



# **Shivaji University, Kolhapur**

**Choice Based Credit System with Multiple Entry and  
Multiple Exit options as per NEP-2020**

**Bachelor of Science (B. Sc. II) Programme Structure  
Under Faculty of Science & Technology**

(To be implemented from Academic Year 2023-24)

### Structure of B.Sc. II Programme (Semester III & IV)

SEMESTER-III (Duration-6 Months)																
Sr. No.	Course (Subject) Title	TEACHING SCHEME						EXAMINATION SCHEME								
		THEORY			PRACTICAL			THEORY				PRACTICAL				
		Credits	No. of lectures	Hours	Credits	No. of lectures	Hours	Internal		University				Hours	Max Marks	Min Marks
								Max Marks	Min Marks	Hours	Max Marks	Total Marks	Min Marks			
1	DSC-C Chemistry-V	2	3	2.4	4	8	6.4	10	4	2	40	<b>80</b>	<b>28</b>	<b>PRACTICAL EXAMINATION IS ANNUAL</b>		
2	DSC-C Chemistry-VI	2	3	2.4				10	4	2	40					
3	DSC-C Botany-V	2	3	2.4	4	8	6.4	10	4	2	40	<b>80</b>	<b>28</b>			
4	DSC-C Botany-VI	2	3	2.4				10	4	2	40					
5	DSC-C Zoology-V	2	3	2.4	4	8	6.4	10	4	2	40	<b>80</b>	<b>28</b>			
6	DSC-C Zoology-VI	2	3	2.4				10	4	2	40					
7	AECC-C Env Studies	4	4	3.2	---	---	---	---	---	---	---	---	---			
8	SEC-III	Any one from pool of courses			2	---	---	---	---	---	---	---	---	2	50	18
<b>TOTAL</b>		<b>16</b>	<b>22</b>	<b>17.6</b>	<b>14</b>	<b>24</b>	<b>19.2</b>	<b>60</b>			<b>240</b>	<b>350</b>	<b>---</b>		<b>50</b>	

**SEMESTER-IV(Duration-6 Months)**

Sr. No.	Course (Subject) Title	TEACHING SCHEME						EXAMINATION SCHEME								
		THEORY			PRACTICAL			THEORY				PRACTICAL				
		Credits	No. of lectures	Hours	Credits	No. of lectures	Hours	Internal		University				Hours	Max Marks	Min Marks
								Max Marks	Min Marks	Hours	Max Marks	Total Marks	Min Marks			
1	DSC-C Chemistry-VII	2	3	2.4	4	6.4	8	10	4	2	40	80	28	As per BOS Guide-lines	100	35
2	DSC-C Chemistry-VIII	2	3	2.4				10	4	2	40					
3	DSC-C Botany-VII	2	3	2.4	4	6.4	8	10	4	2	40	80	28		100	35
4	DSC-C Botany-VIII	2	3	2.4				10	4	2	40					
5	DSC-C Zoology-VII	2	3	2.4	4	6.4	8	10	4	2	40	80	28		100	35
6	DSC-C Zoology-VIII	2	3	2.4				10	4	2	40					
7	AECC-C AECC-D Env. Studies	---	---	---	---	---	---	---	---	3	70	100	25	---	---	
										Project	30		10			
8	SEC-IV	Any one from pool of courses			2	---	---							2	50	18
	<b>TOTAL</b>	<b>12</b>	<b>18</b>	<b>14.4</b>	<b>14</b>	<b>19.2</b>	<b>24</b>					<b>400</b>	---		<b>350</b>	
		<b>28</b>	<b>40</b>	<b>32</b>	<b>28</b>	<b>38.4</b>	<b>48</b>					<b>750</b>	--	---		

• Student contact hours per week: 36.8 Hours (Min.)

• Total Marks for B.Sc.-II (Including EVS) **1100**

• Theory and Practical Lectures :48 Minutes Each

• Total Credits for B.Sc.-II (Semester III & IV): **56**

• **DSC**: -Discipline Specific Core Course: Select any 3subject pairs, relevant to those opted at B. Sc. I, from DSC C1 to DSC C38 and / or DSC IC39 to DSC IC50 and DSC D1 to DSC D38 and/or DSC ID39 to DSC ID50.

