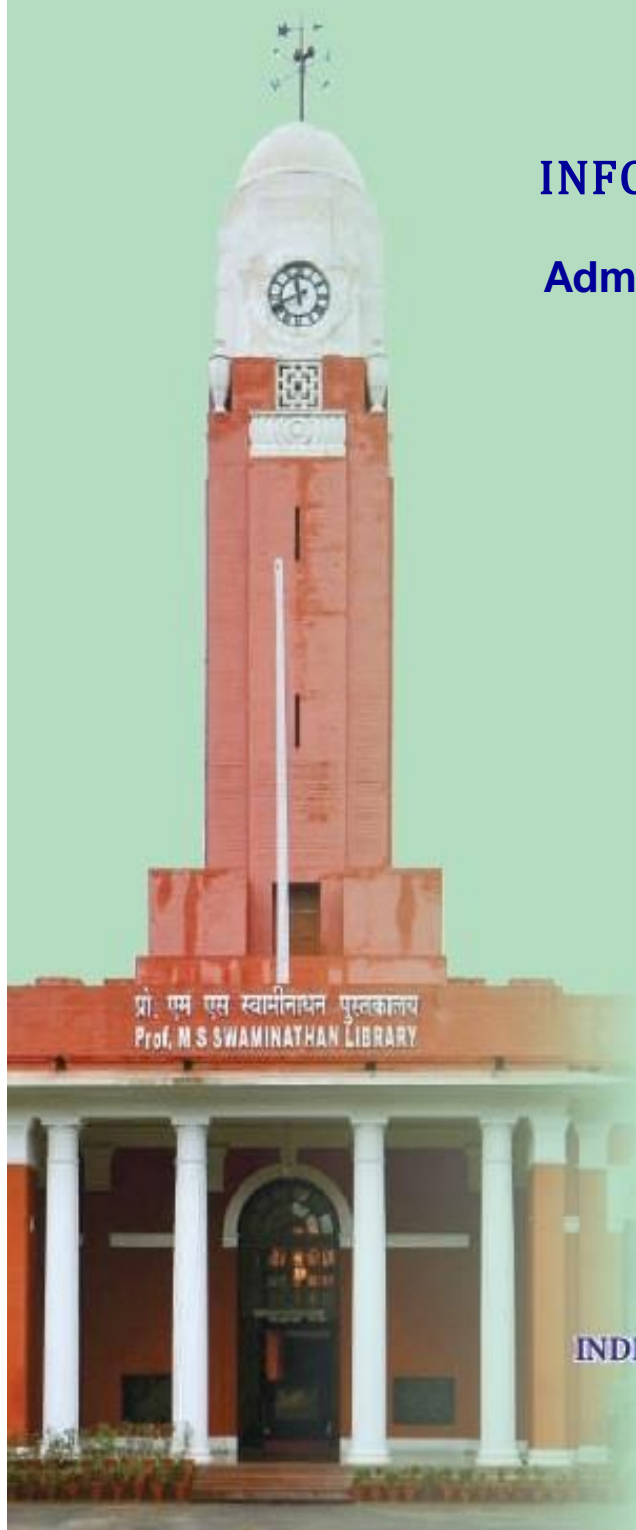




**INFORMATION BULLETIN  
for  
Admission to Ph.D. Courses  
2019 - 20**



**Post Graduate School**

**INDIAN AGRICULTURAL RESEARCH INSTITUTE**

**( Deemed to be University )**

**New Delhi - 110012**

**Post Graduate School**  
**Indian Agricultural Research Institute**  
**New Delhi**

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The academic activity at the Institute is regulated by the Academic Council with Director, IARI and its *Chairman* and the Dean and its *Vice-chairman*. The Academic Council is the competent authority to amend the rules and procedures governing all aspects of post-graduate programmes. All correspondence regarding admission should be addressed to the Registrar, Post Graduate School, Indian Agricultural Research Institute, New Delhi-110012.

This Information Bulletin should not be treated as a legal document.

Candidates are required to submit their application form online. Before filling the online Application Form, the candidates are required to deposit Rs. 1,000/- (One thousand rupees only) (for UR/OBC category) and Rs. 500/- (Five hundred rupees only) (for SC/ST/PC/CWSF category) through ONLINE mode only.

**Account No.: 90293020000339, Name of the account: IARI PHD ENTRANCE EXAMINATION**

**IFSC Code: SYNB0009029**

**Name of the Bank: Syndicate Bank, Branch Name: Pusa Campus, New Delhi-110012**

**Note I: Applications without the prescribed fee shall be summarily rejected.**

**Note II: Fee once paid shall not be refunded under any circumstances.**

## **IMPORTANT DATES**

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(i) Last Date for Receipt of Application	:	April 22, 2019
(ii) Last Date for Receipt of Application through Proper channel and documents submission for online Application Form	:	April 29, 2019
(iii) Download Admit Card	:	May 17-May 26, 2019
(iv) Entrance Examination	:	May 26, 2019
(v) Download Interview Letter	:	June 24-July 01, 2019
(vi) Interview	:	July 08, 2019
(vii) Announcement of Result	:	July 12, 2019
(viii) Download Final Selection Letter	:	July 15-July 26, 2019

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## 1. INTRODUCTION

The Indian Agricultural Research Institute (IARI) is India's largest and foremost Institute in the field of research, higher education and training in agricultural sciences. It has served the cause of science and society with distinction through cutting edge research, generation of appropriate technologies and development of human resources. In fact, the Green Revolution was born in the fields of IARI and our graduates constitute the core of the quality human resource in India's agricultural research and education. The Institute has all along been adjusting and improving its policies, plans and programmes to effectively respond to the needs and opportunities of the nation. During the fifties, the advancement of scientific disciplines constituted the core programme and provided the base for its fast expansion in the 1960's and 1970's in all its three interactive areas, namely, research, education and extension. Besides basic research, applied and commodity research gained great importance resulting in the development of several popular high yielding varieties of almost all major crops and their associated management technologies, which brought about an unprecedented increase in the national food and agricultural production. The main functions of the Institute cover the areas of basic and applied research in the major branches of agricultural sciences; post graduate education at the M.Sc., M.Tech. and Ph.D. levels for which the Institute has been accorded the status of a Deemed to be University under the University Grants Commission (UGC) Act of 1956; specialized post graduate training courses; and extension education and transfer of technology in selected areas. The administrative control of the Institute is vested with Indian Council of Agricultural Research (ICAR), which is an autonomous organization established under the Societies Registration Act, 1860.

The Institute was originally established by the Government of India in 1905 at the village Pusa in north Bihar. After a devastating earthquake in 1934, it was shifted to New Delhi in 1936. That is why it is popularly known as the Pusa Institute. The present campus of the Institute is a self-contained complex spread over an area of about 500 hectares.

The Institute has inherited a great tradition of agricultural research. Since its early days at Pusa, the Institute has been doing pioneering work in various fields of agricultural sciences. The Institute has expanded greatly in its activities, research facilities and scientific personnel in the post-independence years. When the Institute came to New Delhi in 1936 it had five Sections. Today, the Institute's research and educational activities are carried out through a network of 35 Divisions/multi-disciplinary laboratories/Centres of Excellence/units and 8 Regional Stations. The Institute has been accredited by the NAEAB of ICAR, NAAC of UGC as A<sup>+</sup> and ranked 23<sup>rd</sup> among overall institutions of the country by MHRD ranking 2017.

### **Mandate of the Institute**

- Basic, strategic and anticipatory research in field and horticultural crops for enhanced productivity and quality.
- Research in frontier areas to develop resource use efficient integrated crop management technologies for sustainable agricultural production system.
- Serve as centre for academic excellence in the areas of post- graduate and human resources development in agricultural science.
- Provide national leadership in agricultural research, education, extension and technology assessment and transfer by developing new concepts and approaches and serving as a national referral point for quality and standards.

The laboratories are equipped on modern lines for conducting research of a high order. Most of the Divisions also have smart classroom facility. The experimental fields which form an integral part of the Institute's campus cover an area of about 296 hectares, of which about 160 hectares are irrigated. The various Divisions of the Institute are manned by a large body of highly trained and experienced Scientific Staff. The strength of the Post Graduate Faculty of the Institute at present is about 750 in 26 disciplines.

The Institute's Central Library has built-up a collection of over 6,00,000 documents, receives more than 5000 scientific serials annually from all over the world, and is regarded as the best agro-

biological library in South Asia. The library has over 10500 serial files in 40 languages received from more than 90 countries which form 30% of the total scientific serials available in the country. It has spacious reading halls and a documentation centre. The main hub providing Email-internet connectivity through the Institute is located in the Library, which also offers CD-ROM facility and CeRA through the Local Area Network.

Since its early years, the Institute has flourished as a centre for imparting post graduate training to officers of the State Departments of Agriculture in India, as also to other candidates, so as to equip them for manning superior posts in the fields of research, teaching and extension. In 1923, the training programme was placed on an organized basis as a two-year course of specialized post graduate training in different major fields of agricultural sciences, leading to the Associate ship of the Institute (Assoc. IARI). This diploma course, recognized in 1946 as equivalent to the M.Sc. degree of Indian Universities, was replaced by M.Sc. degree in 1958 when the Institute was granted the status of a “Deemed University” under the University Grants Commission Act of 1956 and authorized to award post graduate degrees of Master of Science and Doctor of Philosophy in agricultural sciences. With regard to educational standard and quality, it ranks among the best institutions of post graduate education in the world. A unique feature of the system of instruction at the Institute, which is largely modelled on the course-credit system, is that research, teaching and extension are fully integrated and also that the programme of instruction is broad-based so as to give the student a mastery not only in his/ her major field of specialization but also in supporting minor fields. Currently, instruction leading to the post graduate degrees of the Institute is organized in twenty six subjects (disciplines).

So far, 4148 M.Sc., 69 M.Tech. and 4885 Ph.D. students have been awarded degrees including 467 international students. At present, the total number of students is 1141 (303 M.Sc., 18 M.Tech. and 820 Ph.D.) which include 46 international students.

The amenities available on the campus include a medical dispensary, two primary schools, two government senior secondary schools- one for boys and the other for girls, the Nehru Experimental Centre, a Shopping Complex, Kendriya Bhandar, a bank, and a post office. The Institute is easily reached, both from Delhi and New Delhi railway stations, by means of city bus/Metro trains. Adjacent to the Institute's campus are located, the National Physical Laboratory (NPL), the National Institute of Science Communication (NISCOM) of the Council of Scientific and Industrial Research (CSIR), the Institute of Hotel Management, Catering and Nutrition, a Regional Centre of the National Bureau of Soil Survey and Land Use Planning, the National Seeds Corporation and the State Farms Corporation of India.

The academic programme leading to the award of M.Sc. and Ph.D. degrees in Agricultural Statistics, Bioinformatics, Computer Application, Molecular Biology & Biotechnology, and Plant Genetic Resources are conducted at the sister institutes namely Indian Agricultural Statistics Research Institute (IASRI), National Institute for Plant Biotechnology (NIPB) and National Bureau of Plant Genetic Resources (NBPGR) which are located at this campus. Besides, sister Institutes located at the Campus, from the session 2014-15, students for Ph.D. degree in Floriculture and Landscape Architecture, Fruit Science, Vegetable Science, Post Harvest Technology and Agricultural Engineering are also admitted at the other sister Institutes viz., ICAR-Indian Institute of Horticultural Research (IIHR), Bengaluru and ICAR-Central Institute of Agricultural Engineering (CIAE), Bhopal as IARI PG outreach programme.

## 2. DISCIPLINES (SUBJECTS) FOR ADMISSION DURING 2019-20

The disciplines (main subjects of study) and sub-disciplines (major fields/specializations) within each discipline in which instructions are offered, leading to the Ph.D. degree, are as follows:

Discipline Code	Discipline	Sub-discipline (s) (Major Fields/Specializations)
01.	AGRICULTURAL CHEMICALS	Agricultural Chemicals
02.	AGRICULTURAL ECONOMICS	Agricultural Development and Policy; Agricultural Finance and Project Analysis; Agricultural Marketing and Trade; Farm Management and Resource Economics; and Agri-business Management
03.	AGRICULTURAL ENGINEERING	Agricultural Processing and Structure; Farm Power and Equipment; and Soil and Water Conservation Engineering
04.	AGRICULTURAL EXTENSION	Agricultural Extension; Agricultural Communication; and Agricultural Management
05.	AGRICULTURAL PHYSICS	Agricultural Physics
06.	AGRICULTURAL STATISTICS	Agricultural Statistics
07.	AGRONOMY	Crop Husbandry; and Resource Management
08.	BIOCHEMISTRY	Biochemistry; and Nutrition
09.	BIOINFORMATICS	Bioinformatics
10.	COMPUTER APPLICATION	Computer Application
11.	ENTOMOLOGY	Insect Pest Management; Insect Physiology; Insect Biosystematics; and Insect Toxicology
12.	ENVIRONMENTAL SCIENCES	Environmental Sciences
13.	FLORICULTURE AND LANDSCAPE ARCHITECTURE	Floriculture and Landscape Architecture
14.	FRUIT SCIENCE	Fruit Science
15.	GENETICS AND PLANT BREEDING	Genetics and Plant Breeding
16.	MICROBIOLOGY	Algology; Applied Microbiology; and Soil Microbiology
17.	MOLECULAR BIOLOGY AND BIOTECHNOLOGY	Molecular Biology and Biotechnology
18.	NEMATOLOGY	Nematology
19.	PLANT GENETIC RESOURCES	Plant Genetic Resources
20.	PLANT PATHOLOGY	Fungal Pathology; Mycology; Plant Bacteriology; and Plant Virology
21.	PLANT PHYSIOLOGY	Plant Physiology
22.	POST HARVEST TECHNOLOGY	Post Harvest Technology of Horticultural Crops; and Post Harvest Engineering and Technology
23.	SEED SCIENCE AND TECHNOLOGY	Seed Science and Technology
24.	SOIL SCIENCE AND AGRICULTURAL CHEMISTRY	Soil Science; Soil Science and Agricultural Chemistry
25.	VEGETABLE SCIENCE	Vegetable Science
26.	WATER SCIENCE AND TECHNOLOGY	Water Science and Technology



### 3. SCHEMES OF ADMISSION

The candidates are advised to refer the scheme of examination very carefully. In fact, the schemes like Faculty Upgradation, ICAR-In Service and Departmental (Scientific/Technical) are meant for in service candidates working in SAUs/ICAR research Institutes.

