

Report of
FOURTH DEANS COMMITTEE
on
Agricultural Education in India



Education Division
INDIAN COUNCIL OF AGRICULTURAL RESEARCH
New Delhi

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PREFACE

Growth in agriculture still propels economic growth in India. Majority of our population directly or indirectly depends on agriculture. Situation has not changed much since independence. Therefore, realizing the importance of agricultural growth, the Govt. of India through successive Plans supported development of agricultural education in the country. The comfortable food grain situation that the country enjoys is the result of skilled human resource developed, technological capabilities created for HRD and development of technology and their dissemination to the highly receptive farming community. The human resources developed by the agricultural education system have been primarily responsible for green, white, yellow, and blue revolutions signifying respectively increase in food grain, milk, oilseed and fish production. While on one hand we can be justifiably proud of our achievements on the other hand concerns have been expressed because of declining total factor productivity, rising unemployment, fast degrading natural resources, declining agricultural growth in recent years. This has largely been attributed to decline in quality of instructions imparted to a great extent. There have been several factors attributable to this, the chief among them are declining financial resources, lack of faculty competence in new and emerging frontier areas, extensive inbreeding and lack of adequate skill, entrepreneurship and experiential learning.

The graduates passing out today do not match the requirements of emerging market. Globalization and demand led market necessitate a relook at the content and delivery of curricula and curriculum delivery such that the graduates coming out not only meet the expectations of different stake holders but also be propeller of agricultural growth. For India to occupy pre-eminent position in the international market, it is important that our graduates also remain in the forefront of developing new technologies and disseminate them to the farming community.

In view of ICAR's role as regulator of agricultural education in the country, the Council has been addressing most of the issues over the time through several mechanisms one of which is the constitution of The Deans Committee for revision of course curricula. The IV Deans committee constitution is the step in this direction. The Committee initially deliberated and decided to have the entire exercise done on a bottom up approach so that there is a wider input and acceptability to its recommendations. Major focus was on involvement of different stakeholders. The skills needed among graduates were first articulated and reverse engineering was done for deciding courses for imparting skills. After the finalization of revised course curricula, the participants with the help of faculty developed detailed course syllabi.

The Committee would like to place on record its gratitude to Dr. Mangala Rai, the Secretary, DARE and Director General, ICAR, for reposing faith in the Committee and giving this opportunity to examine all related issues in totality. The terms of reference given to the Committee reflect the vision and concern of the Council for rejuvenating agricultural education to address emerging challenges in agriculture.

The tasks before the Committee was very arduous but the Committee had the wisdom and support from all the stakeholders in the system. The Committee would like to place on record its gratitude for the tremendous support provided by all the Vice-Chancellors, and Deans of different faculties. The Committee expresses thanks to Dr. J.C. Katyal, ex-DDG (Edn) for his support and input. The Committee appreciates the help rendered by Dr S.P. Tiwari, DDG (Edn) and Dr. R.K. Samanta, Acting Director NAARM, Hyderabad Dr. A.Gopalam, Principal Scientist, NAARM, Hyderabad, Dr. K.A.

Varghese, Shri Gulab Singh and other scientists from MPUAT, Udaipur Further, the Committee would like to thank the discipline coordinators, namely Dr. M. Sudarshan Reddy (Agriculture), Dr S.K. Sondhi (Agricultural Engineering), Dr. Pushpa Gupta (Home Science), Dr O.P. Kohli (Horticulture), Dr M.P. Kohli (Fisheries), Dr G.R. Patil and Dr N.S. Rathore (Dairy Technology), Dr D.N. Kulkarni (Food Technology), Dr S.D. Bhardwaj (Forestry) and Dr P.Thungraju (Veterinary Sciences) for their sincerity, commitment and dedicated efforts in developing revised curriculum.

I was very fortunate to have very distinguished academicians on the Committee. It was real pleasure and delight to have worked with them. I would like place on record my gratitude Dr. S.N. Puri, Vice Chancellor, CAU, Imphal; Sh. M.K. Miglani, Ex-VC, CCS HAU, Hisar; Dr N.L. Maurya, DRI, CAU, Imphal; Dr Jagmohan Singh, VC, YSPUH&F, Solan; Dr S.S. Kadam, VC, MAU, Parbhani; Dr J.S. Bhatia, Ex-ADG (EPD), Dr M.P.S. Kohli, Dean (Academic), CIFE, Mumbai; Dr M.C. Nautiyal, Dean, Forestry, GBPUA&T, Ranichauri; Dr Pushpa Gupta, Ex-Dean, Home Science, MPUA&T, Udaipur; Dr N. Balaraman, VC, TNVASU, Chennai; Dr S.P. Tiwari, Ex-Director, NAARM and Dr H.S. Nainawatee, ADG (Accreditation/HRDII). The Committee would like to place on record its gratitude to Dr H.S. Nainawatee, Member Secretary for unstinted and unmatched commitment and support in numerous ways, without which the report could not have been timely completed.

The Committee has worked with all the stakeholders in formulating recommendations, which on implementation, would lead to major improvements in quality of agricultural graduates. The report of the Committee is in two parts. The main report contains recommendations on, norms and standards, curricula revision and academic regulations for colleges, central assistance for implementation of the recommendations, reforms in governance, faculty training needs etc. The supplement volume of the report contains details of recommended syllabi of eight major disciplines of agricultural sciences. It is also our earnest hope that the recommendations would be taken in the right spirit and implemented in a time frame.

Date: August 08, 2006
Place: New Delhi

(S.L. MEHTA)
Chairman

IV Deans Committee on Agricultural Education in India

EXECUTIVE SUMMARY

Department of Agriculture Research and Education, Government of India and Indian Council of Agricultural Research have the mandate of regulating higher agricultural education in the country. This responsibility is being discharged by the Education Division of ICAR through partnership with State Agricultural Universities. From the beginning, the ICAR is providing support for developing and strengthening higher agricultural education. In addition, ICAR has put in motion a number of initiatives and reforms which include establishment of Accreditation Board for Quality Assurance, faculty competence improvement through training, library strengthening, institution of scholarships and fellowships, measures for reducing inbreeding, infrastructure support for library, hostels and procurement of state of the art equipment etc. to have quality assurance in agricultural education. The major reforms operationalized during 1995-2000 taking advantage of AHRD project have led to quality improvement in education, the pace of which is still not as per stakeholders expectation. For course curriculum, revision, which forms important first step for quality improvement, the Council has been periodically appointing Deans Committee. The present IV Deans Committee is in the series which unlike earlier Committees, has been given wide terms of reference so that a holistic approach emerges for quality assurance in agricultural education while addressing the contemporary challenges for employability of passing out graduates.

In order to have wide acceptance and inputs, different stakeholders of agricultural education have been consulted at different levels. A bottom up approach in respect of curriculum development has been undertaken. The skills which graduates must possess have been first articulated and then reverse engineering done to design course curriculum. Three tier meetings were held, initially at the university level, then at national level and finally review at the level of the Committee. The recommendations, therefore, represent in general, a national consensus in respect of various issues that have been flagged to the Committee. The recommendations have been made with a view to reorient course curricula to develop much needed skills and entrepreneurial mind-set among the graduates to take up self employment, contribute to enhanced rural livelihood and food security, sustainability of agriculture and be propeller for agricultural transformation. The major recommendations are briefly enumerated:

1. Norms, Standards and Academic Regulations:

- The Committee has developed Norms and Standards with respect to departments, faculty positions and minimum infrastructure for different faculties at UG level.
- The Committee has revised Academic Regulations and based on indepth discussion developed regulations for UG & PG programme which need to be implemented for uniformity and improving quality.

- **Examination Reforms:**
- **UG:** One mid-term of 20% marks (internal) and final theory of 80% marks (external) has been proposed. Practical examination to be conducted internally for which assessment mechanism is defined.
- **PG:** For M.Sc. and Ph.D. programmes respectively 3 and 2 core courses suggested, for which examination in theory to be external. Rest of courses will have internal system of examination.
- Recommendations have been made for improving quality of research work.

2. Restructuring of U.G. Programmes for Increased Practical and Practice Contents:

- General changes/ modifications have been recommended across the faculty-
 - Experiential learning programmes have been recommended in all disciplines. In Home Science discipline, two years of Professional programme has been suggested with one year of industrial/agribusiness attachment.
 - Flexibility in the course curriculum recommended.
 - Courses on entrepreneurship development, communication skills, computer knowledge, agribusiness, environment science, biotechnology etc. included in all disciplines.
 - Practical content increased substantially and is now 50-60% of the total course load.
 - Major strengthening of Food Technology programme recommended for HRD to meet emerging needs.
 - Initiation of M. Tech. in Food Technology in all Colleges recommended.
 - Recommendations have been made for organizing non-formal education programmes in all SAUs.
 - Full support for creation of one new department in any one emerging areas in each faculty recommended.
- The Committee has also undertaken a major exercise of finalizing detailed syllabi in respect of all faculties and the same is presented as supplement to the main report. To revamp, the agricultural education in totality the committee suggests that a similar exercise may be undertaken for revision of syllabi for Masters and Ph.D. programme.

3. Central Assistance for Strengthening Higher Agricultural Education:

In discharge of its responsibilities for regulating agricultural education, the ICAR has been providing support for strengthening and developing agricultural education. The ICAR support for education has increased from 8.9% in VIII plan to about 14% in X Plan. The Committee strongly recommends increasing development assistance to SAUs and DUs by ICAR to the extent of 20% of its budget. Increased investment is particularly necessary because of major revision in course curriculum, which necessitates investment in infrastructure, faculty training and procurement of the state of the art equipment for entrepreneurial skills and training under the real life situation. The Committee recommends starting non-formal education

programmes by SAUs specially need assessed vocational modules for generating para-professionals for technological and economic empowerment of rural youth.

The committee has suggested a support of Rs. 2536.50 Crores for the Plan period of five years. Following is the detail of major areas recommended for support.

- **Experiential Learning:** In the new curriculum, the Committee has recommended 1-2 years of experiential learning. This is a new initiative with the primary aim of removing weaknesses in the present education system and to develop a cadre of highly skilled professionals who can create their own enterprises. The course design is aimed at competence development through knowledge not only in new and cutting edge technologies but also in all aspects of enterprise management so that the graduates have complete understanding of field problems, project development and execution with the end-to-end approach. Emphasis has been laid on developing skills for career in agri-business and agri-clinic. For experiential learning support recommended is as under:

A.	Home Science	Rs. 50.0 Crores
B.	Food Science and Technology	Rs. 30.0 Crores
C.	Dairy Technology	Rs. 80.0 Crores
D.	Agricultural Engineering	Rs. 69.0 Crores
E.	Agriculture	Rs. 200.0 Crores
F.	Fisheries	Rs. 50.0 Crores
G.	Forestry	Rs. 25.50 Crores
H.	Horticulture	Rs. 22.0 Crores
I.	Veterinary Science	Rs. 75.0 Crores

- **Library:** The Committee recommends further strengthening of library network and online access to journals. All AUs need to be provided 2Mbps connectivity and hosting of at least 50 journals on I CAR portal. For modernization of libraries one time support of Rs 50 lakh per AU has been recommended. A total outlay of Rs. 216.0 crores has been projected for Library strengthening during the XI Plan period.
- **Faculty specific support for curriculum delivery:** In all faculties professional skill development programme included. For implementation the Committee has recommended budgetary support of nearly Rs.50.0 lakhs and Rs.25.0 lakh respectively per PG and UG college. Additionally Rs.50.0 lakh per college has been recommended for instructional farm.
- **Faculty Mobility:** In spite of the fact that I CAR has introduced various schemes viz. Sabbatical Leave and Visiting Scientists Scheme for exchange of faculty, there is practically no faculty exchange or movement of faculty across Universities. The Committee has, therefore, proposed revision of honorarium to Rs. 20,000 per month under Sabbatical Leave rules and Visiting Scientist Scheme. Further, provision of at least four visiting scientists per University per annum is recommended.

- **Performance Linked support:** In order to inculcate spirit of healthy competition, motivation of the faculty and total quality management in education, the Committee considers it critical and essential to build in performance linked support system to universities, colleges and departments and has therefore made specific recommendations in this regard.
- **HRD and HRM:** HRD and HRM are important for not only bringing operational efficiency in organization but also for qualitative improvement in education. It is proposed that every faculty member including those on management position should undergo compulsory need assessed training programme once in 5 years. Such trainings should be linked to annual increment once in 5 years. Education Division should undertake Human Resource Planning at national level as a guide for student enrollment, efficient utilization of resources for skill development, and bridging the technology and HR gaps in agriculture sector.
- **Distance Education:** For reaching the unreached and technological empowerment of youth, establishment of Centres of Distance Education in AU's is recommended. Creation of necessary infrastructure for technology mediated teaching and learning would require a budgetary support of Rs 100 crores.

4. Guidance for assessing training needs and performance of teaching faculty:

The committee has suggested guidelines for training need assessment. For faculty competence improvement at all levels, ICAR's policy should be mandatory training of 20% faculty nationally and 4% internationally each year in best of the institutions. Guidelines have also been suggested for judging performances of the faculty.

5. University Governance:

- **Statutory power to ICAR:** Although, under the allocation of business rules by Government of India, responsibility for regulation of higher agricultural education has been given to DARE, it has not been able to effectively play this role because of lack of statutory powers. As a result there has been a vertical and horizontal expansion of universities and colleges in total disregard of adequate financial resources leading to poor quality of education in agriculture and allied areas. The Committee is, therefore, of strong view that for quality assurance of education in the country, the ICAR is vested with statutory powers for regulating higher agricultural education. This will ensure effective coordination and development of agricultural education.
- Efficient governance in SAUs hold key to accelerate quality improvement. Presently certain vital provisions of SAU Act in many universities are at variance to the ICAR Model Act, 1994 that is hampering the effective co-ordination between institutions and programmes. Further with the changing priorities and new demands as a result of globalization, there is need to revisit ICAR Model Act, for bringing integration and increased efficiency in governance. The Committee therefore recommends:
 - **Integration of Teaching, Research and Extension Education at University level:** A Coordination Committee and organization structure has been proposed to oversee the integration of teaching, research and extension education.

- **Delegation of Powers:** The Committee strongly recommends full delegation of powers in the University hierarchical system. This would enhance efficiency, bring a sense of participation and accountability and facilitate implementation of policies and programmes.
- **e- Governance:** SAUs need to use IT in governance for increased efficiency and reduce bureaucratic delays. All AUs should make 80% of their functioning paperless.
- **Institutional Linkages:** Structured linkages among Universities, ICAR Institutes, Private Institutions, General Universities, International organizations and line departments have been articulated from time to time, yet no major progress is evident. The Committee, therefore, recommends that it should be made mandatory for each SAU to have linkage with at least one ICAR institute for formal research guidance and vice versa. Facilities and expertise available at ICAR institutes should be extended to research scholars and scientists taken on SAU faculty after accreditation. Development grant should be linked with adoption of this reform.
- **Recruitment:** Faculty is the key resource in Universities. Recruitment of competent faculty is the primary step for quality improvement. The Committee recommends continuance of NET as mandatory requirement for initial recruitment (Assistant Professor and equivalent). Recruitment of 15% of the posts at entry level be made mandatory on the basis of open national selection from outside the state to reduce inbreeding and promote national integration. Management positions be filled by lateral entry on the basis of national selection for a tenure of 5years extendable for 2 more terms based on performance assessment. Service rights of person joining from outside should be protected. All SAUs need to adopt a policy of, normally, not recruiting a faculty having all degrees from the same university.
- All recommendations made for SAUs are also for CAU.

Endeavour of the Committee has been major restructuring of curriculum and appropriate central assistance to produce world class professionals, who are equipped to meet demands of global competitiveness, help farmers to wear global outfit, have analytic abilities and entrepreneurship for taking career of self employment and as contributors to livelihood security.

1. INTRODUCTION

The spectacular growth in agriculture has been on account of development of skilled human resource, which played major role in developing technologies, their assessment and dissemination to farming community. This was coupled with higher participation and receptivity of farming community and sound policies of Government of India. The establishment of postgraduate school at IARI was an important milestone, in 1958, heralded growth of agricultural universities in the country. Based on Dr.S. Radhakrishnan Commission on university education and subsequent two Joint Indo-American Study Teams (1955, 1959) recommendations, first agricultural University was set up in Pantnagar in 1960, which paved the way for establishment of agricultural universities in other states.

At present, there are 40 State Agricultural Universities, four of the ICAR Institutes as Deemed Universities (IARI, IVRI, NDRI, CIFE), Allahabad Agricultural Institute and one Central Agricultural University for northeastern region at Imphal. In addition, four Central Universities, namely Banaras Hindu University, Aligarh Muslim University, Vishwa Bharti and Nagaland University have strong agricultural faculty (Annexure I). These institutions enroll on annual basis about 15,000 students at UG level in as many as eleven disciplines and over 7,000 students at PG level in Masters and 1700 in Ph.D. programmes. At any point, there are over 75,000 students studying in SAUs. In addition to this, there are large number of private colleges both affiliated and non-affiliated to SAUs which also annually admit larger number of students. The Human Resource Development by National Agricultural Research and Education System has played a pivotal role in agricultural transformation in the country. Green, blue yellow and white revolutions have been responsible for bringing in prosperity to the farming community.

In order to have quality assurance in agricultural education, Indian Council of Agricultural Research initiated a series of steps. These include setting up of Norms and Accreditation Committee followed by establishment of Accreditation Board in 1996, course curriculum revision through Deans Committee, networking and strengthening of SAUs through development support etc. Courses in the agricultural universities system have been revised based on the recommendations of the Deans Committee. The major exercise was done at the time of Third Deans Committee, which submitted its report in 1995, and this was followed by dialogue with different stakeholders in developing detailed curricula and syllabi for various under-graduate and post-graduate courses by the Education Division of ICAR under Agricultural Human Resource Development Project supported by World Bank. Recognizing the need for quality improvement in agricultural education, World Bank supported ICAR through Agricultural Human Resource Development Programme with an outlay of US \$ 74.2 million for bringing in much needed reforms in agricultural education. The major reforms brought in through this project included:

- 1.Establishment of Accreditation Board** – The new Accreditation procedure has been institutionalized which involved preparation of Self Study Report by the institutions, validation of Self Study Report by a Peer Team and finally decision by the Accreditation Board on accreditation of the institutions. The Board also approved three sectoral committees on Accreditation Norms and New Institutions/Programmes, Curricula and Equivalence, Governance and Personnel/Financial Policies.
- 2.Norms and Standards for improving education** – Uniform academic regulations, examination and evaluation system including grading system made in SAUs. Rural Awareness Work Experience included in the programme, courses in new emerging areas such as Computer Applications, Bio-Statistics, Biodiversity, Biotechnology, Agri-

Business Management, Marketing and Environment incorporated in all degree programmes.

3.Capacity Building for Human Resource Development – The HRD programme were strengthened by supporting, modernization of class-rooms, library strengthening, establishment of students’ laboratories at college level, students counseling and placement cell, supporting construction of International student hostels, girls hostels, education technology cells and providing support for modernization of UG and PG practical and research labs.

4.Faculty Competence Improvement – In order to improve the faculty competence, large number of training programmes were organized through Centres of Advance Studies, Summer and Winter Schools in which 9,000 scientists benefited. Besides nearly 1000 scientists were sent for training in best of the institutions overseas. Sabbatical leave rules as well as Visiting Scientists scheme operationalised. To promote excellence in teaching, five Best Teacher Awards were instituted both at university and national level. Faculty made computer literate and support provided for participating in seminars, symposia both nationally and internationally.

5.Reducing Inbreeding – Extensive inbreeding is the single factor contributing largely for decrease in quality of education. From 1995-2000 major steps were taken for reducing inbreeding:

- All India Competitive Examination each year to fill 15% UG and 25% PG seats in all SAUs. Through this examination each year about 1500 students at UG level and 1000 students at PG level are sent from one Institution to other. This has changed the cultural life on campuses, brought healthy competition, promoted national integration, leading to improvement in instruction.
- 300 National Talent Scholarships at UG level awarded to students who opt to move out of their state of domicile. This is to attract talent to agriculture and promote national integration
- Award of 475 Junior Research Fellowships each year to students on merit for M.Sc programme only if they join programme in the University other than from which they obtained UG degree. This has been a major step in reducing inbreeding to a large extent.
- Recruitment at Assistant Professor level in all SAUs based on NET conducted centrally by Agricultural Scientists Recruitment Board

While all these steps led to some extent improvement in quality of education, still there have been many constraints. These constraints included lack of modernity and state of the art equipments commensurate to world technology development, inadequate financial support and lack of access to latest information. The need for sweeping reforms in agricultural education for improving quality and standards is well recognized now than ever before because of emerging challenges of making Indian agriculture not only sustainable but internationally competitive. Nationally and internationally there are three major pillars for quality assurance:

- (i) Competence of faculty and periodic updating skills and knowledge
- (ii) Modern infrastructure
- (iii) Curriculum and curriculum delivery

Analysis of the present agricultural education system indicates that despite finalization of academic regulations for UG and PG programmes after Third Deans Committee report and initiatives under the Agricultural Human Resources Development Project (AHRDP),

many of the institutions have not yet followed these in letter and spirit and wide variations exist. Universities still suffer from poor governance. The system as a whole has not taken full advantage of modern tools of management for efficient governance. The faculty in SAUs has dwindled with majority chunk of the posts remaining vacant due to financial crunch. Besides curriculum and curriculum delivery have not been changed keeping in view global technology development. There is also no link of curriculum to employment in private agribusiness and processing industries and meeting the demands of extension. Quality of education suffers due to obsolete equipments, outdated and poor laboratory, lecture halls, library and instructional farms. In view of this, ICAR has set up IV Deans Committee with a wider mandate and Term of Reference so that a holistic view could emerge on quality assurance and relevance in agricultural education (Annexure IIa,b). The Terms of Reference for the Committee are:

- (i) Defining UG and PG degrees for general market needs and for specialist jobs and uniformity in UG and PG degree nomenclature.
- (ii) Restructuring of UG programmes for increased practical and practice contents.
- (iii) Central assistance for strengthening of higher agricultural education.
- (iv) Guidelines for assessing training needs and performance of teaching faculties.
- (v) Reforms in governance of SAUs.

The Committee held its first meeting on May 24, 2005 in which it deliberated on TOR and manner in which various issues flagged to the committee, could be looked after. So far as revision of the course curricula is concerned, the Committee decided to follow faculty-based deliberations involving different stakeholders in the system. For this purpose, Chairman was authorized to write to different Universities to initiate the process. The following mechanism was devised:

All SAUs to organize meeting of each faculty at Universities level involving their faculty and different stakeholders including alumni of the institution, agri-business personnel, concerned government department representatives, farmers etc. Major emphasis was on involvement of different stake-holders. The skills needed among graduates to be first articulated and courses designed by reverse engineering, taking care to provide adequate practical skills. The recommendations of these Committees were sent to Coordinators identified for each discipline who compiled the information received as per the format developed. The letter written to all the Vice Chancellors and the questionnaire-format sent to discipline coordinators for preparing initial document are respectively given, in Annexure III and IV. The following Coordinators were identified for various disciplines:

- | | | |
|--------|---------------------------------|--|
| (i) | Agriculture | Dr. S. Sudarshan Reddy, Dean, College of Agriculture, ANGRAU, Hyderabad. |
| (ii) | Agricultural Engineering | Dr S.K. Sondhi, Dean, College of Engineering, PAU, Ludhiana |
| (iii) | Dairy Technology | Dr. N. S. Rathore, Dean, College of Dairy and Food Science Technology, MPUAT, Udaipur and Dr.G.R. Patil, Head, Dairy Technology, NDRI, Karnal. |
| (iv) | Food Technology | Dr. D.N. Kulkarni, Dean, College of Food Technology, MAU, Parbhani |
| (v) | Home Science | Dr. (Mrs.) Pushpa Gupta, Dean, College of Home Science, MPUAT, Udaipur |
| (vi) | Fishery Science | Dr.M.P.S. Kohli, Dean (Acad.), CIFE, Mumbai |
| (vii) | Horticulture | Dr.U.K. Kohli, Dean, College of Horticulture, YSPUH&F, Solan |
| (viii) | Forestry | Dr. S.D. Bhardwaj, Dean, College of Forestry, YSPUH&F, Solan |

(ix) **Veterinary Science** Dr. P. Thangaraju, Dean, Madras Veterinary College, TNV&ASU, Chennai.

Agribusiness Management and Sericulture disciplines are offered only by a few SAUs, hence curricula and syllabi of these were not addressed by the Committee.

Discipline-wise National Meetings: The feedback received after organization of discipline-wise meetings in all universities, was collated and analyzed by the discipline Coordinators. After compilation of responses from all universities, discipline-wise national level meetings were organized by the Deans Committee with respective Deans and stake-holders. In these national meetings the focus was on analyzing the present status of curricula, curriculum delivery and academic regulations, SWOT analysis and looking at requirements of skill and entrepreneurship to face new challenges in the globalized economy. Presence of different stakeholders helped in articulating skill requirements of the agribusiness enterprises also. It was emphasized that the new curricula should be in tune with the new developments taking place nationally and internationally for making agriculture sustainable and productive. The paradigm shift from production to cost competitive and consumer quality acceptance was articulated.

Additional emphasis in these meetings was on how to add value to the time spent by the graduates, to provide skills in latest cutting edge technologies and confidence to do farming or other vocations profitably. It is heartening to state that in many disciplines excellent suggestions were made by line-department officials, agri-business people and farmers and these have been taken into consideration while formulating the revised syllabus. Reorientation recommended takes care of developing needed knowledge, skills, entrepreneurship, agribusiness acumen and communication skills, so that graduates have confidence to take career of self employment. Additionally they are able to contribute to sustainability of agriculture, economic and technological empowerment and ultimately to livelihood and food security in the country. Another cardinal principle was to provide adequate coverage in respect of new technologies such as biotechnology, information technology, bio-informatics, GIS, remote sensing, precision agriculture etc., for new emerging global scenario, coverage on organic farming, international agriculture, processing and value addition, agri-business management, communication skills etc., across different disciplines.

After the finalization of discipline and semester wise course curricula, a major exercise was undertaken to develop detailed course syllabi both for theory and practicals. Since many of the courses have been added anew, relevant practical skills have been included to impart confidence among graduates. In case of agriculture discipline, the RAWE programme has been revisited and the same has been restructured. For other disciplines, details of experiential learning and inplant training have been worked out. Evaluation mechanism and the needed budgetary support for operationalizing the experiential learning have been suggested. For improving competence of the faculty, areas of training and institutions have also received attention. The recommendations in respect of curricula and its delivery, central assistance for quality assurance including experiential learning, faculty training reflect the considered views of the entire agricultural education system and its stake-holders in the country and is articulated discipline wise.

2. NORMS, STANDARDS AND ACADEMIC REGULATIONS

For Quality Assurance in Agricultural Education, it is essential to develop norms and standard for colleges and academic programmes. So far, in the ICAR system a detailed exercise has not yet been undertaken. The Committee during individual faculty-wise meetings deliberated on minimum norms and standards for colleges and recommendations included in this section are based on the consideration that for accreditation of a college at the UG level, norms as suggested must be fulfilled. In addition the institution should also be following major part of the academic regulations. In developing norms of faculties the characteristic feature of SAUs has been taken into the consideration. This relates to the trinity of function (education, research and extension education) where every faculty member has to be involved in more than one function. The Committee recommends that every scientist in the SAUs must devote 70% time on his/her major assignment and 30% on any of the other activities. This would also promote integration at the university level. The faculty requirement for teaching has been worked out on this principle.

In addition to working out minimum departments and faculty, the recommendations are also made in respect of general infrastructure that the colleges must have and organizational structure and minimum budgetary support required for carrying out essential mandated function of the departments. The Committee has only worked out for UG curriculum and suggests that another Committee be given the task of developing Norms and Standards for PG programmes. In developing faculty norms, the essential requirement for teaching at the college level has only been considered. There are other functions, such as NCC, NSS, Physical Education, Hostel Management, Student Counseling and Placement, Cultural & Sports Activities for which time of faculty would be required. The Committee is of the view that every college should have one Physical Instructor and one Assistant Student Welfare Officer to take care of all round development of the student on the campus. The Norms and Standards recommended for UG colleges are as under:

I. General Norms

1. Faculty Positions

- Dean for the faculty/college and Associate Dean for the college having only UG programme
- Head not below the rank of Associate Professor for the Department.
- Faculty needs of a college/department based on the academic programmes and student strength for each faculty is given discipline wise.
- Faculty strength proposed is based on the premise that teaching faculty members devote one-third time in research/extension activity.
- Research and extension scientific staff of the college/campus is required to spend one third time in teaching and that has been taken into consideration while calculating the faculty needs.

2. Library Staff

Sr.	Designation	Number
1	Assistant Librarian	1
2	Library Assistants	1
3	Clerk	1
4	Shelf Assistants	2
	Total	5

Note: Wherever possible services could be outsourced

3. Administrative and support staff:

Sr.	Designation	Dean Office	Deptt. Office
1	Assistant Registrar	1	-
2	Assistant Account Officer	1	-
3	Steno/PA	1	1
4	Assistant	1	
5	Computer operator	2	-
6	Attendants	2	1
7	LDC	1	1

Note: Security, cleaning, maintenance and other services wherever possible could be outsourced.

