MINIMUM STANDARDS FOR HIGHER AGRICULTURAL EDUCATION
(MSHAE)

FORESTRY

Education Division
Indian Council of Agricultural Research
PUSA, New Delhi – 110 012.

REPORT OF THE COMMITTEE

Proceedings of the meeting of the ICAR's Expert Committee constituted vide office order F.No. Edn. 5/4/2013-EQR dated 1 October 2013 to work out the Minimum Standards of Higher Agricultural Education (MSHAE) in terms of infrastructure, laboratories/field facilities, faculty, man-power and other support so as to firm up guidelines for establishing College of Forestry in SAUs/ ICAR Institutes/Deemed Universities, held in the Seminar Hall of the College of Forestry, Kerala Agricultural University, Thrissur on May 27-28, 2014.

Following committee members attended the meeting:

1.	Dr. K.R. Dhiman Former Vice-Chancellor, Dr. YS Parmar University of Horticulture and Forestry, Solan.	Chairman
2.	Dr. Ravinder Raina Sr. Scientists, Dept. of Forest Products, College of Forestry, Dr. YS Parmar University of Horticulture and Forestry, Nauni, Solan - 173 230, Himachal Pradesh.	Member
3.	Dr. Sathish Kumar Bhardwaj Prof. & Head, Dept. of Environmental Science, College of Forestry, Dr. YS Parmar University of Horticulture and Forestry, Nauni, Solan - 173 230, Himachal Pradesh.	Member
4.	Dr. Sanjeev K. Chauhan Assoc. Professor,Dept. of Forestry and Natural Resources, Punjab Agricultural University, Ludhiana-141 004 (Punjab).	Member
5.	Dr. K. Sudhakara Dean, College of Forestry, Kerala Agricultural University, Vellanikkara, Thrissur- 680656, Kerala.	Member
6.	Dr KL Khurana Principal Scientist, Education Division, ICAR, New Delhi	Member Secretary

The following scientists also attended the meeting as Special Invitee:

1. Dr. A. Arunachalam, Principal Scientist, ICAR, New Delhi
2. Dr. K Vidyasagaran, Assoc. Professor and Head, Department of Forest Management and Utilisation, College of Forestry, Kerala Agricultural University, Thrissur

3. Dr. P.O Nameer, Assoc. Professor and Head, Department of Wildlife Sciences, College of Forestry, Kerala Agricultural University, Thrissur.
4. Dr. E.V. Anoop, Assoc. Professor and Head, Department of Wood Science, College of Forestry, Kerala Agricultural University, Thrissur.
5. Dr. T.K. Kunhamu, Assoc. Professor and Head, Department of Silviculture and Agroforestry, College of Forestry, Kerala Agricultural University, Thrissur.
6. Dr. A.V. Santhoshkumar, Assoc. Professor and Head, Department of Tree Physiology and Breeding, College of Forestry, Kerala Agricultural University, Thrissur.
7. Dr. S. Gopakumar, Assoc. Professor, Department of Forest Management and Utilisation, College of Forestry, Kerala Agricultural University, Thrissur.
8. Dr. V. Jamaludheen, Assoc. Professor, Department of Silvicultre and Agroforestry, College of Forestry, Kerala Agricultural University, Thrissur.
9. Dr. Jijesh CM, Asst. Professor, Department of Silvicultre and Agroforestry, College of Forestry, Kerala Agricultural University, Thrissur.
10. Dr. Shaji, M., Asst. Professor, Department of Wildlife Sciences, College of Forestry, Kerala Agricultural University, Thrissur.
11. Dr. Binu NK, Asst. Professor, Department of Tree Physiology and Breeding, College of Forestry, Kerala Agricultural University, Thrissur.
12. Dr. Sreenivasan K, Asst. Professor, Department of Forest Management and Utilisation, College of Forestry, Kerala Agricultural University, Thrissur.
13. Dr K.C Chacko, Retd. Scientist, Kerala Forest Research Instituite, Peechi - Thrissur.
14. Dr. K Indira Devi, Professor, Agrl. Economics, Kerala Agricultural University, Thrissur.
15. Dr. Gethakutty, Professor, Centre for Gender Studies, Kerala Agricultural University, Thrissur.
16. Dr. EK Kurien, Special Officer, Academy of Climate Change and Mitigation, Kerala Agricultural University, Thrissur.

Dr. K. Sudhakara, Dean, College of Forestry, KAU, Thrissur and member of the Committee welcomed the participants. In his introductory remarks, Dr. Sudhakara explained about the achievements of College of Forestry, KAU. He also acknowledged ICAR for providing an opportunity to KAU for hosting this important meeting.

Dr. K.R. Dhiman, Chairman of the Committee sensitised the house regarding the background under which the committee was constituted by the ICAR. He also briefed about Forestry as a growing sector having enormous potential to provide solutions to several challenges in environmental degradation, climate change mitigation and biodiversity conservation. In this regard, ICAR institutes and Agricultural Universities can and need to play an important role to meet increasing demand of trained foresters.

Dr. K.L. Khurana, Member Secretary in his opening remarks elaborated on the initiative taken by ICAR for taking up this task to workout minimum standards and requirements for an institution offering undergraduate and postgraduate degrees in the discipline of Forestry. He mentioned the need of strengthening this discipline in Agricultural Universities and other ICAR institutes. Other members of the Committee also spoke during the occasion.

Dr. A. Arunachalam, made a brief presentation on the views of ICAR on the Forestry education in the country in days to come.