#### Open Scheme

The discipline wise details of seats for Ph.D. to be filled at IARI, New Delhi, and for IARI PG outreach programme at ICAR-IIHR, Bengaluru & ICAR-CIAE, Bhopal are indicated below:

##### A. IARI, New Delhi

OPEN SCHEME							
Discipline Code	Discipline	Number of Seats					
		UR	OBC	SC	ST	PC <sup>@</sup>	Total
01	Agricultural Chemicals	3	2	1	0	(0)	6
02	Agricultural Economics	3	1	1	0	(0)	5
03	Agricultural Engineering*	5	2	1	1	(0)	9
04	Agricultural Extension	4	2	1	0	(1)	7
05	Agricultural Physics	3	1	1	0	(0)	5
06	Agricultural Statistics	3	3	1	1	(1)	8
07	Agronomy	5	3	1	1	(0)	10
08	Biochemistry	3	2	0	0	(0)	5
09	Bioinformatics	3	1	1	0	(0)	5
10	Computer Application	3	1	1	1	(0)	6
11	Entomology	3	2	1	0	(0)	6
12	Environmental Sciences	2	2	1	1	(0)	6
13	Floriculture & Landscape Architecture	2	1	1	0	(0)	4
14	Fruit Science	3	1	1	0	(0)	5
15	Genetics & Plant Breeding	6	3	2	2	(0)	13
16	Microbiology	3	2	1	0	(0)	6
17	Molecular Biology & Biotechnology	4	2	1	1	(1)	8
18	Nematology	2	1	1	0	(0)	4
19	Plant Genetic Resources	3	1	0	1	(0)	5
20	Plant Pathology	4	2	2	1	(1)	9
21	Plant Physiology	3	3	1	0	(0)	7
22	Post Harvest Technology**	2	2	0	0	(0)	4
23	Seed Science & Technology	3	1	1	1	(1)	6
24	Soil Science & Agricultural Chemistry	6	2	2	0	(0)	10
25	Vegetable Science	5	3	1	1	(0)	10
26	Water Science & Technology	3	2	2	1	(0)	8
	<b>TOTAL - A</b>	<b>89</b>	<b>48</b>	<b>27</b>	<b>13</b>	<b>(5)</b>	<b>177</b>

<sup>@</sup> Seats for Physically Challenged (PC) category are to be allocated horizontally over different categories and will be provided to the PC candidates against the category to which they belong. However, if suitable candidate is not available in a particular discipline, the seat can be transferred to another discipline to fill the number of reserved seats in the respective categories based on merit within the category.

	* Agricultural Engineering	UR	OBC	SC	ST	PC <sup>+</sup>	Total
a)	Agricultural Processing and Structure	1	0	1	0	(0)	2
b)	Farm Power and Equipment	2	1	0	1	(0)	4
c)	Soil & Water Conservation Engineering	2	1	0	0	(0)	3

	<b>** Post Harvest Technology</b>	<b>UR</b>	<b>OBC</b>	<b>SC</b>	<b>ST</b>	<b>PC<sup>+</sup></b>	<b>Total</b>
a)	Post Harvest Technology of Horticultural Crops	2	1	0	0	(0)	3
b)	Post Harvest Engineering & Technology	0	1	0	0	(0)	1

#### **B. For IARI PG outreach programme at CIAE, Bhopal**

	<b>Agricultural Engineering</b>	<b>UR</b>	<b>OBC</b>	<b>SC</b>	<b>ST</b>	<b>PC<sup>+</sup></b>	<b>Total</b>
a)	Agricultural Processing & Structure	1	1	0	1	(0)	3
b)	Farm Power & Equipment	2	0	1	0	(0)	3
c)	Soil & Water Conservation Engineering	1	1	0	0	(0)	2
	<b>T O T A L - B</b>	<b>4</b>	<b>2</b>	<b>1</b>	<b>1</b>	<b>(0)</b>	<b>8</b>

#### **C. For IARI PG outreach programme at IIHR, Bangalore**

		<b>UR</b>	<b>OBC</b>	<b>SC</b>	<b>ST</b>	<b>PC<sup>+</sup></b>	<b>Total</b>
a)	Floriculture and Landscaping Architecture	1	1	0	0	(0)	2
b)	Fruit Science	1	0	0	1	(0)	2
c)	Post Harvest Technology (PHT of Horticultural Crops)	1	0	1	0	(0)	2
d)	Vegetable Science	1	1	0	0	(0)	2
	<b>T O T A L - C</b>	<b>4</b>	<b>2</b>	<b>1</b>	<b>1</b>	<b>(0)</b>	<b>8</b>
	<b>GRAND TOTAL</b>	<b>97</b>	<b>52</b>	<b>29</b>	<b>15</b>	<b>(5)</b>	<b>193</b>

**Note:** The PG School, IARI reserves the right to change the number of seats. In case of any change in the number of seats, the same would be posted on the Institute Website.

## **4. ACADEMIC TERMS**

The academic session of the P.G. School, IARI shall commence on **July 25, 2019** and is divided into three trimesters. The duration of the three trimesters for the 2019-20 academic year is indicated below:

<b>Registration of newly admitted students</b>	: July 25-26, 2019
<b>Orientation</b>	: July 27, 2019
<b>I Trimester</b>	: 29 <sup>th</sup> July, 2019 to 16 <sup>th</sup> November, 2019
<b>II Trimester</b>	: 18 <sup>th</sup> November, 2019 to 28 <sup>th</sup> March, 2020
Winter Vacation	: 15 <sup>th</sup> December, 2019 to 29 <sup>th</sup> December, 2019
<b>III Trimester</b>	: 30 <sup>th</sup> March, 2020 to 18 <sup>th</sup> July, 2020
Summer Vacation	: 24 <sup>th</sup> May, 2020 to 14 <sup>th</sup> June, 2020
Trimester Break	: 19 <sup>th</sup> July, 2020 to 26 <sup>th</sup> July, 2020



## 5. ELIGIBILITY

### I. Open Scheme

#### (i) Essential Qualification for Admission

- (a) Only those candidates who had their Bachelor's Degree Programmes under 10+2+4 OR 10+2+3 OR 10+1+4 system (OR awarded B.Sc. degree under 10+2+2 system prior to 1985) OR B.Sc. Agriculture (Hons.) 6 years programme under 10+6 system and fulfill the qualifications as prescribed in this bulletin are eligible to apply for admission.
- (b) **For UR/OBC candidates:** At least 60% marks OR an overall grade point average (OGPA) of 7.00 out of 10.00 OR 3.50 out of 5.00 OR 2.8 out of 4.00 OR 2.21 out of 3.00 in M.Sc./M.Sc. (Ag.)/M.Tech./M.E.

**For SC/ST/PC candidates:** At least 55% marks OR OGPA of 6.50 out of 10.00 OR 3.25 out of 5.00 OR 2.6 out of 4.00 OR 1.95 out of 3.00 in M.Sc./M.Sc. (Ag.)/M.Tech./M.E.

**In case of the universities where OGPA is awarded with equivalence of percentage marks, only OGPA will be considered for determining the eligibility qualification for appearing in the entrance examination. The percentage of marks shall be considered only for candidates coming from universities that do not award grades.**

**Note:** Candidates who appear at the Master's Degree final year Examination in 2019 are also eligible to apply and appear in written entrance examination provisionally for Ph.D. programme. However, they will have to submit documentary evidence of their eligibility on or before **June 29, 2019** failing which they shall not be considered for Interview.

#### (ii) Qualification for Admission to Ph.D. degree programme in different disciplines

**Note:** The applicants are required to submit hard copy of transcripts for verification of courses done during M.Sc. /M.Tech.

Code No.	Discipline	M.Sc./M.Sc.(Ag)/M.Tech./M.E. in
01	Agricultural Chemicals	Agricultural Chemicals / Chemistry / Organic Chemistry / Analytical Chemistry
02	Agricultural Economics	Agricultural Economics / Dairy Economics/ Livestock Economics/ Agricultural Marketing and Cooperation/ Fisheries Economics/Environmental Economics
03	Agricultural Engineering	M.Tech./M.E. in Agricultural Engineering / Farm Power and Equipment / Soil and Water Conservation Engineering / Irrigation and Drainage Engineering / Water Resource Engineering / Agricultural Processing and Structures / Dairy Engineering / Water Science and Technology; M.Sc. in Dairy Engineering are eligible for Ph.D. in Agricultural Processing and Structures (Pre-requisite; B.Sc. / B.Tech. / B.E. in Agricultural Engineering)
04	Agricultural Extension	Agricultural Extension / Extension Education / Dairy Extension / Fisheries Extension / Livestock Extension/ Home Science Extension/Agricultural Extension and Communication/ Veterinary and Animal Husbandry Extension
05	Agricultural Physics	Agricultural Physics / Soil Science / Agricultural Meteorology / Meteorology / Physics / Bio-physics / Water Science and Technology/ Geo-informatics/Remote Sensing/Geo-physics/ Environmental Science
06	Agricultural Statistics	Agricultural Statistics / Statistics / Mathematical Statistics / Bio-Statistics
07	Agronomy	Agronomy / Water Science and Technology/Water Management
08	Biochemistry	Biochemistry / Agricultural Biochemistry / Agricultural Chemistry / Molecular Biology and / OR Biotechnology / Chemistry with Organic Chemistry as a special subject/ Plant Physiology/Biophysics

09	Bioinformatics	M.Sc./M.Sc.(Ag)/M.Tech./M.E. in Bioinformatics/ OR Molecular Biology/ Biotechnology / Computer Sciences/ Computer Application/ Agri.- Informatics/Agricultural Statistics/ Statistics/ Mathematical Statistics/ Bio- Statistics with Bioinformatics as a subject in their Post- Graduation degree
10	Computer Application	M.Sc./MCA/M.Tech./M.E. in Computer Science/ Computer Application/ Computer Engineering / Computer Science Engineering/Information Technology/Agricultural informatics
11	Entomology	Entomology / Agricultural Entomology / Sericulture/Apiculture /Zoology or Plant Protection with Entomology as specialization
12	Environmental Sciences	Environmental Sciences/Agricultural Sciences/Relevant plant sciences
13	Floriculture and Landscaping Architecture	Horticulture or Agriculture with major in Floriculture / Floriculture and Landscaping/Floriculture and Landscape Architecture/Post Harvest Technology of Horticultural Crops / Genetics and / OR Plant Breeding / Plant Genetic Resources / Plant Physiology / Crop Physiology with specialization in Floriculture
14	Fruit Science	Horticulture or Agriculture with major in Fruit Science, Pomology / Genetics and / OR Plant Breeding / Plant Genetic Resources / Plant Physiology with specialization in any of above discipline of Fruit Science
15	Genetics and Plant Breeding	Genetics and / OR Plant Breeding / Plant Genetic Resources / Agricultural Botany/any other branch of Biological Sciences with Plant Genetics and / OR Plant Breeding as a subject
16	Microbiology	Microbiology / Agricultural Microbiology/Environmental Microbiology/ Industrial Microbiology / Soil Science and / OR Agricultural Chemistry / Genetics / Botany / Agricultural Botany / Molecular Biology and / OR Biotechnology / Relevant Life Sciences / Biochemistry with Microbiology as a special subject
17	Molecular Biology & Biotechnology	Molecular Biology and / or Biotechnology / Biochemistry / Plant Physiology/ Genetic Engg./Agricultural Biochemistry / Botany / Agricultural. Botany / Genetics and / or Plant Breeding / Microbiology / Agricultural Microbiology / Plant Genetic Resources/Bioinformatics/Relevant Plant Sciences
18	Nematology	Nematology / Entomology / Zoology / Botany / Mycology and / OR Plant Pathology / Relevant Life Sciences / Molecular Biology and / OR Biotechnology / Plant Protection with Nematology as specialization/ Agricultural Entomology/ Agricultural Microbiology/ Helminthology with Nematology
19	Plant Genetic Resources	Plant Genetic Resources / Genetics / Plant Breeding / Agricultural Botany / Horticulture / Plant Biotechnology / Seed Science & Technology / Plant Physiology / any other branch of Biological Sciences with specialization in these subjects and/or Plant Taxonomy / Economic Botany/Biotechnology
20	Plant Pathology	Mycology and /OR Plant Pathology / Botany / Agricultural Botany / Molecular Biology and /OR Biotechnology / Genetics / Microbiology / Seed Science and Technology / Biochemistry / Plant Genetic Resources / Plant Protection / Relevant Life Sciences with Mycology and Plant Pathology as specialization
21	Plant Physiology	Plant Physiology / Crop Physiology/Horticulture / Botany / Agricultural Botany / Biochemistry / Relevant Life Sciences / Molecular Biology and /OR Biotechnology / Plant Genetic Resources
22	Post Harvest Technology	<b>a) For Post Harvest Technology of Horticultural Crops:</b> Horticulture/Post Harvest Technology/Food Science & Technology/ Microbiology/Biochemistry <b>b) For Post Harvest Engineering and Technology:</b> Agricultural Processing and Structures/Food Engineering/ Food Science & Tech./Food Tech./Post Harvest Engineering/Biochemical Engineering
23	Seed Science & Technology	Seed Science and Technology OR Genetics and /OR Plant Breeding / Plant Physiology OR Crop Physiology / Botany OR Agricultural Botany / Plant Genetic Resources/ Mycology OR Plant Pathology OR Entomology OR Nematology with specialization in Seed Science

24	Soil Science & Agricultural Chemistry	Soil Science and /OR Agricultural Chemistry / Env. Sciences /Agril. Microbiology/Chemistry / Agricultural Physics with specialization in Soil Physics
25	Vegetable Science	M.Sc. in Horticulture or Agriculture with major in Olericulture / Vegetable Science/ Vegetable Breeding/Post Harvest Technology of Vegetable Crops/ Genetics and/or Plant Breeding/ Plant Genetic Resources with specialization in vegetable crops
26	Water Science & Technology	Water Science and Technology / Agricultural Physics / Soil Science and Agricultural Chemistry / Mathematics (with Physical Sciences at Bachelors Degree Level) / M.Tech. in Agril. Engineering /Irrigation Engg./ Civil Engineering

### (iii) Age Limit

The minimum age for admission shall be **21 years as on 31<sup>st</sup> July, 2019**. No relaxation is admissible regarding the minimum age limit.

## II. Departmental Scheme

### a). Admission of In-service candidates of State Agricultural Universities (SAUs) under Faculty Upgradation Scheme (FUS) (Number of Seats: 10)

- Essential Qualifications:** Same as given under Open Scheme.
- Not more than three candidates sponsored by any university shall be admitted in any one year under this stream.
- The candidates sponsored under this scheme should be regular employees of the university and should be likely to continue in service after award of degree. The candidates should be sponsored on deputation terms entitling them to full salary and allowances. No fellowship shall be awarded to them by the IARI.
- The words “**Sponsored for admission under Faculty Upgradation Scheme**” should be clearly inscribed on the application form and on the forwarding letter. The sponsorship certificate as given at **Annexure- I** should be attached with the application and duly forwarded by the Vice-Chancellor or his nominee.