4. Infrastructure

- **Lecture Halls:**

Sr.	Particulars	Number
1	UG Class Room	4
2	PG Class Room	One for each Department
3	Examination Hall	1
4	Practical Laboratory	One for each Department
5	Auditorium	1

Each classroom shall be provided with facilities for projection of slides, transparencies and operation of multimedia.

- **Library Building:** There should be a central library located centrally on the campus for the convenience of students, teachers and scientists. Colleges located away from the main campus within or outside the city should have a separate library

Sr.	Particulars
1	Stack room
2	Catalogue room
3	Reading room
4	Room for Librarian and library staff
5	Research carols
6	Photocopying room
7	Computer room/lab
8	Book Bank

- **Administrative Offices:** The administrative office of the college shall have the following accommodation:

Sr.	Particulars	Number
1	Dean /Associate Dean Office	1
2	PA office	1
3	Strong room/record room	1
4	Committee room	1
5	Office rooms	2
6	Store room	1

7	Common rooms for male students	1
8	Common room for female students	1

- **Student Amenities:** The following amenities are essential for all round development of physical and mental faculties of students.

Sr.	Particulars
1	Outdoor and Indoor games grounds and halls , Gymnasium room
2	Canteen
3	NCC/NSS Office
4	Dispensary/Health Centre or arrangement for health service

5. Equipment: All the laboratories must be equipped with the equipment required for conduct of practicals included in the curriculum.

6. Funds: The Colleges must be financially viable. The college should have provision of committed annual block grants for curriculum delivery, maintenance of buildings, equipments and provision for creation of additional infrastructure and equipments. Following annual funding support per college is recommended from State Government with a provision of a five yearly review of the amount due to inflation or other circumstances.

Sr.	Item	Amount per annum
1	Contingency for curriculum delivery	Rs. 15.0 lakh
2	Maintenance of buildings	Rs. 5.0 lakh or 1% of present infrastructure cost, which ever is higher
3	Maintenance of equipments	Rs. 5.0 lakh or 10% of present infrastructure cost, which ever is higher
4.	New infrastructure and equipments	Rs. 5.0 lakh
5.	Library	2.5 % of the total budget

7. Standards

- **Minimum requirement for faculty recruitment:** As notified by the ICAR from time to time, all the vacancies at Assistant Professor and higher level shall be filled by open competition and NET should be compulsory for recruitment at Assistant Professor and equivalent level.
- **Students- Teacher ratio:** The State Agricultural Universities have adopted trinity of functions of teaching, research and extension education. Hence, every teacher should devote one-third time in research, extension or development activities in addition to teaching. Keeping these points in view, the desirable student to teacher ratio recommended is as follow.

Theory lecture class	50:1
Lab. Practical/workshop etc.	25:1

8. Workload for teachers

Sr.	Activity	Hours per week				
		Dean*	Deptt. Head	Prof.	Assoc. Prof.	Asstt. Prof.
1	Contact hours (Instruction)	4	6	8	12	16
2	Preparation for teaching	2	6	6	10	12

	including library use					
3	Administration, evaluation research/extension, guidance, counseling, development activities, etc.	33	27	25	17	11

* Including Associate Dean

9. Faculty training: Every faculty member should under go need assessed advance training at least once in 5 years to update knowledge and skill. Induction training must be provided for 3 months at entry level.

10. Faculty performance appraisal; Performance appraisal of the faculty should be based on feedback from students, specific efforts made for improving teaching methodology, contributions to course curriculum development, quality of research papers and technology patented/commercialized.

11. Faculty Specific Norms

1. Agriculture

- **Departments:**

- 1 Agronomy
- 2 Genetics and Plant Breeding
- 3 Soil Science & Agricultural Chemistry
- 4 Entomology
- 5 Agricultural Economics
- 6 Agricultural Engineering
- 7 Plant Pathology
- 8 Horticulture and Forestry
- 9 Agricultural Extension
- 10 Biochemistry / Physiology / Microbiology
- 11 Statistics and Social Science

- **Intake Capacity: 60/College**

- **Faculty Norms:**

Sr.	Department	Professor	Assoc. Prof	Asstt. Prof.
1	Agronomy	1	2	5
2	Genetics and Plant Breeding	1	2	5
3	Soil Science & Agricultural Chemistry	1	2	3
4	Entomology	1	2	3
5	Agricultural Economics	1	2	3
6	Agricultural Engineering	1	2	3
7	Plant Pathology	1	2	3
8	Horticulture and Forestry	1	2	5
9	Agricultural Extension	1	2	3
10	Biochemistry / Physiology / Microbiology	1	2	5
11	Statistics and Social Science	1	2	3
	Total:	11	22	41

- **Instructional Farm:** 50 hectare

B. Horticulture

- **Departments:**

- 1 Fruit Science
- 2 Vegetable Crops
- 3 Post Harvest Technology
- 4 Floriculture and Landscaping
- 5 Plant Protection
- 6 Natural Resource management
- 7 Basic Sciences and Humanities

- **Intake Capacity:** 40/College

- **Faculty Norms**

Sr.	Department	Professor	Assoc. Prof	Asstt. Prof.
1	Fruit Science	1	2	3
2	Vegetable Science	1	1	2
3	Floriculture and Landscaping	1	1	2
4	Spices and Plantation Crops	-	1	1
5	Post Harvest technology	1	1	2
6	Plant Protection	-	1	2
7	Basic Sciences and Humanities	-	1	3
8	Natural Resource Management	-	1	2
	Total	4	9	17

C. Forestry

- **Departments**

- 1 Silviculture & Agroforestry
- 2 Forest Biology & Tree Improvement
- 3 Forest Products & Utilization
- 4 Natural Resource Management
- 5 Basic Sciences & Humanities

- **Intake Capacity:** 40/College

- **Faculty Norm**

Sr.	Departments	Professor	Assoc. Prof	Asstt. Prof.
1	Silviculture & Agrofresotry	1	3	6
2	Forest Biology & Tree Improvement	-	1	3
3	Forest Products & Utilization	1	2	4
4	Natural Resource Management	1	2	4
5	Basic Sciences & Humanities	1	2	4
	Total	4	10	21

- **Instructional Farm:** 50 hectare

D. Home science

- **Departments**

- 1 Human Development and Family Studies
- 2 Foods and Nutrition
- 3 Textiles and Apparel Designing
- 4 Family Resource Management
- 5 Home Science Extension and Communication Management

- **Intake Capacity:** 40/College

- **Faculty Norm**

Sr.	Department	Professor	Assoc. Prof	Asstt. Prof.
1	Human Development and Family Studies	1	1	3
2	Foods and Nutrition	1	1	3
3	Textiles and Apparel Designing	1	1	3
4	Family Resource Management	1	1	3
5	Home Science Extension and Communication Management	1	1	3
	Total	5	5	15

- **Instructional Farm:** 5 hectare

E. Agricultural Engineering

- **Departments**

- 1 Agriculture and Basic Sciences (Soil, Agronomy, Mathematics, Physics and Chemistry)
- 2 Basic Engineering (Civil, Mechanical, Computer Science and Electrical Engineering)
Agricultural Engineering
- 3 Farm Power and Machinery
- 4 Processing and Food Engineering
- 5 Soil and Water Engineering

- **Intake Capacity:** 40/College

- **Faculty Norms**

Sr.	Discipline	Professor	Assoc. Prof	Asstt. Prof.
1	Agriculture and Basic Sciences			
	Soil Science and agronomy	-	-	1
	Physics	-	-	1
	Chemistry	-	-	1
	Mathematics	-	-	2
	Business Management	-	-	1
2	Basic Engineering			
	Mechanical Engineering	1	1	2
	Civil Engineering	1	1	2

	Electrical/Computer Science	1	1	2
	Agricultural Engineering			
3	Farm Power and machinery	1	2	4
4	Soil and water engineering	1	2	3
5	Process and Food engineering	1	2	3
	Total	6	9	22

- **Instructional Farm** - 25 hectare

F. Dairy Technology

- **Departments:**

1. Dairy Technology
2. Dairy Engineering
3. Dairy Chemistry
4. Dairy Microbiology
5. Dairy Business Management

- **Intake Capacity:** 40

- **Faculty Norms**

Sr.	Department	Professor	Assoc. Prof	Asstt. Prof.
1	Dairy Technology	1	2	4
2	Dairy Engineering	1	2	4
3	Dairy Microbiology	-	1	2
4	Dairy Chemistry	-	1	1
5	Dairy Business Management	-	1	1
	Total:	2	7	12

G. Food Technology

- **Departments**

Sr. Department

1. Food Science & Technology
2. Food Engineering
3. Food Chemistry & Nutrition
4. Food & Industrial Microbiology
5. Food Trade & Business Management

- **Intake Capacity:** 40/College

- **Faculty Norms**

Sr.	Department	Professor	Assoc. Prof	Asstt. Prof.
1	Food Science & Technology	1	2	4
2	Food Engineering	1	2	4
3	Food & Industrial Microbiology	-	1	2
4	Food Chemistry & Nutrition	-	1	1
5	Foods Trade & Business Management	-	1	2
	Total:	2	7	13

H. Fisheries

- **Departments**
 - 1 Aquaculture
 - 2 Fisheries Resource Management
 - 3 Aquatic Environment
 - 4 Harvest and Post-harvest Technology
 - 5 Basic Sciences and Humanities
- Intake Capacity: **40/College**
- **Faculty Norms**

Sr.	Department	Professor	Assoc. Prof	Asstt. Prof.
1	Aquaculture	1	1	3
2	Fisheries Resource Management	1	1	2
3	Aquatic Environment	-	1	2
4	Harvest and Post-harvest Technology	1	1	3
5	Basic Sciences and Humanities	-	2	3
	Total	3	6	13

- **Instructional Farm:** 25 hectare

III. Academic Regulations

A. Under-Graduate Programme

1. Degree Nomenclature

Sr.	Abbreviation of Degree	Expansion of Degree
1	B.Sc. (Hons) discipline	Bachelor of Science honours in discipline
2	B.Tech.(discipline)	Bachelor of Technology in discipline
3	B.F.Sc	Bachelor of Fishery Science
4	B.V.Sc. & A.H.*	Bachelor of Veterinary Science & Animal Husbandry

*Academic regulations as per regulations of the Veterinary Council of India

2. System of Education

- Formal education with semester system

3. Program Duration

- Minimum: 8 semesters (4 academic years)
- Maximum: 14 semesters (7 academic years)

4. Minimum eligibility requirement for admission

- Pass in 10+2 examination having 50% marks in aggregate for general category and 45 % for SC/ST.

- **Faculty specific eligibility**

Faculty	Eligibility
Agriculture	PCB/PCBM/Agriculture with Science subjects
Home Science	PCB/PCBM/PCM/Home Science Group/ Agriculture Group
Food Science & Technology	PCM/PCBM
Dairy Technology	PCM/PCBM
Fisheries Science	PCB/PCBM
Horticulture	PCB/PCBM
Forestry	PCB/PCMB
Agricultural Engineering	PCM/PCBM

5. Mode of Admission: Entrance examination for seats filled by ICAR. SAUs may follow entrance examination or merit at 10+2 or a combination.

6. Reservation of seats: Reservation of seats shall be governed by the rules of State government. The Committee recommends 25 % ICAR seats to be filled through ICAR entrance examination.

7. Semester Duration: The minimum duration of 110 working days, consisting of 95 instructional days and 15 examination days.

8. Credit Definition: One credit is defined as one-hour lecture/2 hours lab/3 hours field work per week.

9. Attendance

- 75 percent
- Relaxation in minimum attendance requirement should be given only in the case of indoor hospitalization.

10. Maximum Permissible Course Workload

23 credits per semester

11. Course Curriculum and minimum credits requirement

- The ICAR Model Course Curriculum and Syllabus should be followed with 30 per cent variation to meet regional requirements if felt necessary by the Academic Council of the AU.
- The minimum credit requirement for the graduate degree should be 160 credits excluding non-credit courses for language, physical education/NCC/NSS

12. Examination and Evaluation System

- The Committee recommends one mid term of 20% marks (internal) and final theory 80% marks (external). Syllabus of the concerned course shall be sent to the external examiner, who shall prepare the question papers, and also evaluate the answer papers.
- For practicals, it is recommended that examination conducted by course instructor(s) and one teacher nominated by HOD

13. Grade Point: Ten (10) points grading system should be adopted with minimum Grade Point Average (GPA) of 5.00 for passing a subject and Overall Grade Point Average (OGPA) of 5.50 for obtaining a degree.

B. Non-Formal Education

- **Nomenclature**

Sr.	Programme	Duration	Minimum Admission Eligibility
1.	Certificate Course	6 – 12 months	Primary pass
2.	Diploma	2-3 years	Secondary pass

C. Post-Graduate Programs

1. Degree Nomenclature

Sr.	Abbreviation of Degree	Expansion of Degree
1.1	Masters degrees	
i	M.Sc.(subject)	Master of Science in subject
ii	M.Sc. (Ag) subject	Master of Science in Agriculture in subject
iii	M.Sc. (Hort) subject	Master of Science in Horticulture in subject
iv	M.Sc. (Forestry) subject	Master of science in Forestry in subject
v	M.Sc. (Home Sc) subject	Master of Science in Home Science in subject
vi	M.F.Sc.(subject)	Master of Science in Fisheries Science in subject
vii	M.Tech.(subject)	Master of Technology in subject
viii	M.E. (subject)	Master of Engineering in subject
ix	M.V.Sc.(subject)	Master of Veterinary science in subject
1.2	Doctorate	
i	Ph.D.	Doctor of Philosophy

2. System of Education

Master's Degree	Ph.D.
Formal education with Semester system	Formal education with Semester system

3. Duration of Program

Sr.	Duration	Master's Degree	Ph.D.
1	Minimum	4 Semesters (2 Academic Years)	6 Semesters (3 Academic Years)
2	Maximum	8 Semesters	12 Semesters

- No master's or Ph.D. student be allowed to discontinue the academic programme without completing comprehensive examination.
- Committee recommends residential requirements of two and three years respectively for master's and Ph.D. programme.
- In master's degree at least one full semester should be exclusively devoted to research.
- For Ph.D., there should be a minimum period of two years between synopsis submission and thesis submission.

4. Admission

- Minimum eligibility for admission

Masters Degree	Ph.D.
i) Bachelor's degree in respective /related subjects ii) 6.00/10 or equivalent OGPA /equivalent percentage of marks at Bachelor's degree. Those with 3 years bachelor degree should undergo one year remedial courses before registering for the regular courses	i) Master's degree in respective/related subjects ii) 6.0/10 or equivalent OGPA /equivalent percentage of marks at Master's degree. Those with 3 years bachelor degree and 2 years master degree should undergo one year remedial courses before registering for the regular courses

- **Mode of admission**

Master's Degree	Ph.D.
Entrance examination for seats filled by ICAR. SAUs may follow entrance examination or merit or a combination of both.	Entrance examination (80 % weightage) and interview (20 % weightage) for seats filled by ICAR. SAUs may follow entrance examination or merit at Master's level or a combination of both.

- The committee recommends that in service candidates should join another university for pursuing Ph. D. programme and must not be enrolled by the university in which they are employed.

5. Reservation of seats

Master's Degree	Ph.D.
Reservation of seats should be governed by the rules of State government. The Committee recommends 50 % ICAR seats, to be filled through ICAR entrance examination.	Reservation of seats should be governed by the rules of State government. The Committee recommends 50 % ICAR seats.

6. Maximum permissible course workload per semester

Master's Degree	Ph.D.
18 credits	18 credits

7. Minimum credits requirement

Sr.		Master's Degree	Ph.D.
1	Course work	i) 25 Credits of Major courses including 12 credits of core courses and one credit seminar ii) 12 Credits of Supporting courses (Outside discipline)	i) 14 Credits of Major courses including 6 credits of core courses and two credits for two seminars ii) 12 Credits of Supporting courses (Outside discipline)
2	Comprehensive/preliminary exam	Non-credit	Non-credit
3	Thesis	Non-credit	Non-credit

8. Attendance requirement

Masters Degree	Ph.D.
Minimum 75%	Minimum 75%

- Relaxation in minimum attendance requirement should be given only in the case of indoor hospitalization.
- In order to reduce inbreeding SAUs should discourage enrollment of students for three degrees consecutively. One of the three degrees should be from another institution.

9. Advisory Committee

Master's Degree	Ph.D.
3 Members (minimum) (2 from major area including Chairman and one from supporting areas)	4 Members (minimum) (2 from major area including Chairman and 2 others including Supporting areas)

- Advisory Committee of student should be formed within one month of registration

10. Examination and evaluation

Sr.		Master's Degree	Ph.D.
1	Course Work	i) For core courses one mid term of 20% marks of theory (internal) and final examination of 80% marks (external) ii) For other courses internal examination with mid term of 20 % marks iii) Practical, examination be conducted by course instructor(s) and one teacher nominated by HOD	i) For core courses one mid term of 20% marks of theory (internal) and final examination of 80% marks (external) ii) For other courses internal examination with mid term of 20 % marks iii) Practical examination be conducted by course instructor(s) and one teacher nominated by HOD
2	Comprehensive/ preliminary exam, after completion of 75% of Major and Supporting Courses separately. i) Question paper setting and evaluation. ii) Viva-voce and Assessment	Written i) Internal ii) Internal and Satisfactory/ Unsatisfactory	Written i) Internal ii) External and Satisfactory/ Unsatisfactory
3	Thesis submission	After delivery of thesis seminar	i) After delivery of thesis seminar. ii) Thesis should be submitted only after producing proof of acceptance of at least one research paper and submission of another research paper by the student, based on Ph. D. research work in refereed journals as per NAAS list of journals.

4	Thesis Evaluation	By one External Examiner	By two External Examiners
5	Thesis Viva- Voce	By Advisory Committee	By one of the External Examiner with Advisory Committee
6	Final Assessment of Thesis	Satisfactory/ Unsatisfactory	Satisfactory/ Unsatisfactory

- Thesis report should be provided to the chairperson of the Student's Advisory Committee, who should arrange the conduct of oral examination. The chairperson shall also be responsible for effecting corrections suggested by the external examiner in thesis, and give a certificate to this effect.
- All universities should host the thesis data base including abstract on their web site.

11. Grade Point

Sr.	Item	Master's Degree	Ph.D.
1	Scale	10	10
2	Minimum Pass Grade in a course	5.50	5.50
3	Minimum OGPA to obtain degree	6.00	6.00

12. Awards and Medals: Gold medal should be awarded only if the student secures at least 8.0 OGPA, clears all courses in first attempt and in the programme having a batch of at least five students. In case the number of students completing degree in a subject are less than five, then clubbing of related departments into groups should be done for the consideration of award of gold medal.

3. RESTRUCTURING OF UNDER GRADUATE PROGRAMME FOR INCREASED PRACTICAL AND PRACTICE CONTENTS

In order to make higher agricultural education relevant to present day needs, produce graduates with entrepreneurial skills for self-employment and contributors of rural livelihood and food security need is felt for reorienting agricultural education. In view of globalization and development of new technologies, it is essential that the students meet international quality standards. One of the pillars for quality assurance in agricultural education is the curriculum, which takes care of contemporary needs, provides for analytical skill, entrepreneurship and experiential learning for having confidence to do profitable farming and contributors of sustainability of agriculture. With this objective the Committee decided on procedure for reorienting curriculum, the details of which have been given in introduction chapter.

Based on in-depth discussion at university and national level involving different stakeholders, new curriculum has been designed details of which are given in this chapter discipline wise. The main features include inclusion of new areas and increase in practical content through experiential learning duration of which is ranging from 6 months to a year. In all disciplines attachment with industry has been indicated. The details of courses department wise and semesterwise for each of the discipline along with change effected are given. Budgetary support for experiential learning and or professional courses has also been indicated.

In making recommendations, the Committee has taken note of the global developments in science and technology, the skills our graduate must possess to meet new challenges thrown open as a result of globalization and preparing farmers for new opportunities at national and international level. The Committee feels confident that with the implementation of new curriculum coupled with central assistance as recommended would make major change and our graduates would have stamp of international excellence in education.

I. AGRICULTURE

Introduction: Higher Agricultural Education in India was under University Grants Commission (UGC) till early years of sixties, as most of institutions offering agricultural education were affiliated to general universities. However, after the re-organization of the ICAR and creation of DARE, the responsibilities for Higher Agricultural Education were transferred to the ICAR in 1965. However, organized courses in Agricultural Education were started in the beginning of the 20th century when six Agricultural Colleges were established at Kanpur, Lyallpur, Coimbatore and Nagpur in 1905, at Pune in 1907 and at Sabour (Bihar) with diploma programme. The degree programmes, however, were started in early 1920s. By 1947, there were seventeen agricultural colleges offering degree programme in agriculture under the umbrella of State Departments of Agriculture and Animal Husbandry with sporadic efforts on research and development. With the establishment of at least one SAU in each major state of the country, now there are 71 colleges of agriculture in these universities. The agricultural education system itself underwent a major change with the introduction of trimester, 100% internal evaluation and letter grading system with full transparency and subsequently modified into semester system with 10 point grading. In addition, there are more than 50 colleges outside the Agricultural Universities system offering B.Sc. (Ag) degree programme.

Mission: Develop skilled human resource for developing sustainable agriculture farming system leading to technological and economic empowerment of practitioner of agriculture.

Objectives

- To train manpower with more practical orientation to cater to the needs of public, private and corporate sectors in Agriculture
- To impart knowledge and training in interdisciplinary production oriented courses in Agriculture.
- To provide experiential learning and hands - on training for developing entrepreneurial skill for being job provider rather than jobseekers.

Present Status

Number of colleges and enrollment

71 Agricultural Colleges (under State Agriculture Universities)
5452 candidates enrolled annually

RAWE Programme: Almost all the SAUs are offering RAWE Programme in the Fourth year of degree with a total of 18 – 20 credits with variation in duration and manner of conduct.

Examination pattern: The examination system in most of the SAUs is quite variable combination of 50% internal and 50% external in theory component and 50-100% internal in practical component of a course.

Recommendations for New Curriculum: In the meeting organized to finalize curriculum, the consensus emerged that the programme should be restructured to cover majority of courses by sixth semester and seventh and eighth semester be devoted exclusively for giving professional skills in selected combination of subjects and Rural Agricultural Work Experience. This was mainly with the objective of providing adequate experiential learning so that the graduates have confidence and entrepreneurial skills to start vocation. In addition it was emphasized that students should have flexibility in course curriculum selection. Based on in depth discussions, new curriculum has been finalized. The distribution of courses, department wise recommended and semester wise is as under:

Department wise courses

I	Agronomy	
1	Principle of Agronomy and Agricultural Meteorology	3(2+1)
2	Field crops-I (<i>Kharif</i>)	3(2+1)
3	Weed Management	2(1+1)
4	Water Management including Micro-irrigation	3(2+1)
5	Field crops-II (<i>Rabi</i>)	3(2+1)
6	Farming Systems and Sustainable Agriculture	2(1+1)
7	Practical Crop Production – I (<i>Kharif</i> crops)	1(0+1)
8	Practical Crop Production – II (<i>Rabi</i> Crops)	1(0+1)
9	Introductory Agriculture (Ancient Heritage, Agriculture Scenario and Gender Equity in Agriculture)	1(1+0)
10	Organic Farming	3(2+1)
	Total	22(13+9)
II	Genetics & Plant Breeding	
1	Principles of Genetics	3(2+1)
2	Principles of Seed Technology	3(2+1)
3	Principles of Plant Breeding	3(2+1)

4	Principles of Plant Biotechnology	3(2+1)
5	Breeding of Field/Horticulture Crops	3(2+1)
	Total	15(10+5)
III	Soil Science & Agricultural Chemistry	
1	Introduction to Soil Science	3(2+1)
2	Manures, Fertilizers and Agro-chemicals	3(2+1)
3	Soil Chemistry, Soil Fertility and Nutrient Management	3(2+1)
	Total	9(6+3)
IV	Entomology	
1	Insect Morphology and Systematics	3(2+1)
2	Insect Ecology and Integrated Pest Management including Beneficial Insects	3(2+1)
3	Crop Pests and Stored Grain Pests and their Management	3(2+1)
	Total	9(6+3)
V	Agricultural Economics	
1	Principles of Agricultural Economics	2(2+0)
2	Agricultural Finance and Co-operation	2(1+1)
3	Agricultural Marketing, Trade and Prices	2(1+1)
4	Production Economics and Farm Management	2(1+1)
5	Fundamentals of Farm-Business Management (including Product Development, Appraisal and Monitoring)	2(1+1)
	Total	10(6+4)
VI	Agricultural Engineering	
1	Fundamentals of Soil, Water and Conservation Engineering	3(2+1)
2	Farm Power and Machinery	2(1+1)
3	Protected Cultivation and Post-Harvest Technology	2(1+1)
4	Renewable Energy	2(1+1)
	Total	9(5+4)
VII	Plant Pathology	
1	Plant Pathogens and Principles of Plant Pathology	4(3+1)
2	Diseases of Field Crops and their Management	3(2+1)
3	Diseases of Horticultural Crops and their Management	3(2+1)
4	Introductory Nematology	2(1+1)
	Total	12(8+4)
VIII	Horticulture	
1	Production Technology of Fruit Crops	3(2+1)
2	Production Technology of Vegetables and Flowers	3(2+1)
3	Production Technology of Spices, Aromatic, Medicinal and Plantation Crops	3(2+1)
4	Post-harvest Management and Value Addition of Fruits and Vegetables	2(1+1)
	Total	11(7+4)
IX	Agricultural Extension	
1	Dimensions of Agricultural Extension	2(1+1)
2	Fundamentals of Rural Sociology and Educational Psychology	2(2+0)
3	Extension Methodologies for Transfer of Agricultural Technology	2(1+1)
4	Entrepreneurship Development and Communication Skills	2(1+1)
	Total	8(5+3)
X	Biochemistry / Physiology / Microbiology/ Environmental Sciences	
1	Biochemistry	3(2+1)
2	Crop Physiology	3(2+1)

3	Agricultural Microbiology	3(2+1)
4	Environmental Science	2(1+1)
	Total	11(7+4)
XI	Statistics And Computer Application	
1	Statistics	2(1+1)
2	Introduction to Computer and Applications	2(1+1)
	Total	4(2+2)
XII	Animal Production	
1	Live Stock Production and Management	3(2+1)
	Non Credit Courses	
1	Comprehension and Communication Skills in English	2(1+1)
2	NSS/NCC/Physical Education	1(0+1)

Semester wise distribution of courses

	I Semester	
1	Principles of Agronomy and Agricultural Meteorology	3(2+1)
2	Principles of Genetics	3(2+1)
3	Introduction to Soil Science	3(2+1)
4	Fundamentals of soil water conservation and engineering	3(2+1)
5	Plant Pathogens and Principles of Plant Pathology	4(3+1)
6	Production technology of fruit crops	3(2+1)
7	Introductory Agriculture (Ancient, Heritage, Agriculture, Scenario and gender equity in Agriculture)	1(1+0)
	Total	20(14+6)
	II Semester	
1	Introductory Nematology	2(1+1)
2	Statistics	2(1+1)
3	Water management including micro irrigation	3(2+1)
4	Principles of Seed Technology	3(2+1)
5	Principles of Agril. Economics	2(2+0)
6	Dimensions of Agril. Extension	2(1+1)
7	Agricultural Microbiology	3(2+1)
8	Introduction to computer application	2(1+1)
9	Soil Chemistry, Soil Fertility and Nutrient Management	3(2+1)
	Total	22(15+7)
	III Semester	
1	Practical crop production I (Cereals, Pulses and Fodder crops)	1(0+1)
2	Principles of Plant Breeding	3(2+1)
3	Insect Morphology and Systematics	3(2+1)
4	Agricultural Finance and Co-operation	2(1+1)
5	Farm power and machinery	2(1+1)
6	Production Technology of Vegetables & Flowers	3(2+1)
7	Livestock Production and Management	3(2+1)
8	Organic Farming	3(2+1)
9	Crop Physiology	3(2+1)
	Total	23(15+8)

	IV Semester	
1	Practical crop production II (oil seeds & commercial crops)	1(0+1)
2	Manures, Fertilizers and Agrochemicals	3(2+1)
3	Insect Ecology & Integrated pest management including beneficial insects	3(2+1)
4	Agricultural marketing, Trade and Prices	2(1+1)
5	Protected cultivation and Post harvest Technology	2(1+1)
6	Diseases of Field Crops and their management	3(2+1)
7	Production technology of spices, Aromatics Medicinal and Plantation crops	3(2+1)
8	Breeding of Field / Horticultural crops	3(2+1)
	Total	20(12+8)
	V Semester	
1	Farming Systems and Sustainable Agriculture	1+1
2	Principles of Plant Biotechnology	2+1
3	Crop Pests and stored grain pests and their management	2+1
4	Fundamentals of Agri Business Management (Including product development, Appraisal and Monitoring)	1+1
5	Field Crops-I (<i>Kharif</i>)	2+1
6	Fundamentals of Rural Sociology and Educational Psychology	2+0
7	Post harvest management and value addition of fruits and vegetables	1+1
8	Disease of Horticultural crops and their management	2+1
	Total	20(13+7)
	VI Semester	
1	Production Economics & Farm management	2(1+1)
2	Extension Methodologies for Transfer of Agricultural Technology	2(1+1)
3	Biochemistry	3(2+1)
4	Entrepreneurship Development	2(1+1)
5	Field crops-II (<i>Rabi</i>)	3(2+1)
6	Comprehension and Communication Skills in English	2(1+1)
7	Environmental Science	2(1+1)
8	Weed management	2(1+1)
9	Renewable Energy	2(1+1)
10	NSS / NCC / Physical Education (Non credit course)	1(0+1)
	Total	21(11+10)
	VII Semester	
	Rural Agricultural Work Experience (RAWE)	
	Crop Production	5
	Crop Protection	4
	Rural Economics	3
	Extension Programme	4
	Research Station / KVK / DAATT Center activities and Attachment to the Agro-based industries	4
	Total	20 (0+20)
	VIII Semester	
	Courses for Experiential Learning	20

Courses for Experiential Learning: A student has to register 20 credits with major load in one area of electives and rest from among one / two areas of electives in the eighth semester.