Dr. P.O. Nameer, Assoc. Professor & Head, Department of Wildlife Sciences, College of Forestry, KAU made a draft presentation on proposed Minimum Standards of Higher Agricultural Education (MSHAE) in terms of infrastructure, laboratories/field facilities, faculty, man-power and other support so as to firm up guidelines for establishing College of Forestry in Agricultural Universities, ICAR Institutes and Deemed Universities. This was followed by a similar presentation by Dr. Sanjeev K. Chauhan, Assoc. Professor, Dept. of Forestry and natural Resources, Punjab Agricultural University, Ludhiana and member of the committee. There were thorough deliberations on the presentation and based on the suggestions from the esteemed members of the committee and other colleagues the final draft has been prepared.

Dr K.L. Khurana, on behalf of the members of the committee, acknowledged KAU for providing the requisite assistance in hosting this committee meeting at its campus. He appreciated the concerted efforts of Dr K Sudhakara for the excellent hospitality, Dr P.O. Nameer and Dr. Sanjeev Chauhan and the team for preparing and presenting the detailed draft. The final report of the MSHAE for establishing College of Forestry is enclosed as Annexure-I.

(S. K. Chauhan)	**(R. Raina)**	**(S.K. Bhardwaj)**	**(K. Sudhakara)**
Member	Member	Member	Member

K.R. Dhiman
Chairman

K.L. Khurana
Member Secretary

INTRODUCTION

India has a landmass of 3.29 million sq. km. out of which about 20% under natural forest. This land mass (nearly 2.5 % of world's geographical area and only 1.8 % of the world's forest area) supports 16 % of human and 18% of livestock population worldwide. The forests in India are characterised by immense biotic pressure, low productivity and acute degradation. The average productivity of forests in India is 0.7 cu m/ha/yr against the world average of 2.1 cu m /ha/yr. Per capita availability of forest lands in the country is one of the lowest in the world, i.e. 0.08 ha against the world average of 0.64 ha. Despite increased efforts to afforest additional areas, loss of natural forests continued unabated. The direct causes of degradation are poverty, landlessness, deprivation of livelihood from forests, lack of proper land use planning, uncertainties in land tenure system, biotic interferences, inadequate institutional capacity and lack of restrictive covenants and punitive legislations. The research support to the issues of forest policy, forest productivity, wildlife management and conservation, utilisation and substitution of forest products, ecosystem management and newer dimensions of forestry including environmental services, biodiversity conservation, adaptation to and mitigation of climate change, biotechnology, and nano-science applications are, therefore, urgently needed to reverse the trend of degradation, support the livelihoods of poor forest fringe dwellers and to make available forest products at affordable prices.

Besides ecological and economic values, forests of India also have socio-economic, religious and ethnic importance. Forests contribute 1.7 % to GDP of the country and due to ban on green felling over 50 % of the revenue earned by the Forest Departments comes from Non-Wood Forest Products (NWFPs). Nearly 500 million people living in and around forests in India depend on NWFPs for their sustenance and supplemental income. Due to the problems associated with valuation of forests and its services, unrecorded removals, and illegal harvesting, etc., the exactness of the contribution made by the forests is difficult to assess. World Bank has observed that due to usage of old technologies, India is receiving low returns on investment in this

sector. Further research is needed for more accurate economic and social evaluation of the services provided by the forests so as to appreciate their real contribution to the well being of Indian society.

Pressures from sophisticated technology and ever-increasing human and livestock population will also place greater and greater demands on these resources in future. Furthermore, increased social concerns for environmental values have given foresters the additional task of managing land to protect and enhance other resources and services such as wildlife, aesthetics and water quality. The challenges faced by present day natural resource managers for more intensive management and more accurate predictions of environmental impacts are, therefore, unprecedented in the history of mankind. This has lead to changes in forestry and natural resource management curricula, the world-over. In the Indian context, until 1985, forestry education was primarily the responsibility of the Forest Research Institute and Colleges, Dehra Dun.

Establishment of the Ranger's School at Dehra Dun in 1878, which later became the Forest Research Institute in 1906, marked the beginning of forestry education in the country. Traditionally, forestry education in India had been a "restricted area of operation" by FRI and the Indian foresters were trained mainly as "King's estate managers" and the activities of the forest departments were confined to the forest estates.

Although India was one among the early countries to initiate formal forestry education, paradoxically, deforestation of natural forests has been occurring at an alarming rate of 1.3 million ha every year in our country. As forests are destroyed, soil erosion, desertification and changes in microclimate have been occurring at an unprecedented scale. Another significant feature of the forest production dilemma is the increasing dependence on imported pulp, paper, fibre and timber. While dependence on imports may provide short-term answer to meet timber and pulp shortage, there is an urgent need to develop sustainable forest management in the country's natural forests and

expand silviculturally sound plantations in a manner that is ecologically responsible and economically viable. All these warrant reorientation of the forestry education to make it an effective instrument to perform the greatly expanded tasks and meet the ever growing shortage of trained personnel for massive afforestation/reforestation and agroforestry programmes.

The National Commission on Agriculture way back in 1976 has emphasized on starting formal forestry education in the state agricultural universities. This sentiment was reinforced by the National Forest Policy (1988), which highlighted the need to recognise forestry both as a "scientific discipline as well as a profession". Further it stated that "Agricultural Universities and institutions dedicated to the development of forestry education should formulate curricula and courses for imparting academic education and promoting post-graduate research on professional excellence, keeping in view the manpower needs of the country". One of the most significant developments in forestry education in India has been the entry of Indian Council of Agricultural Research in this field in 1985 that marked the beginning of forestry education in State Agricultural Universities. Initially, 13 state agricultural universities were selected for imparting professional education in forestry. Currently there are 53 Universities offering forestry education in the country.