### b). Admission under ICAR In-service Nominee Scheme (Number of Seats: 10)

- Essential Qualification:** Same as given for admission under Open Scheme.
- The candidates sponsored under this scheme should be regular employees of ICAR and should be likely to continue in service after award of degree. The candidates should be sponsored on deputation terms entitling them to full salary and allowances. No fellowship shall be awarded to them by the IARI.
- The word “**Sponsored for admission under reserved seats for ICAR employees**” should be clearly inscribed on the application form and in the forwarding letter. The declaration as given in **Annexure-I** signed by the Director of the concerned Institute should be attached with the application form.

### c). Admission under Departmental Quota (Departmental - Scientific: 10 seats for Ph.D.; Departmental -Technical: 10 seats for M.Sc./Ph.D.)

- This scheme of admission is meant for Scientific and Technical staff working at IARI/IASRI/NBPGR/ NRCPB. Separate circular is issued by the PG School in this regard.
- Essential Qualification:** Same as given for admission under Open Scheme.

## III. Children/widows of security forces

**Five (5)** seats are reserved for the children/widows of security forces as per the following order of priority:

- |              |   |  |
|--------------|---|--|
| Priority I   | : | Widows/Wards of Defence personnel killed in action.  |
| Priority II  | : | Wards of disabled in action and boarded out from service.  |
| Priority III | : | Widows/Wards of Defence personnel who died while in service with death attributable to military service. |

Priority IV	:	Wards of disabled in service and boarded out with disability attributable to military service.
Priority V	:	Wards of Ex-serviceman and serving personnel who are in receipt of Gallantry Awards: (i) Param Vir Chakra; (ii) Ashok Chakra; (iii) Maha Vir Chakra; (iv) Kirti Chakra; (v) Vir Chakra; (vi) Shaurya Chakra; (vii) Sena, Nau Sena, Vayu Sena Medal; (viii) Mention-in-Despatches
Priority VI	:	Wards of Ex-serviceman.
Priority VII	:	Wives of: (i) Defence personnel disabled in action and boarded out from service. (ii) Defence personnel disabled in service and boarded out with disability attributable to military service. (iii) Ex-serviceman and serving personnel who are in receipt of Gallantry Awards.
Priority VIII	:	Wards of Serving Personnel.
Priority IX	:	Wives of Serving Personnel.

## 6. RESERVATION

- i. Fifteen percent (15%) of the total number of seats is reserved for Scheduled Caste (SC) and seven-and-a-half percent for Scheduled Tribe (ST) candidates subject to their being otherwise suitable. In the event of there being no eligible suitable SC candidates in the earmarked discipline, to fill up the mentioned number of seats, such unfilled seats shall be transferred to other disciplines, where eligible suitable SC candidates are available for filling these seats. An identical procedure as above will be followed in the case of ST reservations also. After these two exercises, if any seat(s) still remain(s) unfilled in the SC and ST categories respectively, such unfilled SC/ST seat(s) shall be transferred to SC/ST category and filled up by the available eligible candidate(s) in the concerned category. Under no circumstances, the SC and ST seats shall be transferable from M.Sc. to Ph.D. programme and vice-versa. The SC/ST candidates who are selected for admission on the basis of merit shall not be counted against the reserved quota and there is no maximum limit on the admission of the candidates belonging to the two categories.
- ii. Twenty Seven percent (27%) of the total number of seats is reserved for other backward classes (OBC) candidates subject to their being otherwise suitable as per the norms of ICAR/Govt. of India. In the event of there being no eligible suitable OBC candidates in the earmarked discipline, to fill up the mentioned number of seats, such unfilled seats shall be transferred to other disciplines, where eligible suitable OBC candidates are available for filling these seats. If any seat(s) still remain(s) unfilled, the unfilled OBC seat(s) shall be transferred to UR Category.
- iii. Three per cent (3%) of the total number of seats in each scheme of admission open to Indian nationals is reserved for Physically Challenged (PC) candidates subject to their being otherwise suitable as per the norms of ICAR/Govt. of India. However, in the event of there being no eligible suitable PC candidates in the earmarked discipline, to fill up the mentioned number of seats, such unfilled seats shall be transferred to other disciplines, where eligible suitable PC candidates are available for filling these seats.
- iv. Transfer of unfilled seats from one discipline to another for SC/ST/OBC/PC categories will be subject to the condition that not more than two seats per category in one discipline shall be adjusted as transfer seat.
- v. **Reservation as indicated above shall be applicable individually for Indian Agricultural Research Institute, New Delhi and its PG outreach programme at ICAR-Central Institute of Agricultural Engineering, Bhopal; & ICAR-Indian Institute of Horticultural Research, Bengaluru.**

- vi. **Reservation is subject to change as per Government of India policy applicable from time to time.**

## **7. PROCEDURE FOR APPLICATION**

- i. **Candidates are required to submit their application form online only. For instructions please refer page 26 of this information Bulletin.**
- ii. A candidate who has already been awarded Ph.D. degree from IARI or any other university/Institute shall not be allowed for entrance examination for the same degree.
- iii. **A candidate can apply for admission to one discipline only.**
- iv. As a PG outreach programme of IARI, applications are also being invited for our sister Institutes ICAR-Central Institute of Agricultural Engineering, Bhopal in the discipline of Agricultural Engineering and ICAR-Indian Institute of Horticultural Research, Bengaluru in the disciplines of Floriculture and Landscaping Architecture, Fruit Science, Vegetable Science and Post Harvest Technology (PHT of Horticultural Crops). The candidates shall exercise their choices of Institute for these disciplines while applying.
- v. The candidates who had appeared/appearing in the Master's degree examination in 2019 are also eligible to apply provisionally for admission and appear in the entrance examination, but they will have to submit documentary evidence (including mark sheet for M.Sc. examination) of their eligibility latest by **4.30 P.M. on June 29, 2019.**  
Candidates who are in employment are required to take printout of their application form submitted online and send it through proper channel to the Registrar, Post Graduate School, IARI, New Delhi-110012 so as to reach by **April 29, 2019. Any application received after the last date shall not be entertained.** However, advance copy may be submitted to the PG School along with required documents and details of fees submitted Online.
- vi. **Self-attested copies of the following documents must be enclosed along with the print out of the Application Form submitted online failing which the application form shall not be considered.**
  - a. Matriculation (Class X) certificate for Proof of the date of birth.
  - b. Master's degree certificate and marks sheet.
  - c. Other Backward Class, Scheduled Caste/Scheduled Tribe and Physically Challenged Certificate (whichever is applicable) in the proforma as at **Annexure-II, III, and IV**, respectively from the authorities empowered to issue such certificate of verification issued not more than six months before the date of application/Admission.
  - d. Certificate issued by the competent authority to the children/widows of the security forces.
  - e. Certificate to be produced by candidates who had appeared/appearing for their M.Sc. final examination **2019** in the proforma as at **Annexure-V** along with the transcripts/mark sheets of the completed courses.
  - f. Copy of Bank counterfoil mentioning the details of ONLINE submission of fee (₹1000/- for UR/OBC category and ₹500/- for SC/ST/PC/CWSF category) namely the (i) Name and Branch of the Bank (ii) UTR No. and Date of payment made.
- vii. **If a candidate furnishes wrong information or suppresses any relevant information, the application is liable to be summarily rejected.**
- viii. Candidates must produce originals and as well as one set of self attested copies of the following documents (whichever is applicable) before they join the course, if selected, failing which candidates will not be allowed to join the course.
  - a. Proof of the date of birth.
  - b. Matriculation (Class X) or equivalent certificate and marks sheet.
  - c. Intermediate (Class XII) examination certificate and marks sheet.
  - d. Bachelor's degree certificate and marks sheet.
  - e. Master's degree certificate and marks sheet.
  - f. Other Backward Class, Scheduled Caste/Scheduled Tribe and Physically Challenged Certificate (whichever is applicable) in the proforma as at **Annexure-II, III, and IV**, respectively from the authorities empowered to issue such certificate of verification issued not more than six months before the date of application/Admission.
  - g. Certificate issued by the competent authority to the children/widows of the security forces.
  - h. Certificate to be produced by candidates who are appearing/had appeared for their M.Sc. final



examination **2019** in the proforma as at **Annexure-V** along with the transcripts/mark sheets of the completed semesters / trimesters.

- ix. Admit Cards for the Entrance Examination to be conducted on **May 26, 2019** may be downloaded during **May 17-May 26, 2019**.
- x. If any document submitted by the candidate is found to be false at any stage during his/her study at IARI, his/her admission will be cancelled.
- xi. The candidate must give **a choice for centre of examination** from the list of cities while applying ONLINE, nearest to the permanent address or the university last attended, otherwise PG School will allot the examination centre accordingly. Efforts will be made to honour the choice of centre. However, PG School may allot another centre due to any administrative reasons.
- xii. The candidates selected for admission at IARI/CIAE/IIHR, shall be required to furnish a surety bond for an amount of `50,000/- (Rupees fifty thousand only) on non-judicial stamp paper valuing `100/-duly attested by the notary as per the **Annexure VII**.
- xiii. Ragging in any form is strictly prohibited at these Institutes premises including hostels. The following could be the possible punishments for those who are found guilty of participation in or abetment of ragging. The quantum of punishment shall, naturally, depend upon the nature and gravity of the offence as established by the Disciplinary Committee or the court of law.
  - Cancellation of admission.
  - Suspension from attending classes. Withholding/withdrawing scholarship/fellowship and other benefits. Debarring from appearing in any test/examination or other evaluation process.
  - Withholding results
  - Debarring from representing the institution in any national or international meet, tournament, youth festival, etc. Expulsion from the hostel.
  - Expulsion from the institution for periods varying from 1 to 3 trimesters.
  - Expulsion from the institution and consequent debarring from admission to any other institution. Fine up to `25,000/-.
  - Rigorous imprisonment up to three years.
- xiv. Medical insurance is compulsory for all the students admitted at these Institutes, charges of which shall be borne by the student himself/herself.
- xv. The entrance examination for Academic Session 2019-20 will be **conducted in the cities** namely; **Anand, Bengaluru, Coimbatore, Delhi, Guwahati, Hyderabad, Jabalpur, Kolkata, Ludhiana, Patna, Pune, Udaipur and Varanasi.**

## **8. SELECTION OF CANDIDATES**

### **Academic Attainments (Record)**

Weightage for academic attainments (High School to terminal degree) would be 10%.

### **Entrance Examination**

The weightage for entrance examination is 80%. The candidates will have to appear for Entrance Examination consisting of one paper of three parts: Part-I (General Agriculture) and Part-II & III (Subject Paper). The minimum qualifying mark for appearing in the interview is 50% for UR/OBC, 45% for SC/ST/PC candidates. Total marks (percentile) would be considered for the preparation of merit. The highest mark scored by the candidates within each discipline will be considered as maximum mark (=100%) for calculating the % mark within that discipline.

### **Interview**

The weightage for interview is 10%. Candidates qualifying in the Entrance Examination will be called for interview in the ratio of maximum 1:4 (No. of seats: No. of students called for interview). The interview would be held on **July 1, 2019** in respective Disciplines and the candidates may download their interview letter from **June 24 to July 01, 2019**.

**Merit after the interview and choice as exercised by the candidate in the Application Form shall be the criterion for selection in the respective Institutes subject to fulfillment of all the other requirements for admission.**

The list of selected candidates will be displayed at P.G. School, IARI and on website of IARI, New

Delhi ([www.iari.res.in](http://www.iari.res.in)) on **July 6, 2019** and the selected candidates may download their selection letter from **July 15 to 26, 2019**.

The selected candidates will be allowed to join the Post Graduate School of IARI, New Delhi and its PG outreach programme at CIAE, Bhopal; and IIHR-Bengaluru for pursuing further studies only after they are declared medically fit. **In-service candidates from all schemes will have to produce the proper relieving order from their parent office/department/University at the time of enrolment.**

## 9. COURSE-CREDIT SYSTEM

The student's programme of studies is planned after taking due account of his/her previous academic training. This is done by an Advisory Committee which consists of Chairperson from the major field of specialization and other members from the major and minor fields. Ph.D. students are required to take two minors (minimum of nine credits in each) from supporting disciplines. The course work of each student will also include the following compulsory courses.

- A. **Courses on Introductory Agriculture:** The candidates, who have not been exposed to agricultural science discipline in their last examination, if admitted to Ph.D. programme will have to take Introductory Agriculture courses of 38 credits during the first three trimesters and a training during summer vacation. These courses shall be over and above the prescribed credit load for the Ph.D. degree and will be graded and counted for calculating OGPA like regular courses.
- B. **Compulsory Courses:** Following courses have been introduced as compulsory courses for all **M.Sc./M.Tech.** students: (i) Library and Information Services, (ii) Technical Writing and Communication Skills, (iii) Basic Statistical Methods in Agriculture, (iv) Disaster Management, and (v) History of Agriculture (Non-credit). **For Ph.D. students,** the compulsory courses are: (i) Intellectual Property and its Management in Agriculture, (ii) Agricultural Research, Research Ethics, and Rural Development Programmes, as well as all the five compulsory courses of M.Sc./M.Tech., in case, these are not done at M.Sc./M.Tech level. These courses will be over and above the prescribed minimum credit load for M.Sc./M.Tech./Ph.D. degrees, and will be graded and counted for calculating OGPA like regular courses.

The details of the course credits, course numbers, course titles, residential requirements and other rules and regulations are included in the P.G. School Calendar. The student's attainment in the courses taken by him/her is judged from the grade obtained in each course and the progress is measured in terms of the overall grade point average (OGPA). The maximum attainable OGPA is 10.00 and the minimum passing point is 6.00.

The detailed rules and regulations and also the syllabi of the various courses are given in the Post Graduate School Calendar.

## 10. RESEARCH WORK

As a part of their doctoral programme, students have to undertake research work on problems approved by the Dean as recommended by the Boards of Study in different disciplines and submit a thesis. While students admitted to IARI and PG outreach programme of IARI at CIAE & IIHR normally carry out their research work at these Institutes, but the students admitted at IARI may also be sent for a part or all of research work to IARI regional stations, ICAR Institutes or abroad recognized for the purpose.

## 11. FEES AND EXPENSES

The students are liable to pay fees, funds and other charges as may be laid down from time to time.



SC/ST students are entitled to the reimbursement of the tuition fees.

## 12. RESIDENCE

Limited hostel accommodation is available at IARI, New Delhi. Residence in hostels is subject to the availability of accommodation.

## 13. SCHOLARSHIP, MEDALS AND AWARDS

Financial assistance in the form of IARI scholarship for Ph.D. students will be provided to the extent feasible, as per rules and regulations of the Post Graduate School of the IARI. The value of IARI scholarship is `13,125/- (Thirteen thousand one hundred and twenty five only) per month for a period of three years. The students are also entitled to get a contingent grant of `10,000/- (Ten thousand only) per annum for the purchase of books, chemicals, equipment etc., subject to submission of surety bond as per **Annexure-VII** of this Information Bulletin. Students who had availed the same scholarship previously will not be eligible for scholarship again.