Sr.	Title of the module	Credits
I	Crop Production	
1	Seed Production Technology	3(1+2)
2	Remote Sensing GIS and Land use Planning	3(1+2)
3	Integrated Farming System	3(1+2)
4	Water Management (Watershed Micro-irrigation Problematic Water)	4(1+3)
5	Soil Management (conservation Problematic soil, Soil quality)	4(1+3)
II	Crop Protection	
1	IPM and IDM (Pest Disease Scouting)	4(2+2)
2	Management of Post Harvest insect- pests and diseases	3(1+2)
3	Non-insect pests and their Management	3(1+2)
4	Apiculture	2(0+2)
5	Mushroom (cultivation)	2(0+2)
6	Bio-control agencies and bio-pesticide (mass multiplication and uses)	3(1+2)
7	Pesticides and Plant Protection equipment	3(1+2)
III	Horticulture	
1	Commercial Vegetable Production	3(1+2)
2	Commercial Floriculture	3(1+2)
3	Commercial Fruit Production	3(1+2)
4	Nursery management of horticultural crops	4 (1+3)
5	Protected cultivation of horticultural crops and Seed production of vegetables and flowers	4(1+3)
6	Processing and value addition of horticultural crops	3(1+2)
IV	Post Harvest Technology and Value addition	
1	Post harvest Technology of Horticultural crops	3(1+2)
2	Unit operation for quality value addition processing and development of new products	4(1+3)
3	Post harvest technology of spices, plantation crops, medicinal and aromatic crops	4(1+3)
4	Integrated storage management of fruits, flowers and vegetables	3(1+2)
5	Post harvest handling of cut flowers and dry flowers	3(1+2)
6	Processing of cereals, pulses and oilseed crops including biodiesel	3(1+2)
V	Agri-Business Management	
1	Information & Communication Management	3 (1+2)
2	Management of Agro-based industry	4 (1+3)
3	Marketing Management (Agricultural Import-Export Policy of Govt. of India & Business Laws)	3 (1+2)
4	Financial Management of Agri-Business	4 (1+3)
5	Natural Resources Economics and Management	3 (1+2)
6	Project formulation, Evaluation and Monitoring	3 (1+2)
VI	Social Sciences	
1	Agricultural Journalism	3 (1+2)
2	Visuals and Graphic Communications	3 (1+2)
3	Cyber Extension	2 (1+1)
4	Behavioral Skills	3 (1+2)
5	Livestock, Poultry and Fish Marketing	3 (1+2)
6	Farm Planning and Budgeting	3 (1+2)
7	Government Policies and Programmes Related to Agriculture	3 (1+2)
VII	Basic Sciences	
1	Molecular Breeding	3 (1+2)

2	Plant tissue culture	4 (1+3)
3	Recombinant DNA Technology	3 (1+2)
4	Bio informatics	3 (1+2)
5	Microbial & Environmental Technology	4 (1+3)
6	Molecular Diagnostics	3(1+2)
VIII	Commercial Agriculture	
1	Commercial floriculture	3 (0+3)
2	Commercial fruit production	3 (0+3)
3	Nursery management of horticultural crops	3 (1+2)
4	Cultivation of commercially important medicinal & aromatic plants	2 (1+1)
5	Commercial spices production	3 (1+2)
6	Production technology of economic forest plants	3 (1+2)
7	Commercial seed production technologies	3 (1+2)

Rural Agricultural Work Experience (RAWE): Under this programme two models are suggested and colleges could choose any one depending upon need assessment.

Sr.	RAWE Model I	Duration (Week)
1	Orientation	1
2	Village attachment	16
3	Research Station / KVK / DAATT Center activities and attachment to the Agro-based industries	2
4	Project report preparation and examination	1

Sr.	RAWE Model II	Duration (Week)
1	Orientation	1
2	Village attachment	6
3	Agri-clinics / Plant Health Clinics / Experiential leaning / Industrial Attachment	12
4	Project report preparation and examination	1

RAWEP Attachment with Agro-based Industries: During RAWEP Programme the students will undergo internship in any one of the following industries / companies / institutes for a period of twelve weeks (the list is only suggestive and need based / location specific industries may be included).

- Seed industries / companies
- Fertilizer industries
- Pesticides industries
- Biotechnological industries (Tissue Culture labs)
- Bio pesticides industries
- Commercial nurseries / landscaping units
- Sericulture units
- Food processing units
- Agricultural finance Institutions / Banks / Credit Societies etc.
- Non – Governmental organizations

Evaluation of RAWEP Programme

Attendance: Minimum attendance for this programme - 85%.

Records: Students shall complete the record work based on daily field observation notebooks and weekly diaries maintained by them.

Evaluation Procedure: The students shall be evaluated by Course Coordinator as well as by a designated evaluation Committee.

Note: i) The duration of the RAWEP is 20 weeks with a weightage of 20 credits; ii) Wherever facilities are not available for industrial training and / or agri-clinics, the duration of vocational training may be increased to that extent; iii) RAWEP can be implemented either in the VII or VIII semester as per convenience.

Budget: For implementation of new professional courses and experiential learning support of Rs. 90 lac per college is recommended for purchase of equipments and other infrastructure. In addition Rs. 5 lac as revolving fund to each of the eight departments for operationalization of this programme is recommended. Total outlay Committee estimates would be Rs. 200 crore.

Features of New Curriculum

- Six semesters coursework, one semester RAWEP and one-semester electives in interdisciplinary courses for entrepreneurship development. In the electives, students have flexibility to choose courses. These courses have higher practical exercises for skill updation. The proportion of theory and practical is nearly 50:50
- Adequate expertise for agri-clinic embedded.
- Curriculum redundancy removed.
- Course curricula reoriented to develop needed knowledge skills, entrepreneurial mindset of the student to take up self employment
- Three non-credit courses viz., Comprehension and Developing Communication Skills in English and NSS/ NCC / Physical Education are included.
- Each University may provide specialization in 4 or 5 areas keeping in view the facilities and the need.
- Introduced few new courses like Introductory Agriculture, Renewable Energy, Organic farming, Biotechnology, Agribusiness, Project Development Appraisal and Monitoring and Entrepreneurship Development.

II. HORTICULTURE

Introduction: Horticulture education until 1970 was taught as a part of agriculture curriculum. Realizing the importance of horticulture in promoting livelihood security, economic empowerment and nutritional security, horticulture emerged as a separate discipline. Separate colleges of Horticulture were established with the first college of Horticulture coming in Kerala in 1972. Since then 12 more colleges of Horticulture have been established in the country and with one of the University specializing in Horticulture namely Dr.Y.S.Parmar University of Horticulture and Forestry, Nauni (H.P.)

Horticulture growth in the country has been tremendous in the last over two decades. It has not only led to higher contribution in GDP but also processing and value addition has led to increase in export of fruit, vegetable and processed products. There is tremendous scope for increasing production of Horticulture crops specially fruits, vegetables, flowers, medicinal and aromatic plants, plantation crops, etc. we are fortunate to have different agro climatic regions and can produce tropical, sub-tropical and temperate fruits and vegetables. This is a unique position and we could get advantage of this internationally provided we are able to

develop human resource which are well versed and have skills to take up different aspects of Horticultural development including processing and value addition.

Mission: Capacity building for producing quality horticultural produce at reasonably low cost to compete in the global market and to promote self-employment among the horticultural graduates.

Objectives

- Equip the graduates with current trends and requirements of horticulture Industry.
- Enabling them to help and guide the farmers or involve themselves in achieving cost and quality competitiveness of horticultural produce.
- Enable in market intelligence and participate in world trade of horticultural produce.

List of Horticulture Colleges

1.	College of Horticulture, Vellanikara (KAU, Thrissur)	1972
2.	College of Horticulture, Akola (PDKV, Akola)	1984
3.	College of Horticulture, Nauri, Solan (YSPUHF, Solan)	1985
4.	ASPEE College of Horticulture & Forestry, Navsari (NAU, Navsari)	1988
5.	Horticulture College & Rsearch Institute, Periyakulam (TNAU, Coimbatore)	1995
6.	College of Horticulture, Mudigere (UAS, Dharwad)	1996
7.	Faculty of Horticulture, Mohanpur (BCKV, Mohanpur)	1996
8.	KNK College of Horticulture, Mandasaur (JNKVV, Jabalpur)	2001
9.	College of Horticulture & Forestry, Pasighat (CAU, Imphal)	2001
10.	Faculty of Horticulture, Pundibari (UBKV, Cooch Behar)	2001
11.	College of Horticulture & Forestry, Jhalawar (MPUAT, Udaipur)	2004
12.	VCSG College of Horticulture, Bharsar (GBPUAT, Pantnagar)	2005
13.	College of Horticulture, Arabhavi (UAS,Dharwad)	--

Academic Variations in colleges: The variation with regard to total credit load for B.Sc. (Hort.) in various colleges ranged between 150 to 163 credit hours. While seven colleges were admitting students on the basis of common entrance test, four admitted on the basis of 10+2 examination marks alone. External and internal system of evaluation varied within the colleges ranging from 100 per cent internal to 20 per cent internal and 80 per cent external. Credit hours assigned for RAWE varied from as low as 3 to as high as 21. Grading system was on 10-point scale in all the colleges. However, award of first division varied from 6.00/10 to 8.99/10 OGPA. Minimum attendance required in each course ranged from 70 per cent to 85 per cent amongst various colleges.

Recommendations for New Curriculum

Department-wise courses

	Fruit Science	
1.	Fundamentals of Horticulture	3(2+1)
2.	Plant Propagation and Nursery Management	2(1+1)
3.	Tropical and Subtropical Fruits	3(2+1)
4.	Temperate Fruits	2(1+1)
5.	Orchard Management	2(1+1)
6.	Plantation Crops	3(2+1)

7.	Weed Management in Horticultural Crops	2(1+1)
8.	Principles of Genetics and Cytogenetics	3(2+1)
9.	Principles of Plant Breeding	3(2+1)
10.	Breeding of Fruit and Plantation Crops	3(2+1)
	Total	16+ 10=26
II	Vegetable Crops	
1.	Tropical and Subtropical Vegetables	3(2+1)
2.	Spices and Condiments	3(2+1)
3.	Breeding of Vegetable Tuber and Spice Crops	3(2+1)
4.	Seed Production of Vegetable Tuber and Spice Crops	3(2+1)
5.	Temperate Vegetables	2(1+1)
6.	Potato and Tuber Crops	2(1+1)
	Total	16(10+6)
III	Post Harvest Technology	
1.	Post harvest Management of Horticultural Crops	3(2+1)
2.	Processing of Horticultural Crops	3(1+2)
3.	Fundamentals of Food Technology	2(1+1)
	Total	8(4+4)
IV	Floriculture & Landscaping	
1.	Ornamental Horticulture	3(2+1)
2.	Breeding and Seed Production of Ornamental Crops	3(2+1)
3.	Principles of Landscape Gardening	1(0+1)
4.	Commercial Floriculture	3(2+1)
	Total	10(6+4)
V	Plant Protection	
1.	Fundamentals of Plant Pathology	3(2+1)
2.	Mushroom Culture	1(0+1)
3.	Diseases of Fruit, Plantation and Medicinal and Aromatic Crops	3(2+1)
4.	Diseases of Vegetable, Ornamental and Spice Crops	3(2+1)
5.	Fundamentals of Entomology	3(2+1)
6.	Nematode Pests of Horticultural Crops and their Management	2(1+1)
7.	Insect Pests of Fruit, Plantation, Medicinal and Aromatic Crops	3(2+1)
8.	Apiculture	1(0+1)
9.	Insect Pests of Vegetable, Ornamental and Spice Crops	3(2+1)
	Total	22(13+9)
VI	Natural Resource Management	
1.	Fundamentals of Soil Science	2(1+1)
2.	Soil Fertility and Nutrient Management	2(1+1)
3.	Environmental Science	3(2+1)
4.	Soil and Plant Analysis	2(1+1)
5.	Farm Power and Machinery	2(1+1)

6.	Water Management in Horticultural Crops	2(1+1)
7.	Organic Farming	3(2+1)
	Total	16(9+7)
VII	Basic Sciences	
1.	Elementary Statistics and Computer Application	3(2+1)
2.	Elementary Plant Biochemistry & Biotechnology	3(2+1)
3.	Introductory Crop Physiology	2(1+1)
4.	Introductory Economics	2(2+0)
5.	Horti-Business Management	2(2+0)
6.	Fundamentals of Extension Education	2(1+1)
7.	Entrepreneurship Development and Communication Skill	2(1+1)
8.	Growth and Development of Horticultural Crops	2(1+1)
9.	Structural grammar & Spoken English (NC)	2(1+1)
10.	Introductory Micro Biology	2(1+1)
	Total	22(14+8)
	Others	
1.	Introductory Agro-forestry	2(1+1)
2.	Medicinal and Aromatic Crops	3(2+1)
3.	Introduction to Major Field Crops	2(1+1)
4.	Physical Education (NC)	1(0+1)
	Total	8(4+4)
	Grand Total	128

ii) Semester wise courses

	Semester –I	
1	Elementary Statistics & Computer Application	2+1
2	Fundamental of Soil Science	1+1
3	Introductory Economics	2+0
4	Elementary Plant Biochemistry & Biotechnology	2+1
5	Introductory Crop Physiology	1+1
6	Fundamentals of Horticulture	2+1
7	Principles of Landscape Gardening	0+1
8	Introductory microbiology	1+1
9	Principles of Genetics and Cytogenetics	2+1
10	Structural grammer and Spoken English	1+1 (NC)
11	Physical Education	0+1 (NC)
	Total	21(13+8)
	Semester –II	
1	Tropical and Subtropical Fruits	2+1
2	Tropical and Subtropical Vegetables	2+1
3	Principles of Plant Breeding	2+1
4	Soil Fertility and Nutrient Management	1+1
5	Fundamentals of Food Technology	1+1
6	Water Management in Horticultural Crops	1+1

7	Plant Propagation and Nursery Management	1+1
8	Environmental Science	1+1
9	Growth and Development of Horticultural Crops	1+1
	Total	21(11+9)
	Semester –III	
1	Fundamentals of Plant Pathology	2+1
2	Fundamentals of Entomology	2+1
3	Temperate Vegetables	1+1
4	Nematode pests of horticultural crops and their Management I	1+1
5	Diseases of Fruit, Plantation, Medicinal and Aromatic Crops	2+1
6	Farm Power and Machinery	1+1
7	Temperate Fruits	1+1
8	Weed Management in Horticultural Crops	1+1
9	Commercial Floriculture	2+1
	Total	22(13+9)
	Semester –IV	
1	Soil and Plant Analysis	0+1
2	Spices and Condiments	2+1
3	Ornamental Horticulture	2+1
4	Plantation Crops	2+1
5	Mushroom Culture	0+1
6	Breeding of Fruit and Plantation Crops	2+1
7	Orchard Management	1+1
8	Insect Pests of Fruit, Plantation, Medicinal & Aromatic Crops	2+1
	Total	19 (11+8)
	Semester –V	
1	Organic Farming	2+1
2	Introduction to Major Field Crops	1+1
3	Medicinal and Aromatic crops	2+1
4	Introductory Agroforestry	1+1
5	Breeding of Vegetable, tuber and Spice Crops	2+1
6	Diseases of Vegetable, Ornamentals and Spice Crops	2+1
7	Fundamentals of Extension Education	1+1
	Total	18(11+7)
	Semester –VI	
1	Apiculture	0+1
2	Insect Pests of Vegetable, Ornamental and Spice Crops	2+1
3	Post harvest Management of Horticultural Crops	2+1
4	Seed production of Vegetable, tuber and Spice Crops	2+1
5	Breeding and Seed Production of Ornamental Plants	2+1
6	Processing of Horticultural Crops	1+2
7	Horti-Business Management	2+0
	Communication Skills & Entrepreneurship Development	1+1
	Total	20(12+8)

Experiential Learning: It was felt that the graduates coming out must have adequate hands on experience on different aspects of horticulture for which it was decided that the final year programme be restructured to provide for six months of experiential learning and six months of attachment with industry/modern horticulture farm. In order to provide experiential

learning it is necessary to have adequate infra structure, therefore, budget requirement for experiential learning have been worked out. It is important to instill entrepreneurship and confidence in taking horticulture as a vocation. The experiential learning need to cover different aspects of horticulture and therefore four areas were identified but institutions would have freedom to have add more areas relevant to their region. Following four areas for experiential learning have been detailed as a model with different activities for learning and evaluation. The identification of areas needs to be based on present day needs, horticulture development scenario in the region and University, industry, private partnership potential. There would also be flexibility in choosing experiential learning areas. Committee recommends undertaking two areas for hands on training. For this purpose the students would be required to prepare a work plan in the area selected with an end-to-end approach i.e. from purchasing the input to producing a product and marketing. It would also have components of project development, monitoring and accounting. Students at the end of completion of project will submit report for evaluation. For this programme an advisor will guide students and the Committee appointed by the Dean of the College should do the evaluation of the project. The evaluation will comprise of skills learnt, proficiency in project execution, project report and viva-voce.

Hands On Training/ Experiential Learning: Final year B.Sc. (Hort.) students to select any two areas of the following to undergo specialized training

Protected cultivation of high value crops
Post harvest technology and value addition
Nursery production and management
Floriculture and landscape gardening

VII and VIII Semester

Sr.	Activity	Credits	Weeks
1	Experiential learning (Professional Package)	5+10	14
2	Experiential learning (Professional Package)	5+10	14
3	RHWEP & Placement in industries	0+10	6
	Total	10+30	34

Professional Packages: 14 weeks duration

I.	Protected Cultivation of High Value Horticultural Crops
1	Visit to commercial polyhouses, Project preparation and planning. Specialised lectures by commercial export house
2	Study of designs of green- house structures for cultivation of crops
3	Land preparation and soil treatment
4	Planting and production:
	i. Cultural management including soil/media management in poly houses
	ii. Fertigation and irrigation management
	iii. Integrated Pest Management
	iv. Harvesting and post harvest management; certification and distribution
	v. Cost of production

5	Visit to export houses; Market intelligence; Marketing of produce; cost analysis; Institutional management
6	Report writing and viva-voce
II	Nursery Production and Management
1	Project preparation
2	Nursery registration, methodology and certification
3	Establishment and management of plant propagating structures
4	Establishment of progeny blocks, identification of mother plants and maintenance of bud wood bank
5	Procurement of inputs (pots, polythene, FYM etc.)
6	Techniques and environ management for large scale production
7	Packaging and selling of plant material
8	Working out economics
III	Post Harvest Technology and Value-Addition
1	Design and project formulation
2	Design and lay out of pilot plant, cold store, grading – packing line, cool chain
3	Pre harvest practices to extend shelf life.
4	Quality standards of fruits and vegetables for processing
5	Procurement of raw material, inventory control
6	Post harvest handling; grading; packaging; cool chain transportation and storage of fresh Produce
7	Processing (juice/pulp extraction, concentration, product preparation; dehydration; waste Management; In-plant quality control)
8	Packaging (bottling, corking, sealing, labeling, aseptic packaging, storage)
9	Quality laboratory exercises, quality assurance, analytical tools, hygiene, machinery Maintenance, HACCP, International standards, FPO Licence, PFA standards, codex Laws
10	Sales promotion, certification, distribution and marketing, banking, finance and Institutional management
11	Work experience in food processing plant
IV	Floriculture And Landscape Gardening
1	Preparation of project report, soil and water analysis, preparation of land and layout.
2	Production and Management of commercial flowers
3	Harvesting and post harvest handling of produce
4	Marketing of produce
5	Cost Analysis
6	Institutional Management
7	Visit to Flower growing areas and Export House
8	Attachment with private landscape agencies
9	Planning and designing, site analysis, selection and use of plant material for landscaping
10	Formal and informal garden, features, styles, principles and elements of landscaping
11	Preparation of landscape plans of home gardens, farm complexes, public parks, institutions, high ways, dams and avenues.
12	Making of lawns, use of software in landscape,
13	Making of bouquets, button hole, wreath, veni and gazaras, car and marriage palaces

14	Dry flower Technology (identification of suitable species, drying, packaging and forwarding techniques)
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Budget Requirement For Experimental Learning: The infrastructure and financial requirements for each of the experiential learning module worked out include:

		Rs. In lakh
I	Protected cultivation of high value horticultural crops	
1	Cost of polyhouse	17.5
2	Irrigation provision (drip/mist/fogging, fertigation with tank facility)	1.6
3	Planting material (rose/carnation/ liliun capsicum/ tomato/ cucumber)	1.0
4	Instruments for polyhouse and soil water analysis	0.7
6	Harvesting, collection, grading, packing facility	0.2
7	Shade house	2.0
8	Revolving Fund (For inputs)	1.0
	Total	24.0
II	Nursery production and management	
1	Cost of polyhouse (1,000 sq.mt.)	5.0
2	Shade house (1,000 sq.mt.)	1.0
3	Irrigation facility	0.5
4	Potting shed	1.5
5	Miscellaneous materials (polythene, media, poly bags, growth regulators, budding and grafting knives, secateurs)	1.0
6	Revolving Fund (Cost of seed, nursery, seedlings and rootstocks)	1.0
	Note: Area specification (5000 plants per location; 500 grafts per student)	
	Total	10.0
III	Post harvest Handling and Value Addition	
1	Machinery for Extraction of Juice, Pulp etc.	7.5
2	Boiler	3.0
3	Bottling unit and packaging system	5.3
4	Testing instruments (pH meter, conductivity meter, pressure tester, moisture analyzer etc.)	2.2
5	Cold room and machinery	4.0
6	Recycling Unit	2.0
7	Revolving Fund	1.0
	Note: Processing of fruit products (jam, juice, pulp, squash, RTS); Capacity: 1 quintal per product per student for 18 weeks	
	Total	25.0
IV	Floriculture and Landscape Gardening- Commercial production of loose flowers	
1	Cost of seed and planting material	1.0
2	Garden implements (electric hedge, lawn mower, landscape inputs, (CAD software, tracing table etc.)	4.0
3	Formation of mini gardens	4.0
4	Revolving Fund	1.0
	Note: Flower crops: roses, tuberose, gladiolus, chrysanthemum, marigold jasmine, asters. Area: 0.1 hectare per student.	
	Total	10.0

* For those colleges which fall in the regions where spices and plantation crops are the major crops

** These could be in agriculture faculty in uni-campus universities

It is recommended that a student could be allowed to clear the backlog courses after completing experiential learning.

Features of the New Curriculum

1. Experiential learning for one year in two specific areas.
2. Increased practical skills through experiential learning.
3. Entrepreneurship development
4. Inclusion of new courses on organic farming, farming systems, IPR international treaties, communication skill development, Horti business management, biotechnology, etc.
5. Providing flexibility in the curriculum in the final year.

III. FORESTRY

Introduction: Forestry education in State Agricultural Universities is only two decades old although scientific forestry programmes to train forestry professionals were started as early as 1864. Year 1985 saw the inception of undergraduate forestry education in the country at YSPUHF, Solan and PDKV, Akola. This was followed by GBPUAT, Pantnagar and TNAU, Coimbatore in 1986. JNKVV, Jabalpur and OUAT, Bhubaneswar in 1987 and NAU, Navsari in 1988 followed suit. Later on few more SAUs also started this programme and currently fifteen colleges/Departments of Forestry in SAUs are offering this programme. The first major exercise for developing uniform curricula was undertaken in February 1993 during a national workshop on 'Forestry Course Curriculum in India' at YSPUHF, Naini Solan, HP. Inorder to prepare the forestry graduates to deal with the emerging issues and challenges in forestry sector, the present curricula revision exercise has been under taken. The revision is aimed at introducing newer concepts and delete obsolete and overlapping course contents.

Mission: To develop technically qualified forestry professionals with sufficient skills to manage, conserve and develop diversified forestry resources and products leading to environment and livelihood security.

Objectives

- Equip forestry graduates with current trends and requirements of forestry.
- Enable them to help in forestry development and taking forestry entrepreneurship.
- Enable environmental protection, value addition of forestry products and make forestry farmers globally competitive.

Colleges and Programme

Sr.	College/University	Programmes
1	College of Forestry, YSPUHF, Solan	B.Sc, M.Sc, Ph.D
2	College of Agriculture, OUAT, Bhubaneswar	B.Sc
3	College of Forestry and Hill Agriculture GBPUAT, Ranichauri	B.Sc and M.Sc
4	College of Forestry, PDKV, Akola	B.Sc

5	Forest College and Research Institute, TNAU, Mettupalayam	B.Sc, M.Sc, Ph.D
6	Faculty of Agriculture, JNKVV, Jabalpur	B.Sc
7	Faculty of Forestry, BAU, Ranchi	B.Sc, M.Sc
8	College of Forestry, Sirsi, (UAS), Dharwad	B.Sc, M.Sc
9	Department of Forestry, UBKV, Cooch Behar	M.Sc
10	College of Agriculture, PAU, Ludhiana	M.Sc
11	College of Horticulture and Forestry, MPUAT, Jhalawar	B.Sc
12	College of Forestry, Ponnampet, (UAS, Bangalore)	B.Sc
13	College of Horticulture & Forestry NAU, Navsari	B.Sc, M.Sc
14	College of Forestry, SKUAST, Srinagar,	B.Sc
15	College of Forestry, IGAU, Raipur	B.Sc, M.Sc
16	College of Forestry, KAU, Trichur	B.Sc
17	College of Forestry, CAU, Pasighat	B.Sc

Present status

- Number of colleges: Presently there are 17 colleges functioning under the SAUs offering forestry courses in India.
- RAWE: This program varies in the universities offering B.Sc. forestry as per the local requirements. In most of the cases the RAWE program (Rural Forestry Work Experience) is being implemented by way of attaching the students the respective forest departments for first hand knowledge of operations thereon. The credit loads vary from college to college starting from 0+6 to 0+25. Similarly the number of days of attachment also vary from 45 days to 67 days.
- Examination pattern: It is 100 % external in MPUAT, whereas in TNAU it is 60% internal and 40% external and in PDKV, Akola, it is 20% internal and 80% external. Similarly there are variations in other colleges also.