Annexure-I

Minimum Standards for Establishing a College of Forestry in State Agricultural Universities/ICAR Institutes/Deemed Universities

Departments	Aspects covered
1.Silviculture	Silviculture practices and systems; Plantation Forestry; Nursery management; World Forestry System; Seed Technology, Wasteland Development; Phyto-remediation, energy/industrial plantation
2.Forest Biology and Tree Improvement	Dendrology; Tree Improvement; Biotechnology, Tree Breeding, Cytology and Genetics; Forest certification
3.Forest Resource Management	Forest Survey and Engineering, Forest Mensuration; Conservation of Natural Resources, Hydrology & Watershed Management, Soil and Water Conservation; Soil Survey, Geology and Soil Science; Rangeland Management; Forest Management; Policy and Legislation; Forest Ecology
4.Forest Products and Utilisation	Wood Anatomy; Logging & Ergonomics; Wood Products & Utilization; Utilization of Non-Timber Products; Medicinal & Aromatic Plants, Ethnobiology; Forest Business Management; Marketing and Trade of Forest Produce; Wood Seasoning and preservation, Dendrochronology, Bioenergy
5.Wildlife Sciences	Biodiversity & Conservation; Wildlife Biology and Management; Wildlife Forensics, Ecotourism, Biogeography, Phylogenetic studies
6.Agroforestry	Agroforestry systems and Management; Livestock Management; Social Forestry
7.Forest Protection	Forest Pathology; Forest Entomology and Nematology, Fire Management, Invasive and alien species,

8.Social Sciences	Forest Economics; Forest Tribology and Anthropology and Extension Education, Gender Perspectives, Project Management, Entrepreneurship Development, Communication skills; English
9. Climate Science	Environmental monitoring; Weather monitoring and forecasting, climate advisory services, Agrometeorology, pollution, National Green products, modeling and simulation, Carbon sequestration and trading, Ecosystem services, renewable energy
10.Basic Sciences	Botany, Zoology, Microbiology, Physiology, Biochemistry; Mathematics, BioStatistics, Computer Application, Remote Sensing and GIS

2. Undergraduate and Postgraduate Degrees Nomenclature

Undergraduate **B.Sc. Forestry**

Postgraduate (Master's and Doctorate)

1. M.Sc. Forestry (Silviculture)
2. M.Sc. Forestry (Tree Improvement)
3. M.Sc. Forestry (Forest Resource Management)
4. M.Sc. Forestry (Forest Products and Utilisation)
5. M.Sc. Forestry (Wildlife Sciences)
6. M.Sc. Forestry (Agroforestry)
7. M.Sc. Forestry (Forest Protection)
8. M.Sc. Forestry (Forest Economics/Extension)
9. M.Sc. Forestry (Climate Science)

1. Ph.D. Forestry (Silviculture)
2. Ph.D. Forestry (Tree Improvement)
3. Ph.D. Forestry (Forest Resource Management)
4. Ph.D. Forestry (Forest Products and Utilisation)
5. Ph.D. Forestry (Wildlife Sciences)
6. Ph.D. Forestry (Agroforestry)
7. Ph.D. Forestry (Forest Protection)
8. Ph.D. Forestry (Forest Economics/Extension)
9. Ph.D. Forestry (Climate Science)

3. Eligibility Criteria

B.Sc. Forestry (10+2+4 years)	**Qualified**: Higher Secondary/10+2/Intermediate **Subjects**: PCM/PCMB/Intermediate with Agriculture **Minimum Percentage:** Minimum 50% Marks in Aggregate for Gen./OBC/UPS category and 40% Marks in Aggregate for SC/ST/PH category candidates/ in-service (nominees of Government line departments). **Age:** Minimum 16 years OR Examination of a University/Board/ College/ School in a foreign country recognized by the Academic Council as equivalent to 10+2 with science subjects provided the candidate has obtained at least 60% aggregate marks or 'B' grade/equivalent.
1. M.Sc. Forestry (Silviculture) 2. M.Sc. Forestry (Tree Improvement) 3. M.Sc. Forestry (Forest Resource Management) 4. M.Sc. Forestry (Forest Products and Utilisation) 5. M.Sc. Forestry (Wildlife Sciences) 6. M.Sc. Forestry (Agroforestry) 7. M.Sc. Forestry (Forest Protection) 8. M.Sc. Forestry (Forest Economics/Extension) 9. M.Sc. Forestry (Climate Science)*	Eligibility for admission to M.Sc. (Forestry) B.Sc. (four years) Forestry/Agriculture/Horticulture/Biotechnology/BioSciences, with an OGPA of 6.00/10.00 or its equivalents under course credit system or with a minimum of 60% under annual system from a recognized university or degree from a foreign university with at least 'B' grade or its equivalent recognized by the Academic Council. The prescribed minimum marks shall be relaxed by 5% in the case SC/ST candidates and in service nominees. The order of preference should be : a) B. Sc. Forestry b) B. Sc. Horticulture/Agriculture/Biotechnology subject to undertaking remedial courses c) B. Sc. with 2-year Ranger Certificate course from recognized University/College/Institute *BE/BTech Engineering in Civil/Water Resources/Agrl. Engineering/Environmental Engineering/ Environmental Technology will be considered for M.Sc. Forestry (Climate Science)

1. Ph.D. Forestry (Silviculture) 2. Ph.D. Forestry (Tree Improvement) 3. Ph.D. Forestry (Forest Resource Management) 4. Ph.D. Forestry (Forest Products and Utilisation) 5. Ph.D. Forestry (Wildlife Sciences) 6. Ph.D. Forestry (Agroforestry) 7. Ph.D. Forestry (Forest Protection) 8. Ph.D. Forestry (Forest Economics/Extension) 9. Ph.D. Forestry (Climate Science)	M.Sc. Forestry/ Environmental Science (10+2+4+2)