## 14. DISCIPLINE

The Dean, Post Graduate School is charged with the general control of students and with the maintenance of discipline. The Dean shall have the discretion to remove any student from the rolls of the P.G. School of Institutes for one or several of the following reasons.

- (a) Failure to gain from the course of studies
- (b) Misbehavior
- (c) Failure to pay the dues (fees, etc.) in time
- (d) Continuous absence from studies for a long period

### Notes:

1. Students are prohibited from applying for admission to any other institution without prior permission of the Dean.
2. If any property/equipment on the campus is damaged and loss caused to the Institution as a result of violence, demonstration, strikes, etc. resorted to by the students, the loss would be recovered either directly from the persons specially identified (where possible) or collectively from such groups or associations as were responsible for causing the damage or loss to property.

## 15. STUDENTS' SUPPORT SERVICES

- i. **Prof. M.S. Swaminathan Library:** The IARI library is one of the oldest and the best in South Asia. It is playing the role of National Agricultural Library of India, and is regarded as one of the 10 best agro-biological libraries of the world. The IARI Library has got a well-equipped "Facility Management Unit" and a "Training Cell". Periodic trainings are organized for scientists and students of the Institute for CD-ROM search, Digital Resources, E-Journals, On-line information retrieval etc. Library is fully automated with vast collection of highly specialized research publications on agriculture and related sciences. The collection gets enriched continually. CD ROM, Online journals, CeRA, OPAC are available in campus through LAN connectivity to nearly 2000 users. Reading Halls are having wired internet terminals as well as Wi-Fi connectivity. The library has 10,500 serial files, and 2000 current serials are being procured from 90 countries. Exchange relationship is maintained with 67 Indian and foreign institutions. Library is repository of FAO, CGIAR publications. The IARI Library has been assigned the job of AGRIS database input for National Agricultural Research Database (NARD) in ISO format using AGRIN methodology. This library is contributing in AGRIS database in merging data of 10 core Indian Journals. It has text books section and also Hindi reference books section.

- ii. **Medical Facilities:** A qualified Medical Officer looks after the health of the students, and is Incharge of the IARI Dispensary located in the vicinity of the Hostels. The Medical Officer resides on the Institute campus and is thus available during day and night. The medical service is provided free to students at the dispensary.
- iii. **Sports and Recreation:** The Post Graduate School encourages extra-ccurricular activities that enrich cultural, physical and social life of students. Spacious playgrounds are provided near the student hostels and necessary facilities exist for outdoor games like cricket, football, hockey, volleyball, tennis, badminton and various athletic events. There are facilities also for indoor games in each hostel. There is a Students' Sports Fund to which every student subscribes at the beginning of each academic year.
- iv. **Student Welfare Fund:** With a view to render financial aid to students in distress and to support any other students'activities, a Students' Welfare Fund has been instituted. All students are required to contribute to the fund at the beginning of each academic year. No loan shall ordinarily be given from this fund in the first trimester of admission.
- v. **Students' Counseling and Placement Cell:** A "Student Career Development and Industry Interface Centre" has been established for career counseling and arranging frequent Institute-Industry interface. It has been organizing campus interviews for career counseling and placement of outgoing students in the jobs of their choice.
- vi. **Post Graduate School Students' Union:** All students admitted to the Post Graduate School automatically become members of Post Graduate School Students' Union and are entitled to participate in the Union election.
- vii. **Internet facility:** Internet and intranet and Wi-Fi connectivity has been provided at all the hostels and guest houses for trainees and visiting faculty. Creation of this facility in students' hostels is a step forward in the area of knowledge dissemination and awareness for establishing a healthy and productive relationship between scientists and students for overall national agricultural development. The facility is made available to students free of charge. The course schedules along with contents and suggested reading are also available on IARI intranet system.
- viii. **Communication and Language Laboratory:** This facility created in 2012 is being used to teach English and Hindi language courses and communication skills to students who need improvement in these aspects.

## 16. SYLLABIFOR ENTRANCE EXAMINATION FOR Ph.D.

The Entrance Examination will be in the form of one question paper of three distinct parts. The questions will be of multiple choice and matching types in part I & II (30 marks and 150 marks, respectively) and short analytical type in part III (30 marks). Answers for part I & II are to be given on computerized OMR answer sheets (see **Annexure-VI**) and that of part III in the space provided for the purpose in the question paper. Negative marking to the extent of 0.25 marks for each wrong answer will be applicable in case of part I and II of the questions of the paper.

### PART- I: GENERAL AGRICULTURE

Importance of Agriculture in national economy; basic principles of crop production; cultivation of major crops such as rice, wheat, pigeon pea, cotton, sugarcane, tomato, cauliflower, mango and rose.

Weathering of rocks; soil formation, major soils of India, soil erosion and its control; common farm implements; role of NPK and their deficiency symptoms; manures (FYM, compost and green manure) and fertilizers (urea, diammonium phosphate, single superphosphate and muriate of potash).

Structure and function and cell organelles - mitosis and meiosis; gametogenesis, fertilization and embryogenesis; chromosomal and extra-chromosomal basis of inheritance; mutation and polyploidy; selection methods, hybridization, backcross; plant growth regulators; plant metabolism photosynthesis, respiration and nitrogen fixation.

Isomerism; titrimetry and volumetry; structure and function of carbohydrates, proteins, nucleic acids, enzymes and vitamins.

Major pests and diseases of rice, wheat, maize, pulses, oilseeds, vegetables, cotton, sugarcane and

their management.

Important principles of economics, structural transformation in economy and its globalization; principles of extension education; important rural development programmes in India; organizational set up of agricultural research, education and extension in India, elements of statistics.

## **PART-II AND III: SUBJECT PAPER**

### **AGRICULTURAL CHEMICALS (01)**

Nomenclature and classification of organic compounds, chemical bonding; isomerism and stereo chemistry; properties and reactions of organic functional groups; aliphatic, alicyclic, aromatic and heterocyclic compounds; theory and application of chromatography and spectroscopy (IR, UV, NMR, Mass and tandem techniques) in the study of organic compounds; chemistry of natural products; terpenoids, steroids (cholesterol and Vitamin D), alkaloids (pyrrolidine, piperidine, pyridine, pyrrole groups), lipids, carbohydrates, plant pigments, nucleic acids, amino acids and proteins. Chemical equilibria; chemical kinetics, kinetic theory of gases, thermodynamics; surface chemistry, colloids, emulsions, solutions. Titrimetry, theory of indicators; redox reactions. Classification of pesticides; chemistry of botanical and microbial pesticides (pyrethroids, rotenoids, nicotinoids, neem, BT, bialaphos etc.) and synthetic insecticides (organochlorines, organophosphorus, carbamates etc.), fungicides (inorganic fungicides, dithiocarbamates, azoles, carboxamides, strobilurins etc.), herbicides (alkanoic acids, triazines, ureas, carbamates, anilides, sulfonyl ureas and imidazolinones etc.), fumigants (EDB, EDCT, aluminium phosphide), rodenticides (warfarin, bromadilone) and nematicide (triazophos, phenamifos, carbofuran etc.); pesticide formulation - definition and classification, characterization, specification, surfactants, quality control and application technology; concepts of pesticide residue chemistry, MRL, CODEX, ADI, NOAEL JMPR, regulation and quality control of pesticides, safety aspects including environmental fate, analytical techniques in residue analysis, decontamination and remediation techniques, good laboratory practices; nitrification and denitrification, nitrification inhibitor; N<sub>2</sub>-fixation; radioactivity and radiotracer techniques.

### **AGRICULTURAL ECONOMICS (02)**

Basic concepts in economics, theory of consumer demand, theory of production, market classification, theory of perfect and imperfect competition, theory of distribution, national income accounting, classical and Keynesian theories of income determination, money-concepts, functions, theories of demand for money, supply of money; general equilibrium of product and money markets; IS and LM functions; monetary and fiscal policies, banking - central and commercial, functions and problems of recent macro-economic policies of Government of India; research methodology, steps in agricultural economics research, data collection, analysis and report writing; differential and integral calculus, differential equations, matrix algebra, solution of simultaneous linear equations, linear programming, statistical inference, correlation and regression analysis, time series analysis and theory of index numbers.

Nature and scope of agricultural production economics vis-a-vis farm management; farm business analysis, farm records and farm cost accounting; farm planning and budgeting, production function and resource allocation; cost, profit and supply functions; nature and analysis of risk in farming; systems approach in farming; role of credit in agriculture, principles of agricultural finance, farm financial management, supply and demand for farm credit; recent innovations in the extension of credit to agriculture, theory and practice of co-operation; problems of co-operatives, management of co-operative institutions; cost-benefit analysis of agricultural projects.

Scope of marketing in a developing economy; practice and problems of marketing agricultural inputs and outputs; functions and channels of marketing, co-operative marketing; agricultural price analysis; demand analysis; problems and prospects of storage and processing of agricultural products; agricultural exports - problems and prospects.

Theory of growth and growth models; agricultural policy, planning and development in India, inter-regional variations in agricultural development, agricultural technology and income distribution; agrarian reforms and output and input price policies; infrastructure and institutions for agricultural development, equity and ecological consideration in agricultural development.

## AGRICULTURAL ENGINEERING (03)

### **Part A (Common for all three sub-disciplines/areas): 30 marks**

Basic concepts in calculus, trigonometry, analytical geometry, linear algebra and algebra of real and complex numbers; instrumentation for measurement of forces, torque, temperature, moisture, fluid flow; basic principles of simulation; methods of statistics, dynamics and mechanics of materials; common distributions of random variables and methods of statistical inference; energy sources - their utilisation and efficiencies on the farm; uses and application of computers and electronics including sensors in agriculture, energy management and sustainable renewable energy sources, climate change impacts and resilient agriculture.

**In addition to Part A, attempt any one of the following three sub-disciplines**

### **Part B : (120 Marks)**

In addition, attempt any one of the following three areas depending upon the major field of choice.

- i. Agricultural Processing and Structures:** Application of engineering properties in designs; principle of heat transfer, boundary layer and turbulence; mass transfer operations, mechanisms of moisture movement; theory of drying, equilibrium moisture content; methods of storage and milling; design of material handling devices; mechanical separation; design consideration in farm structure and animal housing; seed processing equipments; plant layout, Materials for different agricultural structures, BIS Standards on practices, equipment and design of storage structures.
- ii. Farm Power and Equipment:** State of farm mechanization; testing of power units and tractor systems; performance capacities of power and machines on the farm; management of power and machinery and their use on the farm; dynamics of machine elements; soil dynamics in tillage and traction, tillage and tractor machines; design considerations in farm machinery and power units; tractor hydraulics, symbols and circuits; ergonomics and safety consideration in machine design, production technology and manufacturing processes.
- iii. Soil and Water Conservation Engineering:** Water resources and history of irrigation in India, major irrigation projects, irrigation potential from different sources, fluid mechanics, aquifers and their characteristics, ground water hydraulics, groundwater recharge, wells and pumps, water lifting devices, energy for groundwater pumping, salt water intrusion in inland and coastal aquifers, groundwater models, groundwater development and management, flow through porous media, vadose zone processes, soil moisture characteristics, field capacity, permanent wilting point, available soil water for plant, soil water potential, collection, analysis and interpretation of hydrological data; application of statistics in hydrology, runoff mechanism, hydrograph, flood routing, principal and practices of irrigation and drainage, crop water requirement, irrigation requirement, soil-plant-water relationships, irrigation scheduling, plant water potential, water movement through soil plant atmosphere system, hydraulics of furrow, check basin and border irrigation, hydraulic design of pressurized irrigation system, irrigation efficiencies, quality of irrigation water, design and operation of irrigation projects, drainage investigations, drainage characteristics of various types of soils, drainage coefficient, design and installation of surface and subsurface drainage system, management of salt affected soils, soil erosion; soil conservation measure; soil and water conservation structures and their design, design and construction rainwater harvesting structures, models for simulation of hydrologic process, application of GIS in land and water management, stream gauging and sediment monitoring; watershed management; open channel flow, hydraulics of open channel flow, energy and momentum principles, specific energy, hydraulic jump, design of different types of irrigation channels, irrigation water measurement, lining of waterways and canals; stability of slopes and design of earthen dams.

## AGRICULTURAL EXTENSION (04)

Concepts, objectives, philosophy and principles of extension education; Genesis and growth of Extension; Extension systems, reforms, innovations, organizational structures in India; Classification of extension approaches; Comparative studies of extension in developed and developing countries; Features of pluralistic extension- public, private, public-private partnership, corporate social responsibility; Agricultural Information (Knowledge) System; Extension methods; e-extension.

Teaching-learning processes, learning theories, pedagogy and andragogy, experiential learning, instructional technologies; Programme planning- principles, processes and tools; Agricultural and rural development programmes and schemes in India.

Principles of Extension management; Theories, processes and functions of management; MBO, Total Quality Management, Organizational Behaviour; Training for Human Resource development, Training design, methods, models and typologies; Training need assessment; Training vs Education.

Entrepreneurship development, Agri-business and market-led extension; Concepts and theories of psychology applied in extension education; Socio-psychological dimensions of human behavior, Socio-psychological factors associated with technology transfer and behavioural change; Social structure; Process of socialization, social interactions and processes; Social change; Values and norms; Rural institutions; Farmers' groups, associations, cooperatives and producer companies; Group dynamics; Gender empowerment and related issues.

Concepts, models, and process of communication; Theories of communication; Mass communication and Agricultural journalism; Information and Communication Technology; Audio-visual aids; Diffusion and adoption of innovations; Grassroots innovations and indigenous technical knowledge.

Elements and process of social research; research typology, Concepts and postulates of measurement; Qualitative and Quantitative techniques of measurement; Research design; Sampling methods; Testing of hypothesis; Scales and tests; Reliability and validity of measuring instruments; Methods of observation and data collection; Statistical methods and Tests of significance; Participatory tools and techniques for rapid appraisal and learning; Tools and techniques for monitoring, evaluation and impact assessment.

### **AGRICULTURAL PHYSICS (05)**

Forms of energy; conservation of mass, energy and momentum; thermodynamics; radioactivity and its applications in agriculture; colligative properties; structure and physical properties of water; molecular forces; principles of spectroscopy. Electromagnetic radiation: visible, infrared, microwave and their application to remote sensing in agriculture; spectral signature of natural targets and spectral indices; sensors and platforms; GIS and GPS. Weather and climate; atmosphere and its constituents; meteorological elements and their measurements; heat balance of the earth and atmosphere; crop weather interactions; climate change and greenhouse effect; evapotranspiration; climatic classification: Koppen and Thornthwaite systems; climatology of India, agro- ecological regions, monsoon, western disturbances, cyclones, droughts. Soils of India; factors and processes of soil formation; physical, physicochemical, and biological properties of soils; soil water retention and movement under saturated and unsaturated conditions; infiltration, redistribution and evaporation of soil water; field water balance and water use efficiency; soil aeration; thermal properties of soil and heat transport; influence of soil water, temperature and aeration on crop growth and their management; soil erosion and control.