Recommendations for new Curriculum

2. Department wise Course Curriculum

Silviculture & Agroforestry		Credits
1	Principles & Practices of Silviculture	4(3+1)
2	Silviculture of Indian Trees	3(2+1)
3	Agroforestry systems and Management	3(2+1)
4	Plantation Forestry	2(1+1)
5	Silvicultural systems	2(2+0)
6	Nursery management	2(1+1)
7	World Forestry System	2(2+0)
8	Livestock Management	2(1+1)
9	Forest Mensuration	3(2+1)
10	Environmental Science	3(2+1)
11	Fundamentals of Horticulture	2(1+1)
	Total	28(19+9)
Forest Biology & Tree Improvement		
1	Forest Ecology, Biodiversity & Conservation	2(1+1)
2	Dendrology	3(2+1)
3	Principles of Tree Improvement	3(2+1)
4	Tree Seed Technology	2(1+1)

5	Fundamentals of wild Life	2(2+0)
6	Forest Pathology	3(2+1)
7	Wild Life Management	3(2+1)
8	Forest Entomology and Nematology	3(2+1)
	Total	21 (14+7)
Forest Products & Utilization		
1	Wood Anatomy	2(1+1)
2	Logging & Ergonomics	2(1+1)
3	Wood Products & Utilization	2(1+1)
4	Wood Science & Technology	3(2+1)
5	Ethnobotany	3(2+1)
6	Utilization of Non-Timber Products	3(2+1)
7	Medicinal & Aromatic Plants	3(2+1)
	Total	18(11+7)
Natural Resource Management		
1	Principles of Hydrology, Soil and Water Conservation	3(2+1)
2	Soil Survey, Remote Sensing and Wasteland Development	3(2+1)
3	Fundamentals of Geology and Soil Science	2(1+1)
4	Rangeland Management	3(2+1)
5	Forest Management, Policy and Legislation	3(2+1)
6	Agrometeorology	2(1+1)
7	Forest Business Management	2(1+1)
8	Marketing and Trade of Forest Produce	3(2+1)
9	Principles of Forest Economics, Project planning and Evaluation	2(1+1)
10	Chemistry and Fertility of Forest Soils	3(2+1)
11	Forest Engineering	2(1+1)
	Total	28(17+11)
Basic Sciences & Humanities		
1	Plant Biochemistry and Biotechnology	3(2+1)
2	Principles of Cytology and Genetics	2(1+1)
3	Entrepreneurship Development and Communication skills	3(2+1)
4	Elementary Statistics and Computer Application	3(2+1)
5	Principles of Plant Physiology	2(1+1)
6	Tree Physiology	3(2+1)
7	Introductory Forest Economics	2(2+0)
8	Forest Tribology and Anthropology	2(2+0)
9	Fundamental of Extension Education	2(1+1)
10	Structural Grammar and Spoken English (NC)	2(1+1)
11	Physical Education (NC)	1(0+1)
12	NCC/NSS (NC)	1(0+1)
Deficiency Courses		
1	Introductory Botany (Math Group)	3(2+1)
2	Basic Mathematics (Biology Group)	3(3+0)
	Total	28(20 +8)

Semester-wise Course Distribution

Semester I		
1	Introductory Forest Economics	2(2+0)
2	Fundamentals of Geology and Soil Science	2(1+1)
3	Agrometeorology	2(1+1)

4	Plant Biochemistry and Biotechnology	3(2+1)
5	Principles of Cytology and Genetics	2(1+1)
6	Tree Physiology	3(2+1)
7	Introductory Botany	3(2+1)
8	Basic Mathematics	3(3+0)
9	Principles of Plant Physiology	2(1+1)
10	Physical Education (NC)	1(0+1)
11	NCC/NSS (NC)	1(0+1)
12	Structural Grammar and Spoken English (NC)	2(1+1)
	Total	22(15+7)
	Semester II	
1	Principles and Practices of Silviculture	4(3+1)
2	Dendrology	3(2+1)
3	Forest Ecology, Biodiversity & conservation	2(1+1)
4	Principles of Hydrology, Soil & Water Conservation	3(2+1)
5	Chemistry and Fertility of Forest Soils	3(2+1)
6	Forest botany and Ethnobotany	3(2+1)
7	Fundamental of Horticulture	2(1+1)
8	NCC/NSS (NC)	1(0+1)
	Total	20(13+7)
	Semester III	
1	Forest Engineering & Survey	2(1+1)
2	Wood Anatomy	2(1+1)
3	Logging & Ergonomics	2(1+1)
4	Soil Survey, Remote Sensing & Wasteland Development	3(2+1)
5	Forest Mensuration	3(2+1)
6	Principles and Methods of Tree improvement	3(2+1)
7	Tree Seed Technology	2(1+1)
8	Tribology and Anthropology	2(2+0)
9	NCC/ NSS (NC)	1(0+1)
	Total	19(12 +7)
	Semester IV	
1	Livestock Management	2(1+1)
2	Wood Science and Technology	3(2+1)
3	Wood Products & Utilization	2(1+1)
4	Silviculture of Indian Trees	3(2+1)
5	Nursery Management & Commercial forestry	2(1+1)
6	Fundamentals of Wild Life	2(2+0)
7	Forest Pathology	3(2+1)
8	Extension Education	2(1+1)
9	NCC/NSS (NC)	1(0+1)
	Total	19 (12+7)
	Semester V	
1	Forest Business Management	2(1+1)
2	Elementary Statistics and Computer Application	3(2+1)
3	Rangeland Management	3(2+1)
4	Silvicultural Systems	2(2+0)
5	Plantation Forestry	2(1+1)
6	World Forestry Systems	2(2+0)
7	Wildlife Management	3(2+1)

8	Principles of Forest Economics, Project Planning and Evaluation	2(1+1)
9	Environmental Science	3(2+1)
	Total	22(15+7)
	Semester VI	
1	Forest Management, Policy and Legislation	3(2+1)
2	Utilization of Non-timber Forest Products	3(2+1)
3	Agroforestry Systems and Management	3(2+1)
4	Medicinal and Aromatic Plants	3(2+1)
5	Forest Entomology	3(2+1)
6	Entrepreneurship Development and Communication Skills	3(2+1)
7	Marketing and Trade of Forest Produce	3(2+1)
	Total	21(14 + 7)
	Grand Total (1 to VI Semesters)	123

NC: Non Credit

Summary of Semester wise Credit Distribution

Sr.	Activity	Credits
1	Course work upto VI Semester	123 (Minimum)
2	FWE/Hands-on-Training in VII Semester	20
3	Multidisciplinary courses/Vocational Training in VIII Semester	20
	Total	163 minimum

Semester VII and VIII

Forestry Work Experience: Total duration of the programme should be 20 weeks and shall be conducted in VII semester (or VIII semester depending on regional suitability). First 4 weeks of the programme shall focus on village attachment and shall be followed by 10 weeks of intensive attachment with State Forest Departments. For 4 weeks students shall be placed in forest based industries for hands-on training. In the concluding 2 weeks the students shall be preparing a complete project report and give an oral presentation. The details of the course are as follows:

Sr.	Course Title	Credits	Days
1	Forestry Work Experience-(Socio-economic surveys -village attachment)	0+4	28
2	Attachment with State Forest Department for Forestry operations	0+10	70
3	Industrial Placement	0+4	28
4	Report Writing and Presentation	0+2	14
	Total	0+20	140

Socio-economic surveys -village attachment (0 + 4)

- Data collection with respect to village profile in respect of socio-economic and Cultural status, farm technology used etc.
- Bench Mark Survey of plant resources (cropping pattern, yield system etc.)
- Schedule development, tabulation, analysis and preparing plan of work.
- Understanding local forestry and other village level institutions (panchayat, Village Forest Committees, corporations, youth/women groups etc.)

- People's participation in developmental programmes with special reference to forestry.
- Exercises on the use of extension methods and teaching aids for Transfer of Technology.

Attachment with Forest Department for Forestry Operations (0 +10)

- Visit to modern forest nurseries, herbal gardens and watersheds
- Study the felling and logging operations, timber lots and important industrial products
- Study working plan, enumeration, volume and yield calculation & compartment history files
- Study the 'CAT' (Catchment Area Treatment Plan) and FDA (Forest Development Agencies)
- Use of forestry equipments/instruments
- Study the regeneration and management of important forestry tree species.
- Sample plots, layout studies, stump analysis, preparation of local volume Tables.

Industrial Placement (0 + 4) Attachment with Forest Based Industries like:

- Wood Workshop and Saw Mills
- Wood Seasoning and Preservation Treatment Plants
- Pulp and Paper Industries
- Katha Making Industry
- Rosin and Turpentine Industry
- Aromatic and Medicinal Plant Units
- Carpentry and bamboo crafts
- Other Wood Products Industries

Works to be undertaken

- Study the Nature of Industrial and Business Organization – Structure
- Raw-material – Collection and Processing of Raw-material
- Production and Management Process
- Marketing and Financial Management

Report writing and presentation

(0+2)

- Compilation of the work/experience detailing the objectives, places and persons visited, work done, experiences / skills gained.
- Presentation of the report before faculty/Committee.

One academic staff member of the college will co-ordinate and monitor the entire programme. Each student or a batch of students shall be sent to a village, Division of the State Forest Department, industry. The evaluation of the programme shall be done by the host industry /State Forest Department (50%) and rest by Committee constituted by the Dean. The assessment will be based on Project Report evaluation and viva-voce.

Hands on Training/Experiential Learning: Areas of specialization for “Hands-on training” should be decided by each college/University as detailed below depending upon local needs and industrial demand. It is expected that the students will prepare a work plan for therelevant area of specialization. An end-to-end approach is to be followed in implementing the programme. While identifying the area of specialization, the college shall take into account the faculty and infrastructure facilities available and their regional

significance. All the students shall have an Advisor, who will guide the students in “Hands-on Training”. A total of 20 credits are allotted for “Hands-on Training” and the evaluation of the same shall be done by the Committee appointed by the Dean of the respective college.

Multidisciplinary Courses

I. Production and Marketing of Quality Planting Material

Activity	Weeks	Credit
<ul style="list-style-type: none"> Project Development Identification of species (grasses, trees, medicinal plants & wild fruits) for nursery raising, time of collection of plant material from selected seed sources, quantity of seed/plant material required, nursery area (open and protected), inputs required, Schedule for intercultural operation- seed treatment, sowing, weeding, fertigation, root hardening treatments. Assessment of demand in local/potential markets and institutions. Physical Needs: <ol style="list-style-type: none"> Number of tree species – 3-5 Minimum planting stock production – 5000seedlings/species Grasses - 0.25ha land area Protected area – 50-100 sq m 	2	0+2
<ul style="list-style-type: none"> Collection, Handling, Processing and Storage of planting material: Identification of superior seed sources, seed collection, treatment and storage 	3	0+2
<ul style="list-style-type: none"> Vegetative Propagation under controlled and ambient conditions Collection of vegetative propagules, treatment and its processing of bare root and containerised seedlings	3	0+3
<ul style="list-style-type: none"> Nursery Management Raising, seed bed preparation, raising of polyhouse, sowing, planting and other inter-cultural operations	11	0+9
<ul style="list-style-type: none"> Marketing of seeds and seedlings; grading of quality stock and pricing 	2	0+2
<ul style="list-style-type: none"> Cost Benefit analysis, Project Report & Presentation 	1	0+2

Infrastructural & Financial Requirement

	Rs. In lakh
Non-recurring	Cost
Seed collection, extraction and processing	
a) Ladders/tree bicycle, Tree Loppers	0.2
b) Seed moisture meter	2.0
Nursery Management	
a) Polyhouse and shade nets	10.4
b) Irrigation facilities	0.3
c) Root trainers, water cans, secateurs, cutting/vegetative material storage boxes	1.5
Storage of Seeds	
a) Deep freezer, Storage cabinets/containers	0.6
Revolving Fund	1.0
Total	16.0

II. Cultivation and Processing of Medicinal Plants

Activity	Weeks	Credit
Market Survey & Prioritization of species: Visit to marketing centers in the region, assessment of demand and trade in specific species suitable for cultivation in the respective regions; exploring possibilities of buy back and linkages with industries.	2	0+2
Project proposal development: Defining objectives, cultivation and processing methodology to be adopted, advisement needed, necessary support required and expected outcome.	1	0+1
Raising of selected crop/s (at least two crops in 500 sq m for each crop): The activities includes all necessary cultural practices for nursery raising, transplantation, hoeing, weeding, irrigation, fertigation, plant protection measures etc.	14	0+9
Harvesting and post-harvest management: The activities include harvesting at optimum stage, drying, garbling, grading, packing and storage.	2	0+4
Primary processing and value addition: The activity involves exposure of the student to basic chemical extraction processes, distillation of essential oils, preparation of powders, tinctures, extractives etc.	3	0+2
Marketing of produce, project report and presentation	2	0+2

Infrastructural & Financial Requirements

Non-recurring	Cost Rs. in lakh
1. Fibre glass house with misting facilities	20.00
2. Construction of water storage tanks (100000 ltrs.)	1.50
3. Sprinkler irrigation facilities	1.00
4. Drying/storage/processing unit	3.00
5. Land development	1.00
6. Essential oil extraction unit	1.00
7. Fixed oil extraction unit	3.00
8. Oil quality testing equipments	4.00
Revolving Fund	1.00
Total	35.50

III. Natural Resource Management

Activity	Weeks	Credit
1. Resource Survey and Evaluation Operational area and land use - 100-250 ha micro watershed Soil, Water, Vegetation, Livestock Resources Soil Erosion – types and extent, land degradation Wastelands – types and extent Climatic parameters Socio-economic parameters- constraints, need and potentials	3	0+4
2. Preparation of Resource Maps using GIS and Remote Sensing GIS and Remote Sensing applications Feeding of data collected from survey and preparation of maps, inventories and reports	8	0+5

Attachment: State/University, GIS and Remote Sensing Centres (GIS and Remote Sensing facilities to be developed at SAUs, if not available).		
3. Preparation of Micro-Plans for efficient use of Natural Resources Soil, Water, Vegetation and others. (The Plan will be prepared on integrated micro-watershed basis for the development and their efficient utilization)	3	0+3
4. Resource Conservation and Production Technologies Resource Conservation <ul style="list-style-type: none"> • Operational area • micro-watershed including arable, non-arable and waste lands conservation • Vegetative measures: Grasses, Shrubs and Trees and their combinations • Structural designs including principles and practices: erosion control measures such as check dams, spurs, Gabion structures • Water conservation: ground water recharging, in-situ water conservation and vegetative and mechanical barriers • Land shaping, trenching, bunding and terracing and mulching • Percolation Structures Production <ul style="list-style-type: none"> • Agroforestry and Avenue plantations including wind breaks, shelterbelts etc.) • Agronomical practices: land use (horticulture, forestry, agriculture) 	4	0+3
5. Case Studies Environment Impact Assessment (EIA) and Strategic Environment Appraisal (SEA) in specific problematic sites or Disaster Management: Forest fire, floods/ droughts/ landslides and slips/ avalanches/storms/tsunami. or Watershed Management	4	0+3
6. Project Report & Presentation	1	0+2

Infrastructural & Financial Requirements

Non-recurring	Cost (Rs . in lakh)
GPS (3 nos), run off measuring devices: Satellite Imageries, GIS Software and Digitizer	8.0
Disaster Management: Fire fighting kit and Fire extinguisher	1.0
Revolving Fund	1.00
Total	10.0

Summary of changes effected in course curriculum and syllabus: The revised B.Sc.(Hons.) Forestry course curriculum consists of several innovative components incorporated into it. First three years (6 semesters) of the degree programme shall be devoted to regular teaching and the fourth year will focus on experiential learning comprising of Forestry Work Experience (FWE), attachment with State Forest Department and industrial placement (7th semester) and one semester of experiential learning. Out of the three such courses recommended i.e. i) Production and marketing of quality planting material, ii)

Cultivation and processing of medicinal and aromatic plants, iii) Natural Resource Management; colleges could develop areas based on their regional need and importance.

The course curriculum has been designed keeping in view the demands of emerging areas and removing obsolete courses. Accordingly, new courses on Forest Engineering, Fundamentals of Horticulture, Introductory Agroforestry, Principles of Forest Economics, Project Planning and Evaluation, Business Management, Communication Skills and Information Technology have been incorporated. Courses on Mathematics (for Biology students) and Introductory Biology (for Math. Students) have been made credit courses while course on Structural & Spoken English has been made non-credit. It is also proposed that SAUs will have freedom for 25-30% variation in course content suiting the regional needs if felt necessary by Academic bodies.

IV. HOME SCIENCE

Introduction: Home Science Education in India was initiated between 1920 and 1940, under the British administration in some schools and colleges. The subject remained in the school curriculum in several states of India and after the independence, many changes were made. Home Science college education was started in 1932 by Lady Irwin College, Delhi followed by Madras University in 1938 at Degree level. Allahabad Agricultural Institute, Naini had also started a Diploma in Home Science in 1935 and it became a university level department in 1945. Some Home Science Colleges were started in traditional universities at Coimbatore, Ludhiana, Bombay and Udaipur.

With the establishment of Agricultural Universities in 1960s and 1970s, Home Science education became a part of its education due to its pivotal role in promotion of qualitative living in an agrarian country like India. The mandate of Home Science education in agricultural universities emerged also due to an increased awareness of the role of women in contributing to the family economy and giving fillip to their standard of living, with special emphasis on the farming community.

Mission: Enhancement the standard of individuals in general and rural families and communities in particular through teaching, research and extension activities. Empowerment of woman and girl child in rural and urban households through self-employment, service support to industries and communities that would help them to become better resource managers and contribute towards national development.

Objectives

- To develop skills and strengths of the students based on scientific principles and knowledge acquired for day-to-day living
- To promote analytical abilities of students towards innovative research to augment the quality of life of family, community and industry in the changing scenario
- To enhance entrepreneurial skills for professional careers
- To develop an appreciation for rural life, its problems and channelize their progress

Present Status

Number of Colleges and enrollment: There are 16 Home Science Colleges in SAUs offering undergraduate and postgraduate programmes. Until 1997-98, Home Science UG Programme was offered as 3-year degree programme after 10+2 of schooling. Based on the recommendations of the Deans meeting held at Udaipur in 1997, the programme was

upgraded into 4 year degree from the academic years 1998-99, with a view to introduce professionalism. Through intensive training, in-plant training and Rural Awareness Work Experience (RAW), the graduates are provided with entrepreneurship skills. A second revision of this programme was made during the Deans' meeting which was held at Hissar during February 1999 by increasing the duration for skilled courses and thus a 2+2 pattern was evolved. Now all 16 colleges of Home Science in SAUs are implementing four year B.Sc. Home Science programme either of 3+1 or 2+2 pattern. A need was felt to critically review and restructure UG Home Science programme to make it more challenging and competitive. Hence a major exercise was done to recast the UG programme in Home Science with in-depth deliberation with the faculty, students, parents and the stakeholders.

Existing pattern of UG programme: Majority of the colleges (10 out of 16) are implementing 2+2 pattern of 4 year UG programme. Six colleges still are continuing with 3+1 pattern. The major reason given for non-adoption of 2+2 pattern is inadequate staff and infrastructure.

Pattern (No. of colleges)	Place and Year of start of Programme	
3+1 (6)	Udaipur, 1998	Hyderabad, 2001
	Bikaner, 1998	Parbhani, 2002
	Palampur, 1998	Hisar, 2002
2+2 (10)	Samstipur, 1998	Banskantha, 2002
	Jorhat 1998	Pantnagar, 2004
	Ludhiana, 1999	Kanpur, 2004
	Faizabad, 2000	Dharwad, 2004
	Madurai, 2001	Imphal, 2004

Intake and number of students enrolled in last 3 years: Intake of students at B.Sc. level ranged from 20 to 80 seats which depended on state needs. Enrolment over last three years declined in few colleges which is a matter of concern. One major reason for decrease in enrolment was two parallel programmes running in the states i.e. 3 years in general universities and 4 years B.Sc. Home Science in SAUs. This necessitated a critical review of H.Sc. programme in SAUs and reorganization to make it more professional and competitive in order to attract talent.

Eligibility for Admission: There is variation in eligibility criteria for admission in UG programme. As per ICAR guidelines, 10+2 with science (all streams) and Home Science group (all Home science papers) were eligible but some colleges also added other subjects for eligibility i.e., Home science as a subject in arts groups (3 colleges) as well as arts and commerce (3 colleges) because of declining enrolment.

Sr.	Eligibility Criteria	Colleges
1	10+2 with science group	Dharwar, Samistpur, Madurai Hyderabad
2	10+2 with Science, Home Science groups, agriculture group	Udaipur, Bikaner
3	10+2 Science, Home Science as a subject	Ludhiana, Palampur, Faizabad
4	10+2 with Science and Agriculture group	Imphal
5	10+2 with Science, arts, commerce, Home science	Hisar, Parbhani
6	10+2 with Science, Vocational stream of H.Sc., Agricultural and arts for vacant seats.	Gujarat

Mode of Admission: There was also variation in mode of admission i.e. admissions were done through entrance test (7 colleges), entrance cum merit (one college) and only on merit of 10+2 (3 colleges).

Duration of Rural Awareness Work Experience (RAWE) and In-plant training: There is variation in duration of RAWE and In-plant training in different colleges.

Sr.	College	RAWE	In-plant training
1	Samstipur	9 weeks	9 weeks
2	Ludhiana	10-12	6 weeks
3	Faizabad	12 weeks	12 weeks
4	Pantanagar	2 week	16 weeks
5	Hisar	12 weeks	10 weeks
6	Hyderabad	8 weeks	8 weeks
7	Imphal	6 weeks	6 weeks
8	Jorhat	12 weeks	8 weeks
9	Dharwad	12 weeks	8 weeks
10	Madurai	6 weeks	6 weeks
11	Bikaner	13 weeks	5 weeks
12	Parbhani	8 weeks	8 weeks
13	Udaipur	4 weeks	16 weeks

Examination: Variations were observed in examination pattern at UG and PG levels in different colleges.

Sr.	Examination pattern	Number of colleges					
		UG		M.Sc.		Ph.D.	
1	Total internal	3		5		2	
2	Total External	Nil		Nil		Nil	
3	Both (Internal : External)	50:50	4	60:40	1	60:40	1
		40:60	2	94:06	2	94:06	1
		20:80	1	75:25	1	75:25	1
		35:65	1	50:50	1		

Recommendations for New Curricula

Course Distribution

Sr.	Courses	Credits	Weightage (%)
1	Basic courses	20	13
2	Home Science core courses	60	37
3	NSS and physical education*	2	
4	Professional courses / skill oriented courses		
	i. Specialization	40-50	25 – 31
	ii. Supporting	10-20	6-12
5	Internship / industrial attachment	20	13
	Total	162	

* Non-credit courses

Details of Courses:**Basic Courses**

Sr.	Courses	Credits
1	Human physiology	3 (3+0)
2	Computer applications	3 (1+2)
3	Marketing management	3 (2+1)
4	Women in agriculture	3 (3+0)
5	Environmental studies	3 (2+1)
6	Personality development	2 (1+1)
7	Biochemistry	3 (2+1)
8	English and technical writing	2 (1+1)
9	Elementary statistics	3 (2+1)
	Total	25*

* Minimum of 20 credits to be offered from the above (to be decided by the College)

Department wise Core Courses*

I. Human Development and Family Studies		
1	Life Span Development	3 (2+1)
2	Early Childhood Care and Development	3 (2+1)
3	Children with Developmental Challenges	3 (2+1)
4	Dynamics of Marriage and Family	3 (3+0)
II. Foods and Nutrition		
1	Food Science and Processing	3 (2+1)
2	Human Nutrition	3 (2+1)
3	Normal and Therapeutic Nutrition	3 (2+1)
4	Food Preservation and Storage	3 (1+2)
III. Textiles and Apparel Designing		
1	Fundamentals of Clothing Construction	3 (1+2)
2	Textile Science and Care	3 (2+1)
3	Apparel Designing and Construction	3 (1+2)
4	Fundamentals of Textile Designing	3 (2+1)
IV. Family Resource Management		
1	Management of Family Resources	3 (3+0)
2	Housing and Space Management	3 (2+1)
3	Fundamentals of Art and Design	3 (1+2)
4	Family Economics and Consumer Education	3 (2+1)
V. Home Science Extension and Communication Management		
1	Home Science Extension and Rural Development	3 (3+0)
2	Instructional Technology	3 (2+1)
3	Communication and Adoption	3 (3+0)
4	Programme Planning, Implementation and Evaluation	3 (2+1)

* Twelve credits from each department (12 × 5 = 60 credits)

Skill oriented Professional Courses: Colleges have the freedom to decide the packages which can be offered based on the demand of the students, needs of the state etc. Colleges have to offer only one package from one department with a maximum of three packages in total. Students can opt a package to fulfill the requirement of 40-50 credits of specialization and 10-20 credits of supportive courses.

c. Professional courses:

I. Organization and management of ECCD programmes	
1. Family counseling	4 (2+2)
2. Developmental assessment of young children	4 (1+3)
3. Readiness material for children	4 (1+3)
4. Developing play material for children	4 (1+3)
5. Creative experiences for children	4 (1+3)
6. Organization and management of dramatic and rhythmic activities for children	4 (0+4)
7. Intervention programmes for developmentally challenged children	4 (0+4)
8. Organization and management of ECCD programmes	5 (1+4)
9. Entrepreneurship in child care services	6 (2+4)
10. Literature for young children	4 (1+3)
11. Infant stimulation programme	4 (0+4)
12. Family and child welfare	3 (3+0)
II. Nutrition and Dietetics	
1. Nutrition for special groups	3 (3+0)
2. Clinical nutrition	3 (3+0)
3. Hospital dietetics	4 (2+2)
4. Community nutrition	3 (1+2)
5. Health, hygiene and sanitation	3 (3+0)
6. Food toxicology	2 (2+0)
7. Dietetic foods	3 (0+3)
8. Food standards and quality control	3 (2+1)
9. Product development	4 (1+3)
10. Bakery and confectionary	4 (1+3)
11. Dietary counseling	4 (0+4)
12. Catering management	4 (1+3)
13. Entrepreneurship development	4 (1+3)
14. Traditional Indian food products	3 (0+3)
15. Food services in institution	3 (2+1)
16. Convenience and health foods	3 (1+2)
17. Project work	3 (0+3)
18. Seminar	1 (0+1)
III. Apparel Production Management*/ Textile Designing**	
1. Traditional Indian textiles	3 (2+1)
2. Principles of design application	3 (1+2)
3. Computer aided designing	4 (0+4)
4. Traditional costumes of India	3 (2+1)
5. Fashion merchandising	3 (2+1)
6. Computer aided designing-Textile designing	3 (0+3)
7. Designing through dyeing and printing	3 (1+2)
8. Fabric embellishment-I	3 (0+3)
9. Computer aided designing – customization	3 (0+3)
10. Design studio practice and project work	4 (0+4)
11. Apparel industry management*	3 (3+0)
12. Apparel manufacture-I*	3 (1+2)
13. Apparel manufacture-II*	3 (3+0)
14. Fashion illustrations*	3 (1+2)
15. Draping techniques*	3 (0+3)
16. Fabric embellishment-II*	3 (0+3)

17. Structural fabric designs**	3 (1+2)
18. Printed fabric designing**	3 (0+3)
19. Knitting technology-I **	3 (1+2)
20. Textile design and colour ways**	3 (0+3)
21. Knitting technology – II**	3 (0+3)
22. Textile industry management**	3 (3+0)
Note: Courses without asterisk are common for both professional courses	
IV. Interior and exterior space designing*/ Institutional House Keeping**	
1. Furniture design and arrangement	3 (1+2)
2. Floor and floor treatments	3 (1+2)
3. Walls and window treatments	3 (1+2)
4. Flower arrangement	3 (1+2)
5. Drawings in interior*	4 (1+3)
6. Traditional and contemporary interiors*	3 (3+0)
7. Computer aided designing*	4 (0+4)
8. Basics in building construction*	4 (2+2)
9. Accessories for interior enrichment*	3 (0+3)
10. Fitting, fixtures and services*	3 (1+2)
11. Space designing – I (Residential buildings)*	3 (0+3)
12. Landscape designing*	3 (1+2)
13. Space designing-II (Public buildings)*	3 (1+2)
14. Functional interiors for special needs*	4 (2+2)
15. Entrepreneurship development*	4 (1+3)
16. Institutional house keeping concepts**	4 (2+2)
17. Intuitional maintenance**	4 (2+2)
18. Services: residences and establishment**	4 (2+2)
19. Table service management**	4 (2+2)
20. Hospitality and hostess training**	4 (2+2)
21. Storage designing**	4 (1+3)
22. Interior designing and decoration**	4 (2+2)
23. Front office management**	4 (2+2)
24. Use and care of institutional equipment**	4 (2+2)
25. Communication skills**	2 (0+2)
Note: Courses without asterisk are common for both professional courses	
V. Information technology and communication management	
1. Print journalism	4 (1+3)
2. Electronic journalism	4 (1+3)
3. Photojournalism	4 (1+3)
4. Mass communication	4 (1+3)
5. Designing information material	4 (1+3)
6. Instructional video production	4 (1+3)
7. Audio video recording and editing	4 (1+3)
8. Digital advertising	4 (1+3)
9. Multimedia production	4 (1+3)
10. Training and HRD	3 (1+2)
11. Project management	3 (1+2)
12. Entrepreneurship development for rural families	4 (1+3)
13. Public relations and social marketing	4 (1+3)

Semester Wise Distribution of Courses

I Semester		
1	Human physiology	3 (3+0)
2	Life span development	3 (2+1)
3	Food Science and processing	3 (2+1)
4	Fundamentals of clothing construction	3 (1+2)
5	Management of family resources	3 (3+0)
6	H.Sc. Extension and rural development	3 (3+0)
	Total	18 (14+4)
II Semester		
1	Women in agriculture	3 (3+0)
2	Environmental studies	3 (2+1)
3	Early childhood care and development	3 (2+1)
4	Food preservation and storage	3 (1+2)
5	Textile science and Care	3 (2+1)
6	Housing and space management	3 (2+1)
7	Instructional methods and media	3 (2+1)
	Total	21 (14+7)
III Semester		
1	Computer Science / Information technology	3 (1+2)
2	Children with developmental challenges	3 (2+1)
3	Human nutrition	3 (2+1)
4	Apparel designing and construction	3 (1+2)
5	Household equipment	3 (2+1)
6	Communication, diffusion and adoption	3 (3+0)
	Total	18 (11+7)
IV Semester		
1	Marketing management	3 (2+1)
2	Personality development	2 (1+1)
3	Dynamics of marriage and family	3 (3+0)
4	Normal and therapeutic nutrition	3 (2+1)
5	Fundamentals of textile designing	3 (2+1)
6	Family economics and consumer education	3 (2+1)
7	Programme planning, implementation and evaluation	3 (2+1)
	Total	20 (13+7)
V Semester		
1	Specialization courses	12-15
2	Supporting courses	6-9
VI Semester		
1	Specialization courses	12-15
2	Supporting courses	4-6
VII Semester		
1	Specialization courses	16-20
2	Supporting courses	0-5
VIII Semester: Inplant and industrial attachment		20
Note: Supporting courses from an area other than specialization including across the faculties in the university.		