4. Medium of Instruction: English

5. Minimum Intake

Degree	Discipline	Minimum Intake/Year
B.Sc. (Honors)	Forestry	50
M.Sc.	Silviculture	4
M.Sc.	Tree Improvement	4
M.Sc.	Forest Resource Management	4
M.Sc.	Forest Products and Utilisation	4
M.Sc.	Wildlife Sciences	4
M.Sc.	Agroforestry	4
M.Sc.	Forest Protection	4
M.Sc.	Forest Economics/Extension	4
M.Sc.	Climate Science	4
	Total M.Sc. seats	**36**
Ph.D.	Silviculture	2

Ph.D.	Tree Improvement	2
Ph.D.	Forest Resource Management	2
Ph.D.	Forest Products and Utilisation	2
Ph.D.	Wildlife Sciences	2
Ph.D.	Agroforestry	2
Ph.D.	Forest Protection	2
Ph.D.	Forest Economics/Extension	2
Ph.D.	Climate Science	2
Total	**Total Ph.D. seats**	**18**

Total

Undergraduate **50**

Master's **36**

Doctorate **18**

6. Land Requirements

Main building and Hostels : 6 ha

Field area : 44 ha

Play grounds & indoor stadium : From common facility of the institute

Total : 50 ha

*Wherever applicable

7. Manpower Requirements of Dean's Office

Manpower	Number
Dean	1

A. Establishment

PA to Dean	1
Assistant Registrar	1
Accounts Officer	1
Superintendent	1
Computer operator	2
Steno/Assistant	2
Operator (Audio visual)	1
Attendants /Messengers	4
Clerk (LDC)	4
Electrician	1
Storekeeper	1
Driver (office vehicle/student buses/tractors)	4
Security, Sanitation and Landscaping and transportation	To be outsourced

B. Central Research and Teaching Laboratories

Laboratory Technicians	2
Laboratory Assistant	2
Laboratory Attendant	1

C. Library Staff

Assistant Librarian	1
Library Assistant	1
Clerk	1
Shelf Assistant	2

D. Students Welfare

To be provided by the Institute/University as the Central Facility

E. Hostel Staff for two Hostels *

Warden	1 (UG and PG; Men & Women)
Assistant Wardens	2 (UG and PG; Men & Women)
Care Taker/Matron	4 (UG and PG; Men & Women, Men & Women)
Attendants	8
Security, Sanitation and Landscaping	To be outsourced

(*As far as possible encourage the concept of common hostel across the colleges/faculties under the university)

8. Faculty Requirements for Divisions/Section

Department	Professor	Associate Professor	Assistant Professor	Total
1. Silviculture	1	2	4	7
2. Forest Biology and Tree Improvement	1	2	4	7
3. Forest Resource Management	1	2	4	7
4. Forest Products and Utilisation	1	2	4	7
5. Wildlife Sciences	1	2	4	7
6. Agroforestry	1	2	4	7
7. Forest Protection	1	2	4	7
8. Social Sciences	1	2	4	7
9. Climate Science	1	2	4	7
10. Basic Sciences	1	2	6	9
	10	**20**	**42**	**72**

9. Administrative and Supporting Staff for Divisions/Section

Department	Steno/PA/ Computer Operator	Attendant/ Messenger	Laboratory Assistant/ Attendant	Field Staff
1. Silviculture	1	1	1	3
2. Forest Biology and Tree Improvement	1	1	1	3
3. Forest Resource Management	1	1	1	3
4. Forest Products and Utilisation	1	1	1	3
5. Wildlife Sciences	1	1	1	3
6. Agroforestry	1	1	1	3
7. Forest Protection	1	1	1	3
8. Forest Social Sciences	1	1	1	3
9. Climate Science	1	1	1	3
10. Basic Sciences	1	1	1	3
	10	**10**	**10**	**30**

Note: Security services to be outsourced

10. Central/Division/Section Laboratories (as per requirements of the teaching and research work of the college)

Common laboratory/facility

- Botanical Garden
- Natural History Museum
- Xylarium
- Tree Nursery
- GIS and Remote sensing Lab
- Computer Lab
- Auditorium (optional)
- Students Activity Centre (optional)

11. Floor Space Requirement

Central Facilities

S. No.	Details	Number of Rooms	Dimensions
1.	Dean office	1	20′ x 24′
2.	PA room	1	10′ x 12′
3.	Committee room with video conferencing facility	1	20′ x 48′
4.	Administrative officer room	1	20′ x 12′
5.	Admin. staff rooms	2	20′ x 12′ each
6.	Examination cell	1	20′ x 12′
7.	Placement cell	1	30′ x 18′
8.	Smart Lecture rooms	6	Seating capacity - 70
9.	Library	1	60′ x 140′

10.	Examination hall	1	Seating capacity - 150
11.	Laboratories	10	30′ x 48′ each
12.	Hostels	4	UG and PG Boys & UG and PG Girls
13.	Toxic chemical waste storage/disposal Unit	1	20′ x 24′
14.	Canteen	1	20′ x 12′ (kitchen) & 20 x 36′ (sitting)
15.	Toilets	2 sets for each floor	
16.	Parking space	As per requirement (APR)	For college and hostels
17.	Vehicles - Dean's car	one	
18.	Vehicle - for Field trips as part of research- Jeep/SUV with four wheel drive	Two	
19.	Vehicle - for Students Field trip - 30 seat capacity bus	Two	
20.	Vehicle - pick up van	One	
21.	Common room for boys and girls	Two	

Department

S. No.	Detail	Number of rooms	Dimensions
1.	Office of Head of the Department	10 (one for every Department)	20′ x 12′ each
2.	Administrative Staff	10 (one for every Department)	12′ x 10′ each
3.	Faculty room	10 (one for every Department)	30′ x 30′ each and to be partitioned
4.	Rooms for Research Scholars	10 (one for every Department)	20′ x 24′ each
6.	Smart Lecture cum seminar room	10 (one for every Department)	Seating capacity - 40 each
7.	Laboratories	20 - Two laboratories (one each for UG and PG) in each departments	20′ x 60′ (one) 20′ x 36′ (one) each for 10 departments

12. Equipment Required

Equipments for the Laboratories

Sl. No.	Name of the Equipment	Number	UG	Department
1.	Soil analysis kit	1	UG	Silviculture (SILV)
2.	Portable soil moisture kit	1	UG	(SILV)
3.	Telescopic tree ladder	1	UG	(SILV)
4.	Seed moister meter	1	UG	(SILV)
5.	Seed/ grain divider	1	UG	(SILV)
6.	Seed precision divider	1	UG	(SILV)
7.	Seed divider	1	UG	(SILV)
8.	Seed grader	1	UG	(SILV)
9.	Seed hand-test sieves	1	UG	(SILV)
10.	Seed sieve shaker	1	UG	(SILV)
11.	Laboratory aspirator	1	UG	(SILV)
12.	Seed blower	1	UG	(SILV)
13.	Illuminated purity work board	1	UG	(SILV)
14.	Hot air seed drier	1	UG	(SILV)
15.	Growth Rooms	3	UG	Forest Biology and Tree Improvement (FBTI)
16.	Hot Plates, Magnetic stirrers, Vortex etc.	6	UG	(FBTI, WLS)
17.	Laminar Flow	4	UG	(FBTI, WLS)
18.	Multiflow Dispenser	2	UG	(FBTI, WLS)
19.	Precision Ovens	6	UG	(FBTI, WLS)
20.	Plant Imager	2	UG	(FBTI)
21.	Shakers (Table Top)	3	UG	(FBTI, WLS)

22.	Spectrophotometer	2	UG	(FBTI)
23.	Thermocycler	6	UG	(FBTI, WLS)
24.	Thermomixer	3	UG	(FBTI)
25.	Tissue lyser	3	UG	(FBTI)
26.	Vacuum Concentrator	2	UG	(FBTI)
27.	Computer for Bioinformatics Section	6	UG	(FBTI, WLS)
28.	PAR & LAI Ceptometer /Canopy analyzer	1	UG	(FBTI)
29.	Leaf area meter	1	UG	(FBTI)
30.	Steady state porometer	1	UG	(FBTI)
31.	Leaf wetness sensor	1	UG	(FBTI)
32.	Scholanders pressure bomb (Plant water console)	1	UG	(FBTI)
33.	Osmometer	1	UG	(FBTI)
34.	Compound microscope (Students)	30	UG	(FBTI)
35.	Stereo microscopes	5	UG	(FBTI)
36.	Compound microscopes (Research – binocular / trinocular)	3	UG	(FBTI, WLS)
37.	Wildlife census equipments (compass, GPS, range finder, bat detectors, mist nets, Sherman traps, tapes etc)	100	UG	Wildlife Sciences (WLS)
38.	Wildlife handling equipments	As per requirement (APR)	UG	(WLS)
39.	Wildlife Field research equipments such as binoculars, telescopes, ultra sonic bat detectors, audio equipments, remote cameras and triggering devises, museum collection equipments, specimen storage cabinets etc	As per requirement (APR)	UG	(WLS)
40.	SLR digital camera and accessories	5	UG	(WLS)
41.	Spectrophotometer	1	UG	(FRM)
42.	Flame photometer	1	UG	(FRM)
43.	Conductivity meter	1	UG	(FRM)
44.	Water bath	1	UG	(FRM)

45.	incubator	1	UG	(FRM)
46.	Laminar Air flow	1	UG	(FRM)
47.	Bomb calorimeter	1	UG	(FRM)
48.	Incubator	1	UG	(FRM)
49.	Automatic weather station	4	UG	(SILV, WLS)
50.	pyranometer	1	UG	(FBTI)
51.	Salinity meter	1	UG	(FRM)
52.	Tensiometers	2	UG	(FRM)
53.	Tree telescope	2	UG	(FRM)
54.	Canopy analyzer	1	UG	(FRM)
55.	Laser Digital caliper (Haglof)	3	UG	(FRM)
56.	Moisture meter	1	UG	(FRM)
57.	Viscometer	1	UG	(FRM)
58.	Digital balance	3	UG	(FRM)
59.	prismatic compass	5	UG	(FRM)
60.	Swedish Bark gauge	3	UG	(FRM)
61.	altimeter	5	UG	(FRM)
62.	Clinometer	5	UG	(FRM)
63.	Hypsometer	APR	UG	(FRM)
64.	Pressler's Increment borers	4	UG	(FRM)
65.	Abney level	10	UG	(FRM)
66.	dumpy level	3	UG	(FRM)
67.	Alidade	3	UG	(FRM)
68.	Christen's hypsometer	APR	UG	(FRM)
69.	Smythie's hypsometer	APR	UG	(FRM)
70.	Improvised calipers	APR	UG	(FRM)

