: Decomposition of  $N_2O_5$
- 1.4 Second order reaction: Derivation of rate constant for equal and unequal concentration of the reactants. Characteristics of Second order reaction.  
Examples : i) Reaction between  $K_2S_2O_8$  and  $KI$  .
- 1.5 Pseudo-unimolecular reactions such as Hydrolysis of methyl acetate in presence of Acid.  
(Numerical Problems Expected)

**2. Mathematical Concepts (Contact hrs: 04)**

- 2.1 Graphical representation : Graph paper, co-ordinates of a point, equation of straight line and intercept, plotting of graph based on experimental data.
- 2.2 Derivative : Rules of differentiation (without proof) pertaining to algebraic and exponential functions. Example related to chemistry.
- 2.3 Integration : Rules of Integration (without proof) pertaining to algebraic and exponential functions. Example related to chemistry.  
(Numerical Problems not expected)

**3. Thermodynamics: (Contact hrs: 04)**

- 3.1 Spontaneous and non spontaneous processes, Second law of thermodynamics and its different statements.
- 3.2 Carnot's Theorem (Heat engine), Carnot cycle and its efficiency.  
(Numerical Problems Expected)

**4. Gaseous State: (Contact hrs: 10)**

- 4.1 a) Ideal and Non ideal gases, b) Deviation from ideal behaviour. (Only Boyle's law)  
c) Causes of deviation, van der Waal's equation, explanation of real gas behavior by van der Waal's equation.
- 4.2 Critical Phenomena : PV-Isotherms of real gases (Andrew's isotherms), continuity of state, Relationship between critical constants and van der Waal's constants.
- 4.3 Liquefaction of gases, Joule-Thomson effect.  
(Numerical Problems expected)



**Reference Books:**

- 1) Mathematical preparation of Physical Chemistry : F. Daniel Mc-Graw Hill Book Com.
- 2) Elements of Physical Chemistry : S. Glasstone and D. Lewis (D. Van Nostrand Co. Inc)
- 3) Physical Chemistry : W. J. Moore (Orient Longman)
- 4) Principles of Physical Chemistry : Maron Prutton
- 5) University Chemistry : B. H. Mahan (Addision - Weseley Publ. Co.)
- 6) Chemistry Principle & Applications : P.W. Atkins, M. J. Clugsto, M.J. Fiazer, R. A. Y. Jone (Longman)
- 7) Physical Chemistry : G. M. Barrow (Tata Mc-Graw Hill)
- 8) Essentials of Physical Chemistry : B. S. Bahl & G.D. Tuli (S. Chand)
- 9) Physical Chemistry : A. J. Mee.
- 10) Physical Chemistry : Daniels - Alberty.
- 11) Principles of Physical Chemistry : Puri - Sharma (S. Nagin)
- 12) Text Book of Physical Chemistry : Soni Dharmarha
- 13) University General Chemistry : CNR. Rao (McMillan)
- 14) Chemistry : Sienko - Plane ( Recent Edn.,)
- 15) Physical Chemistry Through problems : Dogra and Dogra (Wiley Eastern Ltd.,)
- 16) Physical Chemistry : S. Glasstone.
- 17) Basic Chemical Thermodynamics : V. V. Rao.

**SEMESTER-I**  
**PAPER –II (Inorganic Chemistry)**  
**(Total Credits: 2; Contact hrs: 30)**

**1. Atomic Structure and periodic properties (Contact hrs: 06)**

1.1 Atomic Structure

- a) Shapes of s, p, d orbitals.
- b) Aufbau and Pauli's exclusion principle, Hund's rule of maximum multiplicity
- c) General electronic configuration of s and p block elements.

1.2 General Characteristics of s and p block elements w.r.t. Atomic and Ionic radii, Ionization energy, Electron affinity, Electronegativity, Reactivity, Melting and Boiling point

**2. Chemical bonding and Ionic Solids (Contact hrs: 08)**

2.1 Types of chemical bonding

2.2 Ionic Bonding

- a) Formation of ionic bond, Energetics of ionic bonding : Ionisation potential, Electron affinity and Lattice energy.
- b) Characteristics of ionic compounds.
- c) Born-Haber Cycle for Alkali metal halide (NaCl).
- d) Fajan's rules.

2.3 Radius ratio and crystal structure.

- a) Definition: Radius ratio ( $r^+ / r^-$ ), Coordination number, Stoichiometry and unit cell.
- b) Concept and calculation of radius ratio ( $r^+ / r^-$ ) for ionic solid with octahedral geometry.
- c) Radius ratio effect on geometry.
- d) Crystal structure of NaCl and CsCl w.r.t. unit cell, radius ratio, coordination number and stoichiometry.

**3. Covalent bonding: Valence Bond Theory (VBT) Approach (Contact hrs: 08)**

3.1 Valence Bond Theory: Heitler–London Theory and Pauling-Slater Theory

3.2 Limitations of VBT

3.3 Need of Hybridization

3.4 Types of hybridization and shapes of simple inorganic molecules:  $\text{BeCl}_2$ ,  $\text{BF}_3$ ,  $\text{SiCl}_4$ ,  $\text{PCl}_5$ ,  $\text{SF}_6$ ,  $\text{IF}_7$ .

3.5 Valence Shell Electron Pair Repulsion (VSEPR) Theory w.r.t.  $\text{NH}_3$ ,  $\text{H}_2\text{O}$ ,  $\text{ClF}_3$

**4. Covalent bonding: Molecular Orbital Theory (MOT) Approach (Contact hrs: 08)**

4.1 Atomic and Molecular orbitals.

4.2 L.C.A.O. Principle

4.3 Bonding, Antibonding and Nonbonding Molecular orbitals.

4.4 Conditions for successful overlap

4.5 Different types of overlap (s-s, s-px, px - px and py- py or pz- pz)

4.6 Energy level sequence of molecular orbitals for  $n = 1$  and  $n = 2$

4.7 M. O. Diagrams for: a) Homonuclear diatomic molecule.  $\text{H}_2$ ,  $\text{Li}_2$ ,  $\text{Be}_2$ ,  $\text{C}_2$ ,  $\text{N}_2$  and  $\text{O}_2$

- b) Heteronuclear diatomic molecules CO and NO w.r.t. bond order stability and magnetic properties.

**Reference Books:**

- 1) Advanced Inorganic Chemistry - Cotton and Wilkinson
- 2) Inorganic Chemistry - J. E. Huheey
- 3) Concepts and models of Inorganic Chemistry - Douglas & Mc-Daniel
- 4) Principles of Inorganic Chemistry - Puri, Sharma
- 5) New Concise Inorganic Chemistry - (ELBS) - J. D. Lee
- 6) Text book of Inorganic Chemistry - P. L. Soni
- 7) Advanced Inorganic Chemistry - Satyaprakash, Tuli, Basu
- 8) Theoretical Principles of Inorganic Chemistry - G. S. Manku
- 9) Principles of Inorganic Chemistry - Puri, Sharma & Kalia
- 10) Inorganic chemistry: Principles of structure and reactivity – J. E. Huheey
- 11) Advanced Inorganic Chemistry, Vol. I – Gurudeep Raj
- 12) A New Guide to Modern Valency Theory- G. J. Brown

**SEMESTER-II**  
**PAPER III: (Organic Chemistry)**  
**(Total Credits: 2; Contact hrs: 30)**

**1. Fundamentals of organic reaction mechanism** **(Contact hrs: 05)**

- 1.1 Meaning of reaction mechanism.
- 1.2 Curved arrow notation, Half headed and double headed arrows.
- 1.3 Types of bond breaking : Homolytic and Heterolytic.
- 1.4 Types of reagents : Electrophilic and Nucleophilic.
- 1.5 Types and sub-types of following organic reactions with definition and at least one example of each. a) Substitution b) Addition c) Elimination d) Rearrangement.  
(Mechanism is not expected)
- 1.6 Reactive Intermediates with examples carbocations, carbanions (formation, structure, stability and reactions are expected). Carbon free radicals, carbenes, arennes, nitrenes  
(Definition with example only)

**2. Structure and Bonding** **(Contact hrs: 05)**

- 2.1 Hybridization:  $sp^3$ ,  $sp^2$  and  $sp$  w.r.t. methane, ethylene and acetylene respectively.
- 2.2 Bond length, Bond angle and Bond energy with factors affecting these properties  
w.r.t. :  $sp^3$ ,  $sp^2$  and  $sp$  hybridization
- 2.3 Resonance effect with respect to phenol, and nitrobenzene.
- 2.4 Hyperconjugation w.r.t. toluene.
- 2.5 Inductive effect, + I and - I .
- 2.6 Steric effect w.r.t. mesitoic acid.

**3. Cycloalkanes** **(Contact hrs: 03)**

- 3.1 Cycloalkanes - Nomenclature methods of formation
  - (a) Internal Wurtz reaction
  - (b) Distillation of calcium or barium salt of dicarboxylic acid.
- 3.2 Chemical properties of cyclopropane
  - (i) Free radical substitution of chlorine in presence of light.
  - (ii) Action of HBr and conc.  $H_2SO_4$  iii) Catalytic reduction by  $H_2/Ni$

**4. Alkenes, Dienes and Alkynes** **(Contact hrs: 06)**

- 4.1 Nomenclature of alkenes.
- 4.2 Methods of formation of alkenes with mechanism
  - i) By dehydration of lower alcohols.
  - ii) By dehydrohalogenation of lower alkyl halides.
- 4.3 Chemical reactions of alkenes - Hydrogenation, Electrophilic and free radical additions, Hydroboration, Oxidation, Epoxidation, Ozonolysis, Hydration, Hydroxylation, Oxidation with  $KMnO_4$ , Polymerisation of alkenes - ethylene and propylene
- 4.4 Nomenclature and classification of dienes.
- 4.5 Isolated, Conjugated and cumulated dienes.
- 4.6 Butadiene-Methods of formation, polymerisation, 1:2 and 1:4 additions and Diels-Alder reaction.
- 4.7 Alkynes - Nomenclature, Acidity of alkynes.
- 4.8 Electrophilic and Nucleophilic addition reactions, Hydroboration, oxidation.