Internship / Industrial attachment: it is recommended that students be placed / attached to an organization / industry for one semester. 20 credits are assigned to this experience of which 10 credits will be counted in the result while 10 credits will be evaluated as satisfactory / unsatisfactory. The evaluation should be done jointly by the college and the placement organisation. The marking scheme recommended is as follows:

Regularity, Sincerity and devotion	-	25
Initiative, confidence, and skill acquisition	-	35
Project Report and presentation	-	30
Viva	-	10
Total	-	100

Features of New Curriculum

- Two new courses have been added in basic courses namely, personality development and women in agriculture.
- Electives of 2 years
- Flexibility in electives / Professional courses.
- Skill and entrepreneurship focus
- Industrial attachment for one semester
- Supporting courses across the faculty and freedom to choose
- Increase in the duration of skill oriented courses to two years with more weightage on experiential learning for entrepreneurship focus. Under professional courses emphasis has been given on skill development and enterprise management.
- New courses under various packages are – Convenience and health foods, Intervention programmes for developmentally challenged children, Infant stimulation programmes, Fashion merchandising, Apparel industry management, Knitting technology, Functional interiors for special needs etc.
- A course of “Personality Development” has been added as a basic course to strengthen various personality dimensions of the student.
- A new course on “Women in Agriculture” has been added in common courses to sensitize students about a role of rural women, their problems and empowerment. Duration of in-plant training has also been decreased to one semester.
- The curriculum is common for first two years for all the students, while for next two years professional courses will be offered which will include one semester in-plant training and industrial attachment.

Budgetary requirements for operationalization of new curriculum and syllabus

Head	Justification	Rs. In lacs
Equipment	Equipment required for new courses added in the professional package and replacement of old equipment	I Year – 80.0 II Year – 80.0 III Year – 50.0 IV year – 20.0 12.0
	Revolving fund (for three specialization)	
Computer Software	Specific software for professional courses	50.0
	Total	292.0

V. AGRICULTURAL ENGINEERING

Introduction: The agricultural engineering education integrates engineering and agricultural science knowledge and skill to develop technology and/or processes to raise production and productivity of agriculture and other farm produce through efficient utilization of natural resources and conserving the same for future use. The specific activities include, efficient utilization of agricultural inputs through improved implements and machinery ensuring timeliness in farming operations (mechanization), reducing drudgery in agriculture and improving quality of farm produce (processing and value addition). The agricultural engineering education addresses issues relevant to social and technological development of the farmers. The quality and quantum of agricultural inputs and their management techniques and also quality of farm produce and methods of value additions would keep on changing with advancement of industrialization in general and economic upliftment of farmers/processors in particular. It is in this context that the agricultural engineering education is to be analyzed and course curriculum modified to serve the agriculture and industry.

Mission : To educate students in the field of engineering so as to prepare them for careers in agricultural engineering in which they will become leaders in industry, the profession and to conduct quality research by applying engineering principles to solve problems of agricultural system.

Objectives

- To impart education, and entrepreneurial skills in engineering and design, development, manufacturing and operation of equipment and technologies for farm operations for crop production, processing and value addition and efficient use of agricultural inputs and natural resources, including different forms of energy in agriculture.
- To conduct research on development of machines/technologies with an aim to mechanize various farm operations as well as post harvest/product-processing operations.

Development of Agricultural Engineering Education and its Present Status: The first programme in agricultural engineering education in India was introduced in 1942 with Bachelor of Science degree at the Allahabad Agricultural Institute, Naini, Allahabad, U.P. The curriculum was developed to train engineers to help meet the needs of Indian farmers (i) to mechanize their farms using more efficient tools, implements and machines and (ii) to conserve soil and water for efficient use. The farm equipments were mostly traditional or imported and proper use and maintenance were of primary concerns. The processing of products was mainly confined to dairy products and animal feed.

The second programme in agricultural engineering education in India was established in 1952 with Bachelor of Technology (B.Tech) degree at the Indian Institute of Technology (IIT) Kharagpur, West Bengal. IIT introduced Master of Technology (M.Tech) and Ph.D degrees in agricultural engineering in 1957 and 1962 respectively. IIT provided engineering orientation in course curriculum. Other disciplines like agronomy; soil science and botany were added to the department of Agricultural Engineering to support it. With the establishment of State Agricultural Universities (SAUs) during 1960s on the pattern of Land Grant Universities in the United States, the agricultural education in India changed significantly. The teaching, research and extension became integral part of the faculties. The first agricultural engineering programme under this new pattern was started in 1962 at the

Uttar Pradesh Agricultural University (now GB Pant University of Agriculture and Technology), Pantnagar. Presently, there are 23 institutions offering degree programmes in agricultural engineering, out of which 21 institutions constitute State Agricultural University System. In addition there are number of private colleges offering degree programme outside the State Agricultural University system. Of these 16 have programmes leading to masters degree and eight offers Ph.D degree. These institutions have total annual intake capacity of about 860 at bachelor, 280 at masters and 70 at Ph.D degree level. The specializations include Farm Machinery and Power, Soil and Water Conservation Engineering, Irrigation and Drainage Engineering, Post Harvest and Process engineering, Dairy engineering, Renewable Energy and Rural Engineering.

There have been wide variations in the course curriculum from one university to another. Majority of the institutions have entrance test for admission and the eligibility for admission is a (10+2) with science qualification. The number of courses varies from 59 to 62 with course credits ranging from 150-185. The evaluation system varies from 100 per cent internal to 100 per cent external examinations. Only a few offer flexibility of electives to suit the aptitude and career preference of students. Many important and emerging areas are not included or their coverage is inadequate.

Issues Concerning Agricultural Engineering Education and Need for its Revision:

Engineering inputs to agriculture are required in development and optimal utilization of soil and water resources, irrigation and drainage, carrying out field operations for crop production, livestock and fishery with desired level of operational efficiency – achieving timeliness, precision in metering and placement of costly inputs of seed, fertilizer, pesticide, irrigation through machinery and power, practising precision farming. High production and productivity can not be sustained without matching harvest and post-harvest technologies that enable conservation of produce and by-products from qualitative and quantitative damages. This will create storage capacity at farmers level to hold their perishable and semi-perishable commodities without excessive losses to negotiate with the forces of marketing, packaging and transport to remunerative markets. For small farms, with financial limitations and management constraints, so common in India, there is need for creating rural enterprises, custom service centers, agro service centre etc, private or more so cooperative owned, catering to the needs and aspirations of weaker sections of the society. With fossil fuels depleting, new and renewable sources of energy need to be harnessed for production agriculture, agro processing, and rural living based on solar, wind, hydro and bio-energies, energy from biomass of crop or livestock origin or energy plantation; innovative uses of traditional animate energy-men and draft animals, with a human touch, hold good prospects. These engineering and technological needs demand highly trained agricultural engineers, equipped with knowledge, skills and practices of engineering technology with full appreciation of biosciences to handle the challenges before them. Courses and curricula call for revisions – skills of shop, drawing board, field surveys moderated in order to create room for computer use, information technology, GIS, computer aided design and computer aided manufacture, even understanding robotics and its application in hazardous situations in agriculture and allied activities. The earlier programme was aimed at supporting the farming system, whereas the present emphasis has to be on sustaining it. It is felt that there is lack of practical training in the curricula. The in-plant-training has always been a weak link.

Recommendations for New Curriculum: The fixed course constitute 136 credit load for the first three years; and in the seventh semester, a student will be required to have a project of six credit hours, seminar (one credit hour) and a minimum of 15 credit hours from the Cafeteria courses. The recommended new curriculum also includes courses on computer programming, data structures, CAD / CAM machine drawing, entrepreneurship development,

communication skills, agri-business management, besides modifying the basic engineering and agricultural engineering courses taking into account the technological developments, that have taken place during the last decade. Further, the Cafeteria courses and the in-plant-training will help instill greater confidence and improve the employment opportunities of the agricultural engineering graduates. The present proposal suggests an experiential form of practical training. It is recommended that there should be in-plant training for a period equivalent to one semester or two trainings of two months each, wherein the student would complete the process right from the raw material to the finished product; and then market it to the consumer.

New course curriculum

Discipline-wise credit hour distribution

Sr.	Discipline	Course Credit	Weightage (%)
1	Basic Sciences & Humanities	24	13
2	Agricultural Sciences	04	2
3	Basic Engineering	53	29
4	Agricultural Engineering	102	56
	Total	183	100

Semester-wise credit hours distribution

Semester	Credit	Semester	Credit
I	21	V	23
II	24	VI	21
III	24	VII	22
IV	23	VIII	25

Discipline wise distribution of courses

Sr	Course title	Credits
	Basic Sciences and Humanities	
1	Engineering Mathematics-I	3(3+0)
2	Engineering Physics	3(2+1)
3	Engineering Chemistry	3(2+1)
4	Environmental Science	3(3+0)
5	Engineering Mathematics –II	3(2+1)
6	Engineering Mathematics-III	3(3+0)
	Total	18(15+3)
	Agricultural Sciences	
1	Agriculture for Engineers	4(3+1)
	Basic Engineering	
	Civil Engineering	
1	Surveying and Leveling	3(1+2)
2	Engineering Drawing	2(0+2)
3	Engineering Mechanics	3(2+1)
4	Soil Mechanics	3(2+1)
5	Fluid Mechanics	3(2+1)
6	Strength of Material	3(2+1)

7	Design of Structures	3(2+1)
	Total	20(11+9)
	Computer Science & Electrical Engineering	
1	Computers Programming and Data Structures	3(1+2)
2	Applied Electronics and Instrumentation	3(2+1)
3	Electrical M/C's and Power Utilization	3(2+1)
4	Database Management & Internet Applications	2(0+2)
5	Electrical Circuits	3(2+1)
	Total	14(7+7)
	Mechanical Engineering	
1	Workshop Practice	1(0+1)
2	Thermodynamics and Heat Engine	4(3+1)
3	Heat and Mass Transfer	2(2+0)
4	Workshop Technology	3(2+1)
5	Theory of Machines	3(2+1)
6	CAD/CAM Machine Drawing and Computer Graphics	3(1+2)
7	Machine Design	3(2+1)
	Total	19(12+7)
	Social Sciences	
1	Agribusiness Management and Trade	3(3+0)
2	Entrepreneurship Development and Communication Skill	3(2+1)
	Total	6(5+1)
	Agricultural Engineering	
	Farm Power & Machinery	
1	Farm Machinery and Equipment-I	3(2+1)
2	Farm Machinery and Equipment-II	3(2+1)
3	Farm Power	3(2+1)
4	Tractor Systems and Controls	3(2+1)
5	Renewable Energy Sources	3(2+1)
6	Field Operation and Maintenance of Tractors and Farm Machinery-I	1(0+1)
7	Field Operation and Maintenance of Tractors and Farm Machinery-II	2(1+1)
	Total	18(11+7)
	Processing and Food Engineering	
1	Engineering Properties of Biological Materials and Food Quality	3(2+1)
2	Agricultural Structures and Environmental Control	3(2+1)
3	Crop Process Engineering	3(2+1)
4	Dairy & Food Engg.	3(2+1)
5	Drying and Storage Engg.	4(3+1)
6	Refrigeration and Air Conditioning	3(2+1)
	Total	19(13+6)
	Soil & Water Engineering	
1	Soil & Water Conservation Structures	3(2+1)
2	Irrigation Engineering	4(3+1)
3	Ground Water, Wells and Pumps	3(2+1)
4.	Drainage Engg.	2(1+1)
5	Soil & Water Conservation Engg.	3(2+1)
6	Watershed Hydrology	3(2+1)
	Total	18(12+6)
	General Agricultural Engineering	
	Dissertation / Project	6

	Seminar	1
	Total	7(0+7)

Cafeteria Courses (15 credits)

1	Food Packaging Technology	3(2+1)
2	Design & Maintenance of Green House	3(2+1)
3	Waste and By-product Utilization	2(1+1)
4	Development of Processed Products & Equipments	3(2+1)
5	Food Processing Plant Design & Layout	2(1+1)
6	Micro Irrigation Systems Design	3(2+1)
7	Watershed Planning and Management	3(2+1)
8	Minor Irrigation & Command Area Development	3(2+1)
9	Environmental Engg.	3(2+1)
10	Gulley & Ravine Control Structures	3(2+1)
11	Remote Sensing & GIS Applications	3(2+1)
12	Reservior & Farm Pond Design	3(2+1)
13	Tractor Design & Testing	3(2+1)
14	Hydraulic Drive & Controls	3(2+1)
15	Farm Power & Machinery Management	3(2+1)
16	Renewable Energy Technology	3(2+1)
17	Human Engg. & Safety	2(1+1)
18	Biomass Management for Fodder & Energy	2(1+1)
19	Production Technology of Agril. Machinery	3(2+1)
20	Mechanics of Tillage and Traction	3(2+1)
21	System Engineering	3(3+0)
	Total	59(39+20)

Semesterwise courses for B.Tech (Agril. Engg)

	Semester – I	
1	Engineering Mathematics-I	3(2+1*)
2	Engineering Physics	3(2+1)
3	Engineering Chemistry	3(2+1)
4	Workshop Practice	1(0+1)
5	Surveying and Leveling	3(1+2)
6	Engineering Drawing	2(0+2)
7	Environmental Science	3(3+0)
8	Electrical Circuits	3(2+1)
	Total	21(12+9)
	Semester –II	
1	Engineering Mathematics –II	3(2+1*)
2	Computers Programming and Data Structures	3(1+2)
3	Applied Electronics and Instrumentation	3(2+1)
4	Agriculture for Engineers	4(3+1)
5	Workshop Technology	3(2+1)
6	Thermodynamics Heat Engines	4(3+1)
7	Field operation and Maintenance of Tractors and Farm Machinery-I	1(0+1)
8	Engineering Mechanics	3(2+1)
	Total	24(15+9)

	Semester –III	
1	Engineering Properties of Biological Materials and Food Quality	3(2+1)
2	Soil Mechanics	3(2+1)
3	Soil & Water Conservation Engg.	3(2+1)
4	Farm Machinery and Equipment-I	3(2+1)
5	Farm Power	3(2+1)
6	Watershed Hydrology	3(2+1)
7	Engineering Mathematics-III	3(2+1)
8	Agribusiness Management and Trade	3(3+0)
	Total	24(17+7)
	Semester – IV	
1	Farm Machinery and Equipment-II	3(2+1)
2	Renewable Energy Sources	3(2+1)
3	Irrigation Engineering	4(3+1)
4	Crop Process Engineering	3(2+1)
5	Fluid Mechanics	3(2+1)
6	Theory of Machines	3(2+1)
7	Heat and Mass Transfer	2(2+0)
8	Field Operation and Maintenance of Tractors and Farm Machinery-II	2(1+1)
	Total	23(16+7)
	Semester – V	
1	Machine Drawing and Computer Graphics	3(1+2)
2	Machine Design	3(2+1)
3	Dairy & Food Engg.	3(2+1)
4	Tractor Systems and Controls	3(2+1)
5	Electrical M/C's and Power Utilization	3(2+1)
6	Database Management & Internet Applications	2(0+2)
7	Strength of Material	3(2+1)
8	Ground Water, Wells and Pumps	3(2+1)
	Total	23(13+10)
	Semester – VI	
1	Agricultural Structures and Environmental Control	3(2+1)
2	Drying and Storage Engg.	4(3+1)
3	Design of Structures	3(2+1)
4	Drainage Engg.	2(1+1)
5	Soil & Water Conservation Structures	3(2+1)
6	Refrigeration and Air Conditioning	3(2+1)
7	Entrepreneurship Development and Communication Skills	3(2+1)
	Sub Total	21(14+7)
	Semester-VII	
	Project	6
	Seminar	1
	Student will have to take minimum of 15 credits courses from the following	
1	Food Packaging Technology	3
2	Design & Maintenance of Green House	3
3	Waste and By-product Utilization	2
4	Development of Processed Products & Equipments	3
5	Food Processing Plant Design & Layout	2
6	Micro Irrigation Systems Design	3

7	Watershed Planning and Management	3
8	Minor Irrigation & Command Area Development	3
9	Environmental Engg.	3
10	Gully & Ravine Control Structures	3
11	Remote Sensing & GIS Applications	3
12	Reservoir & Farm Pond Design	3
13	Tractor Design & Testing	3
14	Hydraulic Drive & Controls	3
15	Farm Power & Machinery Management	3
16	Renewable Energy Technology	3
17	Human Engg. & Safety	2
18	Biomass Management for Fodder & Energy	2
19	Production Technology of Agril. Machinery	3
20	Mechanics of Tillage and Traction	3
21	System Engineering	3
	Total	59
	Semester-VIII: Student will undertake in-plant-training of 25 credit hours which will include practical training at the Institution, training in one (4 months) / two (2 months each) Industrial Units and Educational tour.	25
	Grand Total	183
	*Tutorial	

In-Plant Training (25 credit hours): The in-plant training is intended to expose the students to an environment in which they are expected to be associated in their future career. The students will be required to have hands-on-experience at progressive farms, research institutions manufacturing or agro-processing industries and in rural areas. The training includes farm planning and development of irrigation/drainage project, watershed development, manufacturing technology of agricultural or processing machinery, testing and evaluation, quality control, marketing and servicing.

Objectives: Hands-on-training in:

- Manufacturing testing and evaluation, sales and marketing and service
- Farm development, irrigation and drainage project planning, watershed development
- Agro-processing, food product development and manufacture

Operational Aspects

- The training shall be compulsory and form a part of the curriculum for the award of the degree
- This programme be conducted in the final year of the degree programme
- Six months duration shall be covered during the final year for the training to be carried out at various centers, plants and institutes
- The detailed programme of work shall be developed and carried out by the students. The evaluation procedures to be followed shall be prepared by the concerned faculty/department of the institute in the form of a manual for reference of students, evaluators and the functionaries concerned. The manual shall contain all details about training programme.
- The credit for training programme shall be 25.
- The programme shall be of residential nature and it shall be compulsory for the student to stay at the place of posting.

- A minimum of 80 percent attendance is necessary during the training programme
- Supervision: In order to take policy decision and to solve the operational and administrative bottleneck if any, there should be a college level committee consisting of the following:

Dean, College of Agricultural Engineering	-	Chairman
Chairman Academic Committee of college	-	Member
Head of concerned department	-	Member

Experiential Learning: The experiential learning is intended to build practical skills and entrepreneurship among the graduates with an aim to deal with work situations and for better employability and self-employment. It will involve setting-up of model plans for food processing and value addition for product diversification, setting up of workshops for manufacturing, operation and maintenance of farm machinery and equipment, maintenance and custom hiring of farm machinery and equipment. Thus, besides in-plant training, two hands-on training programme, each of six weeks duration during summer breaks of second year and third year would be required to be completed by every student. Performance of the students in the training programme be evaluated based on: (a) work quality, (b) acquired knowledge and expertise, (c) attendance, (d) maintenance of records (e) report, (f) demonstration and presentation in seminar, and (g) work outcome.

The suggested areas for experiential learning are as follows:

1. Fabrication of marketable tools and implements

Facility required	-	Production workshop
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2. Processing of agri-produce

Facility required	-	Agro-processing centre
	-	Pilot plant for processing and packaging of selected grain/horticultural crop
3. Custom hiring of package of farm equipment

Facility required	-	Tractor and set of farm implements
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Summary of major changes effected in course curriculum and syllabus: The changes in the course curriculum have been made to make graduates more suitable for private enterprises and entrepreneurship under the changing agro-economic scenario. The specific changes have been as follow

- The new course curriculum comprises of fixed course work of 136-credit load for the first three years; and in the seven semester, a project of six credit hours, seminar (one credit hour) and a minimum of 15 credit hours for the Cafeteria Courses.
- The proposed course curriculum includes new courses on computer programming, data structures, CAD / CAM machine drawing, entrepreneurship development, communication skills, agri-business management
- Existing courses strengthened by adding relevant latest developments in courses.
- In-plant training for an equivalent to one semester or two trainings of two months each, wherein the student would complete the process right from the raw material to the finished product; and then market it to the consumer.
- The Cafeteria courses and the in-plant- training will help instill greater confidence and improve the employment opportunities of the agricultural engineering graduates.
- The experiential hands-on form of practical training during summer breaks.

Budget: In the revised curriculum many cafeteria courses have been included for which infrastructure will need to be developed. The committee recommends providing Rs. 3 crores to each college to have first-rate facility for real hands on experience in their specialized areas.

VI. DAIRY TECHNOLOGY

Introduction: India is the largest producer of milk in the world producing 94 million tones of milk annually. There are 678 milk processing plant in the country requiring large human resource pool to run these dairies. With the introduction of modern technology in the production and processing of dairy products, the concept of milk is shifting towards value added dairy business. The milk production in the country is increasing @ 4% per annum contributing more than Rs. 1,00,000 crores to GDP. In spite of large infrastructure available for processing milk, only 15% of milk is at present processed in the organized sector, hence there is lot of scope for value addition and export in Dairy sector. The dairy industries have opened up new avenues for employment and economy. It is estimated that dairy industry is generating new jobs to the extent of 1.0 lakhs every year. Dairy sector is further expected to grow faster and generate more employment in the near future. Adoption of the latest & advanced dairy and value addition technology in milk processing can minimize losses, provide better quality, nutrition and more employment opportunities. Dairy technologies offer promising option for value addition and resources recovery in terms of consumer food availability and simultaneously more earning at farmers and industry level. There is large scope for milk industry to grow in view of the globalization and increasing purchasing power of consumers. This will further increase the requirement of dairy technologist and researchers.

The existing course curricula of B.Tech. (Dairy Technology), is a unique job oriented degree which leads to a total development of graduates and make them capable to face various situations in varied field of work. Students are also enriched with entrepreneurial qualities to start their own industry. Additionally, the graduates get acquainted with various facets of professionally managed industries which include production management, raw material purchases, personnel management, sales and marketing by virtue of industrial inplant training. This helps students to acquire confidence to work as highly professional human resource for dairy industry.

Mission: Development of highly professional dairy specialists through value based education, research and training in dairy technology for meeting technological & societal needs.

Objective

- Offering Under graduate and Post graduate education in Dairy Technology.
- Teaching, research & development in the various aspects of dairy technology discipline.
- Transfer of technology for employment generation and entrepreneurship development in milk processing.
- Advisory and Consultancy services to industry and users.
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Present Status: At present 11 colleges in the country are offering undergraduate program in Dairy Technology.

Sr.	College/University	Courses/degree offered
1	College of Dairy Science, KVAFSU, Hebbal	B.Tech

2	College of Dairy & Fd. Sci. Tech, MPUAT, Udaipur	B.Tech
3	Dairy Science College, WBUAFS, Mohanpur	B.Tech
4	Sanjay Gandhi Institute of Dairy Tech., RAU, Patna	B.Tech
5	Dairy Technology, PDKV, Warud	B.Tech
6	College of Dairy Technology, IGKV, Raipur	B.Tech
7	College of Veterinary Science, SVUFAS, Tirupati	B.Tech
8	College of Dairy Sci. & Tech., KAU, Mannuthy	B.Tech
9	College of Food & Dairy Tech., AAI Allahabad	B.Tech
10	Sheth MC College of Dairy Science, AAU, Anand	B.Tech, PG Diploma, M.Tech, M.Sc, Ph.D
11	College of Dairy Science, NDRI, Karnal	B.Tech, M.Sc, Ph.D.

While going through the admission procedure and course curricula of various Dairy Science Colleges, it was observed that admission in majority of colleges is through entrance test, where as in few colleges it is on the basis of marks in qualifying examination. In course curricula the theory and practical contents of the syllabus were more or less same but variability exists in duration and nature of in-plant training. Few dairy science colleges provide one-year in-plant training, where as others provide only for a period of six months. Some Dairy Science Colleges send their students for one month summer training. However, complete duration of course is four years in all the colleges. There is external examination pattern in majorities of the colleges to an extent of 60 percent.

Recommendations for New Curriculum:

Discipline-wise courses

I	Dairy Engineering	
1	Dairy Engineering	3 (2+1)
2	Dairy Process Engineering	3 (2+1)
3	Dairy Plant Design and Layout	3 (2+1)
4	Instrumentation and Process Control	3 (2+1)
5	Engineering Drawing	2 (0+2)
6	Principles of Dairy Machine Design	3 (2+1)
7	Workshop Practice	2 (1+1)
8	Fluid Mechanics	3 (2+1)
9	Heat & Mass Transfer	3 (2+1)
10	Thermodynamics	3 (2+1)
11	Refrigeration & Air-conditioning	3 (2+1)
12	Electrical Engineering	3 (2+1)
13	Food Engineering	4(3+1)
	Total	38 (24+14)
II	Dairy Microbiology	
1	Fundamentals of Microbiology	3 (2+1)
2	Introductory Dairy Microbiology	3 (2+1)
3	Food and Industrial Microbiology	3 (2+1)
4	Starter Cultures and Fermented Milk Products	3 (2+1)
5	Dairy Biotechnology	3 (2+1)
6	Quality and Safety Monitoring in Dairy Industry	3 (2+1)
	Total	18 (12+6)

III	Dairy Technology	
1	Market Milk	4(3+1)
2	Traditional Dairy Products	3(2+1)
3	Fat Rich Dairy Products	4(3+1)
4	Cheese Technology	5 (3+2)
5	Ice-cream & Frozen Deserts	4 (2+2)
6	Condensed & Dried Milks	5(3+2)
7	By Products Technology	4(3+1)
8	Judging of Dairy Products	3 (2+1)
9	Food Technology - I	4(3+1)
10	Packaging of Dairy Products	3(2+1)
11	Dairy Plant Management and Pollution Control	2(1+1)
12	Food Technology -II *	3(2+1)
	Total	44 (29+15)
IV	Dairy Chemistry	
1	Physical Chemistry of Milk	3 (2+1)
2	Chemistry of Milk	3 (2+1)
3	Chemical Quality Assurance	3 (2+1)
4	Food Chemistry	3 (2+1)
5	Biochemistry & Human Nutrition	3 (2+1)
6	Organic Chemistry*	3 (2+1)
	Total	18 (12+6)
V	Dairy Business Management	
1	Economic Analysis	2 (2+0)
2	Financial Management and Cost Accounting	4 (3+1)
3	Operation Research	2 (2+0)
4	Industrial Statistics*	3 (2+1)
5	Marketing Management and International Trade	2 (2+0)
6	Entrepreneurship Development and Industrial Consultancy	2 (2+0)
7	IT in Dairy Industry	2 (1+1)
8	Dairy Extension Education*	2 (1+1)
9	Environmental Studies	3 (2+1)
10	Milk Production Management & Dairy Development	3(2+1)
11	Computer Programming*	3(1+2)
	Total	28 (20+8)
	* Optional subject	

Semester wise Courses:

	Semester-I	
1	Physical Chemistry of Milk	3 (2+1)
2	Milk Production Management & Dairy Development	3 (2+1)
3	Engineering Drawing	2 (0+2)
4	Workshop Practice	2 (1+1)
5	Fluid Mechanics	3 (2+1)
6	Economic Analysis	2 (2+0)
7	Fundamentals of Microbiology	3 (2+1)
8	Environmental Studies	3 (2+1)
	Total	21(13+8)
	Optional Course: Organic Chemistry/Industrial Statistics	3 (2+1) NC

	Semester-II	
1	Market Milk	4 (3+1)
2	Introductory Dairy Microbiology	3 (2+1)
3	Heat and Mass Transfer	3 (2+1)
4	Chemistry of Milk	3 (2+1)
5	Thermodynamics	3 (2+1)
6	Electrical Engineering	3 (2+1)
7	Biochemistry & Human Nutrition*	3 (2+1)
	Total	22 (15+7)
	* Can be bifurcated as Biochem. (1+1) and Human Nutrition (1+1)	
	Semester-III	
1	Traditional Dairy Products	3 (2+1)
2	Ice-Cream & Frozen Deserts	4 (2+2)
3	Fat Rich Dairy Products	4 (3+1)
4	Refrigeration and Air Conditioning	3 (2+1)
5	Cheese Technology	5 (3+2)
6	Dairy Engineering	3 (2+1)
	Total	22 (14+8)
	Optional Course: Dairy Extension Education	2 (1+1) NC
	Semester-IV	
1	Food Technology I	4 (3+1)
2	Condensed & Dried Milks	5 (3+2)
3	By Products Technology	4 (3+1)
4	Dairy Process Engineering	3 (2+1)
5	Packaging of Dairy Products	3 (2+1)
6	Marketing Management & International Trade	2 (2+0)
7	Entrepreneurship Development and Industrial Consultancy	2 (2+0)
	Total	23 (17+6)
	Semester-V	
1	IT in Dairy Industry	2 (1+1)
2	Chemical Quality Assurance	3 (2+1)
3	Dairy Biotechnology	3 (2+1)
4	Starter Culture and Fermented Milk Products	3 (2+1)
5	Instrumentation & Process Control	3 (2+1)
6	Quality and Safety monitoring in Dairy Industry	3 (2+1)
7	Financial Management & Cost Accounting*	4 (3+1)
	Total	21 (14+7)
	Optional course: Computer Programming	3 (1+2)
	* Can be bifurcated as Financial Management (2+1) and Cost Accounting (2+0)	
	Semester- VI	No. Credits
1	Food Engineering	4 (3+1)
2	Principles of Dairy Machine Design	3 (2+1)
3	Food Chemistry	3 (2+1)
4	Food and Industrial Microbiology	3 (2+1)
5	Dairy Plant Design and Layout	3 (2+1)
6	Judging of Dairy Products	3 (2+1)
7	Dairy Plant Management & Pollution Control	2 (1+1)
8	Operation Research	2 (2+0)
	Total	23 (16+7)
Opt	Optional course: Food Technology II	3 (2+1)

VII Semester

Hands - on training and experiential learning: The student will undergo campus training in various department of college or off campus training in other College of Dairy Technology, where facility of hand-on training is available.

Sr..	Course Title	Credits
1	Hands-on training and experiential learning	25 (0+25)
	Total	25 (0+25)

VIII Semester: In-plant training in Commercial Dairy Plants.