71.	Brandis hypsometer	5	UG	(FRM)
72.	Haga altimeter	5	UG	(FRM)
73.	Blume-Leiss hypsometer	4	UG	(FRM)
74.	Spiegel relaskop	5	UG	(FRM)
75.	Global positioning systems	5	UG	(FRM)
76.	Wheeler's pentaprism	4	UG	(FRM)
77.	Chain (20 or 30 m)	4	UG	(FRM)
78.	Offset	APR	UG	(FRM)
79.	Cross Staff	APR	UG	(FRM)
80.	Plump Bob	APR	UG	(FRM)
81.	Ranging rods	APR	UG	(FRM)
82.	Tape (30 m)	5	UG	(FRM)
83.	Plane table	5	UG	(FRM)
84.	Trough compass	5	UG	(FRM)
85.	U fork	5	UG	(FRM)
86.	Spirit level	5	UG	(FRM)
87.	Digital level	2	UG	(FRM)
88.	Laser level	2	UG	(FRM)
89.	Level staff	5	UG	(FRM)
90.	Microscope- simple microscope, compound microscope and stereo microscope	5 each	UG	Forest Protection (FPU, WLS)
91.	Autoclave- vertical and horizontal	1 each	UG	(FP)
92.	Pressure cooker (20 L)	2	UG	(FP)
93.	Hot air oven	1	UG	(FP)
94.	B O D Incubator	1	UG	(FP)
95.	Temperature and humidity control chamber	1	UG	(FP)

96.	pH meter	2	UG	(FP, FRM)
97.	Water bath- rectangular thermostatic	1	UG	(FP)
98.	Common balance	2	UG	(FP)
99.	Bunsen burner	2	UG	(FP)
100.	Herbarium press	15	UG	(FP)
101.	Workstation for GIS	10	UG	Basic Sciences (BS)
102.	Scanner cum plotter/Printer	2	UG	(BS)
103.	Global positioning systems	10	UG	(BS)
104.	GIS software - ERDAS/Arc GIS/I GiS Ver.1.1 GIS	2	UG	(BS)
105.	3D Printer	1	UG	(BS)
106.	Universal testing machine micro processor based with PC system and printer	1	PG	Forest Products and Utilisation (FPU)
107.	Near Infra Red (NIR) / Fourier Transform Infrared (FT-IR) Spectrphotometers	1	PG	(FPU)
108.	Wiley mill for powdering wood samples (for cellulose and lignin analysis)	1	PG	(FPU)
109.	Nuclear Magnetic Resonance Spectroscopy (NMR)	1	PG	(FPU)
110.	Atomic Absorption Spectrophotometer (AAS)	1	PG	(SILV)
111.	Yoder apparatus	1	PG	(SILV)
112.	Tree radar system	1	PG	(SILV)
113.	CHNS analyzer	1	PG	(SILV)
114.	Mini tractor will tiller/disc facility	1	PG	(SILV)
115.	Radio transmitters and radio telemetry equipments	5	PG	(WLS)
116.	Wildlife marking equipments such as split-rings, bands, tags, ball chain necklace, betalights, cyalume, punch marking and tattooing equipments, fluorescent powder and hand-held ultra-violet lights	As per requirement (APR)	PG	(WLS)
117.	Sequencer - ABI 3730xl	1	PG	(FBTI)

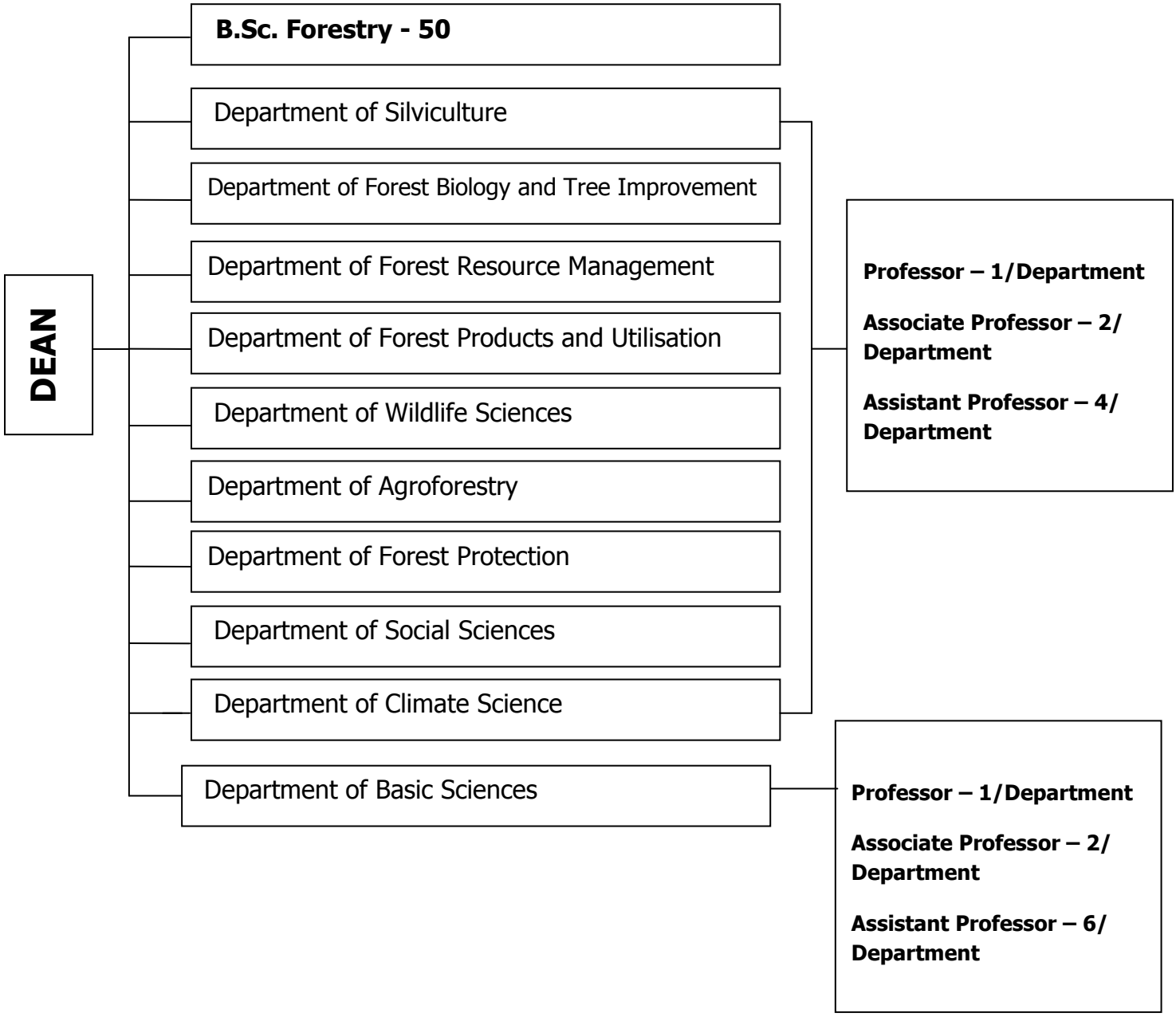
118.	Illumina Sequencing Platform	1	PG	(FBTI)
119.	Cold room -20°C	1	PG	(FBTI)
120.	Cold room 4°C	1	PG	(FBTI)
121.	SNP Genotyping Platform	1	PG	(FBTI)
122.	HPTLC	1	PG	(FBTI)
123.	High Performance Computing Grid	1	PG	(FBTI)
124.	Inductively Coupled Plasma (ICP-OES	1	PG	(FBTI)
125.	High Speed Centrifuge	4	PG	(FBTI)
126.	Water Purification Unit	APR	PG	(FBTI)
127.	-20°C Freezer	3	PG	(FBTI)
128.	-80°C Freezer	3	PG	(FBTI)
129.	Autoclaves	5	PG	(FBTI)
130.	Automated Capillary Electrophoresis System	3	PG	(FBTI)
131.	Autopipetting System	3	PG	(FBTI)
132.	Biolistic Particle Gun	3	PG	(FBTI)
133.	Biophotometer	2	PG	(FBTI)
134.	Biosafety Cabinet	3	PG	(FBTI)
135.	Centrifuge	6	PG	(FBTI)
136.	Cryo-cans	6	PG	(FBTI)
137.	Dry Baths	6	PG	(FBTI)
138.	Electrophoresis Systems and Power Packs	3	PG	(FBTI)
139.	Electroporator	4	PG	(FBTI)
140.	Environmental Chamber	2	PG	(FBTI)
141.	Fermenter	3	PG	(FBTI)
142.	Fluorescent Microscope	3	PG	(FBTI)
143.	Gel Documentation System	4	PG	(FBTI)
144.	Gel Dryers	2	PG	(FBTI)

145.	Hybridization Ovens	2	PG	(FBTI)
146.	Ice Making Machines	2	PG	(FBTI)
147.	Incubator Shakers	4	PG	(FBTI)
148.	Incubator	5	PG	(FBTI)
149.	Lypholyser	1	PG	(FBTI)
150.	Microcentrifuge	6	PG	(FBTI)
151.	Microplate Washer	2	PG	(FBTI)
152.	Microplate Readers	2	PG	(FBTI)
153.	Microwave Digestion Oven	2	PG	(FBTI)
154.	Nanodrop for DNA Quantification	2	PG	(FBTI)
155.	Plate Centrifuges	3	PG	(FBTI)
156.	Real Time PCR	4	PG	(FBTI)
157.	Refrigerator 4 $^{\circ}$C	5	PG	(FBTI)
158.	Semi Dry Blotter	2	PG	(FBTI)
159.	Ultracentrifuge	2	PG	(FBTI)
160.	Ultrasound Sonicator	3	PG	(FBTI)
161.	UV Transilluminator	3	PG	(FBTI)
162.	UV Stratalinker	2	PG	(FBTI)
163.	Water Bath - Shaking	3	PG	(FBTI)
164.	Major Softwares-CLC Genomics and other relevant softwares	APR	PG	(FBTI)
165.	Portable Ethylene Analyzer	1	PG	(FBTI)
166.	Programmable LED Experimentation System	1	PG	(FBTI)
167.	Leaf Spectrometer	1	PG	(FBTI)
168.	Root Image Analysis System	1	PG	(FBTI)
169.	In Situ Root Imager	1	PG	(FBTI)
170.	UV to Near Infrared Range Spectroradiometer	1	PG	(FBTI)
171.	HemiView - Forest Canopy Image Analysis System	1	PG	(FBTI)