• **AECC**- Ability Enhancement Compulsory Course (C): Environmental Studies: EVS Theory and AECC-D EVS Project (Theory:70 & Project:30 marks)

• *There shall be separate passing for internal and University theory as well as practical / project examinations.*

• *Practical Examination shall be conducted annually for 100 Marks per course (subject) and minimum 35 marks are required for passing.*

• *Except Environmental Studies, there shall be combined passing for two theory papers of 40 marks each. i. e. minimum. 28 marks are required for passing out of 80.*

• *Minimum 4 marks are required for passing out of 10 for Internal Examination of each paper.*

• *Examination of SEC shall be either theory or practical depending upon type of SEC.*

### Structure of B. Sc. II Programme Semester V&VI

SEMESTER-V (Duration-6 Months)																
Sr. No.	Subject Title	TEACHING SCHEME						EXAMINATION SCHEME								
		THEORY			PRACTICAL			THEORY			PRACTICAL					
		Credits	No. of lectures	Hours	Credits	No. of lectures	Hours	Internal		University			Hours	Max Marks	Min Marks	
								Max Marks	Min Marks	Hours	Max Marks	Min Marks				
1	DSE-E	2	3	2.4	8	20	16	10	4	2	40	14	<b>PRACTICAL EXAMINATION IS ANNUAL</b>	2	50	18
2	DSE-E	2	3	2.4				10	4	2	40	14				
3	DSE-E	2	3	2.4				10	4	2	40	14				
4	DSE-E	2	3	2.4				10	4	2	40	14				
5	AECC-E	4	4	3.2				10	4	2	40	14				
6	SEC-V	Any one from pool of courses			2	---	---	---	---							
	<b>TOTAL</b>	<b>12</b>	<b>16</b>	<b>12.8</b>	<b>10</b>	<b>20</b>	<b>16</b>	<b>50</b>			<b>200</b>					
SEMESTER-VI (Duration-6 Months)																
1	DSE-F	2	3	2.4	8	20	16	10	4	2	40	14	<b>As per BOS Guide- Lines</b>	2	50	18
2	DSE-F	2	3	2.4				10	4	2	40	14				
3	DSE-F	2	3	2.4				10	4	2	40	14				
4	DSE-F	2	3	2.4				10	4	2	40	14				
5	AECC-E	4	4	3.2				10	4	2	40	14				
6	SEC-VI	Any one from pool of courses			2	---	---									
	<b>TOTAL</b>	<b>12</b>		<b>12.8</b>	<b>10</b>		<b>16</b>	<b>50</b>			<b>200</b>					

	<b>GRAND TOTAL</b>	24	32	25.6	20	40	32				400	800				
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• Student contact hours per week: 28.8 Hours (Min)	• Total Marks for B.Sc.-III (Including English): <b>800</b>
• Theory and Practical Lectures: 48 Min. Each	• Total Credits for B.Sc.-III (Semester V&VI): <b>44</b>
• <b>DSE-Discipline Specific Elective.</b> A candidate shall select one course (subject) from the three Courses (Subjects) selected at B.Sc.–II. Select any 4 pairs of papers from DSE-E1 to DSE-E84 for Sem –V and DSE- F1 to DSE-F84 for Sem-VI	
• <b>AECC-</b> Ability Enhancement Compulsory Course (E & F): English for communication	
• <i>There shall be separatee passing for internal, theory and practical examinations.</i>	
• <i>Practical Examination shall be conducted annually for 200 marks, and minimum 70 marks are required for passing.</i>	
• <i>University semester end exam shall be of 40 marks per paper and minimum 14 marks are required for passing.</i>	
• <i>Minimum 4 marks are required for passing out of 10 for Internal Examination of each paper.</i>	
• <i>Examination of SEC shall be either theory or practical depending upon type of SEC.</i>	

Class	B. Sc. - I	B. Sc. - II	B. Sc. - III	Total
Marks	1200	1100	800	3100
No. of Credits	60	56	44	160

**Nature of Question Paper for B.Sc. Part – II (40 + 10 Pattern)**  
**according to Revised Structure as Per NEP – 2020 to be**  
**implemented from academic year 2023-24**

Maximum Marks: 40

Duration: 2 hrs

**Choose the correct alternative from the following and rewrite the sentence** [8]

1 to 8 MCQ one mark each with four options

- a)
- b)
- c)
- d)

**Attempt any TWO of the following** [16]

- a)
- b)
- c)

**Attempt any FOUR of the following** [16]

- a)
- b)
- c)
- d)
- e)
- f)

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**Shivaji University, Kolhapur**  
**Draft Syllabus as per NEP – 2020**  
**B. Sc. II Zoology**  
**Semester III Paper V**  
**DSC-C (ANIMAL DIVERSITY-II-NEP 2020)**  
**Theory: 30 hrs. (37.5 lectures of 48 minutes)**

**Unit I:**

**Hemichordata** (2 hrs.)

General characters and Classification

**Protochordata** (3 hrs.)

General characters and Classification of Protochordata

**Agnatha** (2 hrs.)

General characters of Agnatha and Classification of cyclostomes up to classes

**Pisces:** (3 hrs.)

General characters and Classification up to orders

**Unit II: Amphibia** (10 hrs.)

General features and Classification up to orders

**Type Study: Frog** (Physiology is not expected)

- Systematic Position, Habit and Habitat
- Morphological Characters
- Digestive System
- Respiratory System
- Heart and Composition of Blood
- Excretory System
- Reproductive System (Male and Female)
- Brain

**Unit III: Reptiles** (4 hrs.)

General characters and Classification up to orders;

Venomous and non-venomous snakes, Biting mechanism in snakes

**Aves** (3 hrs.)

General characters and Classification up to orders

**Mammals****(3 hrs.)**

General characters and Classification up to orders

**Shivaji University, Kolhapur**  
B. Sc. Part II Semester- III  
**ZOOLOGY**  
Semester III Paper-VI  
**DSC-C (BIOCHEMISTRY- NEP 2020)**  
Theory: 30 hrs. (37.5 lectures of 48 minutes)

**Unit I:****Carbohydrate Metabolism:****(10 hrs.)**

- 1) Classification and biological significance of carbohydrates
- 2) Glycolysis
- 3) Krebs Cycle
- 4) Electron Transport Chain
- 5) Pentose Phosphate Pathway
- 6) Gluconeogenesis
- 7) Glycogenesis
- 8) Glycogenolysis

**Lipid Metabolism:****(7 hrs.)**

- 1) Classification and biological significance of lipids
- 2)  $\beta$  oxidation of fatty acids

**Unit II:****Protein metabolism:****(8 hrs.)**

- 1) Structure, Classification and biological significance of proteins
- 2) Transamination
- 3) Deamination
- 4) Urea Cycle/ Ornithine cycle

**Unit III:****Enzymes:****(5 hrs.)**

- 1) Introduction, Classification and Nomenclature
- 2) Mechanism of enzyme action
- 3) Enzyme Kinetics
- 4) Inhibition and Regulation
- 5) Isoenzymes, Co-enzymes and Co-factors.



**B. Sc. Part II Semester- IV**  
**ZOOLOGY**  
**Semester IV Paper-VII**  
**DSC-C (REPRODUCTIVE BIOLOGY - NEP 2020)**  
**Theory: 30 hrs. (37.5 lectures of 48 minutes)**

- Unit I: Structure and hormones of pituitary gland** (3 hrs.)
- Unit II: Functional anatomy of female reproductive system:** (12 hrs.) A.
- Anatomy of female reproductive system**
- a. Histology of Ovary
  - b. Histology of Oviduct/Fallopian Tube
  - c. Histology of Uterus
  - d. Histology of Cervix and vagina
  - e. Reproductive cycle in Human
  - f. Female sex hormones
  - g. Folliculogenesis, process of Oogenesis and structure of ovum
  - h. Menstrual cycle and hormonal regulation
  - i. Transport of ovum and sperm in female genital tract
  - j. Process of fertilization
  - k. Hormonal control in Implantation
  - l. Diagnostic features of pregnancy and hormonal regulation
  - m. Mechanism and hormonal regulation of Parturition and Lactation
- Unit III: Functional anatomy of male reproductive System:** (8 hrs.)
- B. Anatomy of male reproductive System**
- a. Histology of testis
  - b. Histology of Epididymis
  - c. Histology of Seminal vesicle
  - d. Histology of prostate gland
  - e. Histology of Cowper's gland
  - f. Histology of penis
  - g. Male sex hormones
  - h. Process of spermatogenesis and structure of sperm
  - i. Epididymal functions and sperm maturation
  - j. Sperm transportation in male genital tract
  - k. Hormonal control of Testicular activities
- Unit IV: Reproductive Health** (4 hrs.)
- a. Infertility in Male:** causes, diagnosis and management
  - b. Infertility in Female:** causes, diagnosis and management
  - c. Assisted Reproductive Technology:**  
Sperm bank. Frozen embryos. Intrauterine Transfer (IUT). Zygote Intrafallopian Tube Transfer (ZIFT) Gamete Intrafallopian Transfer (GIFT). Intracytoplasmic Sperm Injection (ICSI).
  - d. In vitro fertilization (IVF):** Ovarian stimulation, Egg retrieval, Sperm retrieval, Fertilization and Embryo transfer
- Unit V: Contraceptive Methods:** (3 hrs.)
- a. Temporary methods
  - b. Permanent Methods

**B. Sc. Part II Semester- IV**  
**ZOOLOGY**  
**Semester IV Paper-VIII**  
**DSC- C (APPLIED ZOOLOGY-I -NEP 2020)**  
**Theory: 30 hrs. (37.5 lectures of 48 minutes)**  
**Marks-50 (Credits: 02)**

**Unit I:**

**Introduction to Host-parasite Relationship:** (4 hrs.)

Host, Definitive host, Intermediate host, Parasitism, Symbiosis, Commensalism, Reservoir, Zoonosis

**Unit II:**

**Epidemiology of Diseases:** (4 hrs.)

Transmission, Prevention and control of diseases: Tuberculosis, Typhoid.

**Unit III:**

**Rickettsia and Spirochetes:** (4 hrs.)

Brief account of *Rickettsia prowazekii*, *Borrelia recurrentis* and *Treponema pallidum*

**Unit IV:**

**Insects of Economic Importance:** (6 hrs.)

Biology, Control and damage caused by

- 1) Gram pod borer (*Helicoverpa armigera*)
- 2) Sugarcane leaf hopper (*Pyrilla perpusilla*)
- 3) Lemon Butterfly (*Papilio demoleus*)
- 4) Pulse Beetle (*Callosobruchus chinensis*)
- 5) Rice Weevil (*Sitophilus oryzae*)
- 6) Red Flour beetle (*Tribalium castaneum*)

**Unit V:**

**1. Poultry Farming:** (5 hrs.)

- (a) Principles of poultry breeding,
- (b) Indigenous and Exotic poultry breeds
- (b) Management of breeding stock and broilers,
- (c) Processing and Preservation of eggs.

**2. Sericulture** (7 hrs.)

- (a) Life cycle of *Bombyx mori*
- (b) Types of silkworm
- (c) Rearing equipments
- (d) Diseases and management
- (e) Cocoon formation and Economic importance of silk

**B. Sc. Part II**  
**ZOOLOGY PRACTICAL-I -NEP 2020)**  
**Marks-50 (Credits: 02)**

**PRACTICAL-I (Based on Animal Diversity-II and Biochemistry of Semester-III)**

**Unit I**

**Animal Diversity- II**

1. Study of the following specimens with reference to morphological peculiarities and classification upto orders:
  - a. **Hemichordata:** Balanoglossus
  - b. **Urochordata:** Herdmania
  - c. **Cephalochordata:** Branchiostoma (Amphioxus)
  - d. **Cyclostomata:** Petromyzon
  - e. **Pisces:** Sphyrna (Hammer Headed Shark), Pristis (Saw Fish), Torpedo (Electric Ray), Labeo, Exocoetus (Flying Fish), Anguilla (Eel Fish)
  - f. **Amphibia:** Ichthyophis, Salamander, Bufo, Hyla (Tree Frog)
  - g. **Reptilia:** Chelone (Turtle), Hemidactylus (Wall Lizard), Chamaeleon, Draco (Flying Lizard), Crocodylus (Crocodile), Gavialis.
  - h. **Mammalia:** Duck-billed platypus, Kangaroo, Bat, Squirrel, Loris
2. **Demonstration of Frog:** Digestive System, Respiratory System, Excretory system, Male and Female Reproductive System, heart and brain
3. Characters identifying venomous and non-venomous snakes: Russell's viper, Saw scaled viper, Common krait, Indian Cobra, Sea snake, Rat snake and Checkered keelback
4. Study of any six common birds from different orders with the help of photographs and keys.
5. Dissection of brain of fowl.
6. Temporary preparation of Hyoid apparatus, Sclerotic plates, Pecten and Columella of fowl.
7. Temporary preparation of Placoid, Cycloid and Ctenoid scales in fishes.

**Unit II**

**Biochemistry:**

1. Biochemical tests for Glucose, Fructose, Sucrose, Lactose and Lipid.
2. Estimation of total protein in given solutions by Lowry's method.
3. Study of activity of salivary amylase under optimum conditions.
4. Effect of Temperature and pH on activity of salivary amylase.
5. Urea, urease enzyme activity

**B. Sc. Part II**  
**ZOOLOGY PRACTICAL-II -NEP 2020**  
**Marks-50 (Credits: 02)**

**PRACTICAL-II (Based on Reproductive Biology and Applied Zoology of Semester-IV)**

**Unit I: Reproductive Biology:**

1. Study of Animal house:
  - Set up and maintenance of animal house
  - Breeding techniques
  - Care of normal and experimental animals with the help of model/photographs
2. Stages/phases of menstrual cycle.
3. Surgical techniques: Principles of surgery in endocrinology, Ovariectomy, Tubectomy, hysterectomy, orchiectomy and vasectomy in rats through Demonstration or Video
4. Examination of histological sections from photomicrographs/permanent slides of rat Testis, Epididymis, Ovary, Fallopian tube, Uterus (proliferative and secretory stages), Cervix and Vagina
5. Structure of human sperm and ovum
6. Detection of pregnancy by using kit.
7. Study of contraceptive devices by photographs or models.

**Unit II: Applied Zoology:**

1. Study of arthropod vectors associated with human diseases: Pediculus, Culex, Anopheles, Aedes and Xenopsylla
2. Study of insect pests through damaged products/photographs.
  - i) Crop pests**
    - a. Gram pod borer (*Helicoverpa armigera*)
    - b. Sugarcane leaf hopper (*Pyrilla perpusilla*)
    - c. Lemon Butterfly (*Papilio demoleus*)
  - ii) Stored grains pests**
    - a. Pulse Beetle (*Callosobruchus chinensis*)
    - b. Rice Weevil (*Sitophilus oryzae*)
    - c. Red Flour beetle (*Tribolium castaneum*)
4. Identifying feature and economic importance of *Helicoverpa armigera* (Cotton bollworm), *Papilio demoleus* (Lime butterfly), *Pyrilla perpusilla* (Sugarcane plant hopper), *Callosobruchus chinensis* (Pulse beetle), *Sitophilus oryzae* (Rice weevil) and *Tribolium castaneum* (Red flour beetle).

**Unit III:**

3. **Poultry:** To study the breeds of poultry birds with the help of photographs (2 Indigenous and 2 Exotic poultry birds)
4. **Sericulture:** To study the Life cycle of mulberry silk moth (*Bombyx mori*),  
Types of silk moths – Muga, Tasar and Eri by photographs or specimen

5. Field trip to sericulture center or poultry farm or animal breeding centre or any suitable place to study animal diversity or any place related to theory syllabus. Submission of field trip report (Printed/Hand writings).

#### **Suggested Readings for Paper V and VI:**

1. Berg, J. M., Tymoczko, J. L. and Stryer, L. (2006). Biochemistry. VI Edition. W.H Freeman and Co.
2. Guyton, A.C. and Hall, J. E. (2011). Textbook of Medical Physiology, XII Edition, Harcourt Asia Pvt. Ltd/ W.B. Saunders Company
3. Hall B. K. and Hallgrimsson, B. (2008). Strickberger's Evolution. IV Edition. Jones and Bartlett Publishers Inc.
4. Murray, R. K., Granner, D. K., Mayes, P. A. and Rodwell, V. W. (2009). Harper's Illustrated Biochemistry. XXVIII Edition. Lange Medical Books/Mc Graw Hill.
5. Nelson, D. L., Cox, M. M. and Lehninger, A. L. (2009). Principles of Biochemistry. IV Edition. W.H. Freeman and Co.
6. Pough H. (2008). Vertebrate life, 8th Edition, Pearson International.
7. Young, J. Z. (2004). The Life of Vertebrates. III Edition. Oxford university press.
8. The Protochordates – by S. H. Bhamrah and Kavita Juneja – Anmol Publications, New Delhi
9. Introduction to Protochordata – S. H. Bhamrah and Kavita Juneja – Anmol Publications, New Delhi 8) Chordate Zoology – S. Chand Company, New Delhi
10. Text Book of Zoology – Vertebrates, Vol. II – T. J. Parker and W. A. Haswell Edited by Marshall and Williams, CBS Publications and Distributors, New Delhi.
11. E. L. Jordan – Chordate Zoology, S. Chand and Company, New Delhi.
12. A Text Book of Chordates – A. Thangamani, L. M. Narayan, S. Prasannakumar, N. Arumugam
13. R. L. Kotpal – Modern Text Book of Zoology, Vertebrates

#### **Suggested Readings for Paper VII and VIII:**

1. Arora, D. R and Arora, B. (2001). Medical Parasitology. II Ed. CBS Pub., and Distributors.
2. Atwal, A. S. (1986). Agricultural Pests of India and South East Asia, Kalyani
3. Austin, C. R. and Short, R. V. (1982). Reproduction in Mammals. Cambridge University Press, London. Vol. 1.
4. Chapman, R. F. (1998). The Insects: Structure and Function. IV Edition, Cambridge University Press, UK.
5. Dennis, H. (2009). Agricultural Entomology. Timber Press (OR).
6. Degroot, L. J. and Jameson, J. L. (2010). (6<sup>th</sup> eds). Endocrinology. W. B. Saunders and Company.
7. Dunham R. A. (2004). Aquaculture and Fisheries Biotechnology Genetic Approaches. CABI publications, U.K.
8. Hafez, E. S. E. (1962). Reproduction in Farm Animals. Lea & Fabiger Publisher.
9. Hatcher, R.A. et al. (2001). The Essentials of Contraceptive Technology. Population Information Programme.
10. Knobil, et al. (2014). (4th eds). The Physiology of Reproduction. Raven Press Ltd.
11. Park, K. (2007). Preventive and Social Medicine. XVI Edition. B.B Publishers.  
Pedigo L. P. (2002). Entomology and Pest Management
12. Ganga, G and Chetty, S.J. (1997): An Introduction to Sericulture, 2nd Edition, Oxford and IBH Publishing Co. Ltd. New Delhi.
13. Mohan Rao M.M. (1988): A text Book of Sericulture BSP Publications, Sultan Bazar, Hyderabad.
14. Hisao, Aruga: Principles of Sericulture. Oxford and IBH Publishing Co. Pvt. Ltd. New Delhi.