Sr.	Course Title	Credits
1	In- Plant Training	20 (0+20)
2	Training Report Evaluation	5(0+5)
	Total	25(0+25)

Hands-on training/experiential learning and in-plant training could also be organized in III year.

Total Credits

1. Course credit up to VIth semester 132
2. Hands on Training (VIIth semester) 25
3. In-plant Training and Report and Evaluation (VIIIth semester) 25

Hands - on Training and Experiential Learning: A minimum of two areas for creating infrastructural facilities for Hands - on Training and Experiential Learning has been proposed by each university as detailed below. The areas of specialization opted by colleges is decided upon local needs and industrial demand.

- NDRI, Karnal- i) Specialty Foods, ii) Cheese and Fermented Milks
- College of Food and Dairy Technology, Allahabad - i) Fluid Milk Processing, ii) Cream and Butter
- CDFST, Udaipur- i) Specialty Foods, ii) Energy Conservation and Auditing
- Sheth MC College of Dairy Science, Anand- i) Cheese, ii) Fermented Dairy Products
- Sanjay Gandhi Institute of Dairy Technology, Patna- i) Ice-cream and Forzen Desserts, ii) Dairy By Products
- College of Dairy Science and Technology, Thrissur- i) Concentrated and Heat Desiccated, ii) Membrane Processing.
- Dairy Science college, Bangalore- i) Traditional Dairy Products, ii) Packaging of Dairy Products

During Hands-on-Training and Experiential Learning, students should prepare a business plan/entrepreneurship for production of dairy products in the area of specialized processing from procurement of raw material to processing including packaging and storage, conduct manufacturing, organize resources and utilities, sell the product, maintain accounts and documents, wind up production and submit the report of performance. All the students will be provided with an advisor who will guide the students in “Hands on training”. Twenty five credits are allotted for Hands on training. The evaluation of the “Hand on training” will be conducted by the Committee appointed by the Dean. It is proposed that 250 Kg of products must be prepared per day through a batch of 20 students in Hands-on training and experiential learning training.

Evaluation of Hands on Training (25 Credits): It is recommended that student undergoing Hands-on training be evaluated as per following plan:

Sr.	Activity	Credits
1	Preparation of Business Plan	6
	i. Selection of product to be manufactured	
	ii Innovativeness	
	iii Creativity	
	iv Realistic plan	
	v Overall project report and project presentation	
2	Organizing the Production	3
	i Organization of resources	
	ii Organizing Utility	
	iii Time management	
3	Production and Sales	5
	i Regularity in production	
	ii Product quality	
	iii Positioning of product in market	
	iv Evaluation of presentation	
	v Adhering to rules and regulations	
	vi Adhering to plan	
4	Sales	3
	i Sales performance	
	ii Sales volumes	
	iii Profit generated including C/B ratio, and pay back period, etc.	
5	Documentation and Reports	3
	i Book keeping	
	ii People Management	
	iii Preparation of manual	
	iv Preparation of final report	
6	Oral Examination	5
	i Presentation	
	ii Oral performance	

In-plant Training Evaluation: Eighth semester will be for in-plant training in Commercial Dairy Plants to acquire state of art of technology through exposure to actual field conditions. This will be conducive in enhancing linkages between academic institution & industry and for more job opportunity to outgoing students. The credits allotted for in-plant training will be 25 credits including 5 credits as training report evaluation. One academic staff member of the college will coordinate the in-plant training program as Dean's Representative and monitor the entire in-plant training. Each student or a batch of students will be sent to the Commercial Dairy plants for industrial training. The evaluation shall be done jointly by the representative from host industry and one academic staff member of the College.

Non-formal education: Non formal education is also necessary part in teaching of such emerging field for preparing middle level workers, therefore it is recommended that each Dairy Technology College undertake extend non formal education and prepare electronic study materials for users and industries in various aspects of dairy technology such as Dairy packaging and quality assurance system, Unit operations and value addition in dairy products,

Clean milk production, Indigenous dairy products, Recent advances and present state of arts of Dairy technology, Energy efficient dairy processing technologies, Specialty Foods, Cheese and Fermented Milks, Fluid Milk Processing, Cream and Butter and Ice-cream and Forzen Desserts etc. It is proposed that a certificate course of four to six months should be prepared by each college in at least three to four sections of Dairy Technology as given above. For this **25 lakhs** should be provided to each college for starting a separate wing for non formal education.

Post graduation education: the Committee recommends that Post-graduate course leading to M.Tech. in Dairy Technology should be started in each college, which would enhance R&D activities in the college. Strengthening the existing infrastructure facilities will provide platform for starting post graduate education in Dairy Technology. However, one time grant of Rs. 50 lakh needs to be provided for creating necessary infrastructure including creation of advance technological gadgets and modern instrumentation in Dairy Engineering and Technology department to offer M. Tech. (Dairy Technology) program.

Change in revised Course Curriculum:

- Course curriculum has been revised keeping in view the new trends like quality assurance system, packaging, process auditing, marketing and market research, fermentation technology, specialty dairy products, recent advances in value additions, energy conservation and auditing in dairy industries etc.
- Comprehensive knowledge of dairy technology with practical approach has been suggested for improving the indigenous processing methodology and disseminates the viable technology best suited for dairy sector there by achieving value addition.
- Course is converted in 3+1 system giving more practical thrust with last year devoted to practical training.
- Hands-on training and experiential learning in all colleges depending upon local needs and industrial demand.
- Provision for inviting guest faculty from relevant industry/institution/ organization has also been made to provide industrial experiences to students.

Expected Outcome: It is expected that highly trained manpower will be available to meet demands of growing dairy industries especially modernization of dairy plants along with higher levels of automation to perform new operations. New course curriculum would definitely promote employment opportunities in the field of dairy technology through integration of basic knowledge and conceptual aspects with experiential learning in specialized field and generate trained skill manpower for self-employment and entrepreneurship development.

Infrastructure Support (Per College) Rs. In million

1.	Hands on training: (Experiential learning) One time grant for developing processing facility for each College and Dairy Plant	50.0
2.	Revolving fund for experiential learning – one time grant	1.0
3.	Infrastructure support for new courses including quality analysis laboratory and automatic processing equipments, etc. including model, dairy plant.	15.5
	Total	66.5

VII. FOOD SCIENCE AND TECHNOLOGY

Introduction: India is world's third largest producer even at the present level of productivity due to diverse agro-climatic conditions and large tracts of arable and irrigated land. India has achieved self-sufficiency in grains and pulses. There is also increase in production of milk and milk products and fruit and vegetables. In fact, India produces 50% of world's mango, 19% of banana, 36% of cashew nut, 11% of onion, 38% of cauliflower, 28% of green peas and has 53% of world's buffalo, 23% of sheep, 17% of goat and vast marine resource etc. However, processing and value addition only account for 2% of agricultural produce.

Food processing adds value, enhances shelf life and encourages crop diversification. Moreover, it is employment intensive and generates 1.8 direct employment per ten lakh rupee of investment and 6.4 employment indirectly. Food processing, coupled with marketing, has thus the potential of solving the major problems of agriculture surpluses, wastages, unemployment and uncertain prices to the farmers.

Rapid growth of food processing sector is inevitable since urbanization with globalization is changing life-style and food habits, rising prosperity is increasing demand for value added food products, more and more women joining work force need sheer convenience of processed food and large export opportunities exist globally where price realization is much better. Accordingly, the vision 2015 set out is to realize the vast potential of Indian agriculture by trebling the size of the processed food sector so as to enhance the farmer income, generate employment opportunities, provide choice to the consumer at affordable price and contribute to overall national growth by increasing a) the level of processing of perishables from 6% to 20%. b) value addition from 20% to 35%, and c) increase in global food trade from 1.5% to 3%.

Food Science and Technology is an industrially important discipline dealing with basic and applied sciences and engineering aspects and having interaction of several disciplines of biochemistry, microbiology, chemical and physical engineering, economics of production and marketing, legal and social aspects. With changing food habits and job profile, the ready to cook, ready to serve, and fully processed packaged food and beverages are becoming popular. With the introduction of modern technology in the production and processing of food produce, the concept of food is shifting from survival to value added food business. The agro based food industries have opened up new avenues for employment and economy. It is estimated that food-processing industry is generating new jobs to the extent of 2.5 lakhs every year. Agro processing sector is further expected to grow faster and generate more employment in the near future. The increasing population and limited agricultural land has widened the gap between food requirement and production. This gap can be filled by better post harvest management and by applying appropriate food processing techniques. Adoption of the latest & advanced processing and value addition technology can minimize losses, provide better quality and nutrition and more employment opportunities.

Mission: developing technical manpower required for food industry to meet the global challenges, bring transformation by value addition with better economic returns to farmers and achieve nutritional and health security of the consumers.

Objectives

- To develop internationally competitive skilled manpower in food science and technology for industry, research & development, self employment and service industry

- To develop technologies in the area of processing and value addition for higher economic returns
- To develop & disseminate post-harvest management and processing technologies for reducing losses to meet varied demands of consumer and lead to accelerated growth

Present Status

Colleges and enrollment: The graduate program of 4 years duration leading to B.Tech (Food Science) was first time introduced by Marathwada Agricultural University in 1976. Later on other two universities started UG program in Food Science and Technology; the details are shown below:

Sr.	Name of University	Year	Degree
1	Marathwada Agricultural University, Parbhani	1976	B.Tech. (Food Science)
2	Maharana Pratap University of Agriculture & Technology, Udaipur	1999	B.Tech. (Food Technology)
3	Acharya N.G. Ranga Agricultural University, Bapatla Campus	2003	B.Tech. (Food Science)

There is no uniformity in the academic regulation. The admission capacity of each college varies from 25 to 64.

Mode of admission: Two universities admit students through state level entrance test whereas one university admits students to UG program based on the merit at 10+2 standard. The mandatory courses are offered during initial three years spread over six semesters and job oriented courses, which are optional in nature, are offered in the VII semester.

Inplant Training: The students are sent for inplant training during VIII semester by way of attachment of food industry for varying duration from 3-6 months.

Examination pattern: The examination system in most of the courses is by way of external evaluation to the extent of 80% of marks in both theory and practical. The inplant training to the extent of 18 credit hours is evaluated by way of conducting oral examination and day-to-day evaluation by the supervisor in the industry. The grading is done as satisfactory or unsatisfactory.

Reorientation in education pattern and syllabus for Food Science and Technology is required to cope up with recent needs and present trends of the industries and to fulfill the requirements of stake holders like research and academic institutions, Government's food and drug departments, Industries, NGO's etc. In order to train the manpower with high level of skill and technologies to face the challenges of new economic order under WTO and save not only the post harvest losses but convert the raw agri-products to the high value processed food products to satisfy the consumer needs. Technologists will be needed to meet the demand of the processing industry and R&D, quality assurance and certification, Food safety and legal enforcement, service providers and other stakeholders in the Food chain.

Considering the importance and thrust given by the Government to food processing, the Committee has not only considered the syllabus but has gone in the whole system of Food Technology Education. The College of Food Technology presently established under three universities are lacking infrastructure and they need to be provided with financial support to strengthen facilities for UG and PG practicals, laboratories, computer labs, facility for pilot plants, library with food quality journals, etc.

Recommendations for New Curriculum

Intake Capacity: It is recommended that intake capacity of College of Food Technology, should not exceed forty to provide adequate hands on experience and skills.

Increasing Practical Approach: The technical manpower required for food industry need to have adequate practical skills. Hence the curriculum proposed is heavily modified to include experiential learning in order to provide hand-on-training to the students and make them aware with the real life situation in food industry. Hence two semesters are devoted to the practical training i.e., experiential learning during VII semester and in plant training in the VIII semester by way of attachment to the food industry.

Department-wise Courses

Food Trade And Business Management		
1	Principles of Economics*	2 (2+0)
2	Co-operation, Marketing and Finance	3 (2+1)
3	IT Application in Food Industry*	2(1+1)
4	Business Management & International Trade	3 (3+0)
5	Entrepreneurship Development & Communication Skill	2 (1+1)
6	Food Laws & Regulations	3(2+1)
	Total	15 (11+4)
Food Chemistry And Nutrition		
1	Bio-chemistry	3 (2+1)
2	Human Nutrition	3 (2+1)
3	Food Chemistry – I	3 (2+1)
4	Food Chemistry – II	3 (2+1)
5	Techniques in Food Analysis	3 (1+2)
	Total	15 (9+6)
Food & Industrial Microbiology		
1	Fundamentals of Microbiology	3 (2+1)
2	Food Microbiology	3 (2+1)
3	Fermentation & Industrial Microbiology	3 (2+1)
4	Food Bio-technology	3 (2+1)
5	Food Safety and Microbial Standards	3 (2+1)
	Total	15 (10+5)
Food Engineering		
1	Engineering Drawing	1(0+1)
2	Workshop Practice	2 (0+2)
3	Principles of Engineering	2 (1+1)
4	Food Processing Equipment-I	3 (2+1)
5	Refrigeration & Cold Chain	3 (2+1)
6	Fluid Mechanics & Hydraulics	2 (1+1)
7	Heat & Mass Transfer *	2 (1+1)

8	Food Packaging	3 (2+1)
9	Food Processing Equipment-II	3 (2+1)
10	Energy Generation and Conservation *	3 (2+1)
11	Bio-Chemical Engineering	3(2+1)
12	Instrumentation and Process Control	3 (2+1)
13	Food Plant Design and Layout	3 (1+2)
	Total	33 (18+15)
Food Science & Technology		
1	Principles of Food Processing	3 (2+1)
2	Postharvest Management of Fruits & Vegetables	3 (2+1)
3	Fruits & Vegetable Processing	3 (2+1)
4	Legumes and Oil seeds Technology	3 (2+1)
5	Cereal Processing	3 (2+1)
6	Processing of Meat and Poultry Products	3 (2+1)
7	Bakery and Confectionery Products	3 (2+1)
8	Processing of Fish & Marine Products *	3 (2+1)
9	Extrusion Technology *	2 (1+1)
10	Food Quality	2 (1+1)
11	Processing of Spices and Plantation Crops *	3 (2+1)
12	Processing of Milk and Milk Products	3 (2+1)
13	Food Additives	3(2+1)
14	Environmental Sciences	3 (2+1)
15	Food Industry By-products	3 (2+1)
16	Product Development & Formulation *	2 (1+1)
17	Speciality Foods	3 (2+1)
18	Food Production Trends and Programmes *	2 (2+0)
19	Quality Assurance & Certification	3 (2+1)
	Total	53 (35+18)

Semester- wise courses

	Semester-I	
1	Bio-chemistry	3(2+1)
2	Principles of Food Processing	3(2+1)
3	Engineering Drawing	1(0+1)
4	Workshop Practice	2 (0+2)
5	Principles of General Engineering	2(1+1)
6	Principles of Economics*	2(2+0)
7	Human Nutrition	3(2+1)
8	Fundamentals of Microbiology	3(2+1)
9	Food Chemistry-I	3(2+1)
	Total	22(13+9)
	Semester-II	
1	Co-operation, Marketing and Finance	3(2+1)
2	Post Harvest Management of Fruits & Vegetable	3(2+1)
3	Food Microbiology	3(2+1)

4	Cereal Processing	3(2+1)
5	Refrigeration & Cold Chain	3(2+1)
6	Food Chemistry II	3(2+1)
7	Fluid Mechanics & Hydraulics	2(1+1)
8	Heat and Mass Transfer*	2(1+1)
	Total	22(14+8)
	Semester-III	No. Credits
1	Fruits and Vegetable Processing	3(2+1)
2	Fermentation & Industrial Microbiology	3(2+1)
3	Legumes & Oil seeds Technology	3(2+1)
4	Food Processing Equipment I	3(2+1)
5	Processing of Meat and Poultry Products	3(2+1)
6	Bakery & Confectionary Products	3(2+1)
7	Processing of Fish and Marine Products*	3(2+1)
	Total	21(14+7)
	Semester-IV	Credits
1	Extrusion Technology*	2(1+1)
2.	Food Packaging	3(2+1)
3	Food Quality	2(1+1)
4	Processing of Spices and Plantation Crops *	3(2+1)
5	Processing of Milk & Milk Products	3(2+1)
6	Food Additives	3(2+1)
7	Food Processing Equipment II	3(2+1)
8	Environmental Science	3(2+1)
	Total	22(14+8)
	Semester-V	Credits
1	IT Application in Food Industry*	2(1+1)
2	Techniques in Food Analysis	3(1+2)
3	Food Bio-technology	3(2+1)
4	Food Industry Byproducts & Waste Utilization	3(2+1)
5	Energy Generation and Conservation*	3(2+1)
6	Bio-chemical Engineering	3(2+1)
7	Instrumentation & Processing Control	3(2+1)
8	Food Safety and Microbial Standards.	3(2+1)
9	Seminars – 2 (One Credit Each)	2(0+2)
	Total	25(14+11)
	Semester-VI	Credit
1	Business Management & International Trade	3(3+0)
2	Entrepreneurship Development and Communication Skill	2(1+1)
3	Product Development and Formulation *	2(1+1)
4	Specialty Foods	3(2+1)
5	Food Laws and Regulations.	3(2+1)
6	Food Plant Design and Layout	3(1+2)
7	Food Production Trends and Programs*	2(2+0)
8	Quality Assurance and Certification	3(2+1)
9	Research project	3(0+3)
	Total	24(15+9)

* Student must take minimum 125 credits, which are mandatory.

** As per AICTE norms.

VII Semester- 25(0+25) credits: Hands on Training recommended on campus in various Departments of College or off Campus in other Colleges of Food Technology

VIII Semester- 30(0+30): In plant training for six months off campus/Industry

1. In-Plant Training	25(0+25)
2. Training Report Evaluation	5 (0+5)

Total Credits

1. Course credit up to VI semester	125*
2. Hands on Training (VII semester)	25
3. Inplant Training and Report and Evaluation (VIII semester)	30
Total	180**

Hands on Training: Experiential Learning It is recommended that “Hands on training” in at least two areas should be offered to the students during VII semester. Each college as detailed below, depending upon local needs and industrial demand, should decide the minimum two areas.

- MAU, Parbhani: i) Fruit and Vegetable Technology ii) Bakery and Confectionary
- MPAUT, Udaipur: i) Fruit and Vegetable Technology ii) Bakery and confectionary
- ANGRAU, Bapatla: i) Spices Processing ii) Fruit and Vegetable Technology.

Distribution of Credit Hours for Hands on Training

1. Preparation of Business plan: (6 Credits)

- i) Selection of product to be manufactured
- ii) Innovativeness.
- iii) Creativity.
- iv) Realistic plan.
- v) Overall project report and project presentation.

2. Organization of production (3 credits)

- i) Organization of resources
- ii) Organizing utility
- iii) Time management

3. Production and Sales (5 credits)

- i) Regularity in production
- ii) Product quality
- iii) Positioning of product in market
- iv) Evaluation of presentation
- v) Adhering to rules and regulations
- vi) Adhering to plan.

4. Sales (3 credits)

- i) Sales performance.
- ii) Sales volumes
- iii) Profit generated including C/B ratio, and Pay back period, etc.

5. Documentation and reports (3 credits)

- i) Book keeping

- ii) People management
- iii) Preparation of manual.
- iv) Preparation of final report.

6. Oral examination (5 credits)

- i) Presentation.
- ii) Oral performance.

It is expected that the students will prepare a business plans /entrepreneurship for production of food products in the area of specialization processing: procure raw material processing including packaging & storage, conduct manufacturing, organize resources and utilities, sell the product, maintained accounts and documents, wind up production and submit the report of performance. All the students will be provided with an advisor who will guide the students in “Hands on training”. **25** credits are allotted for hands on training. The Committee appointed by the Dean, College of Food Technology, will conduct the evaluation of the “Hands on training”.

In-plant Training: 30 Credits (Semester-VIII): One academic staff member of the college will coordinate and monitor the inplant training programme. Each student or a batch of student will be sent to the Food industries for industrial training. The evaluation shall be done by the host industry and one academic staff member of the College to be nominated by the Associate Dean of the College concerned.

Changes in New Curriculum

- New courses on food business and trade including entrepreneurship and communication skills, advancements in processing, international food laws, biotechnological applications, etc are added.
- There is increase in the practical approach by way of introducing experiential learning in VII semester.
- A large component of Hands on training incorporated.
- New emphasis is given on skill development to face challenges of WTO.
- Food Technology graduates undergoing new course curricula will be more competent for industrial jobs and capable for self-employment.

Non-Formal Education: In order to fulfill the demand for the middle level technicians and also self-employed entrepreneurs, it is recommended that the College of Food Technology should offer vocational courses for generating middle level workers and technological empowerment. Offering of these vocational courses should be need based. The types of courses offered would be

- ★ Fruits and vegetable preservation
- ★ Bakery & confectionary products
- ★ Indigenous dairy products
- ★ Production technology for snack food
- ★ Spice processing
- ★ Health foods, etc.

Every college will offer at least 3-4 courses of 2-4 months duration as certificate courses. In order to offer such courses developmental grants will be provided to the extent of Rs 25.00 lakh to each college towards the development of infrastructure, conduct of practicals, production of literature, etc.

Budgetary Support for Experiential Learning: Rs 84.5 million for procurement of equipments & machinery for pilot plants processing, packaging and quality analysis including laboratory work for two areas identified per college

PG Programme in Food Science and Technology

Government of India has given priority for strengthening processing and value addition for generation of higher income livelihood security and improving nutrition. Even under National Horticulture Mission major support is provided to public and private sector for establishing processing facilities. There is going to be much greater need for R&D for India to become major world player. It is, therefore, essential that SAUs having Food Technology College should have M.Tech programme to meet skill human resource needs in this sector.

The PG programme will help in strengthening R&D support in the research institutions as well as industrial R&D. Hence, it is recommended to provide financial support to the establishment of M.Tech programme and strengthen the infrastructure facilities in terms of laboratory and equipments. The following financial support from ICAR is suggested for the first five years. Approval should be given only after receipt of concurrence by the State Govt. to accept the full responsibility of continuing faculty beyond 5 years.

Sr.	Item of support	Amount (Rs. In lac)
1	Extension/ renovation of laboratories	15.0
2	P.G. Hostel	25.0
3	New equipments/instruments	50.0
4	Books and Journals	5.0
5	Faculty (1 Prof., 1 Assoc. Prof. & 2 Asstt. Prof.) for a period of five years	60.0
	Total	155.0

VIII. FISHERIES SCIENCE

Introduction: Indian Fisheries Sector has shown tremendous progress in last 50 years. Present fish production in the country is more than 6 million tonnes out of which more than 50% is contributed by inland fisheries sector. The fisheries sector has shown steady growth rate of more than 7% per annum. The major contributing factor for this accelerated growth in fisheries are availability of skilled human resource, development and dissemination of new technologies, high receptivity of fishermen and women and increased investment by the government. The technology development has been the result of sustained research efforts of the central and state fisheries institutions and some traditional universities. There are eight national fisheries institutions in the country under ICAR serving various specialized areas viz. CMFRI, Kochi for marine fisheries resources; CIFT, Kochi for harvest and post harvest technology; CIFRI, Barrackpore for inland fisheries resources; CIBA, Chennai for coastal aquaculture,; CIFA, Bhubaneshwar for freshwater aquaculture; NRC-CWF, Bhimtal for cold water fisheries resources; NBFGR, Lucknow for conservation of native fish germ plasm and CIFE, Mumbai for fisheries education and training.

Fisheries education in the country has progressed at a good pace over the years. Central Institute of Fisheries Education, Mumbai was established under the Government of India in the year 1961 and was brought under Indian Council of Agricultural Research in 1979. It got upgraded as a Deemed University in 1989 and is now offering MFSc and PhD programmes in various disciplines. The first fisheries college under the State Agricultural University was

established at Mangalore in 1969. Now there are thirteen fisheries colleges spread across the country.

Mission: To make available technically qualified fisheries professionals with sufficient skills to manage, conserve and develop diversified fisheries resources in the country to provide food security and quality animal protein.

Objectives

- To create a cadre of fisheries professionals who are well qualified to meet demands of fisheries sector
- To develop entrepreneurial skills.
- To make students aware of national and international issues related to fisheries.

Present status

No. of colleges and enrollment: Following Colleges of Fisheries are currently producing skilled human resources for fisheries sector:

Sr.	Name of Fisheries College	Year of Start	Intake capacity
1	College of Fisheries, Mangalore, Karnataka	1969	40
2	Fisheries College and Res. Inst., Thuthukkudi, Tamilnadu	1977	35
3	College of Fisheries, Panangad, Kerala	1979	50
4	College of Fisheries, Nellore, Andhra Pradesh	1981	30
5	College of Fisheries, Ratnagiri, Maharashtra	1981	40
6	College of Fisheries, Pantnagar, Uttaranchal	1985	20
7	College of Fisheries, Dholi, Bihar	1986	10
8	College of Fisheries, Raha, Assam	1988	20
9	College of Fisheries, Veraval, Gujarat	1991	30
10	College of Fisheries, Railagunda, Orissa	1992	32
11	College of Fisheries, Mohanpur, West Bengal	1995	-
12	College of Fisheries, CAU, Agartala, Tripura	1998	22
13	College of Fisheries, MPUAT, Udaipur	2002	10

Mode of admission: By entrance examination for seats filled by ICAR. SAUs follow merit or merit + entrance test.

RAWE: All colleges have adopted RAWE in semester-VIII. It varies from 105-120 days. It is conducted in Colleges, Central Institutions, Private farms, Feed mills, State Govt. farms. It is done in areas- processing, aquaculture, extension in most of the colleges. In AP RAWE is divided - Farming-5 weeks; Hatchery-4 weeks; Processing- 5 weeks; Feed Plants-1 week; Sea- 1 week; Catch assessment- 2 weeks; Fishery Environment- 1 week; Extension & Economics-2 weeks. RAWE evaluation is done by a. Daily work diary b. Report c. Written test d. Viva voce d. Assignments and seminars.

Examination pattern: In most of the colleges 80-85% is external and 15-20% internal.