## 5. Stereochemistry of organic compounds

(Contact hrs: 05)

- 5.1 Types of stereo-isomerism - Optical isomerism, Geometrical isomerism and Conformational isomerism.
- 5.2 Chiral center [Explanation with lactic acid]
- 5.3 Elements of symmetry
- 5.4 Optical isomerism in lactic acid, tartaric acid and 2,3 - dihydroxy butanic acid
- 5.5 Enantiomers and diastereoisomers.
- 5.6 Racemic modification.
- 5.7 Geometrical isomerism-cause of geometrical isomerism.
- 5.8 Geometrical isomerism w.r.t. C = C  
Geometrical isomerism in maleic acid and fumaric acid.

## 6. Aromaticity and Benzene

(Contact hrs: 06)

- 6.1 Meaning of the terms - Aromatic, non-aromatic, antiaromatic and pseudoaromatic compounds.
- 6.2 a) Kekule structure of benzene  
b) Resonance structures of benzene.  
c) Molecular orbital picture of benzene.  
d) Representation of benzene ring.
- 6.3 Modern theory of aromaticity. Fundamental Concepts - delocalisation of electrons, coplanarity and Huckel's  $(4n + 2) \pi$  rule. Applications of Huckel's rule to naphthalene, pyrrole and pyridine.
- 6.4 Mechanism of electrophilic aromatic substitution in benzene w.r.t. nitration, sulphonation, halogenation and Friedel - Craft's reaction- alkylation and acylation.

## Reference Books

- 1) Organic Chemistry : Hendrickson, Cram, Hammond.
- 2) Organic Chemistry : Morrison and Boyd
- 3) Organic Chemistry : Volume I and II I.L. Finar
- 4) Organic Chemistry : Pine
- 5) Advanced Organic Chemistry : Sachinkumar Ghosh
- 6) Advanced Organic Chemistry : B.S. Bahl and Arun Bahl
- 7) A Guide book to Mechanism in organic Chemistry : Peter Sykes
- 8) Stereochemistry of Organic Chemistry : Kalsi,
- 9) Stereochemistry of Carbon Compounds : Eliel
- 10) Text book of Organic Chemistry : P. L. Sony
- 11) Practical Organic Chemistry : By A. I. Vogel
- 12) Advanced Organic Chemistry - Reactions, Mechanism and Structure : Jerry March
- 13) Organic Chemistry : M.R. Jain
- 14) Organic Chemistry : J. M. Shaigel

**SEMESTER-II**  
**PAPER IV: (Analytical Chemistry)**  
**(Total Credits: 2; Contact hrs: 30)**

**1. Physical properties of liquids** **(Contact hrs: 10)**

- 1.1 Introduction, additive and constitutive properties
- 1.2 Viscosity, coefficient of viscosity, determination of viscosity by Ostwald's Viscometer
- 1.3 Surface tension:- Determination of surface tension by Drop –Weight method
- 1.4 Parachor:-Macleod equation and its modification by Sugden, applications of parachor in the determination of molecular structures as benzene and NO<sub>2</sub> group
- 1.5 Dipole moment, electrical polarization of molecules
- 1.6 Use of dipole moment in the study of molecular structure
- 1.7 Refractive index, Snell's law
- 1.8 Specific and molecular refractivity, Abbe's refractometer: Principle-critical angle phenomenon-construction, working and advantages
- 1.9 Molecular refractivity and chemical constitution.

**2. Environmental Chemistry: Air pollution** **(Contact hrs: 04)**

- 2.1 Introduction: Meaning of terms: Environment, Pollution, Pollutant, Threshold Limit Value (TLV), Dissolved Oxygen (DO), Chemical Oxygen Demand (COD) and Biological Oxygen Demand (BOD)
- 2.2 Types of Pollution (Only Introduction): Air pollution, Water pollution, Sound pollution, Soil pollution, Automobile pollution and nuclear pollution.
- 2.3 Air Pollution: Classification of Air pollutants, Oxides of carbon, Sulphur and Nitrogen as air pollutants with respect to source and health hazards.

**3. Environmental Chemistry: Water pollution** **(Contact hrs: 06)**

- 3.1 Introduction: Resources of water, Types of water Pollutants, water Pollution and its sources (Brief Account)
- 3.2 Treatment of water:
  - A) Potable Water: Parameters of potability of water
    - Step I: Removal of suspended matter :
      - a) Prolonged storage
      - b) Screening
      - c) Sedimentation
      - d) Coagulation
      - e) Filtration
    - Step II: Removal of germs and bacteria- Physical and Chemical method.
      - Physical Methods :
        - a) Boiling
        - b) Exposure to UV or Sunlight
        - c) Distillation.
      - Chemical Method :
        - a) Chlorination
        - b) Fluorination
        - c) Ozonisation
        - d) Aeration
        - e) Use of KMnO<sub>4</sub>
  - B) Industrial Water: Mention names of the methods only, Ion exchange method in detail.
  - C) Municipal Sewage: Meaning of Sewage; mention the names of methods; activated sludge process in detail.

#### **4. Qualitative and Quantitative elemental analysis**

(Contact hrs: 06)

4.1 Qualitative analysis of Carbon, Hydrogen, Nitrogen & Sulphur

4.2 Quantitative analysis of -

i) Carbon and hydrogen by Combustion method

ii) Nitrogen by Kjeldahl's method

iii) Halogen and Sulphur by Carius method.

4.3 Determination of molecular weight of an acid by titration method.

4.4 Empirical formula and molecular formula determination. (Numerical Problems Expected)

#### **5. Petroleum and petrochemicals**

(Contact hrs: 04)

5.1 Constituents and refining of petroleum, cracking, knocking, octane, hydro-forming

5.2 Synthesis and Industrial applications of following petrochemicals:

a) Ethylene oxide

b) Adipic acid

c) Styrene

d) 2-Phenyl ethanol

e) Paracetamol

#### **Reference Books**

- 1) Chemistry - Central Science, Brown, Lemay, Bursten 8<sup>th</sup> Edition.
- 2) Principles of Physical Chemistry - S.H.Maron / C.F.Prutton
- 3) Elements of Physical Chemistry - P.Atkins / J.Paula
- 4) Essentials of Physical Chemistry - A.Bahl / B.Bahl / G.Tuli
- 5) Textbook of Physical Chemistry - S.Glasstone
- 6) Principles of Physical Chemistry - B.Puri / L.Sharma / M.Pathania
- 7) Textbook of Physical Chemistry - P.Soni / O.Dharmarha
- 8) Environmental Chemistry - A.K. De
- 9) Environmental pollution analysis - S.M. Khopkar
- 10) Organic Chemistry : Hendrickson, Cram, Hammond.
- 11) Organic Chemistry : Morrison and Boyd
- 12) Organic Chemistry : Volume I and II I.L. Finar
- 13) Organic Chemistry : Pine
- 14) Advanced Organic Chemistry : Sachinkumar Ghosh
- 15) Advanced Organic Chemistry : B.S. Bahl and Arun Bahl
- 16) Practical Organic Chemistry : By A. I. Vogel
- 17) Industrial Chemistry : Rogers
- 18) Industrial Chemistry : R.K.Das
- 19) Industrial Chemistry : B. K. Sharma

## B.Sc. – I (Chemistry Practical Course)

- N.B.** i) Use of Digital balance is allowed.  
ii) Use S.I. Units Wherever Necessary.

### A) Physical Chemistry.

- 1) Determination of viscosity of given liquids A and B. (Density data of liquids, viscosity of water to be given.) [Any two liquids from, Acetone,  $\text{CCl}_4$ , Ethyl alcohol, Ethylene glycol and n- propyl alcohol]
- 2) Determination of equivalent weight of Mg by Eudiometer.
- 3) Study of specific reaction rate of hydrolysis of methyl acetate in presence of HCl.
- 4) Study of specific reaction rate of hydrolysis of methyl acetate in presence of  $\text{H}_2\text{SO}_4$
- 5) Study of reaction between  $\text{K}_2\text{S}_2\text{O}_8$  and KI (Equal Concentrations)
- 6) Determination of heat of ionization of weak acid.

### Reference Books :

- 1) Practical book of Physical Chemistry : Nadkarni, Kothari & Lawande.
- 2) Experimental Physical Chemistry : A. Findlay.
- 3) Systematic Experimental Physical Chemistry : S.W. Rajbhoj, Chondhekar (Anjali Pub.)
- 4) Experiments in Physical Chemistry : R.C.Das and B. Behra. (Tata Mc. Graw Hill)
- 5) Advanced Practical Physical Chemistry : J. B. Yadav (Goel Publishing House)
- 6) Practical Physical Chemistry : B. D. Khosala ( R. Chand & Sons.)
- 7) Experiments in Chemistry : D. V. Jagirdar

### B) Inorganic Chemistry

#### 1) Inorganic Quantitative Analysis: Volumetric Analysis

- i) To prepare a standard solution of Oxalic acid and determine the strength of Sodium hydroxide solution in terms of normality and  $\text{Kg/dm}^3$
- ii) To prepare a standard solution of Oxalic acid and determine the strength of Potassium permanganate solution in terms of normality and  $\text{Kg/dm}^3$
- ii) To prepare standard solution of Potassium dichromate and determine strength of Ferrous Ammonium Sulphate solution in terms of normality and  $\text{Kg/dm}^3$  (Use internal indicator)

#### 2) Qualitative Analysis:

- 1) Spot Tests: Detection of following cations using spot tests :  $\text{Cu}^{2+}$ ,  $\text{Co}^{2+}$ ,  $\text{Ni}^{2+}$ ,  $\text{Fe}^{3+}$ ,  $\text{Zn}^{2+}$ ,  $\text{Mg}^{2+}$ ,  $\text{Al}^{3+}$ ,  $\text{Pb}^{2+}$ .
- 2) Chromatography: Separation and identification of cations by Paper Chromatographic technique from the following mixtures :
  - a)  $\text{Ni}^{2+} + \text{Cu}^{2+}$
  - b)  $\text{Ni}^{2+} + \text{Co}^{2+}$
  - c)  $\text{Cu}^{2+} + \text{Co}^{2+}$

### Reference Books :

- 1) Vogel's Text Book of Quantitative Chemical Analysis (Longman ELBS Edition)
- 2) Vogel's Text Book of Qualitative Chemical Analysis (Longman ELBS Edition)
- 3) Basic Concepts in Analytical Chemistry (Wiley Eastern Ltd.) : S. M. Khopkar.



## C) Organic Chemistry

### 1) Estimations : (any two)

- i) Estimation of aniline, ii) Estimation of acetamide and iii) Estimation of Aspirin

### 2) Organic Qualitative Analysis.

Identification of at least five organic compounds with reactions including one from acids, one from phenols, one from bases and two from neutrals from the list of the compounds given below-

- i) Acids : Oxalic acid, Benzoic acid and Cinnamic acid
- ii) Phenols :  $\beta$  - Naphthol, Resorcinol.
- iii) Bases : Aniline, p - Toluidine.
- iv) Neutrals : Acetone, Ethyl acetate, Glucose, Chloroform, Chlorobenzene, m-dinitrobenzene, Thiourea.

**Note :** A systematic study of an organic compound involves the following operations which should be taught in details with reactions in the detection of elements and functional group.

- 1) Preliminary tests and physical examination.
- 2) Determination of physical constant.
- 3) Detection of Elements.
- 4) Determination of functional group.
- 5) A search into the literature.
- 6) Special Test.
- 7) Summary.
- 8) Result.

### 3) Organic Preparation: (Any one)

- i) Preparation of benzoic acid from benzamide.
- ii) Preparation of dibenzal acetone from benzaldehyde and acetone.  
(Wt. of crude product is expected. M.P. of the recrystallized product is not expected.)

### Reference Books:

- 1) Vogel's Text Book of Quantitative Chemical Analysis, (Longman) ELBS. Edition
- 2) Vogel's Text Book of Qualitative Chemical Analysis, (Longman) ELBS. Edition
- 3) Hand book of Organic Qualitative Analysis : Clarke
- 4) Comprehensive Practical Organic Chemistry - Quantitative Analysis by V.K. Ahluwalia, Sunita Dhingra, University Press. Distributor - Orient Longman Ltd.,
- 5) Comprehensive Practical Organic Chemistry preparation and Quantitative Analysis. : V.K. Ahluwalia, Renu Agarwal, University Press. Distributor - Orient Longman Ltd.,
- 6) A laboratory Hand-Book of organic Qualitative Analysis and separation : V. S. Kulkarni, Dastane Ramchandra and Co. Pune

# Punyashlok Ahilyadevi Holkar Solapur University, Solapur

Nature of Question Paper for choice based credit system (CBCS) Semester Pattern

• Faculty of Science •

(w. e. f. June 2019)

Time: - 2 hrs.

Total Marks-40

## Instructions:

1. All questions are compulsory.
2. Draw **neat diagrams** and give **equations** wherever necessary.
3. Figures to the **right** indicate **full marks**.
4. Use of logarithmic table and calculator is allowed.

(At. Wts.: H=1, C=12, O=16, N= 14, Na =23, Cl = 35.5)

## Q. No.1) Multiple choice questions

(08)

1) -----

a)      b)      c)      d)

2)

3)

4)

5)

6)

7)

8)

## Q.No.2) Answer any four of the following

(08)

i)

ii)

iii)

iv)

v)

vi)

## Q.No.3 A) Write notes on any one of the following

(03)

i)

ii)

## B) Solve / short answer

(05)

## Q. No.4) Answer any Two of the following

(08)

i)

ii)

iii)

## Q.No.5) Answer any one of the following

(08)

i)

ii)

**Punyashlok Ahilyadevi Holkar Solapur University, Solapur**



**Name of the Faculty: Science & Technology**

**CHOICE BASED CREDIT SYSTEM**

**Syllabus: Mathematics**

**Name of the Course: B.Sc. I (Sem.-I & II)**

**(Syllabus to be implemented from w.e.f. June 2019)**

## 1) Preamble

B.SC I Mathematics is framed to provide the tools to get the easy and precise outcome to various applications of science and technology. Also logical development of various algebraic statements can be made to develop the innovative approach of various concepts and it can be applied to various abstract things. In the theory courses of Algebra, Calculus, Geometry, & Differential Equation.

Various deductions of theorems, corollaries and lemmas will be acquired by Students. Change is the Universal truth of the nature. So our aim is that Students should learn various techniques to find solutions. Students who opted F.Y.B.SC Mathematics have to complete 1 theory courses 1 each semester, one practicals entitled ( Numerical Techniques in Laboratory ) NTL [DSC- I A+I B] Courses (Annual). In the practical course of 100 marks students exercise the problem solving techniques for practical course. The details are mentioned in the syllabus.

## 2) Aims

The aim of the course is to generate Intelligent and Skillful human beings with adequate theoretical and practical knowledge of the various mathematical systems. To include conceptual understanding in basic Phenomena, statements, theorems and development of appropriate problem solving skills suitable for applications and sufficient logical connectivity is provided.

## 3) Objective of the Course

- 1) To design the syllabus with specific focus on key Learning Areas.
- 2) To equip student with necessary fundamental concepts and knowledge base
- 3) To develop specific problem solving skills.
- 4) To impart training on abstract concepts, analysis, deductive techniques.
- 5) To prepare students for demonstrating the acquired knowledge.
- 6) To encourage student to develop skills for developing innovative ideas.
- 7) A student be able to apply their skills and knowledge that is translate information presented verbally into mathematical form select and use appropriate mathematical formulae or techniques in order to process the information and draw the relevant conclusion.
- 8) A Student should get adequate exposure to global and local concerns that explore them many aspects of mathematical sciences

# Punyashlok Ahilyadevi Holkar Solapur University, Solapur

Faculty of Science: B.Sc. I

Choice Based Credit System (CBCS),(w.e.f.2019-20) Structure for B. Sc.-I

Subject/ Core Course	Name and Type of the Paper		No. of papers/ Practical	Hrs/week			Total Marks Per Paper	UA	CA	Credits	
	Type	Name		L	T	P					
<b>Class :</b>	<b>B.Sc.- I Semester – I</b>										
<b>Ability Enhancement Course(AECC)</b>	English(communication skill)		Paper- I	4.0			100	80	20	4.0	
<b>Core</b> (*Students can opt any Four Subjects from the Twelve Subjects Listed below. Out of these Four Subjects One Subject will be CORE and other Three will be ELECTIVE Subjects.)	DSC 1A	Paper-I	2.5	--	--	50	40	10	4.0		
		Paper-II	2.5	--	--	50	40	10			
	DSC 2A	Paper-I	2.5	--	--	50	40	10	4.0		
		Paper-II	2.5	--	--	50	40	10			
	DSC 3A	Paper-I	2.5	--	--	50	40	10	4.0		
		Paper-II	2.5	--	--	50	40	10			
	DSC 4A	Paper-I	2.5	--	--	50	40	10	4.0		
		Paper-II	2.5	--	--	50	40	10			
	<b>Total</b>				<b>24</b>	--	--	<b>500</b>	<b>400</b>	<b>100</b>	<b>20</b>
	<b>Class :</b>	<b>B.Sc.- I Semester - II</b>									
	<b>Ability Enhancement Course(AECC)</b>	English(communication skill)		Paper- II	4.0			100	80	20	4.0
	<b>Core</b> (*Students can opt any Four Subjects from the Twelve Subjects Listed below. Out of these Four Subjects One Subject will be CORE and other Three will be ELECTIVE Subjects.)	DSC 1B	Paper-III	2.5	--	--	50	40	10	4.0	
Paper-IV			2.5	--	--	50	40	10			
DSC 2B		Paper-III	2.5	--	--	50	40	10	4.0		
		Paper-IV	2.5	--	--	50	40	10			
DSC 3B		Paper-III	2.5	--	--	50	40	10	4.0		
		Paper-IV	2.5	--	--	50	40	10			
DSC 4B		Paper-III	2.5	--	--	50	40	10	4.0		
		Paper-IV	2.5	--	--	50	40	10			
		Democracy, Elections and Good Governance			3.0			50	40	10	NC
<b>Total (Theory)</b>					<b>27</b>	--	--	<b>550</b>	<b>440</b>	<b>110</b>	<b>20</b>
<b>Core</b>		DSC 1 A & 1B		Practical I and II	--	--	4	100	80	20	4.0

	DSC 2 A & 2B	Practical I and II	--	--	4	100	80	20	4.0
	DSC 3A & 3B	Practical I and II	--	--	4	100	80	20	4.0
	DSC 4A & 4B	Practical I and II	--	--	4	100	80	20	4.0
<b>Total (Practical)</b>					<b>16</b>	<b>400</b>	<b>320</b>	<b>80</b>	<b>16</b>
<b>Grand Total</b>			<b>51</b>		<b>16</b>	<b>1450</b>	<b>1160</b>	<b>290</b>	<b>56</b>

**\*Core Subjects**

**Chemistry/Physics/Electronics/Computer Science/Mathematics/Statistics/Botany/Zoology/  
Microbiology/Geology/ Geography/Psychology**

## Equivalent Subject for Old Syllabus

### Sem. - I

<b>Sr. No.</b>	<b>Name of the old Paper</b>	<b>Name of the new Paper</b>
<b>1</b>	<b>Paper-I : Algebra</b>	<b>Paper-I : Algebra</b>
<b>2</b>	<b>Paper-II : Calculus</b>	<b>Paper-II : Calculus</b>

### Sem.-II

<b>Sr. No.</b>	<b>Name of the old Paper</b>	<b>Name of the new Paper</b>
<b>1</b>	<b>Paper-III : Geometry</b>	<b>Paper-III : Geometry</b>
<b>2</b>	<b>Paper-IV : Differential Equation</b>	<b>Paper-IV : Differential Equation</b>

**Punyashlok Ahilyadevi Holkar Solapur University, Solapur**  
**Semester Pattern**

**Choice Based Credit System (CBCS) Syllabus**

**B.Sc.I**

**Mathematics**

**(w.e.f. June-2019)**

**Details of Re-Draft Syllabus of B. Sc. Part-I (MATHEMATICS)**

**Semester-wise pattern (Commencing from JUNE– 2019)**

B.Sc. I (Mathematics) (Honors) semester-wise Choice Based Credit System [CBCS] pattern to be implemented from June 2019. This syllabus of Mathematics carries 300 marks. In semester –I Internal examination (college examination) of 10 marks and external examination (university examination) of 40 marks [Total 40 +10 =50] for Theory paper –I & for paper II each, also in semester – II for Theory paper –III & for paper IV each and at the end of second term for **Numerical Technique Laboratory [NTL – I] [DSC-I A+ I B]** will be held. The distribution of marks is as follows.

**Semester –I (DSC-I A)**

- |                               |                           |
|-------------------------------|---------------------------|
| <b>(1) Paper-I: ALGEBRA</b>   | <b>(Marks 40+10 = 50)</b> |
| <b>(2) Paper-II: CALCULUS</b> | <b>(Marks 40+10 = 50)</b> |

**Semester –II (DSC-I B)**

- |  |                           |
|--|---------------------------|
| <b>(3) Paper -III: GEOMETRY</b>  | <b>(Marks 40+10 = 50)</b> |
| <b>(4) Paper-IV: DIFFERENTIAL EQUATIONS</b>  | <b>(Marks 40+10 = 50)</b> |
| <b>(5) Numerical Technique Laboratory [NTL - I] [DSC- I A + I B] (Marks 80 +20 =100)</b> |                           |

Internal exam of 20 marks and annual examination of 80 marks on all the above two papers.

**Note:-**

- (1) Total teaching periods for Paper –I / Paper –II and for Paper –III / Paper –IV are five (5) per week for each semester.
- (2) Total teaching periods for [DSC- I A+I B ] are four(4) per week for whole class as one batch.

**Duration of Annual Examination:**

- (i) For Paper –I /II (Three hours ) in semester -I
- (ii) For Paper –III/IV (Three hours ) in semester -II
- (ii) For NTL –I [DSC- I A+ I B] (Three hours for a batch of 20 students) annually.



## Semester -I

### Paper –I : Algebra

30 Periods

**Unit 1 (A): Matrices :** Symmetric and Skew symmetric, Elementary transformations, Rank of a Matrix(Echelon and Normal form), Characteristic equation of a matrix, Cayley Hamilton theorem and its use in finding the inverse of a matrix. [8]

**Unit 1(B): Linear Equations:** Application of matrices to a system of linear (both Homogeneous and non-homogeneous) equations, Eigen values and Eigen vectors. [7]

**Unit 2(A): Complex Number:** Modulus and Argument of a Complex Number, DeMoivre's Theorem and its applications, Roots of Unity, Roots of Complex Numbers. [8]

**Unit 2(B) : Transcendental Functions :** Circular Functions and their inverses and Hyperbolic Function of a complex variable with their inverses. [7]

### Paper –II: Calculus

30 Periods

**Unit. 1 (A) : Differentiation:** Indeterminate forms and L' Hospital's Rule, Successive differentiation,  $n^{th}$  derivatives of standard functions, Leibnitz rule. Taylor's theorem and Maclaurin's Theorem (Only Statements). Series expansions of  $e^x$ ,  $\cos x$ ,  $\sin x$ ,  $(1+x)^n$ ,  $\log(1+x)$  [8]

**Unit. 1 (B) : Function of two variables:** Limit and Continuity of function of two variables, Partial derivative, partial derivative of higher orders, Homogeneous functions, Euler's Theorem on Homogeneous functions. [7]

**Unit. 2 (A) : Reduction Formulae:**

$$\int_0^{\pi/2} \sin^n x \, dx \qquad \int_0^{\pi/2} \cos^n x \, dx \qquad \int_0^{\pi/2} \sin^n x \cos^m x \, dx$$

(Note that reduction to these forms are not expected) [7]

**Unit. 2 (B) : Vector Calculus:** Scalar point function, Vector point function, Directional derivatives, divergence and Curl and its properties. [8]

## Semester -II

### Paper –III: Geometry

30 Periods

**Unit 1(A):-Change of Axis:** Translations, Rotations, Invariants, and Identifications of conics from

General form of second degree equations, Polar Coordinates, Conversion formulae. [7]

**Unit 1(B): Sphere:** Centre radius form, General form, Diameter form, Equation of Tangent

Plane and condition for tangency, Family of spheres  $S+\lambda S'=0$ ,  $S+\lambda P=0$ . [8]

**Unit 2:-Plane:** General equation of plane, Normal equation, Intercept form Angle between two planes, Plane through three points, Plane through a given point, Sides of a

Plane, Distance of a point from a plane, Family of planes. [15]

### Paper- IV : Differential Equation

30 periods

**Unit 1(A):- Differential Equations of first order and first degree :[Part-I]**

Variables separable, Homogeneous, non- homogeneous differential Equations. [7]

**Unit 1(B):- Differential Equations of first order and first degree: [Part-II]**

Exact differential equations. Necessary and sufficient condition for exactness, Integrating

Factor with four rules, Linear differential equations of the form:  $dy/dx+py=Q$ ; Bernoulli's Equation  $dy/dx+Py=Qy^n$ . [8]

**Unit 2(A) :- Linear Differential Equations With Constant Coefficients :[Part-I]**

Complementary function and particular integral, General solution of  $f(D) y=X$ , Solution

Off  $(D)y=0$  for non-repeated , repeated, real and complex root. [7]

**Unit 2(B) :- Linear Differential Equations With Constant Coefficients : [Part-II]**

Solution of  $f(D)y=X$  , where X is of the form

$e^{ax}$ ,  $\sin(ax)$ ,  $\cos(ax)$ ,  $x^m$ ,  $e^{ax}V$ ,  $xV$  [8]

