

# PROSPECTUS

for  
Admission to Ph.D. Degree Programme  
(2016-17)



**Bihar Agricultural University,  
Sabour -813 210 (Bhagalpur)**

# **Bihar Agricultural University Sabour, Bhagalpur (Bihar)**

Bihar Agricultural University, Sabour (Bhagalpur) is a State Agricultural University, which has been established on 5<sup>th</sup> August 2010 by an Act (No. 20 of 2010) State Legislature of Bihar as a State University specified by the UGC under section 22 of the UGC Act. 1956. The area of activity of this University is extended in three Agroclimatic zones spread over in 25 districts that include 12 Research Stations and 20 Krishi Vigyan Kendra (KVKs).

Bihar Agricultural University, Sabour is having following colleges & Institutes.

1. Bihar Agricultural College, Sabour, Bhagalpur
2. Mandan Bharti Agricultural College, Agwanpur, Saharsa
3. Bihar Veterinary College, Patna
4. Sanjay Gandhi Institute of Dairy Technology, Patna
5. Nalanda Horticulture College, Noorsarai, Nalanda
6. Veer Kunwar Singh Agricultural College, Dumraon, Buxer
7. Bholu Paswan Shasrti Agricultural College, Purnea.
8. Dr. Kalam Agriculture College, Kishanganj

This University is situated about 8 km east of Bhagalpur and the nearest railway station is Sabour. Sabour is directly connected by road, rail and air links. The National Highway No. 80 previously called Assam link road, passes through Sabour which links Gauhati (Assam) and Patna (Bihar). The nearest Air Port (Bhagalpur) is located about 4 kms away from the University campus, which is likely come in operation soon.

The University offers courses for the award of UG, PG & Ph. D. Degree. The Ph.D. Degree is available in Agriculture stream at BAC, Sabour Campus & Veterinary stream at B.V.C., Patna Campus.

## **MANDATE**

The mandate of Bihar Agricultural University, Sabour would include the following objectives:

- To impart education in different disciplines of agriculture and its allied disciplines.
- To undertake strategic and applied research for development of agricultural technology.
- To undertake extension education programme in the State of Bihar, by planning and organizing different programmes of human resource capability in agriculture and related domains.
- To help State Government in production and supply of breeder seeds for multiplication of foundation and certified seeds.
- To serve as a repository of national and international scientific information on various aspects of agricultural and animal production.
- To collaborate with relevant national and international agencies for all round development of agriculture and allied disciplines in the State, in particular and the country as a whole; and also to undertake such other activities, as it may deem fit, from time-to- time.

**PROSPECTUS FOR ADMISSION TO  
DOCTORAL DEGREE PROGRAMME 2016 – 17**

**I. DEGREE PROGRAMME :**

Ph. D. Admission during the academic session 2016–17 is opened in the following disciplines.

**Sabour Campus:** Agronomy, Extension Education, Horticulture (Olericulture), Horticulture (Pomology), Plant Breeding & Genetics and Soil Science & Agricultural Chemistry.

**Patna Campus:** Animal Genetics & Breeding; Animal Nutrition; Animal Reproduction, Gynecology and Obstetrics; Livestock production Management and Veterinary Parasitology.

**II. ADMISSION CRITERIA AND ENTRANCE EXAMINATION:**

- (1) Admission to the university implies acceptance without any modification by the candidate and his/her parents/guardians of all provisions given in the prospectus or any change in the University rules, regulation, fees, etc., that are made from time to time.
- (2) The students who have been temporarily dismissed or permanently dropped from this/any University either on account of poor academic performance or on account of act(s) of indiscipline or those who have been debarred from seeking admission in this/any University shall not be eligible to apply for admission to any programme of this University.
- (3) If any document submitted by the candidate is found to be false at any stage during his/her stay in this University, his/her admission will be cancelled.
- (4) The information indicated in this prospectus is only for general guidance and could be modified/changed from time to time by the University without giving any notice.
- (5) For correspondence regarding admission, contact

**REGISTRAR**

Bihar Agricultural University, Sabour- 813 210, Bhagalpur

Phone: - 0641 –2452614, Fax: -0641 – 2452614

Website: [www.bausabour.ac.in](http://www.bausabour.ac.in)

Email: [registrarbau2015@gmail.com](mailto:registrarbau2015@gmail.com)

- (6) Admission to Ph. D. Degree Programme shall be made at the commencement of the academic year 2016-17.
- (7) The Competitive Test for admission to Ph. D. Programme shall be conducted at BAU, Head Quarter, Sabour on **05.06.2016** from 11.00 AM to 01.00 PM.
- (8) Candidate must affix or paste on the application form only the recent and clear photographs taken within last three months failing which the candidature would be rejected.
- (9) In-service candidates sponsored from alien Organizations/Institutions may not be required to appear in the Competitive Test for seeking admission. However, such candidates may submit his/her application through proper channel on or before **14.05.2016**

**III. AVAILABILITY OF APPLICATION FORM :**

<b>A.</b>	The Application Form and Prospectus can be downloaded from University Website ( <a href="http://www.bausabour.ac.in">www.bausabour.ac.in</a> )	18.04.2016 to 13.05.2016
<b>B.</b>	Dully filled in application form can be submitted along with requisite fee i.e. Demand draft of Rs. 700/- (for General / EBC / BC / RCG category) and Rs. 350/- (for SC / ST category) to the Office of the Registrar, BAU, Sabour.	On or Before 17.05.2016
<b>C.</b>	The DD should be in favour of <b>Comptroller, Bihar Agricultural University, Sabour</b> payable at <b>State Bank of India, Sabour.</b> ( <i>Cash, Cheque, Postal orders and money order shall not be accepted</i> ).	
<b>D.</b>	Last Date for receipt of application form in the office of the Registrar through <b>Registered/Speed Post/Courier</b> only.	17.05.2016

**IV. LAST DATE FOR SUBMISSION OF APPLICATION FORM :**

The completed application form on the prescribed proforma along with self addressed envelop, bearing postage stamp of Rs. 27/- only for sending the admit card along with Acknowledgement Card must reach the **Registrar, Bihar Agricultural University, Sabour- 813210, Bhagalpur on or before 17.05.2016** by post only. Application received after this date shall not be entertained.

**V. SUBJECT WISE NUMER OF SEATS AND ELIGIBILITY CRITERIA**

Number of seat eligibility criteria for admission to Ph. D. Degree Programme for academic session 2016 – 17 is as under:-

Sl. No.	Subjects	BAU Seats	ICAR Seats	Total Seats	Eligibility Criteria
<b>Agriculture Faculty</b>					
1.	Agronomy	3	1	4	M. Sc. (Ag) in Agronomy
2.	Extension Education	1	1	2	M. Sc. (Ag) in Agricultural Extension/ Extension Education
3.	Horticulture (Olericulture)	3	1	4	M. Sc. (Ag) in Olericulture/ Vegetable Sciences/ Horticulture/Horticulture with specialization in Vegetable Sciences/ Horticulture with specialization in Post Harvest Technology
4.	Horticulture (Pomology)	3	1	4	M. Sc. (Ag) in Pomology/ Horticulture/Horticulture with specialization in Fruit Sciences/ Horticulture with specialization in Post Harvest Technology.
5.	Plant Breeding & Genetics	2	1	3	M. Sc. (Ag) in Agricultural Botany/ Plant Breeding/ Genetics/ Genetics and Plant Breeding/Plant Breeding & Genetics.
6.	Soil Science & Agricultural Chemistry	4	2	6	M. Sc. (Ag) in Soil Sciences/ Agricultural Chemistry/ Agricultural Physics / Soil Microbiology/ Soil Chemistry/ Water Science and Technology/Soil & Water Conservation/Soil Science & Agricultural Chemistry
<b>Veterinary Faculty</b>					
1.	Animal Genetics & Breeding	2	1	3	M. V. Sc. in Animal Genetics and Breeding/Animal Breeding and Genetics
2.	Animal Nutrition	1	1	2	M. V. Sc. in Animal Nutrition.
3.	Animal Reproduction, Gynecology and Obstetrics	1	1	2	M. V. Sc. in Animal Reproduction, Gynecology & Obstetrics/ Veterinary, Gynecology & Obstetrics
4.	Live Stock Production Management	1	1	2	M. V. Sc. in Livestock Production Management/Animal Husbandry.
5.	Veterinary Parasitology	1	1	2	M. V. Sc. in Veterinary Parasitology.

**VI. ELIGIBILITY REQUIREMENT:**

The University reserves the right to make addition or deletion in number of seats without any notice. Candidates possessing the minimum eligibility qualifications as given above shall be eligible for admission to the respective Ph. D. Degree Programme, provided that they fulfill the following conditions and qualify the written test and secure a place in the merit list.

- (a) A candidate should possess at least 70% marks in aggregate or 7.0/10.0 in Master's Degree Programme and in case of SC/ST, 65% marks in aggregate or 6.5/10.00 OGPA is required.
- (b) Cut of marks for SC/ST candidate is 40% and 45% for all other categories in the merit list of Entrance Test – cum- Academic Performance.

**VII. VERIFICATION OF ANTECEDENTS:**

Each applicant who seeks admission to this University will be required to submit a *Character Certificate* from the Head of the Institution last attended certifying the following points:

- (a) That the applicant has not taken part in any activity subversive of Rules, Regulations and Discipline of the Institution.
- (b) That the applicant has never used unfair means in any examination of the Institution.

**VIII. MODE OF ADMISSION:**

(a) **Scheme of Examination :**

Candidates willing to secure admission in Agriculture (**Code- A1 to A 6**) and Veterinary (**Code – V 1 to V 5**) streams will have to appear in Competitive Entrance Test.

The candidates will have to select only one subject mentioned in section (V) for admission to Ph.D. Programme. Admission would be allowed to the selected candidates in the subject applied for admission.