### **AGRICULTURAL STATISTICS (06)**

Elements of probability theory, concepts of random variable and distribution function, conditional probability; Bayes' theorem; moments; moment generating and characteristic functions; Chebychev's inequality, law of large numbers; limit theorems; univariate (discrete and continuous) distributions; sampling distributions, transformations; multivariate normal distribution, Wishart's distribution, Hotelling's T<sup>2</sup>; discriminant function; elements of stochastic processes; theory of point estimation; Cramer-Rao inequality; Rao-Blackwell theorem; methods of estimation; confidence intervals; testing of hypothesis, tests of simple hypothesis against simple or composite hypothesis; likelihood ratio test; sequential probability ratio test; large sample tests; non-parametric tests.

Concepts of sampling and non-sampling errors; simple random sampling; stratified sampling, allocation of sample to strata gain due to stratification; ratio and regression methods of estimation; cluster sampling; two stage sampling; systematic sampling; sampling with probability proportional to size with replacement.

Principles of design of experiments; uniformity trials; completely randomized, randomized block and Latin square designs; missing values in randomized block and Latin square designs; analysis of



non-orthogonal data in two-way classification (without interaction); factorial experiments and confounding in symmetrical factorial experiments - design and analysis of  $2n$  and  $3n$  experiments; split and strip plot designs; balanced incomplete block design (BIBD)- parametric relations and general properties; analysis of BIBD with recovery of interblock information.

Statistical analysis for segregation and linkage; random mating and equilibrium in large populations; inbreeding- effects of finite population size; polygenic systems for quantitative characters; genetic variance and correlation; heritability, repeatability; individual, family and combined selections; selection for improving several characters; cross-breeding.

### **AGRONOMY (07)**

Principles of crop production, crop plants in relation to environment, growth analysis concepts; quantitative agro-biological principles and their validity; classification of climate, agro-climatic zones of India; physiological limits of crop yield and variability in relation to the agro-ecological optimum; Tillage - concepts and practices. Principles and practices of weed management in crops and cropping systems; weed biology and ecology, crop weed competition, herbicide classification, selectivity, mode of action and herbicide resistance, integrated weed management. Introduction, origin, history, production, distribution, cultural practices, varieties, quality, biomass production and bioenergetics of field crops, forages, spices and condiments crops. Soil fertility and its management; essential plant nutrients, their functions and deficiency symptoms in plants; organic manures, chemical and biofertilizers. History of irrigated agriculture, soil-water-plant relationship, soil moisture stresses and management; drought resistance in crops, drought tolerance/resistance-mechanism and management; soil and plant moisture conservation techniques, water harvesting and other agrotechniques for dryland agriculture; measurement of soil moisture, irrigation scheduling and methods, quality of irrigation water; watershed management, agricultural drainage; problem soils - saline, alkali, saline-alkali and acid soils, genesis, characteristics and management; wasteland management, soil erosion and its control. Cropping systems - principles and practices; changing cropping patterns in different agro-climatic zones; sustainability - concept and practices; agro-forestry systems - concepts and practices. Modern concepts in agronomy- Conservation agriculture, precision nutrient and water management, organic farming, contract farming, integrated farming system, agronomic biofortification, etc. Basic statistics and principles of experimental designs, methods of statistical analysis and data interpretation.

### **BIOCHEMISTRY (08)**

Importance of biochemistry in plant sciences; plant cell structure, cell organelles and their function; chemistry of bonding, isomerism, free energy, enthalpy and entropy; pH and buffers.

Enzymes and enzyme kinetics; structure, function and immobilization of enzymes; metabolism of carbohydrates, proteins, lipids and nucleic acids; structure and function of vitamins and hormones; metabolism of secondary plant products; nitrate assimilation and biological nitrogen fixation; sulphur metabolism; photosynthesis and respiration.

DNA replication, transcription, and translation, regulation of gene expression in eukaryotes and prokaryotes; viruses and bacteriophages; basic concepts of genetic engineering and its application in crop improvement; elementary concepts of immunology.

Fundamental principles of nutrition, balanced diet, calorie and protein requirement, nutritive value of foods. Chromatography, electrophoresis, isoelectric focusing; ultracentrifugation; radio isotopic techniques in biochemical studies; spectrophotometry and ELISA.

### **BIOINFORMATICS (09)**

Nucleic acids as genetic material; chemistry, structure and function of DNA and RNA, Genome organization in prokaryotes and eukaryotes; DNA replication, Transcription process; RNA processing; RNA editing; Genetic code; Translation and post-translational modifications, Function of genes and genomes; Nucleic acid hybridization; PCR and its applications. Genomics, transcriptomics and proteomics. Molecular markers in basic and applied research; Genetic engineering and transgenics; General application of biotechnology in agriculture.

Genomic and proteomic databases: NCBI/ EBI/EXPASY etc.; SWISSPROT, UniProtKB, PIR-

PSD, PDB, Prosite, BLOCKS, Pfam/Prodom etc. Concepts of sequence analysis, Pairwise sequence alignment algorithms: Needleman & Wunsch, Smith & Waterman, BLAST and FASTA. Scoring matrices for Nucleic acids and proteins: PAM, BLOSUM. Multiple sequence alignment. Sequence based gene prediction and its function identification. Protein structure prediction and homology modelling. Molecular dynamics simulation and docking. Visualization of tertiary structures, quaternary structures, architectures and topologies of proteins using molecular visualization softwares such as RasMol, Cn3D, SPDBV, Chime, Mol4D etc. Phylogenetic trees and their comparison, Phylogenetic analysis algorithms: Maximum Parsimony, UPGMA, Neighbor-Joining.

Theory of probability. Random variable and mathematical expectation. Probability distributions: Binomial, Poisson, Normal distributions and their applications. Concept of sampling distribution: t, chi-square and F distributions. Tests of significance based on normal, t, chi-square and F distributions. Population genetics: Hardy –Weinberg law, Effect of systematic forces on changes in gene frequency. Foundations for Machine learning Techniques: Unsupervised and Supervised Learning, Cross Validation Techniques, Markov Model, Hidden Markov Model.

Computer programming languages: Perl, Bio Perl and Java programming, Object oriented programming, classes, objects, Data types, Operators and expressions. Data encapsulation, Polymorphism, Inheritance. Overview of DBMS; Data associations - Entities, Attributes and Associations, Relationship among Entities, Representation of Associations and Relationship, Data Model classification. Structured Query Language (SQL) - Data Definition Language (DDL), Data Manipulation Language (DML).

### COMPUTER APPLICATION (10)

Computer organization and architecture - Boolean algebra, Number system, Basic concepts of floating point number system, Sequential and combinational circuits, Input/Output unit, Memory Organization, ALU and Control unit, Instruction and execution cycle in CPU, Introduction to microprocessors, Interrupts, CISC and RISC Architecture.

Programming language (C++/JAVA) – Computer algorithms, Flow Charts, Encapsulation, Inheritance, Polymorphism, Building blocks, Control structures, Arrays, Pointers, Dynamic memory allocation, File management, Graphics.

Internet programming- Hyper Text Markup Language (HTML), Building static and dynamic web pages, Client side and server side scripting languages, Interaction with database.

Data structures – Representation of character, string and their manipulation, Linear list structure, Stack, Queue, Heaps, Linked list, Arrays, Tree, Graph, Sorting and Searching algorithms.

Software engineering – Requirement analysis and specification, Software Development Phases, Process models, Project structure, Project team structure, Role of metrics, Measurement, Software quality factors, Coding tools and techniques, Testing, Maintenance, Gantt charts, PERT and CPM, CASE tools.

Networking – Types of Networks, Network topology, Network Operating Systems, Network Management, Data communication and transmission, ISO-OSI reference model, TCP/IP reference model, Internet standards and services, Cryptography, Data compression, Authentication and firewalls.

Compilers and translators – Regular expression, Finite automata, Formal languages, Finite state machines, Lexical analysis, Semantic analysis, Parsing algorithms, Symbol tables, Error handling, Intermediate code optimization, Machine code generation, Machine dependent optimization.

Operating system – Process management: Inter-process communication, Process scheduling; Memory management: Swapping, Virtual memory, Paging and segmentation; Device management: Deadlocks, Semaphores; File systems –Files, Directories, Security and protection mechanisms; Distributed operating systems.

Data base management system – Definition and features, Data models, Relational database: Logical and physical structure, Relational algebra, Relational calculus, Database design, Normalization, Concurrency control, Security and integrity, Query processing and optimization, Indexes, Backup and recovery; Distributed Databases – Concepts, Architecture, Design; Structured Query Language (SQL), PL/SQL.

Numerical analysis – Interpolation, Numerical integration, Solution of ordinary differential



equations, Solution of linear and non-linear system of equations; Statistical methods – Summarization of data, Frequency distribution, Measures of central tendency, Dispersion, Skewness and kurtosis, Test of significance based on normal, chi-square, t and F distributions, Curve fitting, Point estimation.

### ENTOMOLOGY (11)

Position of insects in animal kingdom - their origin, phylogeny and distribution; diagnostics of insect Orders and economically important families; concept of species, speciation and biotypes; rules and regulations of zoological nomenclature; current concepts of insect classification; DNA barcoding. Morphology and anatomy; embryonic and post-embryonic development. Insect ecology - biotic potential, effect of biotic and abiotic environmental factors on insect development and population dynamics, life table analysis, population modelling, remote sensing applications diapause, food chain, migration and dispersal; climate change impacts on insects. Fundamentals of insect physiology-different systems, their structure and function, metabolism; host plant selection, insect nutrition and role of symbionts; Classification, mode of action and metabolism of insecticides; basics of insecticidal formulations and residues; plant products, antifeedants, hormones, growth regulators, semiochemicals; pest outbreaks and resurgence; insecticide resistance and management; plant protection appliances. Biological control-parasites, predators and pathogenic microorganisms of crop pests; ecological engineering; host-plant resistance; genetic engineering. Insect quarantine, invasive species, national and international plant protection organizations. Social and other beneficial insects. Principles of integrated pest management; pests of field crops, horticulture and stored products, vector management, management of non- insect pests including vertebrate pests.

### ENVIRONMENTAL SCIENCES (12)

Fundamentals of components of environment - atmosphere, hydrosphere, geosphere, biosphere, pedosphere and their interaction, energy flow in ecosystems; ecosystems and agro ecosystems of the world; biogeographic regions; soil as a biological habitat; distribution and types of soil organisms and their significance in soil productivity; bio-geochemical cycles in different ecosystems; agro-ecological regions of India; global climatic change- basics, greenhouse gases, impact of climate change on agriculture, ecosystems; adaptation and mitigation options; current environmental issues; international conventions and negotiations on climate change and environment; Natural disaster management, biotic and abiotic interactions and their significance; natural resources - effect of anthropogenic factors on the degradation of natural resources; conventional and nonconventional sources of energy; environmental issues in agriculture and environmental impact assessment; environmental auditing; environmental pollution and agricultural productivity; Biodiversity; environmental microbiology; ecosystem services; soil, water and air pollution and their remediation; inter-relationships of crop and animal production systems with environmental pollution in different eco-systems; waste management; environmental laws; basics of simulation modelling and its applications, analytical techniques for major environmental pollutants; spectrophotometry, chromatography; basic chemodynamics of environmental pollutants; advanced environmental monitoring techniques; basic statistics; chemistry of fossil fuels, fluorocarbon, nitrogen, carbon, halogens, phosphorus, heavy metals and their compounds; pesticides and other hazardous chemicals, basic photochemistry.

### FLORICULTURE AND LANDSCAPE ARCHITECTURE (13)

Importance and scope of floriculture, principles and elements of landscaping, garden styles and designs, annuals, shrubs, climbers, trees, foliage plants, cacti, succulents, palms, ferns, bonsai and their suitability in landscaping. Propagation techniques including tissue culture in ornamental plants, turfgrass management, origin, classification and floral biology of flower crops, factors affecting growth and flowering of ornamental plants.

Production technology of rose, chrysanthemum, gladiolus, carnation, gerbera, orchids, lily, jasmine, tuberose, marigold, antirrhinum, bougainvillea, China aster, fillers and cut greens under open and protected conditions, breeding of flower crops. Role of male sterility, self-incompatibility, polyploidy and mutations in crop improvement. Heterosis breeding and development of F1 hybrids in flower crops, seed production and biotechnology in flower crops. Pre and post harvest factors affecting life of flowers, post harvest management of flowers, value addition in flower crops, flower

arrangement. Role of growth regulators in flower crops.

Important statistical designs; methods of their statistical analysis, general principles of fruits and vegetable production, major methods of preservation and processing of horticultural and ornamental crops.

### **FRUITS SCIENCE (14)**

Area and production of fruits, climatic and soil requirements, cultivation practices of major fruit crops like mango, citrus, banana, grape, papaya, litchi, guava, pineapple, jackfruit, sapota, cashewnut, coconut, ber, pomegranate, date palm, aonla, underutilised and minor fruit crops, temperate fruits like apple, pear, peach, almond, plum, apricot, walnut and cherry; Systematics of fruit crops; Ideotypes, breeding approaches and achievements in fruit crops through conventional and non-conventional techniques, Pollinizers and pollination management in fruit crops; Physiology of growth and development of fruit crops; modern methods of propagation including micropropagation and use of growth regulators in fruit crops; Principles of pruning and training, canopy management; weed control; rootstocks and high density orcharding; Nutrient and water management; use of biofertilizers and bioagents for safe fruit production; physiological manipulations for overcoming problems like biennial bearing, spongy tissue, malformation in mango, delayed maturity and uneven ripening in grapes and granulation in citrus; biotic and abiotic stress management in fruit crops such as guava wilt, citrus decline, bacterial blight in pomegranate, Thanjavur wilt in coconut etc; Maturity standards and ripening physiology of fruit crops; Important statistical designs; methods of their statistical analysis; general principles of flower and vegetable production; major methods of preservation and processing of horticultural crops.

### **GENETICS AND PLANT BREEDING (15)**

Structure and function of cell and cell organelles, cell cycle; mitosis and meiosis; nucleic acids - their structure; Mendelian principles; chromosome structure and organization; types of chromosomes; chromosome function; linkage and crossing over - theories and molecular mechanism; recombination and gene mapping in diploids, fungi, bacteria, and human; ploidy variations - euploids and aneuploids; chromosomal aberrations; extrachromosomal inheritance; gene mutation-mechanism, induction; gene concept; complementation, genetic fine structure; genetic code, information transfer and protein synthesis, gene regulation and gene manipulation; gene transfer technology; origin and evolution of important crop plants like wheat, rice, maize, sugarcane, potato, brassica, cotton, etc.

Genetic basis of plant breeding; pure line selection; male sterility and incompatibility and their use in plant breeding; pedigree selection, mass selection and backcross method of selection; heterosis; plant introduction and exploration and their role in plant breeding; breeding for disease, insect and pest resistance; role of interspecific and intergeneric hybridisation; population improvement procedures; recurrent selection techniques; combining ability and its relationship with the components of gene action; seed production techniques; selection methods and changes in gene frequencies; mutation and its role in breeding; use of biotechnology in plant breeding. Molecular markers and their applications in genetic analysis and plant breeding.

### **MICROBIOLOGY (16)**

Origin and development of microbiology; classification of bacteria, fungi, algae, protozoa; microscopy; methods of isolation, pure cultures, enumeration, sterilization, preservation; morphology and reproduction in bacteria, fungi, actinomycetes, algae, viruses.

Microorganisms in food, fermented foods; spoilages of food; food - borne diseases; microbial pollution of air and water; water purification; energy and metabolic pathways in microorganisms; fermentation and industrially useful microbial processes - citric acid, lactic acid, ethanol, vinegar, production of antibiotics, enzymes, vitamins, amino acids; mutations and genetic recombination, transformation, transduction and conjugation; soil microorganisms and their activities; rhizosphere and phyllosphere; microbial association, microbial decomposition of organic wastes, composting and biogas; nitrification and denitrification; symbiotic and non-symbiotic nitrogen fixation; microbial transformation of phosphates; use of microorganisms and biofertilizers.

## **MOLECULAR BIOLOGY AND BIOTECHNOLOGY (17)**

Structure and organization of prokaryotic and eukaryotic cells; organization and expression of prokaryotic and eukaryotic genome; concept of gene; quantitative trait loci, mutation; genetic recombination; transformation; transduction; conjugation; structure, function and regulation of genes in pro- and eukaryotes; transcription and translation; recombinant DNA, restriction enzymes, vectors, plasmids, cosmids and bacteriophages, expression vectors, cloning strategies, construction and screening of genomic and cDNA libraries, nucleic acid hybridisation and DNA sequencing; restriction fragment length polymorphism; monoclonal antibodies and their application; enzyme engineering; genetic transformation of eukaryotes; crop improvement through genetic engineering; role of tissue culture in crop improvement; microbes in agriculture and industry; structure and function of proteins, nucleic acids, carbohydrates, lipids, enzymes; metabolism, glycolysis, citric acid cycle; respiration, bioenergetics; nucleic acid and protein biosynthesis; photosynthesis, nitrogen fixation.

## **NEMATOLOGY (18)**

History of Indian and world Nematology, importance of nematodes in agriculture and public health; techniques in nematology (microscopy, extraction of nematodes from different habitats, population estimation, handling of nematodes, staining, processing, microtomy, experimental method for proof of pathogenicity, culturing of nematodes, bioassays of nematicides, screening of crop genotypes against plant parasitic nematodes and basic molecular techniques); diversity of nematodes, classical and molecular phylogeny, nematode taxonomy, broader classification of nematodes, identification of plant and soil nematodes, general morphology of nematodes, insect-parasitic nematodes, and model nematodes. Biology and physiology of nematodes, types of parasitism, basic and applied aspects of plant –nematode interaction, symptomatology, histopathology and host specialization. Plant diseases caused by nematodes, nematode interaction with other pathogens, ecological factors influencing nematode activities and population dynamics; principles and methods of nematode control and management, recent advances in nematode management.

## **PLANT GENETIC RESOURCES (19)**

Biodiversity and agricultural intensification; origin and history of agriculture; ecosystem diversity, ecological basis of genetic variations and adaptation; domestication, introduction and adaptation of economically important plants; centres of crop plant origin and diversity; taxonomy of cultivated plants; origin, evolution, global distribution and economic use of important cereals, pulses, oilseeds, fruits, vegetables, commercial crops and medicinal plants; Indian Gene Centre; genetic variation in crop plants and management of germplasm collections - principles of collecting plant genetic resources (PGR), Crop wild relatives - sampling strategies, parameters of genetic diversity; principles and strategies of germplasm regeneration - considerations for regeneration of self and cross-pollinated crops; characterization, diversity analysis and evaluation of plant germplasm using morphological, biochemical and molecular approaches; DNA fingerprinting; strategies of PGR conservation - *ex situ* and *in situ* conservation, biotechnological approaches for conservation - *in vitro* conservation, cryopreservation; seed structure, physiology, biochemistry and storage biology; policy issues - exchange of PGR, plant quarantine, GMOs and biosafety issues, IPR related aspects; national and international programmes, global plant genetic resources networks.

## **PLANT PATHOLOGY (20)**

Landmarks and pioneers of plant pathology; microscopy and staining; structural and physiological differences amongst fungi and fungi like organism, bacteria, rickettsias, phytoplasma and spiroplasma, viruses and viroids; principles of culturing and preservation of pathogens; characteristic symptoms; host pathogen interaction; symbiosis; economically important diseases of crop plants induced by fungi and fungi like organism, bacteria, phytoplasma and spiroplasma, viruses and viroids; phanerogamic parasites, non-parasitic diseases; nutrition, growth, reproduction, life cycle, ultrastructure, genetics, nomenclature and classification of fungi, bacteria, viruses and other plant pathogens; Mendelian principles; cell structure; origin of life and evolution; beneficial microorganisms including mycorrhiza; variation in phytopathogens and their ecology; epidemiology; transmission; detection and diagnostic methods for pathogens; host resistance; seed -borne pathogens and plant quarantine; chemical and biological control, integrated management practices and advances in disease management.

## PLANT PHYSIOLOGY (21)

Atoms, molecules and ions; molarity, molality and normality; pH, buffers, solutions and colloids; permeability, diffusion and osmosis; cell structure and function; structure and metabolic role of cell organelles; concept of water status, water potential and its components, water uptake, transpiration, stomatal physiology, xylem and phloem transport; enzyme - mode and mechanism of action; structure and function of chloroplast; photosynthetic pigments, photosystems, electron transport, ATP synthesis, C<sub>3</sub>, C<sub>4</sub> and CAM pathways; redox potential; photorespiration, chemosynthesis, photosynthetic efficiency, glycolysis, HMP, TCA and glyoxylate cycles; macro - and micro-nutrient elements and their functions, deficiency symptoms, role in metabolism; foliar nutrition; nitrogen metabolism including nitrate reduction, ammonia assimilation, transamination, protein synthesis, nitrogen fixation; carbohydrate metabolism; sulphur metabolism; fatty acid and lipid synthesis and degradation; secondary metabolites; plant hormones - biosynthesis and catabolism, signalling and role in plant growth and development including stress responses; photoperiodism, vernalization and flowering, florigen concept; light receptors-phytochrome, cryptochrome, phototropins; sex expression; Abscission, senescence and PCD; seed physiology; dormancy; growth analysis, measurement of key growth functions such as NAR, LAI, RGR, growth response in relation to environmental factors; crop canopies and light utilization; source-sink relationship, dry matter partitioning; physiological basis of crop productivity - case histories of some crop plants viz, cereals, grain legumes and oilseeds; environmental stresses viz, high and low temperature, light, water, salinity and alkalinity, their terminology and measurement techniques, Phenotyping methods, abiotic stress signalling, mechanisms of stress responses in plants; environmental pollution, green house effects; post harvest physiology, ripening mechanism; molecular biology of plant processes, response to environmental and developmental cues, growth and development; basic principles of methodology/instrumentation in plant physiological research e.g., chromatography, spectroscopy, centrifugation, radioactivity, electrophoresis, hydroponics, tissue culture.

## POST HARVEST TECHNOLOGY (22)

**Choose any one the following sub-disciplines:**

### **i. Post Harvest Technology for Horticultural Crops**

Role of fruits and vegetables in human nutrition; Pre-harvest treatments in relation to postharvest quality of horticultural produce; Biochemical changes in fruits and vegetables with special reference to ripening: role played by ethylene, respiration and transpiration; Important nutrients and enzymes associated with fresh and stored fruits and vegetables; storage of fresh fruits and vegetables; Post harvest management of horti produce-maturity indices, handling, packaging, storage-methods and structures; Post-harvest treatments (HWT, VHT, irradiation, bioagents); Novel molecules (salicylic acid, nitric oxide, 1-MCP); Postharvest diseases, disorders and their management; Various methods of fruit and vegetable preservation: heat processing, dehydration, refrigeration, freezing and chemical preservation, hurdle technology etc; Advances in food processing techniques: microwave heating, vacuum impregnation, HPP, PEF, Ultrasonics; Processed horticultural products and packaging; Spoilage of processed products; Food quality evaluation techniques; Food contaminants Food Safety & Standards; Utilization of horticultural wastes; Postharvest technology of commercially important plantation crops (coconut, cashew, oil palm, cocoa); Bio-technological tools (genes/enzymes/GM crops) for enhancing quality and shelf-life of horti-crops; Important statistical designs and methods of their statistical analysis.

### **ii. Post Harvest Engineering and Technology**

Thermodynamics applied to food processing; Fluid flow analyses; Similitude and Dimensional analysis; Instrumentation involved in food engineering; Heat and Mass transfer; Design of heat exchangers; Mass and energy balance; Losses at different stages of the food chain; Cleaning, Sorting and Grading; Drying; Size reduction; Mechanical separation: Sieving, Clarification, Filtration, Sedimentation; Leaching; Evaporation; Distillation; Crystallization; Coagulation; Mixing; Densification: Granulation and briquetting, Pelletization; Parboiling; Shelling/Dehusking/Decorticating; Milling of cereals, pulses and oilseeds; Pressing and Expelling; Extrusion, Stabilization and Cryogenics; Machineries for processing of agricultural products- cereals, pulses, oilseeds, fruits and vegetables; Handling and packaging of fresh and processed agro produce;

Grain storage structures: On-farm and commercial storage structures for agricultural produce; Design of structure and equipment for handling, storage and packaging of agricultural produce; Test of hypothesis, multiple regression; fundamentals of computers; Cost scheduling and appraisal; PERT and CPM techniques.

### **SEED SCIENCE AND TECHNOLOGY (23)**

Cell structure and function; cell division; pollination, fertilization and embryogenesis; apomixis; Mendelian principles; linkage; recombination and gene mapping; ploidy variations - euploids and aneuploids; chromosomal aberrations; extra-chromosomal inheritance; mutation; genetic basis of plant breeding; pure line, pedigree and mass selection; backcross and recurrent selection techniques; heterosis and combining ability; male sterility and incompatibility and their use in plant breeding and hybrid seed production; chemical composition of seeds; biosynthesis of carbohydrates, proteins and fats; mechanism and factors determining seed germination and dormancy; germination inhibitors and promoters; endogenous hormonal regulation of germination and dormancy; breaking of dormancy; seed vigour and viability; seed quality concept; system of seed quality control; testing, release and notification of varieties, deterioration of varieties; maintenance of genetic purity; area of seed production; management of hybrid seed production - isolation and synchronization of flowering; role of insect pollinators and their efficiency; factors responsible for mechanical injury to seed; seed legislation; seed certification - concept and procedures; measurement of seed quality; metabolic changes associated with seed deterioration; seed packaging, storage and marketing; insect ecology; principles of insect control in field crops; integrated pest management; fumigation and chemical treatment for pest control in store; fungal, bacterial and viral seed borne diseases of cereals, pulses, oilseeds and vegetables and their control; seed moisture; seed drying and processing; history of seed industry in India; national and international organisations for seed quality control and trade.

### **SOIL SCIENCE AND AGRICULTURAL CHEMISTRY (24)**

Rocks and minerals; mineral weathering and soil formation; Soil taxonomy, classification of soils, major soils of India, soil survey; principal silicate structures; nature and properties of organic and inorganic constituents of soils, ion exchange phenomenon; activity of ions in soil system; fixation and release of nutrients. Soil fertility evaluation; movement of water; problem soils, soil-related constraints in crop production and remedial measures, soil amendments; soil and water conservation; sampling and analytical procedures for soils, plants, water, manures, fertilizers and soil amendments; quality of irrigation water; fertilizer recommendations; soil organic matter, soil microflora; carbon, nitrogen and phosphorus cycles; biofertilizers; phosphate solubilization; Darcy's law; Fick's law, steady and transient state diffusion in soils. Essential plant nutrients; manures; utilization of organic wastes and industrial by-products; fertilizers and their production, properties and usage; secondary and micronutrients; soil pollution, chemical and bio-remediation of contaminated soils.

### **VEGETABLE SCIENCE (25)**

Area and production of vegetable crops in India, climatic and soil requirements, seed production techniques in vegetable crops and related problems.

Origin, classification, cytogenetics, floral biology and breeding behaviour of different vegetables; methodology for the improvement of different self-and cross-pollinated vegetable crops including breeding for disease and insect resistance; Mendel's laws of inheritance.

Role of different nutrients, their deficiency symptoms and remedial measures; improved vegetable production technology.

Important statistical designs and methods of statistical analysis general principles of fruits and flower production; major methods of preservation and processing of horticultural crops.

### **WATER SCIENCE AND TECHNOLOGY (26)**

Water resources of India, physical, chemical, biological properties of water; irrigation development in India; command area development; Basic concepts of soil physics and fluid mechanics; infiltration theory; seepage; Darcy's law; Bernoulli's theorem; hydraulic conductivity; soil water flow; composition of atmosphere and its constituents; soil air, thermal properties of soil;



climate characterization, climatic change, flood, monsoon, precipitation, water harvesting; ground water recharge and conservation; various types of droughts, drought indices, drought management, water budgeting.

Evaporation; evapotranspiration; crop water requirement; plant growth processes; water stress in plant; irrigation scheduling; field water balance; soil-plant-water relationship; irrigation methods, irrigation efficiencies, water distribution networking (large and moderate scale); water measurement and conveyance structures; pressurized irrigation system and its design.

Surface and ground water quality; national and international water quality standards; irrigation with poor quality water, waste water management, surface and sub-surface drainage system, drainage for salinity control, drainage effluent management.

Ground water hydraulics, geophysical techniques in ground water, surface hydrology, hydrometeorology; watershed management; soil and water conservation practices and design; irrigated water resource management; degradation of soil and water resources and their mitigation measures.

Water rights; water laws; water disputes; water pricing; water users associations; use of remote sensing and GIS in water resource management; decision support system, expert system for planning and operation of water resources.

## 17. INSTRUCTIONS FOR FILLING UP ONLINE APPLICATION FORM

**STEP 1:** Type "<http://phdentranceiari.icar.gov.in>" on your browser and hit enter (Best viewed on Google Chrome).

**STEP 2:** Click on "Register Here" button on the right side on the homepage.

**STEP 3:** Fill up the required details in the textbox on the page shown above and click on "Register" button.

**STEP 4:** After successful registration, click on "Login" button and enter your email ID and password you entered in Step 3 above. Change the password after the first login.

**STEP 5:** After successful login, a page will open with multiple text & dropdown fields.

**STEP 6:** Select your **admission scheme** from the "Scheme" dropdown. Fill-up all the other details as required and also fill the contact details as well. Then click on "Save and Next" button.

**STEP 7:** After clicking save and next, a new page will open in which **education details** have to be filled. While filling graduation details please enter either "Marks Percentage" or "Obtained OGPA". If you have selected "Obtained OGPA", enter the "Total OGPA" also. After filling all the required details, click on "Save and Next" button to proceed further.

**STEP 8:** After successfully filling the education details, **image upload page will open**, here the applicant will upload his/her photo on "Image Upload" button, Click on "Choose File" and upload your photograph. The candidate's photograph should be less than 100 kb and greater than 10 kb. After uploading photograph, the candidate has to upload **his/her signature**. Here the applicant will upload his/ her signature on "Signature Upload" button below. The candidate's signature has to be less than 20 kb and greater than 10 kb.

**STEP 9:** After uploading the photo and signature, click on **upload button after successful upload**, a message will appear "Upload status: Images uploaded!" like this. Click on "Next" button on the right side of the same page.

**STEP 10:** After clicking "Next" button, a page asking for **Payment Details** will appear. Here you will enter the Online Transaction details (UTR No.) for the registration of IARI Ph.D. Entrance Examination 2019-20. Fees for IARI Ph.D. Entrance Examination 2019-20 is 1000 (One thousand only) for UR/OBC category and ` 500 (Five hundred only) for SC/ST/PC/CWSF category. After filling all the necessary details, click on "Save and Next" button.

**STEP 11:** After clicking "Save and Next" button, preview of your application. Here you can review all your details that have been filled. After checking all the details check the declaration checkbox on the bottom of the page. After checking the check box a Final Submit button will appear below the checked box. Click on button. After clicking on **Final Submit button**, an alert window will open asking for conformation for submission. Click on "OK" to submit your application.

**STEP 12:** After clicking "OK" a page with application form will open. Click on "Print" to print the form.

**STEP 13:** After successful submission, the candidate should take a printout of the online submitted Application Form and send the hard copy of it to **Registrar, PG School, IARI, New Delhi-110012** along with self-attested copies of the following documents:

- Matriculation (Class X) certificate for proof of Date of Birth.
- Master's degree certificate and marks sheet.
- SC/ST/OBC/PC/CWSF certificate (whichever is applicable).
- Certificate required from candidates appeared/appearing for M.Sc./M.Sc.(Ag.)/M.E. or M.Tech. final year examination - 2019.
- Copy of Bank counterfoil mentioning the details of ONLINE transfer of fee (RS.1000/- (One thousand only) for UR/OBC category and Rs.500/- (Five hundred only) for SC/ST/PC/CWSF category) namely the (i) Name and Branch of the Bank (ii) UTR No. and Date of payment made.

**STEP 14:** The hard copy i.e. the printout of online application form duly signed by the candidate along with the required documents (as per STEP 13) must reach the **Registrar, PG School, IARI, New Delhi-110012 on or before April 29, 2019.**

**STEP 15:** Hard copies received after the last date at the IARI, New Delhi will be rejected.

**STEP 16:** Please note that fee shall be submitted ONLINE only.

**STEP 17:** In order to avoid last minute rush, the candidates are advised to apply early enough. The IARI will not be responsible for network problems or postal delay in submitting the hard copy of the applicable form along with the required documents or any other problems of this nature in submission of an online application during last days.

**Note:** The details once submitted cannot be changed later on. Therefore, ensure that you have filled in the correct and complete information before submission of application form.



## ANNEXURE - I

### SPONSORED FOR ADMISSION UNDER FACULTY UPGRADATION SCHEME AND ICAR IN-SERVICE NOMINEES SCHEME

#### Declaration by the Employer of the Candidates

(In the case of candidates employed, his/her application shall not be considered valid unless the declaration is completed in full by the employer or the Head of the Institution).

- i. Certified that the particulars given by Dr./Mr./Ms. \_\_\_\_\_(Name, Designation) in this form have been verified and found correct.
- ii. Dr./Mr./Ms. \_\_\_\_\_ (Name, Designation) will be granted Deputation Leave/Study Leave/Extra-Ordinary Leave or he/she will be given a scholarship or stipend of the value of Rs. \_\_\_\_\_per month. On completion of the training, he/she will be required to serve this Department / Institute / University for a period of \_\_\_\_\_ years.
- iii. If selected for admission, the candidate will be relieved to join the course at IARI/CIAE as directed by the IARI on July 25, 2019.
- iv. If selected for the award of IARI (or other) fellowship, there will be no objection to his/her receiving the scholarship and contingency amounts attached there to subject to the following conditions.
  - (a) \_\_\_\_\_
  - (b) \_\_\_\_\_
  - (c) \_\_\_\_\_
- v. Certified that I am competent to take the decision to sponsor him/her on the terms and conditions mentioned above/the decision to sponsor him/her on the above terms and conditions has been taken by and is being communicated under the direction of who is the competent authority.
- vi. This University/Organization/Department undertakes to pay dues outstanding against the candidate and not paid by him/her.

Signature \_\_\_\_\_  
Designation \_\_\_\_\_  
Address \_\_\_\_\_  
(with Official Seal)

## ANNEXURE – II

### FORM OF CERTIFICATE TO BE PRODUCED BY CANDIDATES BELONGING TO OTHER BACKWARD CLASSES (OBC) CATEGORY AS PER GOVT. OF INDIA NOTIFICATION

This is to certify that Shri/Smt./Kum. \_\_\_\_\_ Son./Daughter of Shri/Smt. \_\_\_\_\_ of Village/Town \_\_\_\_\_ District/Division \_\_\_\_\_ in the \_\_\_\_\_ State belongs to the \_\_\_\_\_ Community which is recognized as a backward class under.

- i) Resolution No.12011/68/93-BCC© dated 10.9.93 published in the Gazette of India Extraordinary Part I Section I No.186 dated 13.9.93.
- ii) Resolution No.12011/9/94-BCC© dated 19.10.94 published in the Gazette of India Extraordinary Part I Section I No.163 dated 20.10.94.
- iii) Resolution No.12011/7/95-BCC© dated 24.5.95 published in the Gazette of India Extraordinary Part I Section I No.88 dated 20.5.95.
- iv) Resolution No.12011/96/94-BCC© dated 9.3.96.
- v) Resolution No.12011/44/96-BCC© dated 6.12.96 published in the Gazette of India Extraordinary Part I Section I No.210 dated 11.12.96.
- vi) Resolution No.12011/13/97-BCC© dated 3.12.97.
- vii) Resolution No.12011/99/94-BCC© dated 11.12.97.
- viii) Resolution No.12011/68/98-BCC© dated 27.10.99.
- ix) Resolution No.12011/88/98-BCC© dated 6.12.99 published in the Gazette of India Extraordinary Part I Section I No.270 dated 6.12.99.
- x) Resolution No.12011/36/99-BCC© dated 4.4.2000 published in the Gazette of India Extraordinary Part I Section I No.71 dated 4.4.2000.
- xi) Resolution No.12011/44/99-BCC© dated 21.9.2000 published in the Gazette of India Extraordinary Part I Section I No.210 dated 21.9.2000.
- xii) Resolution No.12015/9/2000-BCC© dated 6.9.2001.
- xiii) Resolution No.12011/1/2000-BCC© dated 19.6.2003.
- xiv) Resolution No.12011/4/2004-BCC© dated 13.1.2004.
- xv) Resolution No.12011/9/2004-BCC© dated 16.1.2006 published in the Gazette of India Extraordinary Part I Section I No.210 dated 16.1.2006.
- xvi) Resolution No.12011/14/2004-BCC© dated 12.3.2007 published in the Gazette of India Extraordinary Part I Section I No.186 dated 12.2.2007.

Shri/Smt./Kum. \_\_\_\_\_ and /or his family ordinarily reside(s) in the \_\_\_\_\_ District/Division of State. This is also to certify that he/she does not belong to the persons/sections (Creamy Layer) mentioned in Column 3 of the Schedule to the Govt. of India, Department of Personnel & Training O.M.No.36012/22/93-Estt.(SCT) dated 8.9.93 which is modified vide O.M.No.36033.3.2004 Estt.(Res.) dated 9.3.2004.

Dated:

District Magistrate/Deputy Commissioner  
(Seal)

**Note:**

- a) The term "Ordinarily" used here will have the same meaning as in Section 20 of the Representation of the People Act, 1950.
- b) The authorities competent to issue Caste Certificates are indicated below.
  - i) District Magistrate/Additional Magistrate/Collector/Deputy Commissioner/Additional Deputy Commissioner/Deputy Collector / 1<sup>st</sup> Class Stipendiary Magistrate/Sub-Divisional Magistrate/Taluka Magistrate/Executive Magistrate/Extra Assistant Commissioner (Not below The Rank of 1<sup>st</sup> Class Stipendiary Magistrate).
  - ii) Chief Presidency Magistrate/Additional Chief Presidency Magistrate/Presidency Magistrate.
  - iii) Revenue Officer not below the rank of Tehsildar and
  - iv) Sub-Divisional Officer of the area where the candidate and/or his family resides.

### **Declaration/undertaking - for OBC candidates only**

I, \_\_\_\_\_ son/daughter of Shri \_\_\_\_\_ resident of Village/Town/City \_\_\_\_\_ District \_\_\_\_\_ State \_\_\_\_\_ hereby declare that I belong to the \_\_\_\_\_ Community which is recognized as a Backward Class by the Govt. of India for the purpose of reservation in services as per orders contained in Department of Personnel and Training Office Memorandum No.36012/22/93-Estt.(SCT), dated 8.9.1993. It is also declared that I do not belong to persons/Sections (Creamy Layer) mentioned in Column 3 of the Schedule to the above referred Office Memorandum, dated 8.9.1993, which is Modified vide Department of Personnel and Training Office Memorandum No.36033/3/2004 Estt.(Res.) dated 9.3.2004.

Place: \_\_\_\_\_  
Date: \_\_\_\_\_

Signature of the Candidate

\*Declaration/undertaking not signed by candidate will be rejected.

\*False declaration will render the applicant liable for termination of registration at any time.

### **Creamy Layer Definition**

OBC Creamy layer is defined comprehensively at <http://ncbc.nic.in/html/creamyayer.html>

All candidates for the OBC reserved seats should make sure that they do not satisfy any of the creamy layer criteria as listed in the website. Some exclusions for quick reference (no way comprehensive) are as follows.

1. Any of the parents holds a constitutional position in Govt. of India
2. Any one of the parents is a class I officer.
3. Both the parents are class II Officers.
4. Any one of the parents is employed in an equivalent rank to class I officer or both parents equivalent to class II officer in a public sector, insurance companies, banks, universities or in other organizations.
5. Land holdings on irrigated land is 85% or more of the statutory ceiling area.
6. Parents income is as per Govt. of India directives.

## ANNEXURE - III

### FORM OF CERTIFICATE TO BE PRODUCED BY A CANDIDATE BELONGING TO SC/ST CATEGORY IN SUPPORT OF HIS/HER CLAIM

#### FORM OF CASTE CERTIFICATE

1. This is to certify that Shri/Smt./Kumari \_\_\_\_\_ son/daughter of \_\_\_\_\_ village/town\*in District/Division\_\_\_\_\_of the State/ Union Territory\* \_\_\_\_\_ belongs to the \_\_\_\_\_Caste/Tribe\* which is recognised as SC/ST\* under

The Constitution (Scheduled Caste) Order, 1950; The Constitution (Scheduled Tribe) Order, 1950; The Constitution (Scheduled Caste) Union Territories Order, 1951; The Constitution (Scheduled Tribes) Union Territories Order, 1951; as amended by the SCs and STs List (Modification) Order, 1950; the Bombay Reorganisation Act, 1960; the Punjab Reorganisation Act, 1966; the State of HP Act, 1970; the North Eastern Areas (Reorganisation) Act, 1971 and the SCs and STs Order (Amendment) Act, 1976; The Constitution (Jammu & Kashmir) SC Order, 1956; The Constitution (Andaman & Nicobar Islands) SC Order 1959 as amended by SCs and STs Order (Amendment) Act, 1976; The Constitution (Dadra and Nagar Haveli) SCs Order, 1962; The Constitution (Dadra and Nagar Haveli) STs Order, 1962; The Constitution (Pondicherry) SCs Order, 1964; The Constitution Scheduled Tribes (Uttar Pradesh) Order, 1967; The Constitution (Goa, Daman & Diu) SCs Order, 1968; The Constitution (Nagaland) STs Order, 1970; The Constitution (Sikkim) SCs Order, 1968.

2. Applicable in the case of SC/ST persons who have migrated from the State/Union Territory Administration.

The certificate is issued on the basis of the SC/ST certificate to Shri/Shrimati\* \_\_\_\_\_ father/mother\* of Shri/Shrimati/Kumari\* \_\_\_\_\_ of village/town\* \_\_\_\_\_ in District/Division\* \_\_\_\_\_ of the State/Union Territory\* \_\_\_\_\_ who belongs to the \_\_\_\_\_ caste/tribe\* which is recognised as Scheduled Caste/ Scheduled Tribe\* in the State/Union Territory\* issued by the \_\_\_\_\_ (Name of the prescribed authority) vide their letter No. \_\_\_\_\_ dated \_\_\_\_\_.

3. Shri/Shrimati/Kumari\* \_\_\_\_\_ and/or\* his/her family ordinarily reside(s) in Village / Town\* \_\_\_\_\_ of District \_\_\_\_\_ of State/ Union Territory of \_\_\_\_\_.

Signature \_\_\_\_\_  
\*\*Designation \_\_\_\_\_  
(with Seal of Office)

Place \_\_\_\_\_ State/Union Territory Date \_\_\_\_\_

\*Please strike off the words which are not applicable.

#Please quote specific Presidential Order.

% Strike off the paragraph which is not applicable.

**NOTE:** The term “Ordinarily reside(s)” used here will have the same meaning as in Section 20 of the Representation of the People's Act, 1950.

**\*\* List of authorities empowered to issue SC/ST certificate:**

1. District Magistrate/Additional District Magistrate/Deputy Commissioner/Additional Deputy Commissioner/ Deputy Collector / 1st Class Stipendiary Magistrate/City Magistrate/Sub-divisional Magistrate / Taluka Magistrate/ Executive Magistrate / Extra Assistant Commissioner not below the rank of 1st Class Stipendiary Magistrate.
2. Chief Presidency Magistrate/Additional Chief Presidency Magistrate/Presidency Magistrate.
3. Revenue Officers not below the rank of Tehsildar.
4. Sub-Divisional Officer of the area where the candidate and/or his family normally resides.
5. Administrator/Secretary to Administrator/Development Officer (Lakshadweep Islands).

## **ANNEXURE - IV**

### **FORM OF CERTIFICATE TO BE PRODUCED BY A CANDIDATE BELONGING TO PHYSICALLY CHALLENGED CATEGORY IN SUPPORT OF HIS/HER CLAIM**

#### **FORM OF PHYSICALLY CHALLENGED CERTIFICATE**

This is to certify that Shri/Smt./Kumari \_\_\_\_\_ son/daughter of \_\_\_\_\_ village/town \_\_\_\_\_ in District/ Division \_\_\_\_\_ of the State/Union Territory \_\_\_\_\_ belongs to the Physically Challenged category with disability percentage \_\_\_\_\_ and type of disability \_\_\_\_\_ he/she is fit for undergoing the Ph.D. programme in Agricultural Sciences at IARI/IIHR/CIAE.

Signature, Name and Seal of the  
Medical Superintendent  
of the Govt. Hospital

**NOTE:** The criteria for "Physically Challenged" shall be as applicable under the rules and regulations of ICAR/ Government of India for pursuing post-graduate education in agriculture.

## ANNEXURE - V

### FORM OF CERTIFICATE TO BE PRODUCED BY CANDIDATES WHO ARE APPEARING FOR THEIR MASTER'S FINAL EXAMINATION 2019

This is to certify that Shri/Smt./Kumari \_\_\_\_\_ son/daughter of \_\_\_\_\_  
village/town \_\_\_\_\_ in District Division \_\_\_\_\_ of the State/Union Territory is a  
final year student of M.Sc./M.Sc.(Ag)/M.Tech./M.E. in the discipline of \_\_\_\_\_ and  
has appeared/appearing for his/her final year examination, 2019.

Signature and seal  
Dean/Registrar of the University or  
Principal of the College

**NOTE:** This certificate must be issued only by the Principal of the College/Registrar or Dean of the  
University where the student is studying in the final year of his / her Master's Degree.



## ANNEXURE-VI

**POST GRADUATE SCHOOL**  
**Indian Agricultural Research Institute, New Delhi**  
**Ph.D. Entrance Examination for Session 2019-20**  
**Date of Examination: May 26, 2019**  
**OMR ANSWER SHEET**

SIDE - 1

1. ROLL NO.	2. CENTRE OF EXAM. (Write name of the city only)	3. DISCIPLINE NAME	4. DISCIPLINE CODE
<div style="border: 1px solid black; width: 100%; height: 100%; display: flex; align-items: center; justify-content: center;"> <div style="border: 1px solid black; width: 40px; height: 20px; display: flex; align-items: center; justify-content: center;"> </div> <div style="border: 1px solid black; width: 40px; height: 20px; display: flex; align-items: center; justify-content: center;"> </div> <div style="border: 1px solid black; width: 40px; height: 20px; display: flex; align-items: center; justify-content: center;"> </div> <div style="border: 1px solid black; width: 40px; height: 20px; display: flex; align-items: center; justify-content: center;"> </div> <div style="border: 1px solid black; width: 40px; height: 20px; display: flex; align-items: center; justify-content: center;"> </div> </div>			

### GENERAL INSTRUCTIONS

1. Write all information under Serial Nos. 1 - 4 on Side - 1 in CAPITAL LETTERS with a ball point pen.
2. Write all information in boxes 5 to 8 on Side - 2 of the Answer Sheet and shade the appropriate circles with an HB Pencil.
3. Please put your signature with a ball point pen in box 10 on side - 2 of the Answer Sheet.
4. Shade the circles on Side - 2 with an HB Pencil only. For detailed information in this regard see INSTRUCTIONS FOR MARKING ANSWERS given below.
5. Please note that in this Answer Sheet the questions are divided into two parts. The upper part has multiple choice type questions progressing from top to bottom in five columns from question nos. 1-130. Each question has four answering options. Please shade the correct answer as given below.  
 In the lower part three are matching type questions. No. 131-140) progressing from left to right. Each question has five sub questions from (i) - (v) with answering options (a) - (e). Please shade the correct answer as shown in the example below.
6. GEN = General Category; OBC = Other Backward Class; SC = Scheduled Caste; ST = Scheduled Tribe and PC = Physically Challenged
7. Sub - discipline codes are provided for the candidates of Horticulture and Agricultural Engineering.
8. Answer Question Nos. 141-150 in the space provided in the Question booklet.
9. Please return the OMR Sheet and Question Booklet to the invigilator after completion of the examination.

#### EXAMPLE FOR

**Multiple Choice Type**  
**Question Nos. (1 - 30)**

(a) ● (b) ● (c) ● (d) ● (e) ●

#### EXAMPLE FOR

**Cross Matching Type**  
**Question Nos. (131 - 140)**

(i) (a) ● (b) ● (c) ● (d) ● (e) ●  
 (ii) (a) ● (b) ● (c) ● (d) ● (e) ●  
 (iii) (a) ● (b) ● (c) ● (d) ● (e) ●  
 (iv) (a) ● (b) ● (c) ● (d) ● (e) ●  
 (v) (a) ● (b) ● (c) ● (d) ● (e) ●

### INSTRUCTIONS FOR MARKING ANSWERS

1. Use HB Pencil only for shading the circles on Side - 2 of the Answer Sheet.
2. Darken the circle completely so that the letter / number inside the circle is not visible.
3. Darken only ONE CIRCLE for each answer as shown in the example below. If you darken more than one circle, your answer will be treated as wrong.

(a) ● (b) ● (c) ● (d) ● (e) ●

Correct Method

✗ (a) ● (b) ● (c) ● (d) ● (e) ●

Wrong Method

(a) ● (b) ✗ (c) ● (d) ● (e) ●

Wrong Method

(a) ● (b) ● (c) ● (d) ● (e) ●

Wrong Method

4. If you wish to change an answer ERASE completely the already darkened CIRCLE, then make a fresh mark.
5. Shade the CIRCLES only in the space provided. Please do not make any stray marks on the Answer Sheet.
6. Rough work MUST NOT be done on the Answer Sheet. Use your Test Booklet for doing the rough work.

5. Roll Number

0	0	0	0	0
1	1	1	1	1
2	2	2	2	2
3	3	3	3	3
4	4	4	4	4
5	5	5	5	5
6	6	6	6	6
7	7	7	7	7
8	8	8	8	8
9	9	9	9	9

6. Category

GEN (1)
OBC (2)
SC (3)
ST (4)
PH (5)

7. Discipline Code

0	0
1	1
2	2
3	3
4	4
5	5
6	6
7	7
8	8
9	9

8. Sub Discipline Code

1
2
3

9. Answers

Q.No.	Answer	Q.No.	Answer	Q.No.	Answer	Q.No.	Answer	Q.No.	Answer
1	(a) b c d	27	(a) b c d	53	(a) b c d	79	(a) b c d	95	(a) b c d
2	(a) b c d	28	(a) b c d	54	(a) b c d	80	(a) b c d	106	(a) b c d
3	(a) b c d	29	(a) b c d	55	(a) b c d	81	(a) b c d	107	(a) b c d
4	(a) b c d	30	(a) b c d	56	(a) b c d	82	(a) b c d	108	(a) b c d
5	(a) b c d	31	(a) b c d	57	(a) b c d	83	(a) b c d	109	(a) b c d
6	(a) b c d	32	(a) b c d	58	(a) b c d	84	(a) b c d	110	(a) b c d
7	(a) b c d	33	(a) b c d	59	(a) b c d	85	(a) b c d	111	(a) b c d
8	(a) b c d	34	(a) b c d	60	(a) b c d	86	(a) b c d	112	(a) b c d
9	(a) b c d	35	(a) b c d	61	(a) b c d	87	(a) b c d	113	(a) b c d
10	(a) b c d	36	(a) b c d	62	(a) b c d	88	(a) b c d	114	(a) b c d
11	(a) b c d	37	(a) b c d	63	(a) b c d	89	(a) b c d	115	(a) b c d
12	(a) b c d	38	(a) b c d	64	(a) b c d	90	(a) b c d	116	(a) b c d
13	(a) b c d	39	(a) b c d	65	(a) b c d	91	(a) b c d	117	(a) b c d
14	(a) b c d	40	(a) b c d	66	(a) b c d	92	(a) b c d	118	(a) b c d
15	(a) b c d	41	(a) b c d	67	(a) b c d	93	(a) b c d	119	(a) b c d
16	(a) b c d	42	(a) b c d	68	(a) b c d	94	(a) b c d	120	(a) b c d
17	(a) b c d	43	(a) b c d	69	(a) b c d	95	(a) b c d	121	(a) b c d
18	(a) b c d	44	(a) b c d	70	(a) b c d	96	(a) b c d	122	(a) b c d
19	(a) b c d	45	(a) b c d	71	(a) b c d	97	(a) b c d	123	(a) b c d
20	(a) b c d	46	(a) b c d	72	(a) b c d	98	(a) b c d	124	(a) b c d
21	(a) b c d	47	(a) b c d	73	(a) b c d	99	(a) b c d	125	(a) b c d
22	(a) b c d	48	(a) b c d	74	(a) b c d	100	(a) b c d	126	(a) b c d
23	(a) b c d	49	(a) b c d	75	(a) b c d	101	(a) b c d	127	(a) b c d
24	(a) b c d	50	(a) b c d	76	(a) b c d	102	(a) b c d	128	(a) b c d
25	(a) b c d	51	(a) b c d	77	(a) b c d	103	(a) b c d	129	(a) b c d
26	(a) b c d	52	(a) b c d	78	(a) b c d	104	(a) b c d	130	(a) b c d
Q.No. 131	(i) (a) b c d e	Q.No. 132	(i) (a) b c d e	Q.No. 133	(i) (a) b c d e	Q.No. 134	(i) (a) b c d e	Q.No. 135	(i) (a) b c d e
	(ii) (a) b c d e		(ii) (a) b c d e		(ii) (a) b c d e		(ii) (a) b c d e		(ii) (a) b c d e
	(iii) (a) b c d e		(iii) (a) b c d e		(iii) (a) b c d e		(iii) (a) b c d e		(iii) (a) b c d e
	(iv) (a) b c d e		(iv) (a) b c d e		(iv) (a) b c d e		(iv) (a) b c d e		(iv) (a) b c d e
	(v) (a) b c d e		(v) (a) b c d e		(v) (a) b c d e		(v) (a) b c d e		(v) (a) b c d e
Q.No. 136	(i) (a) b c d e	Q.No. 137	(i) (a) b c d e	Q.No. 138	(i) (a) b c d e	Q.No. 139	(i) (a) b c d e	Q.No. 140	(i) (a) b c d e
	(ii) (a) b c d e		(ii) (a) b c d e		(ii) (a) b c d e		(ii) (a) b c d e		(ii) (a) b c d e
	(iii) (a) b c d e		(iii) (a) b c d e		(iii) (a) b c d e		(iii) (a) b c d e		(iii) (a) b c d e
	(iv) (a) b c d e		(iv) (a) b c d e		(iv) (a) b c d e		(iv) (a) b c d e		(iv) (a) b c d e
	(v) (a) b c d e		(v) (a) b c d e		(v) (a) b c d e		(v) (a) b c d e		(v) (a) b c d e

10. CANDIDATE'S SIGNATURE

11. INVIGILATOR'S SIGNATURE

## ANNEXURE - VII

### FORM OF SURETY BOND TO BE EXECUTED BY A CANDIDATE WHO IS PURSUING Ph.D. AS SENIOR RESEARCH FELLOW IN ICAR DEEMED UNIVERSITIES THROUGH A COMPETITIVE EXAMINATION

I \_\_\_\_\_ Son/Daughter of \_\_\_\_\_ resident of \_\_\_\_\_ pursuing Ph.D. in Indian Agricultural Research Institute, deemed to be university under ICAR (hereinafter called the obligor) and Sh./Smt./Kum./ \_\_\_\_\_ Son/Daughter of \_\_\_\_\_ (full address

\_\_\_\_\_ (hereinafter called surety) do hereby bind myself and my respective heirs, executors and administrators to pay to the Indian Agricultural Research Institute, Deemed University under ICAR, a society registered under the Societies Registration Act-1860 Krishi Bhawan Dr. Rajendra Prasad Road, New Delhi-110001 on demand the sum of Rs. 50000/- (Rupees Fifty Thousand only) together with interest thereon from the date of demand of Government rates for the time being in force on Government loans (if payments is made in a country other than India. Equivalent of the said amount in the currency of that country converted at the official rate of exchange between that country and India) and together with all costs between attorney and all client and all charges and expenses that shall or may have been incurred by the IARI.

Whereas the obligor has been pursuing Ph.D. at IARI as a result of the competitive examination held in the year 2019.

And whereas for the better protection of the IARI, the obligor has agreed to execute this bond with such condition as here under is written.

And whereas the said surety has agreed to execute this bond as surety on behalf of the above bounden

Now the Condition of the above Written Obligation is that in the event of the named obligor, Sh./Smt./Kum./ \_\_\_\_\_ leaving the studies after taking admission on the basis of the competitive examination without completion of Ph.D. of 3 years or on his/her being rusticated removed from the Deemed University, the obligor and/or the Surety shall forthwith pay to the IARI as may be directed by the IARI on demand the sum of ` \_\_\_\_\_ (Rupees \_\_\_\_\_) together with interest thereon from the date of demand at Government rates for the time being in force on Government loans.

And upon the obligor Sh./Smt./Kum. \_\_\_\_\_ and \_\_\_\_\_ the surety aforesaid, making such payment the above written obligation shall be void and if no effect otherwise, it shall remain in full force and virtue.

Provided always that the liability of the surety here under shall not be impaired or discharged by reasons of time being granted or by any forbearance act or omission of the IARI or any person authorized by them (whether with or without the consent or knowledge of the surety) nor shall it be necessary for the IARI to sue the obligor first before suing the surety Sh./Smt./Kum./ for amounts due hereunder.

The bond shall in all respect be governed by the laws of India for the time being in force and the rights and liabilities hereunder shall, where necessary, be accordingly determined by the appropriate courts in India.

Signed on dated this \_\_\_\_\_ day of \_\_\_\_\_ two thousand \_\_\_\_\_ Signed and delivered by the obligor above named Sh./Smt./Kum. \_\_\_\_\_ in the presence of \_\_\_\_\_.

Signature of the Candidate \_\_\_\_\_  
Address \_\_\_\_\_  
\_\_\_\_\_

Witnesses :  
(Signature, Name and Address)

1. \_\_\_\_\_
2. \_\_\_\_\_

Signed and delivered by the surety above named

Sh./Smt./Kum \_\_\_\_\_

in the presence of \_\_\_\_\_

Witnesses :

(Signature, Name and Address)

1. \_\_\_\_\_

2. \_\_\_\_\_

\*(In the case of married women candidate, her husband's name is to be mentioned as wife of \_\_\_\_\_).

**Note:** The following persons can also stand sureties for the students :

1. Parent/guardian of the student
2. Guide/teachers of the student
3. Sarpanch of the Village Panchayat to which the student belongs.
4. MLA
5. Local guardian of student, if any
6. Any other Central Government or State Government of Central Autonomous Bodies or equivalent status or comparable higher status employees.