## **Numerical Technique Laboratory [NTL –I] [DSC – I A+I B]**

**4 Periods per week.**

**Assignment –1:** Inverse of Matrix by Cayley-Hamilton Method.

**Assignment –2:** Solution of system of Linear Homogeneous Equation

**Assignment –3:** Solution of system of linear non-homogeneous Equation.

**Assignment –4:**  $n^{\text{th}}$  roots of a complex number.

**Assignment –5:** Leibnitz Rule

**Assignment –6:** Reduction formulae

**Assignment – 7:** Partial differentiation

**Assignment –8:** Numerical examples on gradient, divergence and curl.

**Assignment – 9:** Change of axis and invariants.

**Assignment –10:** Conversion between Polar and Cartesian of points and equations

**Assignment –11:** Family of Planes.

**Assignment –12:** Family of Spheres.

**Assignment – 13:** Linear differential equations.

**Assignment –14:** Particular Integrals of  $e^{ax}$  and  $x^m$ .

**Assignment –15:** Particular Integrals of  $\sin(ax)$  and  $\cos(ax)$ .

**Assignment –16:** Particular Integrals of  $e^{ax}\mathbf{V}$ ,  $x\mathbf{V}$ .

## References

**Paper -I: Algebra**

**Paper -II : Calculus**

**Paper – III: Geometry**

**Paper -IV : Differential Equation**

1. **ALGEBRA, B. Sc. – I (Semester –I) MATHEMATICS- Paper-I by Prof. S. J. Alandkar, Prof. N. I. Dhanshetti, Prof. Dhone A. S. Prof. R. D. Mahimkar, Nirali Prakashan (Edition- July 2014) ISBN 978-93- 5164-169-8.**
2. **CALCULUS, B. Sc. – I (Semester –I) MATHEMATICS- Paper-II by Prof. S. J. Alandkar, Prof. N.I. Dhanshetti, Prof. Dhone A. S. Prof. R. D. Mahimkar, Nirali Prakashan (Edition- July 2014) ISBN 978- 93-5164-162-9.**
3. **GEOMETRY, B. Sc. – I (Semester –II) MATHEMATICS- Paper-III by Prof. S. J. Alandkar, Prof. N. I. Dhanshetti, Prof. Dhone A. S. Prof. R. D. Mahimkar, Nirali Prakashan (Edition- November 2014)ISBN 978-93-5164-339-5.**
4. **DIFFERENTIAL EQUATION , B. Sc. – I (Semester –II) MATHEMATICS- Paper-IV by Prof. S. J. Alandkar, Prof. N. I. Dhanshetti, Prof. Dhone A. S. Prof. R. D. Mahimkar, Nirali Prakashan (Edition- December 2014) ISBN 978-93-5164-445-3.**
5. **Algebra and Geometry by R. B. Kulkarni, J. D. Yadav, S. J. Alandkar, N. I. Dhanshetti. (SUMS Publication) B.Sc.-I Paper-I**
6. **Algebra and Geometry (B.Sc.-I Paper-I ) by Dr. B. P. Jadhav , Prof.A.M.Mahajan ,Prof.S.P.Gade, Prof. Kokare B.D . [Phadke Prakashan]**
7. **Text Books of Matrices by Shanti Narayan.**
8. **A Text Book of Analytical Geometry of Two dimensions, by P. K. Jain and Khalil Ahmid , Wiley Eartern Ltd. 1994.**
9. **Calculus and Differential Equations (B.Sc. –I ,Paper –II)**
10. **Calculus and Differential Equations (B. Sc. I , Paper- II) by Dr. B. P. Jadhav , Prof.A.M.Mahajan , Prof.S.P.Gade, Prof. Kokare B.D . [Phadke Prakashan]**
10. **Differential Calculus by Shanti Narayan**
11. **Differential Calculus by Shanti Narayan**
12. **A text book of Vector Calculus , by Shanti Narayan.**
13. **Differential equations, by G. S. Diwan, D. S. Agashe. Popular Prakashn , Bombay.**
14. **Introductory course in Differential Equation by D. A. Murray Orient Longman**

**Punyashlok Ahilyadevi Holkar Solapur University, Solapur**



**Name of the Faculty: Science & Technology**

**CHOICE BASED CREDIT SYSTEM**

**Syllabus: PHYSICS**

**Name of the Course: B.Sc. I (Semester –I and II)**

**(Syllabus to be implemented from w.e.f. June 2019)**

# PUNYASHLOK AHILYADEVJI HOLKAR SOLAPUR UNIVERSITY, SOLAPUR

## Choice Based Credit System (CBCS) Pattern Syllabus

### B.Sc. Part I Physics (w. e. f. June 2019)

- i) There will be two theory papers of 50 (80 % UA & 20 % CA) marks for each semester. Practical examination at the end of second semester will be of 100 (80 % UA & 20 % CA)marks. Total marks for physics subject will be 300 (80 % UA & 20 % CA) and  $5 + 5 + 4 = 14$  Credits.
- ii) There shall be 2.5 periods (2.5 Credits) per paper i.e. 5 periods per week for theory and 4 periods (4 Credits) per week for each batch of 20 students for practical.
- iii) The duration of theory examination for each paper will be 2 hours each and that for practical will be 6 Hours. There will be two sessions for annual practical examination morning and evening each of 3 hours.
- iv) Examination of Physics theory Paper-I & II will be held at the end of first Semester.
- v) Examination of Physics theory Paper-III & IV will be held at the end of second Semester.
- vi) Practical examination of both semesters will be held at the end of semester II. Every student will have to perform two experiments (one experiment from each Group).

## Semester – I

### (Theory Course: DSC 1A)

#### Titles of theory papers

**Core Subject DSC 1A: Physics Paper I – Mechanics and properties of matter.**

50 (80 % UA and 20 % CA) Marks and (2.5 Credits)

**Core Subject DSC 1A: Physics Paper II – Optics and Laser.**

50 (80 % UA and 20 % CA) Marks and (2.5 Credits)

## Semester – II (Theory Course: DSC 1B)

### Titles of theory papers

Core Subject DSC 1B: Physics Paper III – Heat and Thermodynamics.

50 (80 % UA and 20 % CA) Marks and (2.5 Credits)

Core Subject DSC 1B Physics Paper IV –

Electricity, Magnetism and Basic Electronics.

50 (80 % UA and 20 % CA) Marks and (2.5 Credits)

## Practical Course of Semester – I & II (Practical Course examination of Core DSC 1A & 1B at the end of second semester)

### Titles of Practical Groups

Core Subject Practical (DSC 1A): Group I – General Physics and Heat

50 (40 UA and 10 CA) Marks and (2 Credits)

Core Subject Practical (DSC 1B) Group II – Electricity, electronics, and optics

50 (40 UA and 10 CA) Marks and (2 Credits)

ANNUAL PRACTICAL EXAMINATION AT THE END OF 2nd SEMESTER  
OF 100 Marks (UA – 80 Marks + CA – 20 Marks)

Group (I & II) experiments UA  $(35 * 2) + CA (10 * 2) = 70 + 20 = 90$  Marks

Scale down of 35 Marks for UA per Group: As per given in the practical slips. 10 marks for certified Journal.

Scale down of 20 Marks for CA: - Internal examination of  $(35*2 = 70)$  Marks reduced to 20 marks)

10 Marks for certified journal should not be given in case of loss certificate. Student may appear practical examination for  $35+35=70$  marks with prior permission of his/her Principal. External Examiner will allow him/her only after submission of permission letter of his/her Head of Physics Department / Principal.

PUNYASHLOK AHILYADEVJI HOLKAR SOLAPUR UNIVERSITY, SOLAPUR

Nature of Question Paper for choice based credit system (CBCS) Semester Pattern

• Faculty of Science •

(w. e. f. June 2019)

Time: - 2 hrs.

Total Marks-40

Instructions:

1. All questions are compulsory.
2. Draw **neat diagrams** and give **equations** wherever necessary.
3. Figures to the **right** indicate **full marks**.
4. Use of logarithmic table and calculator is allowed.

**Q. No.1) Multiple choice questions**

(08)

- 1) -----  
a)      b)      c)      d)
- 2)  
3)  
4)  
5)  
6)  
7)  
8)

**Q.No.2) Answer any four of the following**

(08)

- i)  
ii)  
iii)  
iv)  
v)  
vi)

**Q.No.3 A) Write notes on any one of the following**

(03)

- i)  
ii)

**B) Solve / short answer**

(05)

**Q. No.4) Answer any Two of the following**

(08)

- i)  
ii)  
iii)

**Q.No.5) Answer any one of the following**

(08)

- i)  
ii)

**NB:** Minimum two numerical type sub questions must be asked in question number 1 and 2. One each from question number 3A, and 4 must be of numerical type sub question.



# CORE PAPER (DSC 1A): PHYSICS PAPER - I

## Title: - Mechanics and Properties of Matter.

**Topic 1 – Moment of Inertia** **09**  
Review of M.I., Moment of Inertia of 1) Circular disc 2) Rectangular lamina 3) Spherical Shell 4) Fly wheel.

**Topic 2 – Pendulums** **10**  
Introduction, Theory of compound pendulum, Bar pendulum, Kater's Pendulum, Bessel's Theory, Bifilar pendulum (parallel suspensions of equal lengths), Torsional Pendulum.

**Topic 3 – Elasticity** **07**  
Introduction, Equivalence of shear strain to compression and extension strains, Relation between elastic constants, Poisson's ratio of rubber tube (Theory and experimental method)

**Topic 4 – Surface Tension** **08**  
Review of S.T., relation between excess pressure and surface tension, excess pressure inside a liquid drop and soap bubble, Jaeger's method to determine Surface Tension, Factors affecting Surface Tension, Applications of Surface Tension.

**Topic 5 – Viscosity and Fluid dynamics** **08**  
Introduction, Newton's law of viscosity, streamline and turbulent flow, Critical velocity and Reynolds number, Equation of continuity, Energy possessed by liquid, Poiseuille's equation, Bernoulli's theorem and its applications to 1) Venturimeter 2) Atomiser. Factors Affecting on viscosity.

### Reference books:-

- 1) Properties of matter- D.S. Mathur
- 2) A Text book of properties of matter- N.S. Khare & S.Kumar
- 3) Physics Vol.I –David & Robert Resnick
- 4) University Physics-Mechanics of a particle- Anvar Kamal

# CORE PAPER (DSC 1A): PHYSICS PAPER - II

## Title: - Optics and Laser

**Topic 1 – Geometrical Optics and aberrations** **10**

Introduction, Fermat's principle, Deduction of laws of reflection and refraction by Fermat's principle, Chromatic and Spherical aberration, methods to minimize Chromatic and Spherical aberrations.

**Topic 2 – Optical Instruments** **08**

Introduction, Types of eye-pieces, Gauss eye piece, Ramsden's eye-piece, Huygen's eye-piece, Construction, working and Application of Spectrometer and Optical bench.

**Topic 3 – Interference** **08**

Introduction, Interference in parallel faced thin film (Reflected light only), wedge shaped film, Newton's rings and its applications.

**Topic 4 – Diffraction** **08**

Introduction, Types of diffraction, Plane diffraction grating and its elementary theory, its application to determine wavelength, Comparison between prism and grating spectra

**Topic 5 – Laser** **08**

Introduction, Spontaneous and Stimulated emission and absorption, Einstein's Coefficients, Population inversion, Optical Pumping, Cavity resonator, He-Ne and Ruby Laser, Properties and application.

**Reference books:-**

1. Ray Optics by R K Verma.
- 2..Text Book of Optics ( new edition ) – Brijlal and Subramanyam
3. Optics( second edition ) – Ajay Ghatak
4. Concept of Physics – H C Verma
5. Laser and Optics – B. B. Loud
6. Optics by Mathur

# **CORE PAPER (DSC 1B): PHYSICS PAPER - III**

## **Title: - Heat and Thermodynamics**

### **Topic 1 –Transport Phenomenon**

**08**

Introduction, mean free path, Claussius expression for mean free path ( Collision cross section),Transport Phenomenon, Coefficient of Viscosity, Thermal Conductivity and its dependence on temperature and pressure

### **Topic 2 - Liquefaction of Gases**

**08**

Liquefaction of gases by J-T effect, Linde's air liquefier; cooling by adiabatic demagnetization and expression for fall in temperature, experimental setup for adiabatic demagnetization of paramagnetic substances, properties of liquid helium

### **Topic 3 – Thermodynamics**

**10**

Laws of thermodynamics, Reversible and Irreversible processes, Isothermal and adiabatic process, Adiabatic relations, work done during isothermal and adiabatic processes, Entropy change in reversible and irreversible processes

### **Topic 4 – Heat engines**

**08**

Introduction:, Carnot's heat engine and its efficiency; Heat engine, Otto cycle and its efficiency Diesel cycle and its efficiency, comparison between Otto and diesel engine.

### **Topic 5 –Refrigerator**

**08**

General principle, Refrigeration Cycle, coefficient of performance of refrigerator, Vapor compression Refrigerator, Air conditioning (principle and applications)

### **Reference books:-**

1. Treatise on heat – Saha & Shrivastav
2. Kinetic theory of gases – V.N. Kelkar
3. Heat and Thermodynamics – Brijlal & Subrahmanyam

## **CORE PAPER(DSC 1B): PHYSICS PAPER – IV**

**Title: - Electricity, Magnetism and Basic Electronics**

**Topic 1 – Varying Current: 08**

Introduction, Growth and decay of current in L-R circuit, Charging and discharging of capacitor through resistor and inductor separately. Time constant of the LR and CR circuits.

**Topic 2 – A.C. Circuits: 08**

Complex number, J-Operator and its applications to AC circuits, Reactance, Susceptance, Impedance, Admittance and power factor, L-C-R circuit, series and parallel resonance circuits, sharpness of resonance and quality factor, AC bridge (Owen's bridge).

**Topic 3 – Magnetostatics and Ballistic Galvanometer: 08**

Introduction:, Biot and Savart's law & its application to determine magnetic induction at a point on the axis of current carrying coil of single turn and Solenoid.

**Ballistic Galvanometer** : Construction theory and working of Ballistic Galvanometer, Damping in the B G, Constants of B G.

**Topic 4 – Electronic circuit components and Devices: 09**

Classification of electronic circuit components as passive and active (Resistor, Capacitor, Inductor, Transformer, Switches, Relays, Diodes, Transistor, FET, SCR, UJT and IC) with their symbol and specification. Bridge rectifier with Pie-Filter, Clippers, Clampers, Zener diode and its application as a voltage regulator.

**Topic 5 – Bi-Junction Transistor (BJT): 09**

Construction and working of transistor, input-output and transfer characteristics of CE & CB mode, Relation between  $\alpha$  and  $\beta$ . Transistor as amplifier (CE mode)

**Reference books:-**

- 1) Principles of electronics –V.K. Mehta
- 2) Electronics principles- Malvino
- 3) Basic electronics & linear circuits- Bhargav, Kulshrtha &Gupta
- 4) Electricity and Magnetism – Khare & Shrivastav
- 5) Foundations of electromagnetic theory- Reitz & Milford
- 6) Electronic devices & circuits-Allen Mottershed

# PHYSICS PRACTICAL OF CORE DSC 1A & DSC 1B: OF 04 CREDITS

## Group I – General Physics and Heat (DSC 1A)

1. Bar pendulum
2. Bifilar's pendulum
3. Torsional pendulum
4. Moment of Inertia of disc by annular ring
5. Poisson's ratio
6. Surface Tension by liquid drop method
7. Thermal conductivity of insulator by Lee's method
8. Viscosity of water by Poiseuille's method
9. Viscosity by Stoke's method
10. Frequency of AC mains by magnetic and nonmagnetic wire
11. Temperature coefficient of resistance of Copper wire
12. L C of various measuring instruments (V C, M S G, Spherometer, Travelling Microscope, Galvanometer, Voltmeter, Ammeter, Spectrometer, Monometer, Optical Bench); Instrumental zero errors of each instrument and its correction for more accuracy in the measurements. .

## Group II – Electricity, electronics, and optics (DSC 1B)

1. Use of Spectrometer to determine Angle of prism
2. Dispersive power of prism
3. Diffraction grating to determine its grating element
4. LASER (to determine its wavelength of LASER beam by using diffraction grating)
5. Newton's ring (to determine Wavelength and Radius of curvature of Plano-convex lens)
6. Photo cell (verification of inverse square law)
7. Bridge rectifier and  $\pi$  filter -  $\beta$  &  $\gamma$
8. Output Characteristics Transistor amplifier in CE mode: determination of  $\beta$
9. Zener diode as a voltage regulator (Plot voltage resistance graph as well as Knee Characteristic curve I – V and comments)
10. Liquid lens to determine the refractive index of any liquid
11. Impedance of LCR series circuit.
12. Classification of electronic circuit components: (resistors, capacitors, inductors, Diodes, transistors, field effect transistors, silicon controlled rectifiers, potentiometers, rheostats, thermistors, thermocouples, Integrated Circuits, Relays); Colour code of resistors and capacitors; identification of their values.

**NB: Ten experiments from each group must be completed to certify the Journal.**

### Reference Books:-

- 1) Advanced Practical physics –Nelkon
- 2) Practical physics - Rajopadhye and Purohit
- 3) Practical Physics – P R Sasi Kumar

**Punyashlok Ahilyadevi Holkar Solapur University, Solapur**



**Name of the Faculty: Science & Technology**

**CHOICE BASED CREDIT SYSTEM**

**Syllabus: ZOOLOGY**

**Name of the Course: B.Sc. I ( Sem-I & II )**

**(To be effective from the academic year June-2019).**

# Punyashlok Ahilyadevi Holkar Solapur University, Solapur,

## Faculty of Science

### Choice Based Credit System (CBCS)

( 2019 -2020 : W.e.f. June 2019)

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**Choice Based Credit System:** With the view to ensure worldwide recognition, acceptability, horizontal as well as vertical mobility for students completing undergraduate degree, Solapur University has implemented Choice Based Credit System (CBCS) at Undergraduate level.

The CBCS provides an opportunity for the students to choose courses from the prescribed courses comprising core, elective/minor or skill based courses. The courses can be evaluated following the grading system, which is considered to be better than the conventional marks system. Therefore, it is necessary to introduce uniform grading system in the entire higher education in India. This will benefit the students to move across institutions within India to begin with and across countries. The uniform grading system will also enable potential employers in assessing the performance of the candidates. In order to bring uniformity in evaluation system and computation of the Cumulative Grade Point Average (CGPA) based on student's performance in examinations.

#### · **Outline of Choice Based Credit System:**

1. **Core Course:** A course, which should compulsorily be studied by a candidate as a core requirement is termed as a Core course.

2. **Elective Course:** Generally a course which can be chosen from a pool of courses and which may be very specific or specialized or advanced or supportive to the discipline/ subject of study or which provides an extended scope or which enables an exposure to some other discipline/subject/domain or nurtures the candidate's proficiency/skill is called an Elective Course.

**Discipline Specific Elective (DSE) Course:** Elective courses may be offered by the main discipline/subject of study is referred to as Discipline Specific Elective.

3. **Ability Enhancement Courses (AEC):** The Ability Enhancement (AE) Courses may be of two kinds: **Ability Enhancement Compulsory Courses (AECC)** and **Skill Enhancement Courses (SEC)**. "AECC" courses are the courses based upon the content that leads to Knowledge enhancement; (i) Environmental Science and (ii) English/MIL Communication. These are mandatory for all disciplines. SEC courses are value-based and/or skill-based and are aimed at providing hands-on-training, competencies, skills, etc.

· **Credit:** Credit is a numerical value that indicates students work load (Lectures, Lab work, Seminar, Tutorials, Field work etc.) to complete a course unit. In most of the universities 15 contact hours constitute one credit. The contact hours are transformed into credits. Moreover, the grading system of evaluation is introduced for B.Sc. course wherein process of Continuous Internal Evaluation is ensured. The candidate has to appear for Internal Evaluation of 20 marks and University Evaluation for 80 marks.

# Punyashlok Ahilyadevi Holkar Solapur University, Solapur

## Faculty of Science

### Choice Based Credit System (CBCS),(w.e.f.2019-20) Structure for B. Sc-I Zoology

Subject/ Core Course	Name and Type of the Paper		No. of papers/ Practical	Hrs/week			Total Marks Per Paper	UA	CA	Credits
	Type	Name		L	T	P				
<b>Class :</b>		<b>B.Sc.- I Semester – I</b>								
<b>Ability Enhancement Course(AECC)</b>		English (communication skill)	Paper- I	4.0			100	80	20	4.0
<b>Core</b> (*Students can opt any Four Subjects from the Twelve Subjects Listed below. Out of these Four Subjects One Subject will be CORE and other Three will be ELECTIVE Subjects.)		DSC 1A	Paper-I	2.5	--	--	50	40	10	4.0
			Paper-II	2.5	--	--	50	40	10	
		DSC 2A	Paper-I	2.5	--	--	50	40	10	4.0
			Paper-II	2.5	--	--	50	40	10	
		DSC 3A	Paper-I	2.5	--	--	50	40	10	4.0
			Paper-II	2.5	--	--	50	40	10	
		DSC 4A Zoology -Animal Diversity I and II	Paper-I Animal Diversity I	2.5	--	--	50	40	10	4.0
			Paper-II Animal Diversity II	2.5	--	--	50	40	10	
<b>Total</b>				<b>24</b>	--	--	<b>500</b>	<b>400</b>	<b>100</b>	<b>20</b>
<b>Class :</b>		<b>B.Sc.- I Semester - II</b>								
<b>Ability Enhancement Course(AECC)</b>		English (Communication skill)	Paper- II	4.0			100	80	20	4.0
<b>Core</b> (*Students can opt any Four Subjects from the Twelve Subjects Listed below. Out of these Four Subjects One Subject will be CORE and other Three will be ELECTIVE Subjects.)		DSC 1B	Paper-III	2.5	--	--	50	40	10	4.0
			Paper-IV	2.5	--	--	50	40	10	
		DSC 2B	Paper-III	2.5	--	--	50	40	10	4.0
			Paper-IV	2.5	--	--	50	40	10	
		DSC 3B	Paper-III	2.5	--	--	50	40	10	4.0
			Paper-IV	2.5	--	--	50	40	10	
		DSC 4B Zoology-Comparative Anatomy and Developmental Biology of vertebrates	Paper-III Comparative Anatomy of vertebrates	2.5	--	--	50	40	10	4.0
			Paper-IV Developmental Biology of vertebrates	2.5	--	--	50	40	10	
		Democracy, Elections and Good Governance		3.0			50	40	10	NC
<b>Total (Theory)</b>				<b>27</b>	--	--	<b>550</b>	<b>440</b>	<b>110</b>	<b>20</b>
<b>Core</b>		DSC 1 A & 1B	Practical I and II	--	--	4	100	80	20	4.0
		DSC 2 A & 2B	Practical I and II	--	--	4	100	80	20	4.0
		DSC 3A & 3B	Practical I and II	--	--	4	100	80	20	4.0
		DSC 4A & 4B Zoology	Practical I and II	--	--	4	100	80	20	4.0
<b>Total (Practical)</b>						<b>16</b>	<b>400</b>	<b>320</b>	<b>80</b>	<b>16</b>
<b>Grand Total</b>				<b>51</b>		<b>16</b>	<b>1450</b>	<b>1160</b>	<b>290</b>	<b>56</b>

\*Core Subjects

Chemistry/Physics/Electronics/Computer Science/Mathematics/Statistics/Botany/Zoology/ Microbiology/Geology/ Geography/Psychology



# Punyashlok Ahilyadevi Holkar Solapur University, Solapur

Faculty of Science

Choice Based Credit System (CBCS)

(W.e.f. June 2019)

• **Title of the Course:** B.Sc. Part-I

• **Subject:** Zoology

• **Introduction:** This course provides a broad overview of Zoology and to produce expert hands that would have sufficient knowledge and expertise to solve the urgent problems of the region by using Zoology. The course structure is basic science centric where students learn core science and are taught necessary fundamental subject for that purpose.

• **Objectives of the course:** The objectives of B. Sc. Zoology course are:

- To provide an intensive and in depth learning to the students in field of Zoology.
- Beyond simulating, learning, understanding the techniques, the course also addresses the underlying recurring problems of disciplines in today scientific and changing world.
- To develop awareness & knowledge of different organization requirement and subject knowledge through varied branches and research methodology in students.
- To train the students to take up wide variety of roles like researchers, scientists, consultants, entrepreneurs, academicians, industry leaders and policy.

**Course outcome and Advantages :** Zoology has tremendous job potential.

- The successful students will be able to establish research organizations with the help of agriculture, environment protection and also their own industry for transgenic animals, clinical pathology, genetic counseling, human karyotyping etc.
- Scientific Research Organizations.
- Universities in India & abroad.
- 

• **Eligibility and Admission:** A Candidate passing 10+2 with biology MLT , dairy science , Fisheries, Agricultural science as one of the subject and passed from state syllabus / CBSE / equivalent with minimum passing percentage of as per the directives of the higher education and Solapur university, Solapur.

• **Duration:** The duration for this program is of 3 years with semester pattern (06 Semesters)

• **Medium of Instruction:** English

• **Syllabus Structure:**

- The University follows semester system.
- An academic year shall consist of two semesters.
- Each B.Sc. course shall consist of three years i.e. six semesters.
- B.Sc. Part-I Zoology shall consist of two semesters: Semester I and Semester II.

In semester I, there will be two core papers is having paper I and paper II of 100 marks.

Similarly in Semester II there will be two core papers is having paper I and paper II of 100 marks. English will be as Ability Enhancement Course (AECC) in both Semester I and II. English paper carries 100 marks in each semester.

The scheme of evaluation of performance of candidates shall be based on

University assessment as well as College internal assessment as given below. For B.Sc. Part-I Zoology sem I & II the internal assessment will be based on Internal tests, Home assignment, Tutorials, Seminars, Group discussion, Brain storming sessions etc. as

given below. Practical course examination is of 100 marks shall be conducted at the end of semester II. The practical examination of 100 marks shall also consist of 80 marks for University practical assessment and 20 marks for college internal assessment.

· **Scheme of Evaluation**

As per the norms of the grading system of evaluation, out of 100 marks, the candidate has to appear for college internal assessment of 20 marks and external evaluation (University assessment) of 20 marks.

**Semester – I:**

**Theory: (100 marks)**

University Examination (80 marks): No. of theory papers: 2 (paper I and paper II of 40 marks each )

**Internal Continuous Assessment: (20 marks and 10 marks each for two papers )**

(a) Internal test- Home assignment / tutorials / seminars / viva/ group discussion/ outreach programs.

**Semester – II**

**Theory: (100 marks)**

University Examination (80 marks): No. of theory papers: 2 (paper III and paper IV of 40 marks each)

**Internal Continuous Assessment: (20 marks and 10 marks each for two papers)**

(a) Internal test- Home assignment / tutorials / seminars / viva/ group discussion/ outreach programs.

**Practical Examination: (100 marks)**

University Examination (80 marks): No. of practical course: 1

**Internal Continuous Assessment: (20 marks)**

(a) Internal practical test - Scheme of marking: **10 marks**

(b) Viva/group discussion/model or chart/attitude/attendance/overall behavior: **10 marks**

**Passing Standard**

The student has to secure a minimum of 4.0 grade points (Grade C) in each paper. A student who secure less than 4.0 grade point (39% or less marks, Grade FC/FR) will be declared fail in that paper and shall be required to reappear for respective paper. A student who failed in University Examination (theory) and passed in internal assessment of a same paper shall be given FC Grade. Such student will have to reappear for University Examination only. A student who fails in internal assessment and passed in University examination (theory) shall be given FR Grade. Such student will have to reappear for both University examination as well as internal assessment. In case of Annual pattern/old semester pattern students/candidates from the mark scheme the candidates shall appear for the same 70 marks of external examination and his performance shall be scaled to 100 marks.

· **ATKT**

Candidate passed in all papers, except **5 (five)** papers combined together of semester I and II of B.Sc. Part-I Zoology examination shall be permitted to enter upon the course of Semester III of B.Sc. Part-II Zoology

**B.Sc .I Semester-I & II, ZOOLOGY**  
**Choice Based Credit System (CBCS) Structure (2019-20)**

**Semester- I (Theory)**

<b>Paper</b>	<b>Title</b>	<b>Marks</b>
<b>I</b>	<b>Animal diversity-I ( Paper I )</b>	<b>50 (40- UA and 10-CA)</b>
<b>II</b>	<b>Animal diversity-II (Paper II)</b>	<b>50 (40- UA and 10-CA)</b>

**Semester- II (Theory)**

<b>Paper</b>	<b>Title</b>	<b>Marks</b>
<b>III</b>	<b>Comparative Anatomy of vertebrates ( Paper III )</b>	<b>50 (40- UA and 10-CA)</b>
<b>IV</b>	<b>Developmental Biology of vertebrates (Paper IV)</b>	<b>50 (40- UA and 10-CA)</b>

**PRACTICAL AT THE END OF SEMESTER-II**

<b>PRACTICAL</b>	<b>Title</b>	<b>Marks</b>
<b>I</b>	<b>Animal diversity I &amp; II AND Comparative Anatomy of vertebrates and Developmental Biology of vertebrates</b>	<b>100 (80 UA+20 CA)</b>

**SEMESTER – I**  
**CORE COURSE- I-**

**(Total credits: 4)**

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**PAPER I: Animal Diversity- I**  
**(Total credits 2.0, Contact Hrs 30.0)**

<b>Unit 1: Kingdom Protista</b>	<b>3</b>
General characters and classification up to classes; locomotory organelle and locomotion in protozoa ,nutrition in protozoa.	
<b>Unit 2: Phylum Porifera</b>	<b>3</b>
General characters and classification up to classes; canal system in <i>Sycon</i>	
<b>Unit 3: Phylum Cnidaria</b>	<b>3</b>
General characters and classification up to classes; polymorphism in hydrozoa	
<b>Unit 4: Phylum Platyhelminthes</b>	<b>3</b>
General characters and classification up to classes; life history of <i>Taenia solium</i>	
<b>Unit 5: Phylum Nemathelminthes</b>	<b>4</b>
General characters and classification up to classes; life history of <i>Ascaris lumbricoides</i> and its parasitic adaptations	
<b>Unit 6: Phylum Annelida</b>	<b>3</b>
General characters and classification up to classes; metamerism in annelid, economic importance of annelids with reference to earthworm and leech	
<b>Unit 7: Phylum Arthropoda</b>	<b>4</b>
General characters and classification up to classes; vision in arthropoda, metamorphosis in insects, economic importance of insects.	
<b>Unit 8: Phylum Mollusca</b>	<b>3</b>
General characters and classification up to classes; torsion in gastropods economic importance of molluscs	
<b>Unit 9: Phylum Echinodermata</b>	<b>4</b>
General characters and classification up to classes; water-vascular system in Asteroidea	
	<b>Total- 30</b>

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**PAPER II: Animal Diversity- II**  
**(Total credits 2.0, Contact Hrs 30.0)**

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<b>Unit 1: Protochordates</b>	<b>3</b>
General features and phylogeny of protochordata	
<b>Unit 2: Agnatha</b>	<b>3</b>
General features of agnatha and classification of cyclostomes up to classes	
<b>Unit 3: Pisces</b>	<b>4</b>
General features and classification up to orders; economic importance of fishes	
<b>Unit 4: Amphibia</b>	<b>5</b>
General features and classification up to orders; parental care	
<b>Unit 5: Reptiles</b>	<b>5</b>
General features and classification up to orders; poisonous and non-poisonous snakes, types of snake venom, symptoms and treatments of snake bite	
<b>Unit 6: Aves</b>	<b>5</b>
General features and classification up to orders; flight adaptations in birds	
<b>Unit 7: Mammals</b>	<b>5</b>
General features and classification up to orders; adaptive radiation in mammals	
	<b>Total -30</b>

**References:**

- Ruppert and Barnes, R.D. (2006). *Invertebrate Zoology*, VIII Edition. Holt Saunders International Edition.
- Barnes, R.S.K., Calow, P., Olive, P.J.W., Golding, D.W. and Spicer, J.I. (2002). *The Invertebrates: A New Synthesis*, III Edition, Blackwell Science
- Young, J. Z. (2004). *The Life of Vertebrates*. III Edition. Oxford university press.
- Pough H. *Vertebrate life*, VIII Edition, Pearson International.
- Hall B.K. and Hallgrimsson B. (2008). *Strickberger's Evolution*. IV Edition. Jones and Bartlett Publishers Inc.

## SEMESTER – II

CORE COURSE II-

(Total credits: 4)

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### PAPER III: COMPARATIVE ANATOMY OF VERTEBRATES

(Total credits 2.0, Contact Hrs 30.0)

<b>Unit 1: Integumentary System</b>	<b>4</b>
Derivatives of integument with reference to glands and digital tips	
<b>Unit 2: Skeletal System</b>	<b>4</b>
Appendicular and axial skeleton in vertebrates	
<b>Unit 3: Digestive System</b>	<b>5</b>
Brief account of alimentary canal and digestive glands	
<b>Unit 4: Respiratory System</b>	<b>5</b>
Brief account of skin, gills, lungs, air sacs and swim bladder	
<b>Unit 5: Circulatory System</b>	<b>4</b>
Evolution of heart and aortic arches	
<b>Unit 6: Urinogenital System</b>	<b>4</b>
Succession of kidney, Evolution of urinogenital ducts	
<b>Unit 7: Nervous System</b>	<b>4</b>
Comparative account of brain	
	<b>Total - 30</b>

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**PAPER IV: DEVELOPMENTAL BIOLOGY OF  
VERTEBRATES**

(Total credits 2.0, Contact Hrs 30.0)

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<b>Unit-I: Gametogenesis:</b>	<b>03</b>
(a) Spermatogenesis and oogenesis with reference to mammals	
(b) Vitellogenesis in birds and structure of hens egg	
<b>Unit-II: Fertilization</b>	<b>03</b>
(a) External fertilization in amphibians	
(b) Internal fertilization in mammals	
(c) General mechanism of fertilization in mammals	
<b>Unit-III: Early Embryonic Development up to Gastrulation</b>	<b>05</b>
(a) Cleavage, blastulation and gastrulation in frog	
(b) Cleavage, blastulation and gastrulation in human	
(c) Fate map of blastula in frog and human	
<b>Unit-IV: Placenta in mammal</b>	<b>04</b>
(a) Implantation of blastocyst in humans, human placenta and functions	
(b) Types of placenta on the basis of histology	
<b>Unit-V: Development and its Regulation</b>	<b>05</b>
(a) Cellular differentiation: Definition, mechanism of differentiation	
(b) Cellular movements: Epiboly, emboly and its significance in development	
(c) Apoptosis: Definition, general mechanism and significance	
<b>Unit-VI: General Topics in Embryology</b>	<b>05</b>
(a) Metamorphosis in frog tadpole and its hormonal regulation	
(b) Types of twins in human	
<b>Unit-VII: Recent Developments in Human Embryology</b>	<b>05</b>
(a) Principles and applications of ultrasound	
(b) Causes of miscarriages	

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**REFERENCES:**

- Kardong, K.V. (2005) *Vertebrates' Comparative Anatomy, Function and Evolution*. IV Edition. McGraw-Hill Higher Education.
- Kent, G.C. and Carr R.K. (2000). *Comparative Anatomy of the Vertebrates*. IX Edition. The McGraw-Hill Companies.
- Hilderbrand, M and Gaslow G.E. *Analysis of Vertebrate Structure*, John Wiley and Sons.
- Walter, H.E. and Sayles, L.P; *Biology of Vertebrates*, Khosla Publishing House.
- Gilbert, S. F. (2006). *Developmental Biology*, VIII Edition, Sinauer Associates, Inc., Publishers, Sunderland, Massachusetts, USA.
- Balinsky, B.I. (2008). *An introduction to Embryology*, International Thomson Computer Press.
- Carlson, Bruce M (1996). *Patten's Foundations of Embryology*, McGraw Hill, Inc.



# Practical Course in Zoology for B. Sc. I

## For both Semester I and II

(Credits 4)

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### 1. Study of the following specimens (General characters and classification)

**CD/Model/Chart/Slides/Virtual**

- *Amoeba, Euglena, Plasmodium, Paramecium*
- *Sycon, Hyalonema, and Euplectella*
- *Obelia, Physalia, Aurelia, Metridium*
- *Taenia, Ascaris, Fasciola*
- *Aphrodite, Nereis, Pheretima, Hirudinaria*
- *Peripatus, Palaemon, Crab, Limulus, Scolopendra, Julus, Periplaneta*
- *Chiton, Dentalium, Pila, Unio, Sepia, Octopus*
- *Pentaceros, Ophiura, Echinus, Cucumaria and Antedon,*
- *Balanoglossus, Herdmania, Branchiostoma*
- *Petromyzon, Sphyrna, Pristis, Torpedo, Labeo, Exocoetus, Anguilla*
- *Ichthyophis, Salamandra, Bufo, Hyla*
- *Chelone, Hemidactylus, Chamaeleon, Draco, Vipera, Naja, Crocodylus, Gavialis*
- **Any six** common birds from different orders:
- *Ornithorhynchus, Pteropus, Rattus, Loris, Funambulus*

### 2. Study of the following permanent slides/lab.specimens:

- (a) T.S. and L.S. of *Sycon*,
- (b) *Taenia*- Scolex, mature & gravid proglottid
- (c) Whole mount of male and female *Ascaris* and Liverfluke
- (d) Observation and identification of protozoans, helminthes, arthropod vectors

### 3. Key for Identification of poisonous and non-poisonous snakes: Cobra & Rat Snake

(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.)

#### **4 . Osteology: CD/Model/Chart/Slides/Virtual CD**

- a) Disarticulated skeleton of frog: Skull, Atlas, Typical Vertebra, Pectoral and Pelvic Girdle
- b) Study of mammalian skulls: One herbivorous and one carnivorous animal

**5. Frog** - Study of developmental stages - whole mounts and sections through permanent slides – cleavage, blastula, gastrula, tadpole external and internal gill stages. (CD/Model/Chart/Slides/Virtual CD)

**6. Chick Embryology:** Study of chick egg and W.M. of embryonic stages: 24hrs, 33hrs, 48hrs, 72 hrs.

**6 Placenta:** Study of the different types of mammalian **placenta**- histological sections using permanent slides or Intact placenta of Rat / Human using laboratory material / photomicrographs./  
**CD/Model/Chart/Slides/Virtual CD**

**7. Examination of gametes** - frog/rat - sperm and ova through permanent slides or photomicrographs./  
**CD/Model/Chart/Slides/Virtual CD**

#### **8. Cytological Preparation:**

- (a) Stained preparation of mitochondria using vital staining with suitable material
- (b) Stained preparation of nucleus in blood smear using Leishman's stain
- (c) Study of Osmosis: Effect of Isotonic, hypotonic and hypertonic solution on blood cells

**8) Study Tour** / – Visit to any suitable place of Zoological interest to study animal biodiversity / IVF and hospital Facility / Research Center and submission of report. **All necessary precautions must be taken while organizing study tour with reference to the safety of students.**

**(Or)**

A small project report or review article submission of any one topic related to any Ecological and Applied Zoological interest.

# Scheme of Marking for University Practical Examination

**Total Marks: 80**

Q.1.	Cytological preparation of mitochondria / nucleus ( <b>any one</b> )	10
Q.2.	Effect of isotonic / hypotonic / hypertonic solution on blood cells ( <b>any one</b> )	10
Q.3.	Spotting ( <b>Five spots</b> )	
	(a) Identify & classify giving reasons	
	(b) Identify, sketch & label	
	(c) Identify & describe	
	(d) Identify & give evolutionary significance	
	(e) Identify & classify giving reasons	
Q.4.	Identification and explanation of mammalian placenta ( <b>any one</b> )	10
Q.5.	Identification and explanation of:	10
	(a) Any one bone: Identify, sketch & label	
	(b) Any one developmental stages of frog: Identify & explain	
	(c) Any one gamete of frog / rat: Identify, sketch & label	
	(d) Any one poisonous / non-poisonous snake: Identify & describe	
	(e) Any one of: canal system / parasite / W.M. of chick embryo: Identify & describe	
Q.6.	Tour Report/ project report or review article submission	10
Q.7.	Laboratory Record (Journal)	10
Q8:	Viva –Voce (General)	10

**B O S in Zoology**