(b) **Merit list:**

The merit list shall be prepared on the basis of total marks obtained by the candidates in Entrance Test-cum-Academic Performance as mentioned below;

**Entrance Test-cum-Academic Performance**

<b>(i)</b>	Entrance	80%
<b>(ii)</b>	Master Degree	10%
<b>(iii)</b>	Bachelor Degree	10%

(c) **Subject with code number for appearing in the Competitive Entrance Examination.**

Sl. No.	Subject	Code No.
<b>Agricultural Faculty</b>		
1.	Agronomy	A 1
2.	Extension Education	A 2
3.	Horticulture (Olericulture)	A 3
4.	Horticulture (Pomology)	A 4
5.	Plant Breeding & Genetics	A 5
6.	Soil Science & Agricultural Chemistry	A 6
<b>Veterinary Faculty</b>		
1.	Animal Genetics & Breeding	V 1
2.	Animal Nutrition	V 2
3.	Animal Reproduction, Gynecology & Obstetrics	V 3
4.	Live Stock Production Management	V 4
5.	Veterinary Parasitology	V 5

(d) **Choice of programme:**

The selected candidate shall be allowed for admission in discipline/subject concerned only for which he/she has appeared in the competitive examination based on merit, availability of seats and reservation policy of Bihar Govt. in the subject concerned, at the time of counseling.

(e) **Breaking of tie:**

For determining the merit of candidates in case of a tie, performance at Master Degree level examination will form the criteria. If performance at Master level is equal, then their age would determine the priority

**IX. REFUSAL OF ADMISSION:**

- (a) The Vice-Chancellor reserves the right to refuse the admission of any candidate despite his/her fulfillment of the academic requirements for admission on the basis of Entrance Test-cum-Academic performance, for reasons to be recorded in writing whose admission in the opinion of the Vice-Chancellor shall not be in the best interest of the University. The decision of the Vice-Chancellor shall be final and legal binding on the candidate.

- (b) The students who have been permanently dropped or temporarily dismissed from this/any University either on account of poor academic performance or on account of act of indiscipline or those who have been debarred from seeking admission in this University shall not be allowed to appear in the Competitive Test or will also not be allowed to seek admission as a sponsored candidate. Even if such a candidate has appeared in the competitive Test either by concealing the facts or due to oversight, shall not be eligible for admission.
- (c) Candidates found using unfair means in Entrance Competitive Test of this University shall be permanently debarred from appearing in future in the Competitive Test of the University.
- (d) It is the responsibility of the candidate to furnish full and correct information on the application form. Any admission made on the basis of wrong or concealed information, supplied by the candidates or due to any oversight or error in the Registrar office and detected subsequently to the admission, or joining of the candidate would be cancelled at the cost and risk of the candidate.

#### X. RESERVATION OF SEATS:

Code numbers of various reservation categories have been given below:

Category	Code number
General (General)	101
Scheduled Caste (SC)	102
Scheduled Tribe (ST)	103
Extremely Backward Class (EBC)	104
Backward Class (BC)	105
Reserve Category Girls (RCG)	106

Reservation of seats shall be given as per Bihar Govt. Rules.

#### Categories wise seats for Ph. D Degree (Agriculture Faculty)

Sl. No.	SUBJECT	Seats	UR	EBC	SC	BC	RCG	ST	Roaster point
1.	Agronomy	3	1	1	-	1	-	-	58-60
2.	Extension Education	1	1	-	-	-	-	-	61
3.	Horticulture (Olericulture)	3	1	-	1	1	-	-	62-64
4.	Horticulture ( Pomology)	3	2	1	-	-	-	-	65-67
5.	Plant Breeding & Genetics	2	1	-	1	-	-	-	68-69
6.	Soil Science & Agricultural Chemistry	4	2	1	-	1	-	-	70-73
	<b>Grand Total</b>	<b>16</b>	<b>8</b>	<b>3</b>	<b>2</b>	<b>3</b>	<b>0</b>	<b>0</b>	<b>58-73</b>

#### Categories wise seats for Ph. D Degree (Veterinary Faculty)

Sl. No.	SUBJECT	Seats	UR	EBC	SC	BC	RCG	ST	Roaster point
1.	Animal Genetics & Breeding	2	1	-	-	1	-	-	29-30
2.	Animal Nutrition	1	1	-	-	-	-	-	31
3.	Animal Reproduction, Gynecology & Obstetrics	1	-	1	-	-	-	-	32
4.	Live Stock Production Management	1	1	-	-	-	-	-	33
5.	Veterinary Parasitology	1	-	-	1	-	-	-	34
	<b>Total</b>	<b>06</b>	<b>3</b>	<b>1</b>	<b>1</b>	<b>1</b>	<b>0</b>	<b>0</b>	<b>29-34</b>

**XI. SUBJECT CODE:**

A candidate has to clearly specify in the application form the subject code number given under section VIII-C.

**XII. INSTRUCTION FOR FILLING THE APPLICATION FORM:**

Instructions to the candidates for filling the application form are given in Appendix – I.

**XIII. FEE:**

The details of the fee have been given in Appendix – II. Selected Candidates shall have to take admission by depositing the required fee.

**XIV. SYLLABUS:**

Syllabus for competitive Entrance Examination for admission to Ph. D. Degree Programme is appended (Appendix - III).

**XV. COUNSELING:**

Candidates called for counseling will be required to submit their relevant documents in original as given below with one set of self attested photocopies of the certificates/mark sheet.

- (a) High School/equivalent examination Mark sheet as well as certificate for proof of age.
- (b) Intermediate/equivalent examination Mark sheet and certificate.
- (c) Bachelor Degree Examination Mark sheet/Transcript and Provisional Degree Certificate or Degree Certificate.
- (d) Master Degree Examination Mark sheet/Transcript and Provisional Degree Certificate or Degree certificate.
- (e) Caste certificate issued by the C.O. /BDO (in case, candidate claiming for reservation).
- (f) Two points Character Certificate from Head of the Institution last attended.
- (g) Domicile Certificate issued by the Competent Authority.

Counseling does not guarantee admission. It depends on merit and availability of seats in a particular discipline. In case, candidates fail to attend the counseling on the prescribed date & time, his/her candidature shall automatically be rejected. University shall not bear any responsibility for any postal delay. .

**XVI. RESIDENTIAL REQUIREMENT:**

A minimum period of 6 semesters shall be the residential requirement for completing the courses in Ph. D. Degree Programme and the maximum period in which the regular student must obtain his/her degree shall be 12 semesters. It is compulsory for the students to stay in the University/College Hostel. The students may be required to move to other campuses also for one or more semesters for research work.

**XVII. UNIVERSITY FELLOWSHIP:**

The University Fellowship shall be awarded to 75% students admitted in a particular subject on the basis of their performance in First Semester result.

**XVIII. PROCEDURE TO APPLY:**

- (a) A candidate can apply for admission to only one subject. No change would be allowed thereafter.
- (b) The application form along with Admit Card and verification card, self-addressed envelope bearing postal stamps of Rs. 27/- only, and filled neatly and correctly by the applicant should be sent with necessary sets of attested copies of the documents viz, High School Certificate as a proof of date of birth, mark sheet of 10<sup>th</sup>, 12<sup>th</sup>, Bachelor and Master Degree Examination, caste certificate and domicile certificate if applicable so as to reach **the Registrar, Bihar Agricultural University, Sabour-813 210 Bhagalpur on or before the last date i.e. 17.05.2016** by Registered/Speed Post only. Any application received after the last date shall not be entertained.

- (c) The Candidate who is appearing in the Master Degree Examination is also eligible to apply provisionally for admission and appear in the Competitive Test for admission in Ph. D. Degree Programme. However, he/she must have course completion along with CGPA **before 04.07.2016**
- (d) If a candidate furnishes wrong information or suppresses any relevant information, his/her admission will be cancelled.
- (e) Candidate must enclose attested copies of the following certificate (whichever is applicable) and document in order as indicated below. The candidature of the candidate who fails to attach Xerox copies of certificates will not be considered. If selected, candidate has to submit original certificate at the time of counseling.
- (1) Proof of date of birth
  - (2) Matriculation (Class X) or equivalent certificate and Mark sheet
  - (3) 10+2/Intermediate Examination certificate and Mark sheet
  - (4) Bachelor Degree Certificate and Transcript.
  - (5) Master Degree Certificate/ Provisional Degree Certificate and Transcript/Final Grade sheet.
  - (6) Domicile and Caste Certificate (if applicable) issued by C.O./B.D.O/competent authority
  - (7) Self-addressed envelope bearing postage stamp worth Rs. 27/- only for sending admit card along with a postcard for acknowledgement

Admit card for the Competitive Test to be conducted on **05.06.2016** will be sent by Registered post well in advance to all eligible candidates who have submitted their application form complete in all respect by the due date. Those who do not get the Admit Card may approach to the office of the Registrar one day before the Examination i.e. on **04.06.2016** for issue of Duplicate Admit Card with payment of Rs. 50.00 only.

#### IMPORTANT DATES

1.	Availability of Application Form and Prospectus at university website	18.04.2016 to 13.05.2016
2.	Last date of submission of Application Form	17.05.2016
3.	Issue of Admit Card	30.05.2016
4.	Issue of Duplicate Admit Card	04.06.2016
5.	Date, time and venue of Examination	05.06.2016 (Sunday) 11.00 AM to 01.00 PM B.A.C., Sabour (Bhagalpur)
6.	Date of Publication of Merit List at University website	07.07.2016
7.	Date, time and venue of Counseling	15.07.2016 (Friday) Auditorium, BAC, Sabour 9.30 AM onwards
8.	Date of Admission	18.07.2016
(Candidate may have to stay one more Day for counseling at his/her own cost)		



### DIRECTIONS FOR CANDIDATE

1. The candidate shall be present at the centre 30 minutes before the commencement of the Examination.
2. Candidate will not be admitted to the Examination Hall after 30 minutes from the commencement of the Examination.
3. Candidate who does not produce the Admit Card shall not be allowed to sit in the examination hall by the Centre Superintendent/Invigilator.
4. Candidate must preserve the Admit Card till his/her admission in the institution/Department.
5. Candidates are not allowed to leave the Examination Hall before expiry of the time and handing over the answer sheet and Question paper (Test Booklet) to the concerned Invigilator.
6. The candidate shall not remove any page(s) from the Test Booklet and if any page(s) is/are found missing from his/her booklet, he/she will be prosecuted against and shall be liable for cancellation of his/her candidature and legal action.
7. The candidate must fill in the Box with **black ballpoint pen** of good quality.
8. Candidates are not allowed to bring any **books, notes or calculator, cell phone** etc. in the Examination Hall.
9. Candidate must follow the instructions strictly as given by the invigilators in the examination hall.
10. No cutting or overwriting is allowed.
11. Impersonation in any form will lead to cancellation of candidature and legal action.

## Appendix – I

### INSTRUCTION FOR FILLING THE APPLICATION FORM

**Please read the following instruction carefully before filling up the application form.**

Application form must be filled by applicant's own handwriting in English only.

All entries in the box provided in item 1 to 10 must be made in block letters only with a ball pen. Please ensure that three recent identical passport size photographs from same negative (showing the portion of body chest upward) are pasted at appropriate places. The photographs to be affixed must be attested by Guzzetted Officer/Head of the Institution last attended/attending.

Do not fill in the places meant for office use only.

- The candidate is required to write his/her name in Capital letter in English in the same order as entered in his/her Matric examination/Mark sheet/certificate as below :

R	A	J		K	U	M	A	R		S	I	N	G	H									
---	---	---	--	---	---	---	---	---	--	---	---	---	---	---	--	--	--	--	--	--	--	--	--

- Write the name of father :

- Write the name of mother :

- Write the name of Guardian (if father is not alive) :

- Date of birth must be entered in Christian era as recorded in High School Certificate e.g. 8<sup>th</sup> September 1982 be entered as

0	8		0	9		1	9	8	2
Date			Month			Year			

- Write complete address:

--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--

- Sex (Write 'M' for male and 'F' for female)

- Nationality :

- Domicile of Bihar (Write 'Yes' or 'No')

- Reservation Category : As defined in item-X

- Write your caste, if you sought reservation :

- Subject code : As defined in item- VIII (c)

- Percentage of marks secured: Enter the actual percentage of marks secured in Matric/10<sup>th</sup>, Inter/12<sup>th</sup>, Bachelor's Degree and Master's degree up to two digits after decimal, for example 79.66.

- Please write your full Mailing Address with PIN CODE

- The details of the Bank Draft should be entered at the appropriate space provided in the application form.

- Please ensure that the declaration is duly signed by the father/guardian (if father is not alive). Forged signature is liable to disqualify the candidate from counseling.

- The appearing candidate must ensure that the certificate of forwarding officer is duly signed by the Head of the Institution attending along with seal.

- The candidate who is appearing in the Master Degree Examination is also eligible to apply provisionally for admission and appear in the Competitive Test Examination. However, he/she must complete the degree requirement **before 04.07.2016**. Attested copy of transcript/ mark sheet/final grade sheet must be submitted to the office of Registrar through **email- [registrarbau2015@gmail.com](mailto:registrarbau2015@gmail.com)** latest by **04.07.2016**.

- Formula for conversion of OGPA into percentage of marks and vice-versa adopted by the University from where candidate has obtained degree certificate may be mentioned at appropriate place of Application form.

**Appendix – II**

**Ph.D. Degree Programme**

<b>Sl. No.</b>	<b>Item</b>	<b>Rs.</b>
1.	Course Registration fee (per student per semester)	125.00
2.	Migration fee/Emigration fee (once in Academic Programme)	150.00
3.	Laboratory caution money (Refundable)	500.00
4.	Semester fees to be charged in each semester	
	(a) Admission fee	150.00
	(b) Tuition fee	2000.00
5.	Examination fee to be charged in each semester	400.00
6.	Library security money (Refundable)	1000.00
7.	Library fee (per semester)	200.00
8.	Medical fee (per semester)	150.00
9.	Athletic fee (per semester)	150.00
10.	Extra Co-curricular fee (per semester)	150.00
11.	Common Room fund (per student per semester)	50.00
12.	Hostel fund (per student per semester)	50.00
13.	Hostel charge	
	(a) Hostel Security money (Refundable)	500.00
	(b) Seat rent (per student per semester)	400.00
14.	Development fee/charges (once in Academic Programme)	3000.00
15.	University Registration fee (once in Academic Programme)	100.00
16.	Bihar State Inter University Sports & Cultural meet	10.00
	<b>Total</b>	<b>9085.00</b>

**Fees to be charged semester-wise**

***First Semester***

<b>Category</b>	<b>Ph. D. Programme (Rs.)</b>	<b>Remarks</b>
General	9085.00	
SC/ST	6685.00	Only tuition fee and exam fee will not be charged
EBC/BC-1*	7085.00	Tuition fee will not be charged from EBC/BC – 1*

**Note:** \* Such EBC/BC-I students who are recipient of scholarship/fellowship/stipend shall be charged full fee as in the case of general category students.

***Fee to be charged in Subsequent Semester***

<b>Category</b>	<b>Ph. D. Programme (Rs.)</b>	<b>Remarks</b>
General	3835.00	
SC/ST	1435.00	Only tuition fee and exam fee will not be charged
EBC/BC-1*	1835.00	Tuition fee will not be charged from EBC/BC – 1*

**Note:** \* Such EBC/BC–1 students who are recipient of scholarship/fellowship/stipend shall be charged full fee as in the case of general category students.

### **Appendix – III**

#### **SYLLABUS FOR COMPETITIVE TEST FOR ADMISSION TO**

#### **Ph. D. DEGREE PROGRAMME**

#### **AGRONOMY (CODE - A 1)**

##### **UNIT – I**

Crop growth analysis in relation to environment; agro-ecological zones of India. Quantitative agro-biological principles and inverse yield nitrogen law; Mitscherlich yield equation, its interpretation and applicability; Baule unit. Effect of lodging in cereals; physiology of grain yield in cereals; optimization of plant population and planting geometry in relation to different resources, concept of ideal plant type and crop modeling for desired crop yield. Scientific principles of crop production; crop response production functions; concept of soil plant relations; yield and environmental stress. Integrated farming systems, organic farming, and resource conservation technology including modern concept of tillage; dry farming; determining the nutrient needs for yield potentiality of crop plants, concept of balance nutrition and integrated nutrient management; precision agriculture; crop residue recycling and management, sustainable agriculture and good agricultural practices.

##### **UNIT – II**

Soil fertility and productivity - factors affecting; features of good soil management; problems of supply and availability of nutrients; relation between nutrient supply and crop growth; organic farming - basic concepts and definitions. Criteria of essentiality of nutrients; Essential plant nutrients – their functions, nutrient deficiency symptoms; transformation and dynamics of major plant nutrients. Preparation and use of farmyard manure, compost, green manures, vermicompost, biofertilizers and other organic concentrates their composition, availability and crop responses; recycling of organic wastes and residue management. Commercial fertilizers; composition, relative fertilizer value and cost; crop response to different nutrients, residual effects and fertilizer use efficiency, fertilizer mixtures and grades; agronomic, chemical and physiological methods of increasing fertilizer use efficiency; nutrient interactions. Time and methods of manures and fertilizers application; foliar application and its concept; relative performance of organic and inorganic manures; economics of fertilizer use; integrated nutrient management; use of vermin compost and residue wastes in crops.

##### **UNIT - III**

Weed biology and ecology, crop-weed competition including allelopathy; principles and methods of weed control and classification; weed indices. Herbicides introduction and history of their development; classification based on chemical, physiological application and selectivity; mode and mechanism of action of herbicides. Herbicide structure - activity relationship; factors affecting the efficiency of herbicides; herbicide formulations, herbicide mixtures; herbicide resistance and management; weed control through bio-herbicides, myco-herbicides and allelochemicals; Degradation of herbicides in soil and plants; herbicide resistance in weeds and crops; herbicide rotation. Weed management in major crops and cropping systems; parasitic weeds; weed shifts in cropping systems; aquatic and perennial weed control. Integrated weed management; cost: benefit analysis of weed management.

##### **UNIT - IV**

Water and its role in plants; water resources of India and Bihar, major irrigation projects of India and Bihar, extent of area and crops irrigated in India and different states. Irrigation and irrigation management- definition,

objectives and limitations. Soil water movement in soil and plants; transpiration; soil-water-plant relationships; water absorption by plants; plant response to water stress, crop plant adaptation to moisture stress condition. water requirement of crops. Soil, plant and meteorological factors determining water needs of crops; scheduling, depth and methods of irrigation; micro irrigation system; fertigation; management of water in controlled environments and poly houses. Concept of of ET, CU, PET, ETc, Epan, and their importance in assessing WR, IW/ CPE ratio and its importance. Water management of the crops and cropping systems; quality of irrigation water and management of saline water for irrigation; leaching requirement , irrigation efficiencies and methods of increasing field water efficiency, Excess of soil water and plant growth; water management in problem soils; drainage requirement of crops , drainage coefficient and methods of field drainage, their layout and spacing.

## **EXTENSION EDUCATION (CODE – A 2)**

### **UNIT- I**

Approaches of Agricultural Extension: A critical analysis of different approaches of agricultural extension. Importance and relevance of indigenous knowledge system, identification and documentation of ITK, Integration of ITK system in research formulation, Concept of Agricultural Knowledge and Information System, Training of Stakeholders of AKIS. Cyber Extension - Concept of cyber extension, national and international cases of extension projects using ICT and their impact of agricultural extension, alternative methods of financing agricultural extension - Scope, limitations and experience and cases. Research - Extension -Farmer - Market linkage: Importance, Scope, Implications etc., Market - Led Extension, Farmer - Led Extension, Concept of Farm Field School, Farm School, Public - Private Partnership: Meaning, Models, Identification of various areas for partnership. Stakeholder's analysis in Extension. Main streaming gender in Extension - Issues and Prospects. Implications of WTO - AOA for extension services, re-orientation of extension services for agri-business and marketing activities, GOI-NGO collaboration to improve efficiency of extension. Extension and contemporary issues: Extension and issues related to rural poverty. Privatization of Extension. Intellectual Property Rights (IPRs). Extension Reforms in India - Decentralized decision making, Bottom up planning, Farming System and Situation based Extension Delivery System, Extension delivery through Commodity Interest Groups. Organization innovations in Extension - ATIC, IVLP, Kisan Call Centres.

### **UNIT- II**

Scaling technique - meaning, types, principles, steps and quality, techniques of attitude scale construction - Paired comparison, Equal appearing intervals, Successive Intervals, Summated ratings, Scalogram analysis, Scale discrimination technique, Reliability and Validity of Scales. Sociometrics, content analysis, case studies, Q-sort techniques, Semantic different technique. Projective and Semi projective techniques, Critical incident techniques, Computer packages for analysis - usage in Extension Research. Knowledge scale measurement. Participatory tools and techniques in behaviour Research - Data collection and Evaluation. Impact analysis, e-data collection and information analysis.

### **UNIT- III**

Paradigm shift in training - learning scenario, Training Approaches - Experiential learning - laboratory - organization development (system) approaches; Training Design, Designing an effective training programme, Harmonizing training needs, Course Objective, content and methods. Designing an effective training session - the semantics involved, Designing experiential training sessions, simulation exercises, and openness in training transaction - managing dilemmas, ambivalence and conflicts and confusion (for both trainers and trainees). Recent Training Techniques for understanding and facilitation team building, group dynamics, motivation and empowerment, laboratory methods: micro-lab process work, and sensitivity training, Psychological instruments as training tools: TAT, Inventories, Cases, etc. Participatory Training Techniques - Lecture, Brainstorming, Group discussion and Training Games. Role Play, Psycho-drama, Coaching, Counseling, etc., Trainer's roles and dilemmas, Factors Effecting Training Effectiveness and Training Evaluation.

#### **UNIT- IV**

Introduction to organizations: Concept and Characteristics of organizations, Organizational Behaviour - Context and concept - levels of organizations - formal and informal organizations, Theories of organizations: Nature of organizational theory - classical theories - features of Bureaucracy - administrative theory and Scientific management - Neo-classical theories - the human relations movement - modern theory. Systems approach to study organization needs and motives - Attitude, values and ethical behaviour - alienation and work - work motivation - communication and interpersonal behaviour - organization communication - leadership behaviour -decision making, problem solving techniques - organizational climate - change proneness and resistance to change, Organizational change, Organizational structure - Process in organizing - Dimension of Motivation Climate. Departmentation - Span of Management - Delegation of authority - Centralization and decentralization - line and staff organization - functional organization - divisionalisation - Project organization - Matrix organization - free form organization - top management structure. Individual behaviour in organization. Fundamentals of Human relations and Organizational behaviour, Groups and teams - Organisational culture and performance. Dynamics of Organization behaviour - leadership conflict situations and inter group behavior- Organisational Development - Factors effecting organization effectiveness. Creativity, leadership, motivation and organization development.

#### **UNIT- V**

Concepts in Instructional Technology, Scope of Instructional Technology. History of agricultural education in India. Guidelines for curriculum development in Agricultural Universities. Curriculum design development. Course outline, Lesson plans for theory and practicals. Teaching and learning styles. Theories of learning. Cognitive levels. Instructional Course Objective. Motivation of students. Instructional Methods. Experiential learning cycle. Innovative Instructional Aids. Computer Assisted Instruction. Programmed instruction technique. Team Teaching. E-Learning, Art of Effective Communication. Distance education. Student evaluation - Question Bank. Appraisal of Teacher Performance. Review of research in Instructional Technology. Introduction to organizations: Concept and Characteristics of organizations, Organizational Behaviour- Context and concept - levels of organizations - formal and informal organizations, Theories of organizations: Nature of organizational theory - classical theories - features of Bureaucracy - administrative theory and Scientific management - Neo-classical theories - the human relations movement - modern theory. Systems approach to study organization needs and motives - Attitude, values and ethical behaviour - alienation and work - work motivation - communication and interpersonal behaviour - organization communication - leadership behaviour -decision making, problem solving techniques - organizational climate - change proneness and resistance to change, Organizational change, Organizational structure - Process in organizing - Dimension of Motivation Climate. Departmentation - Span of Management - Delegation of authority - Centralization and decentralization- line and staff organization - functional organization - divisionalisation- Project organization- Matrix organization-free form organization - top management structure. Individual behaviour in organization. Fundamentals of Human relations and Organizational behaviour, Groups and teams - Organisational culture and performance. Dynamics of Organization behaviour - leadership conflict situations and inter group behavior- Organisational Development - Factors effecting organization effectiveness. Creativity, leadership, motivation and organization development.

## **HORTICULTURE OLERICULTURE (CODE- A 3):**

### **UNIT - I**

Introduction, botany and taxonomy, climatic and soil requirements, commercial varieties/ hybrids, sowing/ planting times and methods, seed rate and seed treatment, nutritional and irrigation requirements, intercultural operations, weed control, mulching, physiological disorders, harvesting, post-harvest management, plant protection measures and seed production of cool season vegetables: Potato, cabbage, cauliflower, knoll kohlrabi, sprouting broccoli, Brussels, sprout, Root crops: carrot, radish, turnip, beetroot, Bulb, onion, garlic, Peas, broad bean, green leafy vegetables.

### **UNIT – II**

Introduction, botany and taxonomy, climatic and soil requirements, commercial varieties/ hybrids, sowing/ planting times and methods, seed rate and seed treatment, nutritional and irrigation requirements, intercultural operations, weed control, mulching, physiological disorders, harvesting, post harvest management, plant protection measures, and economics of crop production and seed production of Warm Season Vegetables: Tomato, Eggplant, Hot and Sweet Peppers, Okra, Beans, Cowpea and Cluster Bean, Cucurbitaceous Crops, Tapioca and Sweet Potato, Green Leafy vegetables.

### **UNIT – III**

Classification of vegetables, Principles of breeding of vegetable crops; Heterosis, mutation breeding, polyploidy, male sterility system, self incompatibility: mechanisms favoring self and cross pollination; origin, botany, taxonomy, floral biology, cytogenetics, genetics, breeding objectives; Various breeding methods: introduction, selection, hybridization, mutation), varieties and varietal characterization, resistance breeding for biotic and abiotic stress, quality improvement, molecular marker, genomics, marker assisted breeding and QTLs, biotechnology and their use in breeding in vegetable crops-Issue of patenting, PPVFR Act for the crops viz. Potato, Tomato, Eggplant, Hot Pepper, Sweet Pepper, Okra, Peas & Beans, Amaranth, Chenopods, Lettuce, Gourds, Melons, Pumpkins & Squashes, Cabbage, Cauliflower, Carrot, Beetroot, Radish, Sweet Potato and Tapioca.

### **UNIT – IV**

Cellular structures and their functions; definition of growth and development, growth analysis and its importance in vegetable production; Physiology of dormancy and germination of vegetable seeds, tubers and bulbs; Role of auxins, gibberellins, cytokinins, ethylene and abscisic acid; Application of synthetic hormones, plant growth retardants and inhibitors for various purposes in vegetable crops; Role and mode of action of morphactins, antitranspirants, anti-auxin, ripening retardant and plant stimulants in vegetable crop production; Role of light, temperature and photoperiod on growth, development of underground parts, flowering and sex expression in vegetable crops; apical dominance; Physiology of fruit set, fruit development, fruit growth, flower and fruit drop; parthenocarpy in vegetable crops; phototropism, ethylene inhibitors, senescence and abscission; fruit ripening and physiological changes associated with ripening; Plant growth regulators in relation to vegetable production; morphogenesis and tissue culture techniques in vegetable crops.

### **UNIT – V**

Definition of seed and its quality, new seed policies; DUS test, scope of vegetable seed industry in India. Genetical and agronomical principles of seed production; methods of seed production; use of growth regulators and chemicals in vegetable seed production; floral biology, pollination, breeding behaviour, seed development and maturation; methods of hybrid seed production; Categories of seed; maintenance of nucleus, foundation and

certified seed; seed certification, seed standards; seed act and law enforcement, plant quarantine and quality control; Physiological maturity, seed harvesting, extraction, curing, drying, grading, seed processing, seed coating and pelleting, packaging (containers/ packets), storage and cryopreservation of seeds, synthetic seed technology; Agro-techniques for seed production in solanaceous vegetables, cucurbits, leguminous vegetables, cole crops, bulb crops, leafy vegetables, okra and vegetatively propagated vegetable crops.

## **HORT. POMOLOGY (CODE- A 4)**

### **UNIT – I**

Area, production and productivity, nutritional values, commercial varieties of regional, national and international importance, ecophysiological requirements, recent trends in propagation, rootstock influence, planting systems, cropping systems, root zone and canopy management, nutrient management, critical stages of water management, fertigation, role of bioregulators, abiotic factors limiting fruit production, physiology of flowering, pollination fruit set and development, honeybees in cross pollination, physiological disorders- causes and remedies, quality improvement by management practices; maturity indices, harvesting, grading, packing, storage and ripening techniques; industrial and export potential, Agri. Export Zones(AEZ) and industrial supports. Intellectual property rights, regulatory horticulture. Detection of genetic. Constitution of germplasm and maintenance of core group. Origin and distribution, taxonomical status - species and cultivars, cytogenetics, genetic resources, blossom biology, breeding systems, breeding objectives, ideotypes, approaches for crop improvement - introduction, selection, hybridization, mutation breeding, polyploidy breeding, rootstock breeding, improvement of quality traits, resistance breeding for biotic and abiotic stresses, biotechnological interventions, achievements and future thrust in the following selected fruit crops.

Mango, banana, citrus, papaya, guava, sapota, jackfruit, pineapple, annonas, avocado, aonla, pomegranate, phalsa, ber, apple, pear, quince, grapes, Plums, peach, apricot, cherries, hazelnut Litchi, loquat, persimmon, kiwifruit, strawberry, Nuts- walnut, almond, pistachio, pecan, Minor fruits- mangosteen, carambola, bael, wood apple, fig, jamun, rambutan, pomegranate, custard apple, carambola, and Plantation crops-coconut, arecanut, tea, coffee and cocoa.

### **UNIT – II**

Introduction, life cycles in plants, cellular basis for propagation, sexual propagation, apomixis, polyembryony, chimeras, Bud sport. Principles factors influencing seed germination of horticultural crops, dormancy, hormonal regulation of germination and seedling growth. Seed quality, treatment, packing, storage, certification, testing. Asexual propagation – rooting of soft and hard wood cutting under mist by growth regulators. Rooting of cuttings in hotbeds. Physiological, anatomical and biochemical aspects of root induction in cuttings. Layering – principle and methods. Budding and grafting – selection of elite mother plants, methods. Establishment of bud wood bank, stock, scion and inter stock, relationship –Graft Incompatibility. Rejuvenation through top working – Progeny orchard and scion bank. Micro-propagation – principles and concepts, commercial exploitation in horticultural crops. Techniques - *in vitro* clonal propagation, direct organogenesis, embryogenesis, micrografting, meristem culture. Hardening, packing and transport of micro-propagules. Physiological disorder of national importance.

### **UNIT – III**

Growth and development- definition, parameters of growth and development, growth dynamics, morphogenesis. Annual, semi-perennial and perennial horticultural crops, environmental impact on growth and development, effect of light, photosynthesis and photoperiodism, effect of temperature, heat units, thermoperiodism. Assimilate partitioning during growth and development, influence of water and mineral nutrition during growth and development, biosynthesis of auxins, gibberellins, cytokinins, abscisic acid, ethylene, brassinosteroids, growth inhibitors, morphactins, role of plant growth promoters and inhibitors.



Developmental physiology and biochemistry during dormancy, bud break, juvenility, vegetative to reproductive interphase, flowering, pollination, fertilization and fruit set, fruit drop, fruit growth, ripening and seed development. Growth and developmental process during stress - manipulation of growth and development, impact of pruning and training, chemical manipulations in horticultural crops, molecular and genetic approaches in plant growth development. Analytical technique in horticulture research.

## **PLANT BREEDING & GENETICS (CODE- A 5)**

### **UNIT I**

Cell- structure and its type; Mendel's laws; Chromosomal theory of inheritance.; Multiple alleles, Gene interactions, Sex determination, differentiation and sex-linkage, Sex-influenced and sex-limited traits; Linkage-detection, estimation; Recombination and genetic mapping in eukaryotes, Somatic cell genetics, Extra chromosomal inheritance; Population - Mendelian population – Random mating population -Frequencies of genes and genotypes Hardy-Weinberg equilibrium; Nature, structure and replication of the genetic material; Organization of DNA in chromosomes, Genetic code; Protein biosynthesis; Genetic fine structure analysis, Allelic complementation, Split genes, Transposable genetic elements, Overlapping genes, Pseudogenes, Oncogenes, Gene families and clusters; Regulation of gene activity in prokaryotes; Molecular mechanisms of mutation, repair and suppression; Bacterial plasmids, insertion (IS) and transposable (Tn) elements; Molecular chaperones and gene expression. Gene regulation in eukaryotes, RNA editing; Gene isolation, synthesis and cloning, genomic and cDNA libraries, PCR based cloning, positional cloning; Nucleic acid hybridization and immunochemical detection; DNA sequencing; DNA restriction and modification, Anti-sense RNA and ribozymes; Micro-RNAs (miRNAs); Genomics and proteomics; Functional and pharmacogenomics; Metagenomics; Methods of studying polymorphism at biochemical and DNA level; Transgenic bacteria and bioethics; Gene silencing; genetics of mitochondria and chloroplasts; Concepts of Eugenics, Epigenetics, Genetic disorders and Behavioural genetics; Architecture of chromosome in prokaryotes and eukaryotes; Artificial chromosome construction and its uses; Special types of chromosomes; Cell Cycle and cell division; synaptonemal complex and spindle apparatus, anaphase movement of chromosomes and crossing over and recombination models, cytological basis, Structural and numerical variation in chromosomal number and its Evolutionary significance, Introduction to techniques for karyotyping; Chromosome banding and painting - *in situ* hybridization and various applications; euploidy - haploids, diploids and polyploids ; Utilization of aneuploids in gene location, somatic segregation and chimeras – endomitosis and somatic reduction ; balanced lethals and chromosome complexes; Inter-varietal chromosome substitutions; Polyploidy and role of polyploids in crop breeding; Evolutionary advantages of autopolyploids vs allopolyploids — Role of aneuploids in basic and applied aspects of crop breeding, Alien addition and substitution lines; Apomixis - Evolutionary and genetic problems in crops with apomixes; Reversion of autopolyploids to diploids; Genome mapping in polyploids - Interspecific hybridization and allopolyploids; Synthesis of new crops (wheat, triticale and brassica) – Hybrids between species with same chromosome number, alien translocations - Hybrids between species with different chromosome number; Gene transfer using amphidiploids – Bridge species; Fertilization barriers in crop plants at pre-and post fertilization levels- *In vitro* techniques to overcome the fertilization barriers in crops; Chromosome manipulations in wide hybridization ; case studies – Production and use of haploids, dihaploids and doubled haploids in genetics and breeding.

### **UNIT II**

Ultrastructure of the cell; Differences between eukaryotic and prokaryotic cells, macromolecules; Structure and function of cell wall, nuclear membrane and plasma membrane; Cellular Organelles ;Bioenergetics; Ultrastructure and function; Chloroplast and other photosynthetic organelles; Interphase nucleus- Structure and chemical composition; Cell division and physiology of cell division; Historical background of molecular genetics; Genetic material in organisms; Structure and properties of nucleic acid, DNA transcription and its regulation, Genetic code, regulation of protein synthesis in prokaryotes and eukaryotes – ribosomes, t-RNAs and translational factors;

Transposable elements; Mechanisms of recombination in prokaryote; DNA organization in eukaryotic chromosomes – DNA content variation; Gene amplification and its significance; Proteomics and protein-protein interaction; Signal transduction; Genes in development; Cancer and cell aging; Biotechnology and its relevance in agriculture ;Tissue culture- History, callus, suspension cultures, cloning; Regeneration; Somatic embryogenesis; Anther culture; somatic hybridization techniques; Meristem, ovary and embryo culture; cryopreservation; Techniques of DNA isolation, quantification and analysis; Genotyping; Sequencing techniques; Vectors, vector preparation and cloning, Biochemical and Molecular markers, mapping populations ;Molecular mapping and tagging of agronomically important traits. Statistical tools in marker analysis, Robotics; Marker-assisted selection for qualitative and quantitative traits; QTLs analysis in crop plants, Gene Pyramiding; Genomics and genoinformatics for crop improvement; Marker-assisted backcross breeding for rapid introgression, Generation of EDVs; Recombinant DNA technology, transgenes, method of transformation, selectable markers and clean transformation techniques, physical methods of gene transfer. Production of transgenic plants in various field crops & commercial release; Biotechnology applications in male sterility/hybrid breeding, molecular farming; MOs and related issues; GMO; International regulations, biosafety issues of GMOs; Intellectual property rights; Nanotechnology and its applications in crop improvement programmes.

### **UNIT III**

History of Plant Breeding (Pre and post-Mendelian era); Objectives of plant breeding, characteristics improved by plant breeding; Centres of Origin-biodiversity and its significance; Genetic basis of breeding self- and cross - pollinated crops including mating systems and response to selection, Plant introduction and role of plant genetic resources in plant breeding; Self-incompatibility and male sterility in crop plants and their commercial exploitation; Pure line theory, pure line selection and mass selection methods; pedigree, bulk, backcross, single seed descent and multiline method; Population breeding in self-pollinated crops (diallel selective mating approach);Breeding methods in cross pollinated crops; progeny selection schemes, recurrent selection schemes for intra and interpopulation improvement and development of synthetics and composites; Hybrid breeding - genetical and physiological basis of heterosis and inbreeding, production of inbreds, breeding approaches for improvement of inbreds, predicting hybrid performance; seed production of hybrid and their parent varieties/inbred; Breeding methods in asexually/clonally propagated crops; Concept of plant ideotype and its role in crop improvement; Transgressive breeding; Mutation breeding its nature and its classification; Breeding for abiotic and biotic stresses; Cultivar development- testing, release and notification, maintenance breeding, Participatory Plant Breeding, Plant breeders' rights and regulations for plant variety protection and farmers rights; Mendelian traits vs polygenic traits - its inheritance - Multiple factor hypothesis; Variations associated with polygenic traits; Nature of gene action; Principles of Analysis of Variance (ANOVA) - Expected variance components, random and fixed models; MANOVA, biplot analysis; Designs for plant breeding experiments – principles and applications; Genetic diversity analysis –Association analysis; Path analysis and Parent - progeny regression analysis; Discriminant function and principal component analyses; Selection indices - selection of parents; Simultaneous selection models- concepts of selection - heritability and genetic advance; Generation mean analysis; Mating designs- Diallel, partial diallel, line x tester analysis, NCDs and TTC; Concepts of combining ability and gene action; Analysis of genotype x environment interaction; Models for GxE analysis and stability parameters; AMMI analysis – principles and interpretation; QTL mapping in Genetic analysis; Marker assisted selection (MAS) in Plant breeding and factors influencing MAS.

### **SOIL SCIENCE AND AGRICULTURAL CHEMISTRY (CODE- A 6)**

#### **UNIT – I**

Soil as a three phase system. Soil texture, textural classes, mechanical analysis, specific surface. Soil consistence; dispersion and workability of soils; Soil structure - genesis, types and management soil structure; soil aggregation,

and stability; soil tilth, characteristics of good soil tilth; Soil water: potential, soil water retention, soil-water constants, measurement of soil water content, energy state of soil water, soil water potential, soil-moisture characteristic curve; hysteresis, measurement of soil-moisture potential.

Water flow in saturated and unsaturated soils, Poiseuille's law, Darcy's law; hydraulic conductivity, permeability; measurement of hydraulic conductivity in saturated and unsaturated soils. Infiltration; internal drainage and redistribution; evaporation; hydrologic cycle, field water balance; soil-plant-atmosphere continuum. Composition of soil air; renewal of soil air - convective flow and diffusion; measurement of soil aeration; aeration requirement for plant growth; soil air management. Energy balance; thermal properties of soil; measurement of soil temperature. Soil Consistency, Atterbergs' limits and its practical significance, Plasticity ; Soil crusting : types, measurement and management. Soil erosion: Wind and water erosion, factors, types . Soil conservation measures Watershed : concepts and its implication in modern context Water Use Efficiency: Concept

## **UNIT – II**

Soil fertility and soil productivity; nutrient sources – fertilizers and manures; essential plant nutrients - functions and deficiency symptoms. Nutrient interactions and plant growth. Soil and fertilizer nitrogen – sources, forms, immobilization and mineralization, nitrification, denitrification; biological nitrogen fixation - types, mechanism, microorganisms and factors affecting; nitrogenous fertilizers and their fate in soils; fertilizer use efficiency. Soil and fertilizer phosphorus - forms, immobilization, mineralization, reactions in acid and alkali soils; factors affecting phosphorus availability in soils; phosphatic fertilizers - behavior in soils and management under field conditions. Potassium - forms, equilibrium in soils and its agricultural significance; potassium fixation; management of potassium fertilizers under field conditions. Sulphur - source, forms, fertilizers and their behavior in soils; calcium and magnesium– factors affecting their availability in soils; management of sulphur, calcium and magnesium fertilizers. Micronutrients – critical limits in soils and plants; factors affecting their availability and correction of their deficiencies in plants; role of chelates in nutrient availability. Common soil test methods for fertilizer recommendations; quantity– intensity relationships; soil test crop response correlations and response functions. Fertilizer use efficiency; blanket fertilizer recommendations – usefulness and limitations; site-specific nutrient management; integrated nutrient management. Soil fertility evaluation - biological methods, soil, plant and tissue tests; soil quality in relation to sustainable agriculture.

Fertilizer control order (FCO), Specifications, Methods of fertilizers and manures analysis, Fertilizer dose calculation.

## **UNIT – III**

Composition of the earth's crust and soils. Elements of equilibrium thermodynamics, chemical equilibria, electrochemistry and chemical kinetics. Soil colloids: inorganic and organic colloids - origin of charge, concept of point of zero-charge (PZC) and its dependence on variable-charge surface charge characteristics of soils; diffuse double layer theories of soil colloids, zeta potential, sorption properties of soil colloids; soil organic matter - fractionation of soil organic matter, clay-organic interactions. Ion exchange processes in soil; cation exchange-theories based on law of mass action, adsorption isotherms, donnan-membrane equilibrium concept, clay-membrane electrodes and ionic activity measurement, Schofield's ratio law and its implication in plant nutrition ; Suspension effect. Thermodynamics, statistical mechanics; anion and ligand exchange, fixation of oxyanions, hysteresis in sorption-desorption of oxy-anions and anions, shift of PZC on ligand exchange, AEC, CEC; Potassium, phosphate and ammonium fixation in soils covering specific and non-specific sorption; Problem soils (Acid Soils, Acid sulphate soils, Saline soils, Saline alkali SOils, Alkali soils etc), their characteristics and their management strategies. Chemistry of acid soils; active and potential acidity; lime potential, salt-affected soils and amendments; soil pH, E<sub>Ce</sub>, ESP, SAR and important relations; soil management and amendments, submerged soils. Quality of irrigation water, different parameters and its measurement. D value and its practical implication.

## UNIT – IV

Crystallography, space lattice, coordination theory, structure, chemical composition and properties of clay minerals; genesis and transformation of crystalline and non-crystalline clay minerals. Rocks and minerals : origin, Classification and its implication in soil genesis. Factors of soil formation, soil forming processes; weathering of rocks and mineral; soil profile; weathering sequences of minerals. Concept of soil individual; soil classification systems - soil survey and its types; soil survey techniques - conventional and modern; soil series – characterization and procedure for establishing soil series; benchmark soils and soil correlations; soil survey interpretations; soil mapping, thematic soil maps. Landform – soil relationship; major soil groups of India with special reference to respective states; land capability classification and land irrigability classification; land evaluation and land use type (LUT) – concept and application.

## UNIT – V

Soil microbial ecology, types of organisms in different soils; biochemistry of root-soil interface; soil enzymes, origin, activities and importance; soil characteristics influencing growth and activity of microflora. Microbial transformations of nitrogen, phosphorus, sulphur, iron and manganese in soil; biochemical composition and biodegradation of soil organic matter and crop residues, humus formation; cycles of important organic nutrients. Biodegradation of pesticides, organic wastes and their use for production of biogas and manures; biotic factors in soil development; microbial toxins in the soil. Preparation and preservation of farmyard manure, animal manures, rural and urban composts and vermicompost. Biofertilizers – definition, classification, specifications, method of production and role in crop production. Concept of Soil Quality and Soil health. Soil Quality assessment techniques. Biological degradation of soils and its implication in crop production

## UNIT – VI

Soil, water and air pollution problems. Nature and sources of pollutants – agricultural, industrial, urban wastes, fertilizers and pesticides, acid rains, oil spills etc. Sewage and industrial effluents – their composition and effect on soil properties/health, and plant growth and human beings; soil as a sink for waste disposal. Pesticides – their classification, behavior in soil and effect on soil microorganisms. Toxic elements – their sources, behavior in soils, effect on nutrients availability, effect on plant and human health. Pollution of water resources due to leaching of nutrients and pesticides from soil; emission of greenhouse gases – carbon dioxide, methane and nitrous oxide. Carbon sequestration-Concepts, approaches and potential Remediation/amelioration of contaminated soil and water; remote sensing applications in monitoring and management of soil and water pollution. Soil degradation: types, Physical, Chemical and Biological, factors of degradation, management option.

## ANIMAL GENETICS & BREEDING [CODE –V 1]

**Unit 1 : Overview of Genetics** History and development of genetics. Classic researches and pioneer scientists in genetics. Mendelism and its deviations. Chromosomes and heredity. Sex in relation to chromosomes and genes. Linkage and crossing over. Artificial transmutation of genes. Penetrance and expressivity. Multiple factor inheritance. Gene modifiers. Non-chromosomal genes and their inheritance, Chromosomal aberrations. Mosaicism and chimerism.

**Unit 2 : Advanced Genetics** Fine structure of chromosomes and chromosomal banding. Gene and mechanism of gene action. DNA replication. Central dogma. Protein synthesis. Genetic code and DNA cloning. Recombinant DNA technology. PCR. Gene banks. Split gene. Genetic control of hormone coordination, metabolism and metabolic diseases. Use of biotechnological tools in improving animal productivity. Application of immunogenetics. Biochemical polymorphism. Chromosomal studies in livestock improvement programmes.

Development of clones in relation to animal productivity and maintaining biodiversity. Production of transgenic animals. Gene mixing for useful functions.

**Unit 3 : Overview of Breeding** Brief history of domestication of livestock. Important breeds of livestock & poultry with special reference to economic characters. Evolution of genetic systems. Isolating mechanisms and origin of species / sub-species, their adaptation. Mating systems for different livestock and poultry. Genetic and phenotypic consequences and applications of inbreeding and out-breeding. Genetic basis of heterosis and its use. Diallele and polyallele crossing. Reciprocal and reciprocal-recurrent-selection. Combining ability. Developments in population and production of livestock and poultry in India. Status of Animal Genetic Resources in India.

**Unit 4 : Genetic Properties of Population** Population Vs individual. Inheritance and continuity of population. Effective population size. Biodiversity. Description of animal population. Value and means; Average effect of gene and gene substitution. Components of total phenotypic variance of a population. Resemblances between relatives. Concept of heritability, repeatability; & phenotypic, genetic and environmental correlations. Methods of estimation, uses, possible biases and precision of estimates.

**Unit 5 : Population Genetics** Gene and genotypic frequencies and factors affecting them. Hardy Weinberg Law and consequences of it. Prediction of selection response by different methods. Selection for threshold characters. Indirect selection and correlated response. Theoretical basis of change of population mean and variance on inbreeding and cross breeding. Genotype – environment interaction. Metric characters under natural selection. Quantitative trait loci and their applications. Marker-assisted selection.

**Unit 6 : Genetic Strategies** Purpose-wise breeding strategies for livestock and poultry under different agro-climatic zones of India. Evaluation of past genetic improvement programmes for livestock and poultry in India. Bottlenecks in implementation of livestock breeding programmes in India. Evaluation and characterization of various indigenous breeds of livestock and poultry. *Ex-situ* and *In-situ* conservation of animal and poultry genetic resources. Development of new breeds / strains for better productivity in animals. Open nucleus breeding system in livestock improvement in India. Bio-technology and its role in improving animals and poultry production. Role of artificial insemination / frozen semen / embryo transfer / ONBS / MOET technology in animal breeding.

Formulation of breeding programmes : Purpose-wise, breed-wise, region-wise for different species of livestock and poultry. Programmes for genetic improvement of non-descript livestock population of different species. Evaluation and current recommendations of cross breeding programmes of cattle, sheep and goat in India.

**Unit 7 : Selection & Selection Experiments** Basis and methods of selection. Construction of selection indices. Different methods of sire evaluation. Selection differential and intensity of selection. Prediction of response. Improvement of response. Effect of selection on variance. Realised heritability. Long-term and short-term objectives of selections. Selection experiments in livestock and poultry. Role of control population in selection experiments. Selection for disease resistance and development of general and specific disease resistant strains / breeds. Purpose based selection and breeding of domestic animals and poultry. Genetic-slippage. Estimation of genetic divergence and its implications in livestock improvement programmes. Selection for better feed conversion efficiency in meat animals and poultry.

**Unit 8 : Genetic Laboratory Techniques** Culturing *Drosophila* stock. Study of *Drosophila* with markers. Gene sequencing. Blood group typing. Karyotyping and chromosomal mapping. Concept of recombinant DNA techniques cloning and gene mapping. Nucleic acid hybridization. Development of breed descriptors at molecular level for different livestock and poultry breeds. Biochemical polymorphism analyses – blood groups, transferrins, milk proteins. Collection and storage of samples for DNA fingerprinting; isolation and quantification of DNA from blood and semen; Restricted enzyme digestion of genome DNA, Analysis and transfer of DNA from agarose

electrophoresis; Nucleic acid hybridization; Analysis of DNA fingerprinting, PCR-RFLP assay. Cryogenic preservation of animal germplasm.

**Unit 9 : Research Techniques for Quantitative Animal Genetics** Use of computers in handling animal breeding data. Estimation of variances and covariances. Development of statistical models for analyses of breed data and to quantify environmental variance. Estimation of inbreeding and relationship. Estimation of inbreeding rate in a closed herd / flock. Estimation and interpretation of genetic and phenotypic parameters. Development of efficient selection programmes and procedures. Estimation of genetic gains. Designing and evaluation of breeding strategies like reciprocal recurrent selection, diallele and polyallele crossing. Designing field based progeny testing programmes. Development of efficient methods and traits for genetic evaluation of males under indigenous conditions. Data bank concept.

**Unit 10 : Laboratory Animal Breeding** Laboratory animal species *viz* mice, rat, guinea pig, rabbit, dog and monkey – Their chromosome numbers – genome size – major genes. Physiological, nutritional, reproduction parameters, maintenance protocol – pedigree recording, planned mating. Selection and Mating methods /systems- monogamous, polygamous and others. Genetic control and monitoring-Record keeping-Ethics and legislation for management and use of laboratory animals. Nomenclature for different strains, inbred lines (SPF line, Knockout mice, etc.) – Animal model for human disease. Specific utility of different laboratory species for different requirements.

## **ANIMAL NUTRITION (CODE- V 2)**

**Unit 1: Energy and Proteins** Nutritional significance of carbohydrates, lipids and proteins. Cell-wall fractionation. Available energy from organic nutrients. Partitioning of dietary energy. Basal metabolic rate. Energy retention. Factors affecting energy utilization. Direct and indirect calorimetry. Dietary lipids - their digestion, absorption and metabolism. Essential fatty acids. Effect of dietary fat on milk and body composition. Proteins - digestion, absorption and utilization. Comparative efficiency of amino acids as energy source. Essential and critical amino acids. Protein evaluation. Metabolizable protein concept. Protein energy inter-relationship. Energetic of protein utilization for maintenance and different productive functions.

**Unit 2: Minerals, Vitamins and Feed Additives** Minerals: Classification of minerals, Physiological functions, Deficiency symptoms and toxicity - Inter-relationships - Synergism and antagonism - Requirements - Different sources and bio-availability - Role of chelated minerals. Vitamins: Physiological functions and co-enzyme role - Deficiency symptoms, hyper-vitaminosis. Requirements, Sources and vitamin analogues - Antivitamins – Feed Additives: Nutritional role. Prebiotics - Probiotics, phytochemicals other metabolic modifiers. Role of phytochemicals as growth promoters.

**Unit 3: Rumen Eco-system and Functions** Rumen and its environment. Development of functional rumen. Digestion kinetics in reticulo-rumen. Role of rumen microbes, Significance of rumen fungi- Defaunation and transfaunation. Microbial fermentation in rumen. VFA production, inter-conversion and utilization. Dietary protein breakdown. Microbial protein synthesis. NPN compounds and their utilization. Ammonia toxicity - Role of slow release urea compounds. Manipulation of rumen fermentation. Bio-hydrogenation and utilization of dietary lipids. Methanogenesis and methane inhibitors.

**Unit 4: Non-ruminant Nutrition** Comparative gastrointestinal physiology of monogastrics – digestion and metabolism of organic nutrients in poultry and swine. Significance of minerals and vitamins in mono-gastrics. Inter relationship in nutrient sparing activity. Feeding systems. Role of feed additives - Factors affecting nutritional quality and performance. Special nutritional needs of rabbits, horses and companion animals.

**Unit 5: Nutrient Requirements** Energy protein requirements for maintenance and productivity in ruminants and non-ruminants. Colostrum feeding of calf, mineral and vitamin requirements. Dry matter intake in relation to

productivity. DM: water intake ratio. Palatability. Nutritional intake and energy density. Feeding standards - NRC, ARC, Kears and Indian. Nutrient requirements under temperate and tropical environment. Feeding strategies during stress and natural calamities - Ration formulation - least cost rations.

**Unit 6: Forage Conservation and Evaluation** Natural and cultivated forages-Their composition and nutritive values. Nutritive value Index. Forage quality evaluation in range animals -Role of indicator methods-Advances in silage and haymaking- Factors affecting quality of conserved forages- Quality criteria and grading of silage and hay under tropics-artificial drying of forages.

**Unit 7: Feed Processing and Technology** Methods of feed processing - physical, chemical and biological effect of processing on nutritional quality and utilization. Pelleted and extruded feeds. Quality control of raw feedstuffs and finished feeds: Significance of BIS (standards). Handling and storage of raw and finished feeds. Methods to improve shelf life of fat rich feeds, By-products of newly introduced commercial crops including residues of genetically modified feeds. Alternative feed resources. Current approaches in enriching tropical feed resources - concept of total mixed ration and advances in complete diet formulation.

**Unit 8: Anti-metabolites and Toxic Principles** Naturally occurring anti-nutritional factors and common toxins in feeds and forages. Methods of detoxification. Health hazards due to residual pesticides in feeds and forages - Environmental pollutants.

**Unit 9: Elements of Research Methodology** Principles of animal experimentation - Experimental designs in nutritional research. Modern methods of feed evaluation – *In vitro*, gas production and nylon bag techniques, Rumen simulation techniques - RUSITEC Tracer techniques in nutrition research - Role of NIR Spectroscopy - Feed microscopy in quality evaluation of feedstuffs.

#### **Unit 10: Clinical Nutrition**

Role of nutrition to control digestive and metabolic disorders (milk fever, ketosis, ruminal acidosis-laminitis, bloat), metabolic profile tests. Role of nutrition in immunity, nutrition and reproduction, nutrients as antioxidants. Role of nutrition in management of GI parasites

### **ANIMAL REPRODUCTION, GYNECOLOGY & OBSTETRICS (CODE- V 3)**

**Unit 1: Veterinary Gynaecology** Biology of sex. Development of female genitalia. Functional anatomy of female reproductive system of farm animals. Growth, puberty and sexual maturity. Reproductive cycles (oestrous cycle) in female farm animals. Oogenesis and folliculogenesis. Follicular dynamics and ovulation. Transport and survival of gametes, fertilization, cleavage, implantation and maternal recognition of pregnancy. Sex determination and differentiation, Development of foetus and foetal membranes. Period of embryo and period of fetus, Teratology of fetus, Placenta- classification and functions. Gestation and pregnancy diagnosis in farm animals.

**Unit 2 : Reproductive Endocrinology** Reproductive hormones, classification, synthesis, chemical composition and mechanism of action. Hypothalamus, pituitary, thyroid, gonadotropic, gonadal, placental and pineal gland hormones. Prostaglandins, pheromones, growth factors and hormone antagonists and their significance in animal reproduction. Hormonal assays. Hormonal regulation of male and female reproduction. Clinical uses of hormones.

**Unit 3 : Accidents during Gestation** Pregnancy, Pseudocyesis, Ectopic pregnancy, Abnormalities of fertilization and foetal development, Superfecundation and superfetation. Abortion – bacterial, viral, mycotic, protozoal, physical, toxic and miscellaneous causes, diagnosis and prevention, Dropsy of foetal membrane and foetus, Maceration, mummification, Pyometra, Antepartum vagino-cervical prolapse, Uterine torsion and displacement of uterus. Retained fetal membranes.

**Unit 4 : Veterinary Obstetrics** Pelvis and pelvimetry. Parturition – Signs approaching parturition, initiation and stages of parturition, induction of parturition and postpartum period. Presentation, position and posture. Causes and forms of dystocia and its treatment. Epidural anaesthesia. Obstetrical maneuvers including fetotomy and Caesarean section. Post-partum complications in domestic animals, retention of placenta, uterine prolapse, endometritis, metritis, septic metritis. Post parturient metabolic disorders.

**Unit 5 : Andrology**

Comparative anatomy of male reproductive system. Thermoregulation of testis and blood testis barrier, Growth, puberty and sexual maturity. Spermatogenesis including cycle of somniferous epithelium and spermatogenic wave. Sperm morphology and ultra-structure of spermatozoa, sperm transport, maturation and storage in male genital tract, Secretions of male reproductive tract including accessory glands and their role in reproduction, Sexual/mating behaviour. Training of young bulls for semen collection, Semen and its composition, biochemistry of semen and sperm metabolism, sperm abnormalities and its classification, sperm separation and spermatozoa karyotyping. Breeding soundness evaluation of bulls, testicular cytogram, routine semen analysis, advances in semen analysis techniques including fluorescent dyes.

**Unit 6 : Male Infertility** Fertility, infertility and sterility in male domestic animals. Causes and forms of male infertility. Testicular hypoplasia, cryptorchid, testicular degeneration, orchitis, affections of epididymis, vas deference, penis, prepuce and accessory glands & their management, tumors of the male reproductive tract, nutritional infertility, Vices in the males. Libido problem and its management, fertility markers.

Evaluation of male for breeding soundness, reproductive health status. Effect of parental drugs and vaccines on semen quality.

**Unit 7 : Frozen Semen Technology and Artificial Insemination** History and development of artificial insemination. Advantages and disadvantages of AI and frozen semen, selection of bulls for AI purpose. Management of breeding bulls, methods of semen collection in different domestic animals, semen evaluation including latest techniques for evaluation of motility and fertilization. Ideal extenders, extenders for liquid semen. Preservation of semen at various temperatures. Processing and preservation of liquid semen. Extenders for frozen semen, principles and techniques of semen freezing. Cold shock and ultra-low temperature shock. Cryoprotectants. Semen additives. Evaluation of frozen semen. Transport and storage semen. Handling of frozen semen, Liquid nitrogen and its containers. Insemination techniques. Estrus and estrus detection tools, Planning and organization of semen bank.

**Unit 8 : Reproductive Technology** Synchronization of oestrous cycle in domestic animals, control of ovulation. Embryo transfer technology – History, advantages and disadvantages, superovulation, collection, evaluation, preservation and transfer of oocytes / embryos. History of *in vitro* maturation and fertilization. Recovery of oocytes *in vitro* and *in vivo*, maturation, fertilization, culture, evaluation, preservation and transfer of oocytes / embryos. Micromanipulation of embryos. Embryo splitting and cloning. Stem cells and production of transgenic animals. Sex determination and gene insertion. Establishment of laboratory for ETT, IVM, IVF and IVC. Use of Ultrasonography, laparoscopy and ovum-pick technology in farm animals.

**Unit 9 : Infertility in Cows and Buffaloes** Fertility, infertility and sterility. Fertility indices, Evaluation of herd fertility. Incidence and economic role of infertility, forms of infertility, congenital and hereditary defects, infectious diseases. Pathological conditions of ovary, oviduct, uterus, cervix and vulva. Management causes of infertility. Hormonal causes of infertility, anestrus, repeat breeding, cystic ovarian degeneration, sexual health control and reproductive health programmes. Breeding soundness examination of cows and buffaloes.



**Unit 10 : Reproduction and Infertility in Ovine/Caprine** Puberty, sexual maturity, breeding season, oestrous cycle, Breeding and conception, gestation, parturition, peri-parturient and obstetrical complications. Synchronization of oestrous cycle. Embryo transfer. Causes of infertility and their management.

**Unit 11 : Reproduction and Infertility in Swine** Oestrous cycle, synchronization of oestrous cycle, Hormonal control of reproduction. Various forms of infertility in swine and their management. Various obstetrical problems and their management.

**Unit 12 : Equine Reproduction** Physiology and pathology of equine reproduction. Research techniques and methodology for the study of equine reproduction. Equine andrology. Reproductive behaviour and management of stallion. Semen collection, examination and artificial insemination. Pregnant mare behaviour . Application of modern reproductive techniques in equine reproduction. Equine infertility.

### **Unit 13 : Canine and Feline Reproduction**

Functional anatomy of dog and cat reproductive system, oestrous cycle and endocrinology of oestrous cycle and detection of optimum breeding time. Exfoliative vaginal cytology. Methods of pregnancy diagnosis, contraception. Medical termination of pregnancy. Infertility in bitches, disorders of oestrous cycle, pseudopregnancy, pyometra, cystic endometrial hyperplasia, tumors of reproductive tract. Difficult whelping – types and methods of handling dystocia. Caesarean section. Ovarian hysterectomy. Peri-parturient complications. Semen collection, evaluation, techniques of artificial insemination, infertility in male including testicular tumors – cryptorchid, affections of prostate.

## **LIVESTOCK PRODUCTION MANAGEMENT (CODE- V 4)**

**Unit 1: General** Present status and future prospects of livestock and poultry development in India. Animal production systems in different agro-climatic zones of the country. Sustainability issue in relation to environment. Livestock farming systems. Effect of mechanization of agriculture on livestock sector. Breeds of cattle, buffalo, sheep, goat, pigs, equine, camels, rabbits and poultry. Various livestock and poultry development programmes & their impact on productivity & health. Livestock behaviour vis-à-vis adaptation and production. Behaviour & welfare. Systems of behaviour. Sexual behaviour in various species of livestock and poultry. Social order in farm animals. Behavioural aberrations – causes and control. Adaptation of livestock and poultry in tropics, deserts cold and high altitudes. Biosecurity and environmental considerations. Emerging challenges for livestock production in relation to the climate change scenario. Biotechnology in animal improvement.

**Unit 2: Breeding Management** Basic principles of inheritance. Concept of heritability, repeatability and selection. Important methods of selection and systems of breeding in farm animals and birds. Importance of maintaining breeding records and their scientific interpretation.

**Unit 3: Feeding Management** Nutrients and their functions. Nutritional requirements and feeding managements of different categories of livestock and poultry. Feed additives including antibiotic and probiotic feeding in farm animals and birds. Formulation and compounding of rations for various categories of livestock and poultry. Least cost ration formulation. Systems of feeding livestock and birds. Feeding standards for livestock and poultry. Feed conversion efficiency of various categories of livestock and poultry. Processing and storage of conventional and non-conventional feed ingredients. Agro-industrial by-products in animal feeds.

**Unit 4: Reproduction Management** Reproductive systems of farm animals and birds. Climate and nutrition affecting reproductive performance in farm animals. Importance of early pregnancy diagnosis. Methods of heat detection. Artificial insemination. Oestrous prediction and synchronization. Causes of disturbed fertility and its prevention in farm animals. Management factors affecting reproductive efficiency. Summer and winter management problems and their solutions.

**Unit 5: Shelter Management** Housing systems, Selection of site and lay out of animal and poultry houses. Space requirement for livestock and poultry, Housing designs in different agro-climatic regions. Macro and micro-climatic changes affecting designs of animal and poultry houses. BIS (standards) for livestock and poultry housing. Construction of cheap animal and poultry housing utilizing local resources. Automation in livestock farming. Types & designs of Milking parlours suitable for different scales of production. Disposal of animal wastes under urban and rural conditions. Disposal of carcasses.

#### **Unit 6: Health Management**

General approach to livestock health programmes. Prevention of diseases. Hygiene and sanitation on animal farm. Symptoms of ill health, important infectious diseases of livestock and poultry and their control. Vaccination schedules in animals and poultry. Internal and external parasites and their control. Accidental health disorders and their control. Common disinfectants used on animal farms. Concept of first aid at farms. Segregation and quarantine management for large animals and birds. Quarantine Act, Zoonotic diseases, labour health programme.

**Unit 7: Production and Management of Cattle and Buffalo** Cattle and buffalo production trends and factors affecting them. Prenatal and postnatal care and management of cattle and buffalo. Care of neonates and young calves. Management strategies for reducing mortality in calves, age at first calving, and calving intervals. Management to improve reproductive efficiency in cattle and buffalo. Management strategies against summer & winter stress. Feed conversion efficiency for growth and milk production. Application of body condition scoring & other scoring techniques to improve productivity & efficiency of dairy animals. Milking management: hand vs machine milking practices. Standard milking protocols for clean milk production. Management practices for high yielding cows & buffaloes. Standard norms for manpower deployment for dairy farms & measures for improving labour efficiency. Dairy farm management efficiency measures. Mechanization & automation of various dairy farm operations (milking, feeding, waste disposal, heat detection, identification & health monitoring).

**Unit 8: Production and Management of Other Animals** **Draft animals:** Population dynamics of various categories of draft and work animals in India. Characteristics of draft animals. Estimating draft capacity of different species. Harness for various types of draft animals. Training of work animals. Feeding, care and management of draft animals. Management of camel with special reference to rearing, feeding and watering. Behavioural studies of various draft animals. Economics of draft animals *vis-à-vis* machine power. **Sheep and goat:** Selection of breeds and breeding systems for improving wool, mohair, meat and milk. Feeding practices for economic rearing. Scope of intensive milk and meat production from goat. Mutton and wool production from sheep. Low cost shelter management. Sheep and goat reproduction. Health management. **Poultry:** Brooding of chicks. Management of growing, laying and breeding flocks. Shelter management. Cage layer management and well-being of birds. Light management. Hatchery business management. Management during stress. Chick sexing. Maintenance of farm records. Health and sanitation problems. Prevention and disease control. Poultry shows. Handling care of table eggs and processing of birds for meat. **Equine:** Care and management of horses, feeding and breeding systems, shelter management, shoeing, preparation and management of race horses. **Swine:** Importance of pig as a meat animal. Selection of breeds and breeding systems for improving pig production. Feeding strategies for pigs. Care and Management of pregnant sows and unweaned piglets. Reproduction problems in pigs and remedial measures. **Rabbit:** Economic importance. Important fur and meat type breeds. Housing, handling, feeding, watering, breeding, management, sanitation and health care of rabbits.

**Unit 9: Wildlife Management** Status of wildlife in India and its conservation. Biological and ecological basis of management of wildlife. Breeding and feeding of wildlife in captivity. Principles & practices health management of wild animals.

**Unit 10: Forage Production and Conservation** Classification of feeds and forages. Feed and fodder resources used for feeding of livestock and poultry. Nutritive value of feeds and fodders. Conservation and preservation of feeds and fodders. Annual and perennial fodder crops. Strategies for round the year fodder production. Pasture development and management. Enrichment of poor quality roughages.

**Unit 11: Economics and Marketing of Livestock and Poultry and their Products** Economic principles as applied to livestock production. Production functions. Farm size, resources and product combinations. Cost concepts. Criteria for use of resources in livestock production. Maintenance of evaluation of different production records. Insurance and financing of livestock enterprises. Project formulation for setting up livestock farms. Different approaches to marketing of livestock and its products. Present status of cattle fairs and methods of selling livestock. Market news and information. Estimation of cost of different livestock products (milk, meat, egg & wool). Determination of prices of livestock products.

## **VETERINARY PARASITOLOGY (CODE- V 5)**

**Unit 1: Veterinary Helminthology** Introduction to veterinary helminthology, general account of morphology, classification, life-cycle patterns, epizootiology, pathogenesis, symptoms, diagnosis; treatment and control of parasites belonging to the various families.

### **Unit 2: Veterinary Entomology**

Introduction to veterinary entomology, classification, distributions, morphology, life-cycle, seasonal patterns and economic significance of insects and acarines belonging to the various families. Treatment, control and integrated arthropod pest management. Current advances in immunological interventions/ Control of arthropods.

**Unit 3: Veterinary Protozoology** Introduction to veterinary protozoology, classification, morphology, life-cycle, clinical symptoms, pathogenesis, diagnosis, chemotherapy, prophylaxis and control of parasites belonging to the various families.

**Unit 4: Clinical Parasitology** Clinical and parasitological signs of parasitic infections in domestic animals, Parasitic diseases of skin, eyes, alimentary, respiratory, urinary, genital, nervous, cardio-vascular and haematopoietic systems. Keys to identification and different diagnosis of helminthic eggs, nematode larvae, gravid proglottids of major tape worms, blood protozoans and apicomplexan group of parasites.

**Unit 5: Parasitic Zoonoses** Introduction and importance of parasitic zoonoses, classification of parasitic zoonoses, geo-veterinary and epidemiological aspects including factors influencing prevalence, distribution and transmission of diseases. Role of reservoir hosts, natural habitat, wildlife and their public health significance, clinical features, pathology, diagnosis, treatment, control and prophylaxis of zoonotic parasitic infections.

### **Unit 6: Management of Livestock Parasitism**

Factors affecting epidemiology, host environment, development and survival of infective stages, microhabitat, seasonal development (hypobiosis/diapause), dietary and host factors altering susceptibility, concurrent infections. Influence of genetic factors, general approaches to control of parasitic diseases – stock management practises, stock rates, rotational grazing, clean grazing. Parasite worm burden (EPG). Strategic and tactical control strategies involved in chemical control of helminth, protozoan and arthropod infestations. Broad and narrow-spectrum anthelmintics, antiprotozoal drugs, insecticides and acaricides. Newer drug delivery systems-slow and pulse release methods. Anthelmintic failure – drug resistance monitoring and management. Prospects of alternative methods of control, breeding for host resistance against parasites. Control of vectors and intermediate hosts and sustainable management. Estimation of economical losses due to parasitic diseases.

**Unit 7: Immunoparasitology** General principles of parasitic immunity and immune responses to helminths, protozoa, arthropods – The adaptive immune responses, evasion of immunity, classical antiparasite responses – concomitant immunity, premunition, spring-rise, self-cure, VLM, CLM, parasitic granuloma, nodule formation, Parasitic antigens relevant to immunity and diagnosis, their identification and purification-general protocols, immunomodulators and their use in immunopotential. Demonstration and characterisation. Development of live, attenuated, killed and new generation vaccines.

**Unit 8: Diagnostic Parasitology** Laboratory diagnostic procedures for parasite identification and detection, coprodetention techniques, floatation/concentration, methods, direct microscopy, parasitic staining and special techniques used in parasite identification. Culture and identification of nematode larvae, cercaria, identification of metacestodes and animal infestation, methods for parasite isolation. Diagnostic procedures for manage and bot infestations. General immunodiagnostic assays (ELISA, IFAT, Dot-ELISA, EITB). Principles of validation of diagnostic assays, and OIE recommendations for diagnosis and knowledge of referral laboratory of O.I.E. and molecular techniques used in parasite epidemiology and diagnosis.