Recommendations for New Curriculum:

Department-wise credit hours

Sr.	Departments	Credits
1	Aquaculture	32(19+13)
2	Fisheries Resource Management	24(14+10)

3	Aquatic Environment	20(12+08)
4	Harvest and Post-harvest Technology	26(15+11)
5	Basic Sciences and Humanities Basic Sciences : 05+05 = 10 Social Sciences : 11+07 = 18	28(16+12)
	Physical Education/NSS/NCC (NC)	-
	Total	130(76+54)

The following courses are as optional courses:

- | | |
|-----------------------------------|--------|
| 1. Fish Immunology | 2(1+1) |
| 2. Rural Sociology and Psychology | 2(1+1) |
| 3. Elementary Statistics | 2(1+1) |

Department wise distribution of courses

Sr.	Department/ Courses	
I	Aquaculture	32(19+13)
1	Principles of Aquaculture	2(1+1)
2	Freshwater Aquaculture	3(2+1)
3	Fish Nutrition and Feed Technology	3(2+1)
4	Culture of Fish Food Organisms	2(1+1)
5	Aquaculture Engineering	3(2+1)
6	Ornamental Fish Production and Management	2(1+1)
7	Coastal Aquaculture and Mariculture	3(2+1)
8	Finfish Breeding and Hatchery Management	3(2+1)
9	Shellfish Breeding and Hatchery Management	3(2+1)
10	Fish Diseases and Management	4(2+2)
11	Biotechnology & Bioinformatics	2(1+1)
12	Genetics and Breeding	2(1+1)
II	Fisheries Resource Management	24(14+10)
1	Taxonomy of Finfish	3(1+2)
2	Taxonomy of Shellfish	3(1+2)
3	Anatomy of Finfish and Shellfish	3(2+1)
4	Biology of Finfish and Shellfish	3(2+1)
5	Inland Fisheries	3(2+1)
6	Physiology of Finfish and Shellfish	3(2+1)
7	Marine Fisheries	3(2+1)
8	Fish Population Dynamics and Stock Assessment	3(2+1)
III	Aquatic Environment	20(12+8)
1	Meteorology and Geography	2(1+1)
2	Soil and Water Chemistry	3(1+2)
3	Limnology	3(2+1)
4	Oceanography	3(2+1)
5	Marine Biology	3(2+1)
6	Aquatic Ecology and Biodiversity	3(2+1)
7	Aquatic Pollution and Coastal Zone Management	3(2+1)

IV	Harvest and Post-Harvest Technology	26(15+11)
1	Food Chemistry and Fish in Nutrition	3(2+1)
2	Refrigeration and Equipment Engineering	2(1+1)
3	Freezing Technology	3(2+1)
4	Fishing Craft Technology	2(1+1)
5	Canning and Fish Packaging Technology	3(2+1)
6	Navigation and Seamanship	2(1+1)
7	Fishing and Gear Technology	3(2+1)
8	Fish Products and Byproducts Technology	4(2+2)
9	Fish Microbiology and Quality Assurance	4(2+2)
V	Basic Sciences and Humanities	28(16+12)
1	Information & Communication Technology	2(1+1)
2	Statistical Methods	2(1+1)
3	Fisheries Economics	3(2+1)
4	Fisheries Extension Education	3(2+1)
5	Fisheries Administration and Legislation	2(2+0)
6	Disaster Management in Fisheries	2(1+1)
7	Financing and Marketing Management	2(1+1)
8	Entrepreneurship Development and Communication Skills	2(1+1)
9	Principles of Biochemistry	3(2+1)
10	Fundamentals of Microbiology	4(2+2)
11	Biochemical Techniques and Instrumentation	3(1+2)

Semester-wise distribution of courses

No	Semester/Course title	Credit hours
I Semester		
1	Principles of Aquaculture	2(1+1)
2	Taxonomy of Finfish	3(1+2)
3	Taxonomy of Shellfish	3(1+2)
4	Meteorology and Geography	2(1+1)
5	Principles of Biochemistry	3(2+1)
6	Fundamentals of Microbiology	4(2+2)
7	Information & Communication Technology	2(1+1)
8	Statistical Methods	2(1+1)
	Total	21(10+11)
II Semester		
1	Freshwater Aquaculture	3(2+1)
2	Anatomy of Finfish and Shellfish	3(2+1)
3	Biology of Finfish and Shellfish	3(2+1)
4	Soil and Water Chemistry	3(1+2)
5	Limnology	3(2+1)
6	Food chemistry and Fish in Nutrition	3(2+1)
7	Biochemical Techniques and Instrumentation	3(1+2)
	Total	21(12+9)
III Semester		
1	Fish Nutrition and Feed Technology	3(2+1)
2	Culture of Fish Food Organisms	2(1+1)
3	Inland Fisheries	3(2+1)

4	Oceanography	3(2+1)
5	Marine Biology	3(2+1)
6	Refrigeration and equipment engineering	2(1+1)
7	Freezing technology	3(2+1)
8	Economics	3(2+1)
	Total	22(14+8)
IV Semester		
1	Aquaculture Engineering	3(2+1)
2	Ornamental Fish Production and Management	2(1+1)
3	Coastal Aquaculture and Mariculture	3(2+1)
4	Physiology of Finfish and shellfish	3(2+1)
5	Fishing Craft Technology	2(1+1)
6	Canning and Fish Packaging Technology	3(2+1)
7	Extension Education	3(2+1)
8	Fisheries Administration and Legislation	2(2+0)
	Total	21(14+7)
V Semester		
1	Finfish Breeding and Hatchery Management	3(2+1)
2	Shellfish Breeding and Hatchery Management	3(2+1)
3	Diseases and Management	4(2+2)
4	Marine Fisheries	3(2+1)
5.	Ecology and Biodiversity	3(2+1)
6	Navigation and Seamanship	2(1+1)
7	Fishing and Gear Technology	3(2+1)
8	Disaster Management in Fisheries	2(1+1)
	Total	21(13+8)
VI Semester		
1	Biotechnology & Bioinformatics	2(1+1)
2	Genetics and Breeding	2(1+1)
3	Fish Population Dynamics and Stock Assessment	3(2+1)
4	Pollution and Coastal Zone Management	3(2+1)
5	Fish Products and Byproducts Technology	4(2+2)
6	Fish Microbiology and Quality Assurance	4(2+2)
7	Financing and Marketing Management	2(1+1)
8	Entrepreneurship Development and Communication Skills	2(1+1)
	Total	22(12+10)

VII Semester “Hands-on Training” (Experiential Learning): A minimum of two areas should be decided by each university as detailed below depending upon local needs and industrial demand. It is expected that the students will prepare a business / work plan for the relevant area of specialization. An end-to-end approach is to be followed in implementing the program. (For example, in processing : the program may start with raw material procurement, and include processing, packaging and storage, organize resources and utilities, sell the product, maintain accounts and documents, wind-up production and submit a report of performance). While identifying the area of specialization, the college shall take into account the faculty and infrastructure facilities available and their regional significance. The students shall also be permitted to take modules across the areas of specializations, based on the structure of the specialization. All the students shall be provided with an advisor, who will guide the students in “Hands-on Training”. A total of 25 credits are allotted for “Hands-on

Training” and the evaluation of the same shall be conducted by the Committee appointed by the Dean of the respective college.

Areas of specialization for “Hands-on Training”

I	Ornamental fish culture	Credits
1	Preparation of work plan	3
	World trade, export potential, exogenous and indigenous species, aquarium keeping	
2	Varieties of ornamental fishes	3
	Studies on traits of different varieties of ornamental fishes	
	Collection and identification of native species	
3	Fabrication and maintenance of aquaria	3
	Fabrication, Setting up and maintenance of aquaria	
	Water quality management	
4	Accessories	1
	Types of filters, aerators, and decoratives; aquarium plants and their propagation	
5	Feeding	2
	Feeds and feeding, Culture of live feed	
6	Breeding and health management	3
	Breeding of live bearers, barbs, goldfish, tetras, chichlids, gauramis, fighters and catfishes	
	Broodstock management	
	Diseases and their control	
7	Marketing	2
	Packing and transportation, health certification, Pricing, and marketing	
8	Documentation and report	2
	Book keeping, resource management, preparation of final report	
7	Oral examination	1
	Presentation, Oral performance	
	Total	20
II	Seed Production	
1	Preparation of work plan	3
	Target seed production, broodstock requirement, Infrastructure facility, Inputs, Supplies and marketing	
2	Species and site selection	2
	Species selection	
	Site selection	
3	Hatchery	4
	Layout plan, design, construction / fabrication, operational management	
	Broodstock management, live food production	
4	Breeding	4
	Selection of brooders, acclimatization, induced breeding, collection and estimation of eggs and spawn, packing and transportation.	
5	Nursery and Rearing pond management	4
	Pre-stocking and post-stocking management, harvesting, packing, transport and supply	
6	Documentation and reports	2

	Book keeping, Human Resource management, Preparation of manual and final report	
7	Oral examination	1
	Presentation, Oral performance	
	Total	20
III	Trade and Export Management	
1	Preparation of project plan	3
	Learning to buy, product selection, procurement, project formulation, preparation of plans. Registration procedures	
2	Marketing	4
	Marketing research (products, markets)	
	Supply chain management	
3	Export and import management	5
	Export and import procedures, documentation, licensing, inspection, export schemes. Pre-shipment and post-shipment finance.	
4	Seafood regulations	2
	Import regulations in US, Japan and EU. Domestic regulations	
5	Mock export	3
	Industry attachment, Compliance to different regulations, clearing and forwarding (C&F)	
6	Documentation and reports	2
	Book keeping, Human Resource management, Preparation of manual and final report	
7	Oral examination	1
	Presentation, Oral performance	
	Total	20
IV	Aqua-Clinic	
1	Preparation of project plan	3
	Project Formulation, Finance Mobilisation, Business Management	
2	Soil and Water Testing	5
	Instrumentation. Weather Conditions, Temperature, pH, Turbidity, Salinity, Dissolved Oxygen, Carbon Dioxide, Alakalinity, Hardness, Ammonia, Nitrites Nitrates, Phosphates, Iron, BOD, Plankton Analysis, Water Management and Bio-remediation	
	Soil Texture and Structure, Available Nitrogen, Available Phosphorus, Organic Carbon	
3	Disease Diagnosis	6
	Microscopy, Case History, Sample Collection, Clinical Examination, Postmortem Examination, Sample Preservation, Sterilization Techniques, Bio-chemical Test for Bacterial Identification, Histo-pathological Techniques, Immunological Techniques, Dot Blot Test, PCR Test, Aqua Medicines in the market and Banned Antibiotics, Dose Calculation, Treatment Schedule and Drug Administration. Quarantine and certification	
4	Feed Analysis	3
	Preliminary Examination (History, Colour, Odour, Texture), Estimation (Moisture, Ash, Crude Protein, Calcium, Phosphorus, Nitrogen Free Extracts, Total lipids, Water Stability), Knowledge on Proximate composition of Branded Feeds available in the market, Recommendation (Feed Quantity and Schedule), Quality assessment and certification.	

5	Advisory Services	
	Farm design, water quality, seed quality, feed formulation, information services, etc	
6	Documentation and reports	2
	Book keeping, Human Resource management, Preparation of final report	
7	Oral examination	1
	Presentation, Oral performance	
	Total	20
V	Post Harvest technology	
1	Preparation of project plan	3
	Project Formulation, Finance Mobilisation patterns, Business Management	
2	Preparation of ready to eat value added products	5
	Selection of viable product, Selection of raw material, Recipe standardization, Preparation of products,	
	Packaging and marketing	
3	Cured products preparation and marketing	4
	Selection of viable method of drying, Raw material procuring, Development of dried products,	
	Packaging & marketing	
4	Fresh fish marketing	
	Fresh fish dressing, packing, transportation, marketing, cold chain / Live fish marketing	
5	Food safety and Quality assurance	5
	Development of HACCP plans for different products, Analytical methods for different bacteria and quality monitoring parameters	
6	Documentation and reports	2
	Book keeping, Human Resource management, Preparation of final report	
7	Oral examination	1
	Presentation, Oral performance	
	Total	20
VI	Aqua farming	
1	Preparation of Project Plan	3
	World trade, domestic trade, export potential, project formulation, Finance mobilization, Business management	
2	Suitable Varieties of Fish / Prawn	1
	Studies on traits of different varieties of cultivable fish and shellfish, collection and identification of indigenous & exotic, species, types of farming.	
3	Farm Design and Construction	1
	Site selection, Design and construction of ponds, reservoir and Effluent treatment system.	
4	Pond Preparation	2
	Eradication of predator and weed fishes, eradication of aquatic weeds, pond sterilization, sun drying, ploughing, leveling and liming / gypsum treatment of pond bottom, water filling, fertilization.	
5	Seed Stocking	1
	Tests for selection of good quality seed, source & transport of seed, stocking time and density, size of stocking, acclimatization, estimation of survival rate (using survival nets)	

6	Pond management	8
	Stock manipulation and management, production & maintenance of natural food, supplementary feeding-common feeds used, feeding schedule, soil and water quality management- Estimation of various soil & water quality parameters for sustainable culture, trouble indicators and health management, chemicals, antibiotics and probiotics used.. Use of aerators, sampling for estimation of feed requirement, growth and health condition.	
7	Harvesting and marketing	1
	Days of culture, time of harvest, methods followed, precautions considered to maintain quality of product, Methods of packing and transport, market outlets, International quality standards for farmed products, cost- benefit analysis.	
8	Documentation and Report	2
	Book keeping, resource management, preparation of final report	
9	Oral Examination	1
	Presentation, Oral performance	
	Total	20

Each college may consider having not more than two such programs for experiential learning for which ICAR need to provide funding support. List of facilities and equipments needed for this program are:

Supports for Equipments for experiential learning: Important infrastructure/equipments required for Seventh semester skill development programs are:

Rs. In lakh					
Ponds 2 ha unit	20.0	Feed Mill	10.0	Generator	5.0
One hatchery	10.0	Air Blower/Pumps	6.0	Spectrophotometer	6.0
Pigment analyzer	15.0	PCR	12.0	Kjeltech	7.0
Soxtech	7.0	Research Microscope	6.0	Fish bone separator	10.0
Freezers	20.0	Cold Room	5.0	Can Feeler	2.0
FRP tanks/sheds	10.0	Filter and overhead tanks	10.0	Demand Feeders	5.0
Automatic Water Analyzer	10.0	Product development equipments	15.0	Electrophoretic assembly	3.0
Luminometer	6.0	UV cross linker	2.0	Fraction Collector	4.0

A college may choose any of the equipments from the above indicative list or purchase any other equipment as per requirement of the chosen experiential learning program limited to a maximum of Rs. 350.0 lakh for each experiential learning areas and additionally Rs. 7.00 lakh under revolving fund to each college.

In-plant training : 20 credits (VIII Semester): The suggested duration for this program is 17 weeks, with initial one week for orientation, 14 weeks for industry attachment and last two weeks for report writing. This may be offered either in VII or VII semester, considering the seasonality in fisheries activities.

One academic staff member of the college need to co-ordinate and monitor the entire “In-plant training” program. Each student or a batch of students shall be sent to the aqua farm, hatchery, ornamental fish culture unit, processing plant, product development unit or export

agency – whichever is accessible to the college. Those colleges, which could not identify a suitable private firm for In-plant training program, may approach the Central Institute of Fisheries Education, Mumbai or any fisheries institutes under ICAR for making suitable arrangements. The evaluation of the program shall be done by the host industry (50%) and one academic staff member of the college (50%) to be nominated by the Dean / Associate Dean of the college.

Non formal and distance education: Colleges are encouraged to offer non-formal training programs that are need-based, customized and self-financed. They may be either certificate courses of 6-12 months duration or diploma courses of 2-3 years duration. The eligibility would be 10+2. However, they shall not become permanent programs and shall be co-terminus with the market needs. There is a good scope for distance education and virtual programs for important areas of fisheries sector viz. aquaculture, ornamental fish culture and breeding etc. taking advantage of IT tools available now. For content development each college need to be provided. Rs. 5 lakh.

Changes Effected in Course Curriculum and Syllabus:

- Revised B.F.Sc. program will have 6 semesters of course work; seventh semester Hands-on- Training program in the area specified with a credit load of 20 credits and eighth semester industry attachment.
- New courses added are Ornamental fish production and management; Biotechnology & Bioinformatics; Genetics & Breeding; Ecology & Biodiversity; Coastal Zone Management; Disaster Management in Fisheries; Entrepreneurship Development; Biochemical Techniques & Instrumentation; Information & Communication Technology.
- Several courses revised/merged to accommodate all course work in 6 semesters so that semesters VII and VIII can be used for skill development and industry attachment. Anatomy of fin fish and shell fish combined so also Biology of fin fish and shell fish and Physiology of fin fish and shell fish. Languages, computer courses, NSS, physical education are recommended as non-credit courses and compulsory for all. Canning technology and Packaging technology are merged as one course. Genetics and biotechnology split up as Genetics and Breeding and Biotechnology & Informatics separately.
- The theory to practical ratio now will be 3:4 approximately.
- The students will have more practical exposure and while working in last two semesters their professional skill and confidence level will be much higher which will help them to start their own enterprize.

4. CENTRAL ASSISTANCE FOR STRENGTHENING HIGHER AGRICULTURAL EDUCATION

Over the years we have been able to develop a sound base for Agriculture Education in almost every state mainly on account of tremendous support provided by Indian Council of Agricultural Research. In 1960s and 70s major support was provided under development grant for infrastructural development including construction of buildings, hostels, library, faculty training nationally and internationally, library strengthening including procurement of text books, journals and databases, student and faculty amenities, students study tour, development of facilities for practical training as well as hands on training including internship. Upto the VI Plan almost 33 per cent of the ICAR budget was devoted for strengthening agricultural education in the country and this is the major reason that most of the Universities established during that period have excellent infrastructure which is largely contributed by ICAR.

The share of agricultural education within ICAR budget increased from 8.9 % in VIII Plan to 14% in X Plan. However, there is a need to step up this support for agricultural education to at least 20% of ICAR budget. The states contribution related mainly to establishment costs as well as sharing of infra structure development especially civil works. Realizing the importance of Agricultural Education for propelling agriculture development in during 60s & 70s states, various state governments were also very liberal and in fact accorded high priority. The situation changed drastically and became worst after the implementation of the Fifth Pay Commission recommendations. Many factors have contributed to decline in the quality of agricultural education but the main contributing factors have been lack of adequate financial support for infra structure development, faculty improvement and library strengthening.

During IX and X Plan, ICAR has stepped up financial support and this has now made reversal of the decline in the quality of agriculture education. But it is still much below the stakeholders' expectation and certainly not in consonance with the developments taking place globally. Since quality assurance is the national over riding priority for bringing in research excellence, it is essential that adequate central assistance is provided for strengthening of Higher Agriculture Education. This is the only and surest way of providing world-class human resource to meet the demands of global competitiveness and meet highly professional competence requirements of modern agriculture.

The skills and knowledge of our graduates have to meet new international standards. The Committee supports strongly the need of increasing in central assistance for strengthening of Higher Agricultural Education. The recommendations in this report are based on the consideration that higher investments are required for supporting Agriculture education to bring professionalism and to produce graduates who are job providers rather than job seekers.

The Committee recommends that except for the central activities the support to agricultural universities should be allocated on college-wise basis and a mechanism should be developed to ensure that it is used for the purpose it is provided. Following are the major components recommended for providing central assistance to agricultural universities and their constituent colleges for imparting quality and relevant skill based education.

Civil Work Support should be provided for repair, renovation, modernization and furnishing of academic infrastructure and student hostels. The quantum of support may be linked to age of the building, area of jurisdiction of the university (e.g. tribal, difficult or backward area), earlier support provided and assessed need.:

Following specific support for new construction is recommended:

Girls Hostels: In the last two decades in most of the universities, there has been welcome change in respect of girls students enrollment. In fact, even in north, in many universities enrollment of girls students has doubled. In Dr. Y.S. Parmar University of Horticulture and Forestry, the girls students enrollment is about 50%. Most of the state governments now have provided for reservation of girl students in Agricultural Sciences. One of the major difficulties for girls in pursuing higher studies in agriculture sciences is the lack of availability of residential accommodation. Recognizing the role of women technological empowerment, the ICAR developed a very sound pro-active policy of fully supporting construction of girls hostels. This has paid rich dividends in terms of girls enrollment. With the increasing number of girls students coming to agricultural sciences, it is necessary that adequate infrastructure is built for residential accommodation. For this purpose, the Committee recommends that based on assessment of the number of girls, support for construction of one girls hostel at each off-campus college and upto three hostels on-campus. The Committee recommends, support with a maximum ceiling of Rs.75.0 lakh per hostel.

In the XI plan period as per the Committees assessment, a total of 60 new Girls Hostels would be needed, for which a provision of Rs.45.0 crore is recommended.

International Hostel: ICAR should continue its policy to support construction of International Hostel in view of larger number of students seeking admission in SAUs. For this Committee recommends provision of Rs. 15.00 crore on 50% finance basis.

Faculty & Student Amenities: Support for outdoor games, playgrounds, swimming pool and indoor halls for gymnasium, TT, badminton may be provided. The support should be limited to construction cost only and may be provided after approval of design and estimates by the Council. The maximum one time support by the Council may be limited to Rs. 25 lakh per SAU in a plan period.

Renovation of Hostels, Laboratories and Class Rooms: Most of the Universities have created facilities of boys and girl hostels, laboratory and other building with ICAR support. In most cases they are old and with small investment could be modernized. Therefore Committee recommends following support for renovation and modernization of these buildings.

Hostels & Laboratories more than 50 years old	Rs. 100 lakh each
Hostels & Laboratories between 25-49 years old	Rs. 25.00 lakh each
Less than 25 years old	Rs. 15.00 lakh each

Total budget required for this activity would be around Rs. 150 crore. Which would be one time support.

Curricula Delivery: Outcome of the modern curricula and syllabi mainly depends upon its effective delivery. The major components of the delivery are latest delivery tools, modern equipments, latest instructional material and needed contingent support for conduct of practical and skill/practice courses. The following support for curricula delivery is recommended.

Contingency for Practicals: The contingent support may be used for recurring materials and small accessories/component of equipments of routine use. The following contingent support for conduct of practicals is recommended per student per year.

- UG: Rs. 5000
- PG: Rs. 7500

Laboratory Strengthening

Equipments: Globally technological developments are taking place at a very rapid rate. In fact, the capacity of scientists to undertake research has undergone major transformation on account of availability of modern state of the art electronic equipments, which make it possible to do analysis and interpretation of data at a scale unthinkable before. The manual work has given way to automation in analysis at enormous scale and capacity. The developments in Molecular biology and Bio-technology, Natural Resources Management, GIS, Remote Sensing, etc. have come mainly because of the rapid growth in instrumentation. Our universities have not kept pace with the technological development in instruments on account of financial inadequacy. The equipments in most universities are still primitive or obsolete and this has impacted on the quality of research and work done. In view of the higher stakes for attaining international leadership, it is necessary that universities are provided modern equipments in new and emerging area. This will enable our students to compete internationally by virtue of having better exposure and capability to use new tools and technologies for advance research. For this purpose, two-tier support is recommended. For the instruments, which are costly and sparingly used, it is necessary to provide them in Common Instrumentation Laboratory so that optimization of the limited resources is ensured.

For this purpose, the Committee recommends one time grant, for development of Common Instrumentation Facilities at University level, of Rs.1.0 crore per university. It would also be essential to provide support for two skilled technicians so that scientists needing the services of the centre could avail on first-cum-first serve basis. The second tier support for instrumentation relates to procurement of most commonly used equipment at college level for undergraduate and postgraduate students. These equipments be open to students use independently and individually so as to acquire skill, competence and confidence. For this purpose, it is recommended that each Post graduate level College be provided one time grant of Rs.50.0 lakhs and each Undergraduate level college Rs.20.0 lakhs. This support is with a rider that these grants would to be procure only modern equipment and not the common instrumentation and equipments already expected as per norms.

Repair and AMC of equipments and Computers: Each College should be provided Rs. 5.0 lakh annually.

Preparation of Instructional Material: For effective curricula delivery and conduct of practicals and practice/skill based courses it is equally important to have quality instruction materials. The use of manuals, power point presentation, multi media, interactive study materials, soft tools, digital specimen, real life experimental procedures etc. need to be enforced in teaching of various courses. For preparation of such modern curricula delivery tools and materials, annual support of Rs. 2.00 lakh per college is recommended. Additionally, for establishment of a Teaching Technology lab a one time support of Rs. 5.00 lakh and Rs. 10.00 lakh respectively for per UG and PG college is recommended.

Library: With the every increasing knowledge explosion the cost of acquisition of journals and other publications have been increasing. With the financial squeeze most of the SAU libraries are not in a position to even purchase textbooks which is adversely impacting on quality of education. The Committee considers it most essential to have network of libraries and access to journals on line with one hard copy and electronic mirror image at least at one location. All SAUs need to be provided 2 Mbp connectivity, hosting on ICAR portal and at least 50 journals on line with connectivity given to respective colleges for concerned journals. The support for this should ideally come from NAIP. For renovation, furnishing and modernization of libraries, a one time grant of Rs. 50.0 lakh should be provided for the

Central library of each university. At least 50 percent of this amount should be used for modernization of the central library. Library support should also be provided for annual fee of ICAR-ERNET network and for purchase of textbooks for book banks.

Library Networking & online journal subscription

Sr.	Description	Creore
1	Bandwidth cost @ Rs. 20 crore per annum for 200 sites for 5 years (2MBps (1:1) for 60 sites, 512 kbs for 140 sites)	100.0
2	Video conferencing and IP telephony for SAUs / CAUs / approx. 40 nos) capital one time	10.0
3	Annual Maintenance @ 10% pa (Rs. 15 lakh) for 5 years	1.0
4	Internet Data Center Infra for 20000 users (Servers, SANs Backup, firewall, IPS/IDS, softwares, Anti-Virus, EMS, Portal,	20.0
5	Recurring cost of softwares @Rs. 2 Cr. PA for 5 years	10.0
6	On line subscription for 50 Journals (Archived mirror copy)	20.0
7	Campus network in 20 institutions	10.0
8	Recurring cost for AMC of Hardware @ Rs. 1.5 Cr. PA for 5 years	7.5
9	Bandwidth of 45 Mbps for Data centre for 5 year	7.0
10	Manpower cost and operations of DC and DR	5.0
11	Training	1.0
	Total cost for 5 years	191.5

Support for Books

- SAUs having mono campus- Central library: Rs. 10 lakh per annum
- SAUs having multi off-campus: Rs. 5 lakh for main library and Rs 2.0 lakh for each PG college and Rs. 1. lakh for each UG college per annum.

Student Placement and Counseling: With the shrinkages in job opportunities in government sector, the graduates have to find placements in private sector. For this purpose, it is necessary to have campus interviews. In order to have university-private partnership and linkages, the Committee feels that each university should have a most modern Student Placement and Counseling Centre. This will play a major role in bringing awareness among the students about the new national and international opportunities for employment as also entrepreneurship development. The centre would also play an important role in personality development, and enhancing communication skills. For this purpose, the Committee recommends a provision of one time grant of Rs.30.0 lakhs to each university including development of communication centre.

Instructional Farms/Facilities

Farms: In order to equip students with actual field environment and impart training on farms (Agriculture, Horticulture, Livestock, Poultry, Fish ponds etc.) in agricultural and allied sciences, it is important to allocate funds for establishment and maintenance of instructional farms complexes commensurate to the requirements of individual faculty. Support to the tune of 50 lakhs be given to each college after making the need based assessment.

Clinical and Diagnostic Service Centers

Veterinary Clinical Complex: Veterinary Clinical complex is the primary and essential unit to impart training in health management and treatment of livestock, & sick animals. One time support of Rs. 75 lakh for establishment of Clinical Complex is therefore, recommended.

Soil Plant Clinic: At present except for one or two universities organized plant clinic is non-existent. This will help in control and management of plant diseases and also this will help in circumventing deleterious effects of insecticides, fungicides, weedicides and certain known and un-known toxicological agents, plants etc. ICAR may develop ideal model for establishment and maintenance of soil plant clinic and provide financial support of Rs. 20 lakhs for each college.

Automation/IT/Computerization: Over the years all SAUs have built good computer facilities through support received under NARP and NATP from ICAR. It is necessary that every student, faculty member and other employees should be computer literate, the Committee recommends

- Internet connectivity in hostel rooms for PG students.
- Internet connectivity in every department and Lecture hall.
- One computer for every faculty member identified as excellent teacher/research/extension worker.
- LCD Projector in every class room.

Skill development

Experiential Learning: In the revised syllabus, the Committee has laid emphasis on experiential learning. This is a major structural change recommended for bringing professionalism and practical work experience in real life situations to graduates. In all disciplines except Home Science, programme is targeted for imparting hands on-practical Training. In case of Home Science two years of experiential learning has been built. In order to bring in high quality entrepreneurship skills and professional competence, it is essential that adequate budgetary support is built for infra-structure facilities for providing experiential learning. The Committee has developed and recommended production oriented courses, visit to farmers field, stay in rural environment, earn while you learn and production to consumption project working. The Committee has included experiential learning courses and programmes in all disciplines. These programmes will build confidence, facilitate skill development through experiential learning and facilitate in producing job providers rather than job seekers. Modification in course curriculum necessitates change in methodology in teaching and learning and development of facilities like model farms, dairy plants, food processing facilities, workshops, procurement of state of the art equipments for practical training, ICT facilities etc. The necessary budget has been indicated for each discipline.

RAWE/ In-plant training: For this important activity students need to be provided stipend as they have to mostly live outside and have to incur expenditure. It is recommended that a provision of Rs. 2000 per student/month be made. Of this amount Rs. 1500/- would be contributed by ICAR & Rs. 500 would be states share. Of the ICAR share of Rs. 1500, Rs. 1000 would go as stipend to the student and Rs. 500 towards operationalizing of the programme (meeting faculty expenses, contingency expenses POL, medicines during clinic etc). The states share will go towards stipend to the student. In case states provide more

support the same could be provided to the student. This should be for the duration spent in the village or for inplant training outside the university.

Internship: Internship allowance to Veterinary graduates is recommended at Rs. 2000 per month/student as ICAR share of which Rs. 1500 is provided to the student and Rs. 500 to the college for operationalization of the scheme per month limited to no more than six months. Rs. 500 per month need to be provided by state govt. which would also go to the student.

Students Study Tours: Support for travel expenses / POL / hiring of vehicle for one study tour be supported fully by ICAR with a maximum limit of Rs. 2000 per student.

Fellowships and Scholarships: Inbreeding in education and faculty is a serious issue affecting both quality and relevance of education. The proportion of persons obtaining all the three higher degrees from the same university including faculty members has rapidly increased over time. This trend needs to be arrested by appropriate policies and support. Some beginning has been made to tackle this problem by way of filling 15 % and 25 % seats respectively in UG and PG programmes through entrance test conducted by ICAR. This initiative can be made further effective by providing fellowship/scholarship to all the candidates who choose to move out of their State from where the education for eligibility examination was passed. It is heartening that the Council has already implemented this for the National Talent Scholarships and all those candidates who move out of their State for admission in UG programmes through ICAR receive the scholarship. This provision needs to be extended to masters and Ph.D. programmes also. It is recommended that all candidates should be provided JRF/SRF, who, based on ICAR examination, move for masters/Ph.D. to a university of the State other than the State from where they obtained UG/Masters degree.

Human Resources Development

Faculty Competence Improvement: Educational institutions world over are known because of the competence of the faculty. Recruiting quality faculty is the first step but it is the continuing quality updation in knowledge and skill of faculty which holds the key for quality education. Therefore, career development planning including building and rebuilding of faculty competence through regular training is an overriding priority. This is particularly important in view of rapid development in science and technology. Committee recommends that life long learning be inculcated in the faculty and mechanism developed whereby each faculty member undergoes mandatory training at regular span of 5 years. The Committee recommends that training of 21 days for Assistant Professor, 10-14 days for Associate Professor, 5-7 days for Head of Departments and 3 days for Deans every five yearly. The training programme must be properly developed taking into consideration the current status of competence of the faculty, requirements of new curriculum with focus on acquisition of knowledge and expertise in frontier areas such as biotechnology, information technology, food technology, market intelligence, modeling, agri-business management, GIS, IPR and international trade besides entrepreneurship, communication, project development and assessment skills, etc. This career development plan envisages that every faculty member should have opportunity of participation in one training programme every five years which means that 20 per cent of faculty under goes training every year.

In many frontier areas, there is tremendous technology gap. In order to bridge this gap Committee recommends that four per cent of the staff must have opportunity of training in the best institutions overseas. This investment in building the competence of the faculty is not only critical and essential but would ensure continued high quality education and training which is a prerequisite for bringing excellence in research for accelerating agriculture growth

in the country. The Committee recommends that for this purpose budgetary provision of Rs100 crore should be made. This support may be used for national and international trainings in cutting edge technologies and modern curriculum delivery, meetings conducted by the Education Division within or outside the SAUs, national and international scientific and academic meets including library science.

Skill Up-gradation of Para-professionals and other Staff: Training in the university or outside should be organized; preference may be given for group trainings in computers, laboratory skills and modern office management, administrative and finance procedures. Rs. 2.0 lakh per annum should be provided to each university for this purpose.

Human Resource Planning and Management: Presently human resource development is largely based on adhoc-ism in total disregard of man power need assessment in different sectors of Agriculture for example large state like Bihar has a very limited intake in Agriculture compared to Maharashtra which admits disproportionately high number of students. Sectorally there is a high demand for competent human resources in the area of Dairy Technology, Food Technology, Horticulture, Fisheries, Agri Business Management and Veterinary and Animal Sciences but the number of graduates coming out in these disciplines is lower than the needed requirement. In fact there is no creditable system of human resources need assessment. In order to have proper and adequate development of human resources it is necessary that human resources planning is undertaken on scientific basis so that enrollment in discipline is regulated. This would require need assessment for professionals in specific subject areas, review of their training needs for sustainable performance and career advancement. It would also be important to consider knowledge and skill profile needs of prospective job market. Committee recommends studies on man power need assessment and organization of workshops sectorally at national level and involvement of different stakeholders in review and assessment of skilled human resources sectorally. In addition Committee recommends regular mechanism for forecasting of potential placement opportunities nationally and internationally. In order to take advantage of inherent strength built in our educational system, concerted effort be made for marketing of Agricultural Universities overseas. Some of the institutions like IARI, IVRI, NDRI, CIFE as well as SAUs could be supported for opening off campus colleges and programmes in Asian, African and Middle East countries. For human resources planning, man power need assessment and marketing of agricultural education overseas, the Committee recommends making a provision of Rs.100 crore.

Support for Examination Reforms: The Committee has suggested major reforms in the examination system of both UG and PG courses. For the implementation of these reforms including external examination in UG and PG courses, several new mechanisms will have to be put in place. These include creation of Examination cell, appointment of examiners, secret printing of papers, TA/DA and attractive remuneration to the paper setters and evaluators, disciplined copying free examination infrastructure etc. Most universities neither have these mechanisms nor resources to create these. Evaluation of experiential learning, inplant training, skill and practical courses etc. would need, never before used examination/evaluation processes. A support of Rs40 Crore during Plan period is recommended.

Support to and Deans for Academic Improvements and Management: For management of quality and relevant education and for effecting improvements in education, several new and innovative actions and steps are needed to be taken by Deans of the colleges. Many of such requirements can not be envisaged before hand, some examples of such needs could be, to meet travel and hospitality expenses for lecturing by outstanding national and international

academicians who happen to be in the region of the university/college, for exposing students to management experts, successful farmers, agribusiness persons etc. some other exigent situations and needs may also arise in the conduct of practicals, skill courses, experiential learning etc. or for exposing students to newly or just available techniques and tools for which regular support is not available. For all such needs and to meet any other emergent and exigent expenditure for education management and improvements a support of Rs. 4 lakh per annum, at the disposable of the discipline Dean is recommended.

Vocational Training: Small and marginal farmers, landless labourers, farm women and school drop outs in villages constitute bulk of the 40 million unemployed or semi employed work force of the country. They are not able to have gainful employment mainly because of lack of technological empowerment. On the other hand State Agricultural Universities with faculty strength of about 25,000 churn out only about 12,000 graduates, which is much below the HRD capacity of these institutions. Universities are concentrating mainly on formal education while there is need for non-formal education especially in respect of knowledge and technological empowerment of vast section of work force in rural areas. This will expand the opportunities for off farm employment and decrease dependence of large segment on agriculture resources for livelihood. Neglect of middle level skill and manpower development appears to be major lacunae for ensuring livelihood security. The absence of well structured vocational programmes have created communication gap in not only effective transfer of technology from lab to land but also becoming partner in agriculture transformation. Vocational training on a large scale in various fields can partly bridge this gap. Rural youth unable to pursue higher education, school and college drop outs, women in agriculture who have no facilities of higher education can easily be provided skills and oriented towards agriculture vocation as per their traditional occupations. Typically introduction of vocational courses in animal husbandry, dairy technology, fisheries, horticulture, vegetable, fruit, poultry production, medicinal and aromatic plants cultivation, plantation crops, nursery raising, fruit and vegetable preservation, milk processing, poultry, sericulture, maintenance and custom hiring of farm machinery, hybrid seed production, vermi-composting, hi-tech horticulture, precision agriculture and organic farming, etc. offer vast potential to create productive profitable, sustainable and self employment in agriculture. With little investment necessary skills can be built using the infra structure and faculty resources available in the SAUs especially in KVKs. However, the essential requirement is ensuring quality of vocational programmes. These programmes should basically have inbuilt mechanism for extensive experiential learning so that participants acquire professionalism, skills and entrepreneurship which allow them to have self-employment. This will lead to total transformation in rural areas.

In order to have quality vocational instructions, it is important that each of the University be liberally supported for infrastructural development. The programme should be partly financed for contingent support. The Committee recommends that each University should aim and initiate vocational training programmes in 3-4 areas on the basis of need assessment for a fixed duration. The programme may consist of training from 21 days to 6 months or certificate/diploma course but the major objective should be to provide adequate skills so that they have confidence and be gainfully self-employed. It would also be important to have end-to-end approach so that the participants also have expertise relating to marketing. For this purpose the Committee recommends support of Rs75-100 lakh for infrastructure development at each college with a total investment of Rs.200 crore for all colleges under SAUs.

Distance Education: Distance education is becoming a reality. The distance education technologies could be used effectively to share under-graduate and graduate level courses, extension programmes, research findings and national and international speakers. Current

technologies include audio-video, multimedia via satellite and computer system. We need to provide global environment through internet. Infact, computer aided instructions consists of text, graphics, photographs, animated images, video, audio and mixing real time information on various issues like weather forecast, insect-pest development, land use planning, etc. The internet based course promotes continuing education. It is estimated that 75% of the students drop out by 10+2 stage and this is the major work force in rural India who have no access to modern technology. Through distance education, it is possible to reach those unreached and technological empowerment of women for accelerating pace of agricultural development. For technology mediated learning through distance mode Committee recommends a provision of Rs. 150 crore for hardware content development and establish centres of Distance Education in each SAUs/DUs.

Support to Central Universities: Central universities having agricultural faculty and not receiving UGC grants for agricultural education and research should be treated at par with one faculty of an agricultural university, provided it follows curriculum and academic regulations prescribed by ICAR and grant to be restricted only to the programs of agricultural sciences. The items of support may include contingency for practical, purchase of lab equipment including computers, library strengthening, instructional farm development, participation of faculty in seminar, workshop, conferences etc. The committee recommends a provision of Rs. 15 crores in total.

Support to Deemed Universities: Although ICAR institutes, which are Deemed Universities, are getting financial support under ICAR budget, they are discharging very important task of HRD. The Committee, therefore, recommends a grant of Rs. 2.50 crore annually to each Deemed University for upgradation of Library, Practical Labs, Class rooms, Instructional material development faculty and student amenities, etc.

Performance Linked Support: It is well recognized that despite very many efforts made, the quality of graduates both at undergraduate and postgraduate students do not conform to the expectations of the various stakeholders. The efforts made under AHRD project had reversed the trend in decline of quality education but there is still tremendous scope and need for quality improvement in agricultural education. The IV Dean Committee has included several recommendations in this regard. In order to motivate the faculty and bring total quality management in educational institutions, it is also critical and important to build in performance-linked support systems, which includes incentives for performance and disincentives for non-performers. With the sound system of management it is possible to have major strides for quality assurance in agricultural education. The following specific recommendations would help galvanize the system for better performance.

- Additional grant of Rs. 5,000/- per JRF qualified from the college each year and Rs.3,000/- per each student admitted through Entrance examinations conducted by ICAR in Dean's grant for quality improvement.
- Additional grant of Rs. 10,000/- per SRF to the concerned department from where the student completed the Masters programme.
- Special grant of Rs. 3 lakhs to the college with the best performance in ICAR entrance examination in each discipline. In faculties having more than 30 colleges, this grant be given to first and second rank colleges.
- Special grant of respectively Rs. 10, 7.5 and 5.0 lakh to the universities whose students secure highest, second or third highest number of JRF in terms of percentage of total students who appeared and obtained JRF.

- In case from any college no student gets JRF then the Dean's grant which is given for quality improvement in education be reduced to half and in case for two consecutive years nobody gets JRF then the Dean's grant be totally stopped.
- In case none of the candidate from any university gets JRF then university grant be reduced by 25%.
- Teachers teaching 90 and more theory lectures in SAUs and 24 lectures in DUs be provided Rs. 2,000/- per year towards purchase of subject matter books.
- Teachers who are identified as excellent teachers by student feed back be provided a computer with necessary accessories.

Summary of Support

		Rs. In Crore
Sr.	Component	Support
	Plan Support	
1	Civil Works	250.00
2	Curricula Delivery	225.00
3	Equipments	250.00
4	Library	225.00
5	Student Counseling and Placement	15.00
6	Instructional farm/Plant animal Clinic etc.	100.00
7	Automation, Communication, IT and e-governance	50.00
8	RAWE, Skill Based and Inplant Trainings including Internship for Veterinary	90.00
9	HRD and HRM including Faculty mobility and Guest Faculty	150.00
10	Examination Reforms	40.00
11	Grant to Education Managers	55.00
12	Experiential Learning	601.5
	• Home Science	50.00
	• Food Technology	30.00
	• Dairy Technology	80.00
	• Agricultural Engineering	69.00
	• Agriculture	200.00
	• Fisheries	50.00
	• Forestry	25.50
	• Horticulture	22.00
	• Veterinary Science	75.00
13	Performance Linked Support	20.00
14	Vocational Education	200.00
15	Distance Education	150.00
16	Support to Deemed Universities	50.00
17	Support to Central Universities	15.00
	ICAR Network	50.00
	Total	2536.50

5. GUIDELINES FOR ASSESSING TRAINING NEEDS AND PERFORMANCE OF TEACHING FACULTIES

In the University system there are three pillars- faculty, infrastructure and curricula. on which quality assurance is built. The most important of which is the quality of faculty and its continued competence updation. During early phase of Agricultural University establishment recruitment of faculty was largely done on the basis of quality and competence in open selection at national level. However, with passage of time this has given way in many cases to balkanization and parochialism with the result that most Universities have extensive inbreeding which is one of the factors contributing to poor quality of graduates. Additionally it is seen that though Universities have been established on land grant pattern with integration of teaching, research and extension education, there is still wide spread lack of complete integration. With rapid developments in science and technology specially cutting edge technologies, the technology gap is widening. This has been made worse by lack of recruitment of new faculty largely during last decade or so. The opportunities which were available during 60s and 70s to have training of faculty in best of the Universities overseas specially in United States under USAID have almost disappeared and neither the state government nor the center has made provision for adequate funds for knowledge updation of faculty in structured manner, so essential for quality assurance in SAUs.

ICAR took bold policy decision in 1997 of making provision for training of each faculty once in five years nationally through increase in summer schools, winter schools and training programmes through Center of Advance Studies (CAS) and Terms of Excellence (TOE). TOE and CAS have been instrumental in giving first rate training in many of the new and emerging areas because ICAR provided enough funds initially for purchase of state of the art equipments and necessary budget for training. This benefited largely the faculty at Assistant Professor level mainly because of the requirement of two training programmes for assessment and promotion to higher grade. Such a requirement does not exist for higher level of scientists and managers as a result of which the very aim of updation in competence of senior faculty was not achieved.

It is, therefore, in the interest of the organization, for improving quality of education, to have a structured mechanism for career development of faculty through need assessed regular training at different levels so that faculty is not only abreast with current developments, but have adequate knowledge and expertise in cutting edge technologies. Remaining forefront in new and emerging areas is a prerequisite for providing knowledge and expertise to our graduates in real life situations. The Committee, therefore, recommends that realizing the ICAR goal, at least one training every five year be made mandatory with the following duration of courses at different levels.

- Assistant Professors: At least 21 day programme
- Associate Professor: 10-14 day programme
- Heads and professors: 7 day programme
- Deans of colleges and Directors: 3-5 day programme on management
- Vice-Chancellors and Directors of DUs: Retreat for two days

The methodology for training need assessment must be based on bottom up approach. During deliberation of the Committee with stakeholders in some of the faculties important areas for training including institutions have been identified whereas for other faculties this exercise would need to be done afresh. The Committee is of the view that the need assessment exercise should begin at the college level. The Board of studies of individual discipline need

to flag the areas of training for different categories of scientists based on SWOT analysis, then synthesis at the college level by Deans and subsequent transmission to DDG Education. In many of the areas it may be important to organize group training while in other cases it would require individual training. The main purpose of training should be:

- Acquiring skills in the newly emerging areas and cutting edge technologies.
- Updation of knowledge in frontier areas.

The Committee recommends the following:

- Induction training: ICAR has been organizing induction training for scientists at initial entry level and this has been appreciated by all. Similar induction training need to be built-in in SAUs for a period of 3-4 months with a focus on pedagogy, computer literacy, knowledge about national and international agriculture, curriculum development, financial and administrative rules and procedures, etc.
- **Training overseas:** In key emerging areas such as biotechnology, processing and value addition, GIS, remote sensing, IPM, INM, agribusiness management, diagnostics, IPR, speciality foods, packaging, international quality standards, exports, entrepreneurship development, etc. faculty need to be trained in best of the institutions globally. It is recommended that as an institutional goal four per cent of the faculty be sent for training overseas every year for a period ranging from three months to one year depending upon the area and the time required for necessary skill acquisition. The training also need to be provided to ICAR scientists as well since the Committee has recommended linkage of SAUs with at least one ICAR institute and vice versa. Since knowledge and qualification of teachers holds the key for quality of education, building and rebuilding of faculty competence assumes importance. The focus need to be in basic and applied sciences relevant to different branches of agriculture sciences. Building faculty competence will ensure skill and entrepreneurship development among graduates for taking up enterprise and be job provider. ICAR need to develop HRD policy to make mandatory training and retraining of the faculty. For this purpose the Committee recommends providing support for national and international trainings to the extent of Rs.150 crores. Out of this Rs. 25 crores be earmarked for providing facilities to the faculty members on return for maximizing the impact and benefit from training overseas.

In the succeeding sections some account of areas identified has been given and this list by no means is exhaustive. For Home Science faculty detailed exercise has been done considering the major restructuring of Home Science curriculum. Without this training it will not be possible to operationalize new curriculum. The same will hold true for other faculties but for these faculties exercise shall have to be done.

Philosophy of Structured trainings

- Induction training for teachers: Entrepreneurship, Computational skills, communication skills and training on effective learning and teaching, educational technology.
- In-service training on global developments and issues pertaining to Management of education
- Training for Comptrollers and Registrars on Educational administration and financial management

- Training for Heads of the Departments on Educational administration evaluation systems and management
- Refresher program for teachers on applied and basic courses
- Training for technical, administrative and financial staff.

Human resources development

- Educational technologies and their applications
- Technology-based teaching learning (ICT and multimedia)
- Experiential learning and group learning
- Personality development
- Communication and presentation skills
- Developing winning research proposals
- Quality assurance in education
- WTA and GATTS
- Content development for distant education
- Evaluation of students' learning
- Andragogy for self-employment and entrepreneurial skills
- Curriculum design and development

Training Areas: Following is a suggestive list of areas for faculty trainings

6. Home Science

Area of Training	Institutions that offer Training
Human Development and Family Studies	
Early childhood education	NCERT, New Delhi; Ryerson Poly-technique Institute, Toronto, Canada
Parent counseling	Tata Institute of Social Science, Mumbai BM Institute, Ahmedabad
Special education for young children	MS University, Baroda, Dyslexia Association, 15, Sambasivam street, Chennai
Guidance and counseling	Tata Institute of Social Science, Mumbai MS University, Baroda Banjara Academy, Bangalore, Ryerson Poly-technique Institute, Toronto
Family assessment techniques	Dept. of Family Studies, TISS, SNDT, Mumbai
Foods and Nutrition	
Food Processing & Value Addition	CFTRI, Mysore, NDRI, Karnal
Dietetics	Hospitals, AIIMS, New Delhi, Nanawati Hospital, Mumbai
Institutional Food Service Management	Institutes of Catering Management, New Delhi, Mumbai
Bakery and Confectionary	Institutes of Catering Management, New Delhi, Mumbai
Food Standards and Quality Control	CFTRI, Mysore, IICT, Hyderabad NIN, Hyderabad
Family Resource Management	
Interior Decoration	Institute of Interior Decoration, New Delhi
Furniture Designing	NID, Ahmedabad National and International Furniture Industry

Area of Training	Institutions that offer Training
Auto-cad	Computer Training Institute
Space Designing	School of Architecture, Mumbai National Building Organization, New Delhi School of Architecture, USA National Research Council on Housing, Ontario, Canada
House Keeping	Hotel Industry and Hotel Management Institutes Institute of Hotel Management, Australia
Management	NAARM, Hyderabad International Centre for Event Marketing, Delhi IRMA, Ahmedabad
Textiles and Apparel Designing	
CAD – Textile Design for woven & printed designs	NID, Ahmedabad LECTRA Systems, Bangalore, TUKA Tech, New Delhi, BTRA, Mumbai
CAD – Pattern Making & Marker making	NITRA, Ghaziabad LECTRA Systems, Bangalore
Apparel manufacturing Technology	NITRA, Ghaziabad, BTRA, Mumbai, IIT, Delhi, C.H.Sc., Hyderabad ,PAU, Ludhiana
Design process, fashion illustrations and portfolio development	C.H.Sc., Hyderabad NID, Ahmedabad
Apparel Industry management	IIM, Ahmedabad, NITRA, Ghaziabad, C.H.Sc., Hyderabad
Home Science Extension & Communication Management	
Video & Multi-Media Production	NAARM, Hyderabad, Institute of Mass Communication, Orissa, Jamia Milia Islamia, New Delhi,
Journalism & Mass Communication	Jamia Milia Islamia, New Delhi, Institute of Mass Communication
Extension Training & Programme Management	MANAGE, Hyderabad, NAARM, Hyderabad, IRMA, Ahmedabad
Entrepreneurship Development and Management	NIESBUD, New Delhi, ECID, Ahmedabad

Agriculture:

- Molecular Breeding and marker assisted selection
- Transgenic development in crop plants
- Micro irrigation
- Recent trends in organic farming
- Seed production process and marketing of Agricultural and Horticultural Crops
- Remote sensing and GIS
- Agro processing – New Trends
- Advances in Food Engineering
- System approach for water resource management
- Animal Nutrition
- Application of IT in Agriculture
- Mushroom cultivation
- Greenhouse Technology
- Integrated Nutrient Management
- Integrated Pest and Disease Management
- Post-harvest Technology and Value Addition

- Bio Informatics
- Diagnostics
- Precision farming
- Protected cultivation
- Hybrid seed production
- Disaster Management
- Crop modeling

Agricultural Engineering

- Fruit and vegetables – Preservation processing and storage
- Agro Processing – New Trends
- RS & GIS applications to water resources
- Systems approach for water resource management
- Computer Aided Designing
- Recent developments in farm machinery and power
- Advances in thermo-chemical gasification
- Food packaging
- Food processing engineering
- Biotechnology in food engineering

Food Technology

- Bakery and confectionary
- Extension products
- Fruit & vegetable processing
- Spices processing
- Food quality standards
- Packaging and value addition

Fisheries

- Fish Biotechnology
- Sea Foods
- Remote Sensing & GIS
- Fish Nutrition
- Processing, Value addition and Packaging of Fish Products
- Fish Product Quality Standards and Certification

Horticulture

- Protected Cultivation
- Post Harvest Processing and Value Addition
- Development of Transgenics for Biotic Stress
- Organic Production of Fruits and Vegetables
- Hybrid Vegetable Seed Production
- Disease and Pest Management in Tomato, Brinjal and Cucurbits
- Drying of Flowers for Export
- Extending Self life and Management of Flowers for Export

Forestry

- Propagation of Elite Forest Trees
- Tissue culture for propagation of Bamboo, Teak etc.

- Wood Processing and Value Addition
- Agroforestry in Environment Protection in Different Agro ecosystems
- Minor Forest Product Utilization through Value Addition
- Forest and Natural Resource Management
- Physiological aspects of Forest Tree Growth and Development

Dairy Technology

- Speciality Foods
- Fluid Milk Processing
- Fermented Dairy Products
- Membrane Processing
- Packaging of Dairy Products
- Energy Auditing and Conservation in Dairying
- Dairy Byproduct Utilization
- Heat Desiccated and Concentrated Dairy Product Development

Veterinary and Animal Sciences

- Marker Assisted selection & Quantitative trait loci
- Identification of genes for disease resistance and breeding
- Gene Transfer and therapy
- Stem Cell research
- Residue assessment in animal products
- Zoonosis
- Teaching/Education Technology
- Vaccinology & Immunology
- Artificial insemination in pet animals
- Molecular marker for disease diagnosis
- Quality Assurance in Education research and services
- Control of Transboundary diseases
- Computer aided teaching technologies and multimedia
- Ultrasonography and Digital imaging
- Laproscopy and arthroscopy
- Planning in Education, Research and Extension (TT) Administration & budgeting
- Critical care and management
- Wild life anesthesia
- Small animal orthopedics
- Feed analytical techniques
- Value addition of livestock products and quality control
- Modern reproductive technology
- Forensic sciences & Toxicological analysis

Performance of teaching faculty: Following guidelines are suggested for assessing performance of teaching faculties

- **Students response:** The best way to judge the performance of the teacher is getting response from students who have been taught. However, looking into cultural milieu and social fabric in India, the response of the students may be skewed because of differences in internal assessment. It is, therefore, suggested that a questionnaire may be given to the students after they have completed the courses in the college. The

questionnaire should specially ask about quality of teaching and the effort made towards teaching improvement. The second method of assessment could be the performance of the students in examination. Third assessment criteria should be based on the quality of research work done and the number of papers published from the thesis in two years time. In case no publication has come from thesis there should be negative scoring. The Committee suggests the following criteria for assessment.

- Performance of the students in examination
- Quality of research as judged by national award like Jawahar Lal Nehru Award, etc.
- Quality of papers published in impact journals out of thesis under guidance.
- Award won by faculty
- Development of instructional material and its quality
- Communication skills and interest in participation in various co-curricular activities including games and sports.
- Discipline and punctuality
- Participation in seminars of students
- Number of lectures taken
- Efforts made for skill transfer to students.

6. REFORMS IN GOVERNANCE OF SAUs

With a view to provide common base for establishment and academic governance of the SAUs, ICAR brought out first Model Act in 1966 which was revised in 1984 and again in 1994. The basic premise underlying development of Model Act has been bringing uniformity in the Acts for the establishment of SAUs and ensuring good governance through established structures for managing and coordinating education, research and extension education. Despite having common Model Act, different states developed Acts for their SAUs at striking variance with the model Act mainly because agricultural education is not on the concurrent list. These deviations primarily relate to the appointment of Vice Chancellors, constitution of Board of Management, Academic Council etc. In fact in some of the States politicians or bureaucrats dominate Board of Management and as a consequence autonomous functioning of SAUs is impinged. Since ICAR does not have statutory authority to regulate agricultural education it does not have much say in enforcing the provision of the Model Act. In addition as a consequence ICAR is not in a position to even enforce norms and standards for quality education and institutions keep on mushrooming both horizontally and vertically.

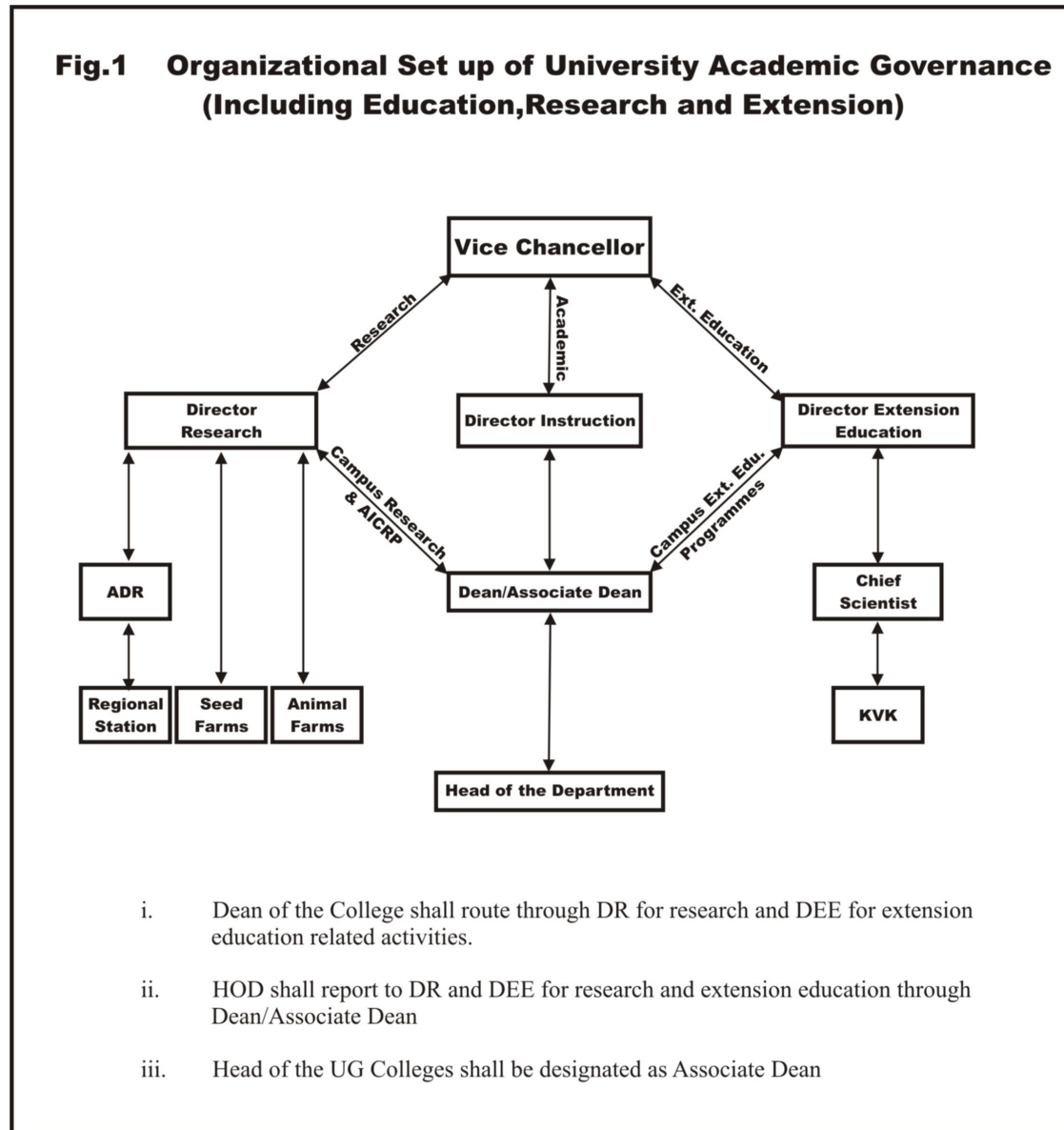
The Committee therefore recommends that the ICAR be vested with the statutory powers to regulate agricultural education for quality assurance. Such a step will go a long way in ensuring relevance and quality of education in addition to soundness and vibrancy of the national agricultural education system.

Efficient governance in SAUs holds key to accelerate quality improvements in Education, Research and Extension. SAUs and other institutions are facing new challenges in the wake of globalization and competitiveness. The developments in information technology necessitate relook at the way universities are managed. We need to reduce bureaucratic delays, ensure that the faculty gets an environment, which allows the blossoming of their talent. For this, universities will have to move towards e- governance. At national level support need to be provided through NAIP for development of software packages for administration and finance management across NARS institutions. Some recommendations made for bringing reforms in governance are as under.

Integration of Teaching, Research and Extension: To oversee the integration of teaching, research and extension at the college level the Committee recommends the constitution of Coordination Committee consisting of Director of Instruction (Chairman), Director Research, Director Extension Education Dean and Heads of the department of the college.

In SAUs, there is trinity of functions viz. education research and extension Education and every faculty member must perform at least two of the three functions. Every faculty borne on teaching cadre should devote 30% of the time in an academic year for undertaking research and or extension education apart from teaching. Likewise a faculty borne on research and extension education cadre should spend 30% of their time in teaching or extension education or research as the case may be. Dean / Associate Dean must take a minimum of 32 lectures in a year while all Directors should take 16 lectures per year of a regular academic programme.

In order to effectively bring integration between teaching, research and extension and effective academic governance the flow chart (Fig. 1) depict organizational set up. Some additional responsibilities have also been defined in order to bring vibrancy to the system.



Duties of Director Instructions

- Chairman academic coordination committee for teaching, research and extension education.
- Co-ordination & integration of academic programme including admissions of UG and PG and management and control of external examinations at UG and PG level
- