

To,

#### SHIVAJI UNIVERSITY, KOLHAPUR - 416 004, MAHARASHTRA

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शिवाजी विद्यापीठ, कोल्हापुर - ४१६ ००४,महाराष्ट्र

दूरध्वनी - ईपीएबीएक्स - २६०९०००, अभ्यासमंडळे विभाग दुरध्वनी ०२३१ - २६०९०९३/९४



#### SU/BOS/Science/481

### Date: 01/07/2023

The Principal, All Concerned Affiliated Colleges/Institutions Shiyaji University Kolhapur	The Head/Co-ordinator/Director All Concerned Department (Science)
Shivaji University, Kolhapur	Shivaji University, Kolhapur.

Subject: Regarding syllabi of B.Sc. Part-II (Sem. III & IV) as per NEP-2020 degree programme under the Faculty of Science and Technology.

#### Sir/Madam,

With reference to the subject mentioned above, I am directed to inform you that the university authorities have accepted and granted approval to the revised syllabi, nature of question paper and equivalence of B.Sc. Part-II (Sem. III & IV) as per NEP-2020 degree programme under the Faculty of Science and Technology.

	B.Sc. Part-II (Sem III & IV) as per NEP-2020									
1.	Mathematics	8.	Chemistry							
2.	Statistics	9.	Sugar Technology (Entire)							
3.	Physics	10.	Microbiology							
4.	Astrophysics	11.	Industrial Microbiology							
5.	Zoology	12.	Electronics							
6.	Botany	13.	Geology							
7.	Plant Protection									

This syllabus, nature of question and equivalence shall be implemented from the academic year 2023-2024 onwards. A soft copy containing the syllabus is attached herewith and it is also available on university website <u>www.unishivaji.ac.in</u>)

The question papers on the pre-revised syllabi of above-mentioned course will be set for the examinations to be held in October /November 2023 & March/April 2024. These chances are available for repeater students, if any.

You are, therefore, requested to bring this to the notice of all students and teachers concerned.

Thanking you,

**W**Registrar Dr. S. M. Kubal

Copy	to:
Copj	

The Dean, Faculty of Science & Technology	8	P.G. Admission/Seminar Section
Director, Board of Examinations and Evaluation	9	Computer Centre/ Eligibility Section
The Chairman, Respective Board of Studies	10	Affiliation Section (U.G.) (P.G.)
B.Sc. Exam/ Appointment Section	11	Centre for Distance Education
	The Dean, Faculty of Science & Technology Director, Board of Examinations and Evaluation The Chairman, Respective Board of Studies B.Sc. Exam/ Appointment Section	The Dean, Faculty of Science & Technology8Director, Board of Examinations and Evaluation9The Chairman, Respective Board of Studies10B.Sc. Exam/ Appointment Section11



# 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)

		Duration-6 Months)																		
G	e		TE	ACHING S	SCH	IEME			EXAMINATION SCHEME											
Sr. No.	Course (Subject) Titl	THEORY				PRA	CTICAL			THEORY Internal University								PRACTICAL		
- 100		Credits	No. of lectures	Hours		Credits	No. of lectures	Hours		Max Marks	Min Marks		Hours	Max Marks	Total Marks	Min Marks	Hours	Max Marks	Min Marks	
1	DSC-C Chemistry-V	2	3	2.4		4	8	6.4		10	4		2	40	80	28				
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	80	28	F EX	PRACTICAL EXAMINATION		
4	DSC-C Botany-VI	2	3	2.4						10	4		2	40			IS ANNUAL			
5	DSC-C Zoology-V	2	3	2.4		4	8	6.4		10	4		2	40	80	28				
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 courses	pool of		2											2	50	18	
	TOTAL	16	22	17.6		14	24	19.2		60				240	350			50		

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

						SEMES	TER_IN	V( <b>D</b> ur	ration_	6 Month	hs)								
			TE	ACHING S	CHEME			(Dui	anon		EXA	MINATI	ON SCHE	EME					
Sr.	itle									PRACTICAL									
No.	se ct) T	]]	THEORY PRACTICAL					Internal     University											
	Cours (Subjee	Credits	No. of lectures	Hours	Credits	No. of lectures	Hours	Mov	Marks	Min Marks		Hours	Max Marks	Total Marks	Min Marks	Hours	Max Marks	Min Marks	
1	DSC-C Chemistry-VII	2	3	2.4	4	64	8		10	4		2	40	- 80	28		100	35	
2	DSC-C Chemistry-VIII	2	3	2.4		0.4	0		10	4		2	40	00	20		100	55	
3	DSC-C Botany-VII	2	3	2.4	4	4 64			10	4		2	40	80	20	As per BOS	100	35	
4	DSC-C Botany-VIII	2	3	2.4	4	0.4	0		10	4		2	40	- 00	28	Guide- lines	100	55	
5	DSC-C Zoology-VII	2	3	2.4	4	4 6.4			10	4		2	40	00	20		100	25	
6	DSC-C Zoology-VIII	2	3	2.4	4				10	4		2	40	- 00	20		100	55	
7	AECC-C AECC-D											3 Decise at	70	100	25	-			
,	Env. Studies		6	1 6								Project	ject 50		10				
8	SEC-IV	Any one	from poo	l of courses	2											2	50	18	
	TOTAL	12	18	14.4	14	19.2	24							400			350		
		28	40	32	28	38.4	48							750					
• Stu	ident contact hours	per week	:: 36.8 H	ours (Min.)			• Total	Marks	s for B.S	cII (Inc	ludi	ing EVS)	1	100					
• The	ory and Practical L	ectures :	48 Minut	es Each			• Total	Credit	ts for B.	ScII (Se	emes	ster III &	IV): 56						
• DS to	C: -Discipline Spec DSC D38 and/or D	cific Core SC ID39	e Course: to DSC	Select any D50.	3subject pa	airs, relevan	t to those	opted	at B. So	e. I, from	DS	C C1 to I	DSC C38 a	and / or I	DSC IC39	to DSC IC5	0 and DS	C D1	
• Al	ECC- Ability Enha	ncement (	Compuls	ory Course	(C): Enviro	onmental Stu	udies: EV	S The	ory and	AECC-D	) EV	S Projec	t (Theory:	70 & Pro	oject:30 n	narks)			
• Th	• There shall be separate passing for internal and University theory as well as practical / project examinations.																		
• Pr	• Practical Examination shall be conducted annually for 100 Marks per course (subject) and minimum 35 marks are required for passing.																		
• Ex	ccept Environment	al Studie	s, there s	hall be con	nbined pas	sing for two	theory po	apers o	of 40 m	arks each	h. i.	e. minim	um. 28 m	arks are	required	for passing o	out of 80.		
• M	inimum 4 marks ar	re require	ed for pas	sing out of	10 for Inter	rnal Examir	nation of e	each p	aper.										
$\bullet Ex$	amination of SEC	shall be	either th	eory or pra	ctical depe	nding upon	type of SI	ЕС.											

	SEMESTER-V										(Duration-6 Months)											
			TEACH	ING SCH	EME									EXAMIN	NATION SCH	EME						
Sr.	itle	TH	EORY		P	PRACTICAL						THE	DRY		PRACTICAL							
No.	a T								Internal Univ			versity			T							
	Subjec	Credits	No. of lectures	Hours	Credits	No. of lectures	Hours		Max Marks	Min Marks		Hours	Max Marks	Min Marks	Hours	Max Marks	Min Marks					
1	DSE-E	2	3	2.4					10	4		2	40	14								
2	DSE-E	2	3	2.4		8 20			10	4		2	40	14	PRA	ACTICA	L					
3	DSE-E	2	3	2.4	8		16		10	4		2	40	14	EXAM	IINATIO	N IS					
4	DSE-E	2	3	2.4					10	4		2	40	14	ANNUAL							
5	AECC-E	4	4	3.2					10	4		2	40	14								
6	SEC-V	Any o	one from p courses	pool of	2										2	50	18					
	TOTAL	12	16	12.8	10	20	16		50				200									
						SEME	STER-V	/I (	Duratio	n–6 Mo	nth	ls)										
1	DSE-F	2	3	2.4					10	4		2	40	14								
2	DSE-F	2	3	2.4						10	4		2	40	14	As per						
3	DSE-F	2	3	2.4	8	8 20	16		10	4		2	40	14	Guide-	200						
4	DSE-F	2	3	2.4	0		16		10	4		2	40	14	Lines		70					
5	AECC-E	4	4	3.2					10	4		2	40	14								
6	SEC-VI	Anyo	one from p courses	pool of	2										2	50	18					
	TOTAL	12		12.8	10		16		50				200									

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

GRAND TOTAL     24     32     25.6     20     4	40 32			400	800					
Student contact hours per week: 28.8 Hours (Min) Total Marks for B.ScIII (Including English): 800										
Theory and Practical Lectures: 48 Min. Each	• Tot	Total Credits for B.ScIII (Semester V&VI): 44								
• DSE-Discipline Specific Elective. A candidate shall select	t one course	(subject) fr	om the thre	e Courses	(Subjects)	selected at	B.Sc.–II. Se	lect any	4 pairs	
of papers from DSE-E1 to DSE-E84 for Sem –V and DSE-	- F1 to DSE-	F84 for Set	m-VI							
• AECC-Ability Enhancement Compulsory Course (E & F):	English for	communica	tion							
• There shall be separatee passing for internal, theory and practical examinations.										
• Practical Examination shall be conducted annually for 200 marks, and minimum 70 marks are required for passing.										

• University semester end exam shall be of 40 marks per paper and minimum 14 marks are required for passing.

• 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.

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

# <u>Nature of Question Paper for B.Sc. Part – II (40 + 10 Pattern)</u> 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 t sentence	he [8]
1 to 8 MCQ one mark each with four options a) b) c) d)	
Attempt any TWO of the following a)	[16]
b)	
c)	
Attempt any FOUR of the following a)	[16]
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

Unit I.

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)

CIIIC I	•	
Carbo	ohydrate Metabolism:	(10 hrs.)
1)	Classification and biological significance of carbohydrates	
2)	Glycolysis	
3)	Krebs Cycle	
4) 5)	Electron Transport Chain	
5) 6)	Choopeageneeis	
0) 7)	Gluconeogenesis	
(/ 8)	Glycogenolysis	
0)	Grycogenorysis	
Lipid	Metabolism:	(7 hrs.)
1)	Classification and biological significance of lipids	
2)	$\beta$ oxidation of fatty acids	
Unit I	I:	
Protei	in metabolism:	(8 hrs.)
1)	Structure, Classification and biological significance of proteins	
2)	Transamination	
3)	Deamination	
4)	Urea Cycle/ Ornithine cycle	
Unit I	П:	
Enzyr	nes:	(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.

(3 hrs.)

## 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 Unit II: Functional anatomy of female reproductive system: Anatomy of female reproductive system	(3 hrs.) (12 hrs.) A.
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	
1. 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 Intra	fallopian Tube
Transfer (ZIFT) Gamete Intrafallopian Transfer (GIFT). Intracytoplasmic Sperm	Injection
(ICSI).	
d. In vitro fertilization (IVF): Ovarian stimulation, Egg retrieval, Sperm retriev	al,
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, Reserved	voir,
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 ( <i>Helicoverpa armigera</i> )	
2) Sugarcane leaf hopper ( <i>Pyrilla perpusilla</i> )	
3) Lemon Butterfly ( <i>Papilio demoleus</i> )	
4) Pulse Beetle ( <i>Callosobruchus chinensis</i> )	
5) Rice Weevil ( <i>Sitophilus oryzae</i> )	
6) Red Flour beetle ( <i>Tribalism castaneum</i> )	
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 <i>Bombyx mori</i>	
(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.
- 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 secretary 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 (Tribalism 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), *Sitophiluso ryzae* (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.
- 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 3Hill.
- 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). (6th 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.