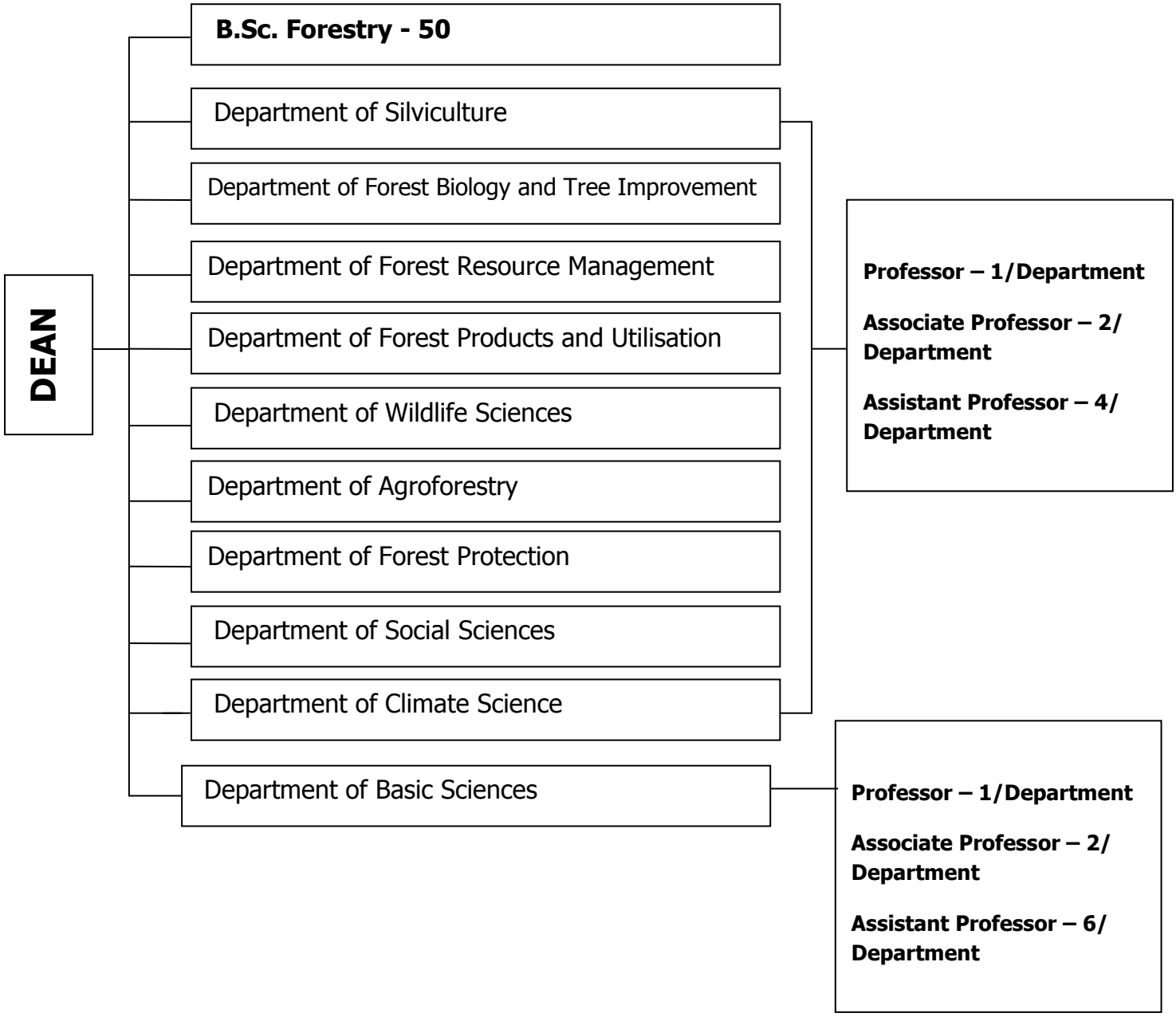
172.	IRGA Photosynthesis System	1	PG	(FBTI)
173.	Chlorophyll Fluorometer	1	PG	(FBTI)
174.	Sap flow meter	1	PG	(FBTI)
175.	Infra red thermometer	1	PG	(FBTI)
176.	Eddy covariance CO_2/H_2O flux measurement system	1	PG	(FBTI)
177.	Soil CO_2 flux system	1	PG	(FBTI)
178.	UV-Bio Radiometer with Recorder	1	PG	(FBTI)
179.	Florescence microscope	1	PG	(FBTI)
180.	Dissection microscopes	20	PG	(FBTI)
181.	Microtome	1	PG	(FBTI)
182.	Vacuum oven with vacuum pump	1	PG	(FRM)
183.	Microwave oven	2	PG	(FRM)
184.	Melting point apparatus	1	PG	(FRM)
185.	Bark separator	2	PG	(FRM)
186.	Topo Abney	5	PG	(FRM)
187.	CHN Analyzer	1	PG	(FRM)
188.	Ravi multimeter	5	PG	(FRM)
189.	Vertex digital hypsometer (Haglof)	3	PG	(FRM)
190.	Micrometer- stage and ocular	4 each	PG	(FP)
191.	Colony counter	1	PG	(FP)
192.	Inoculation chamber (Laminar airflow chamber)	2	PG	(FP)
193.	Ultra violet lamps	APR	PG	(FP)
194.	centrifuge	2	PG	(FP)
195.	Electronic monopan balance	2	PG	(FP)
196.	Spectrophotomer or colorimeter	1	PG	(FP)

197.	Haemocytometer/ Petroff-Hausser counting chamber	1	PG	(FP)
198.	Filters-Seitz filter	1	PG	(FP)
199.	Orbital incubator / hot palte stirrer	1	PG	(FP)
200.	Rotary flask shaker	1	PG	(FP)
201.	Inoculation needle	APR	PG	(FP)
202.	ICP (OES)	1	PG	Climate Science (CS)
203.	Microwave digester	1	PG	(CS)
204.	Infrared thermometer	1	PG	(CS)
205.	Air weather monitoring system	1	PG	(CS)
206.	Manual and automatic agrometeorology	1	PG	(CS)
207.	Solar radiation assessment system	1	PG	(CS)
208.	Soxhlet apparatus	1	PG	(FRM)

College of Forestry – Overview



College of Forestry – Overview



College of Forestry – Supporting Staff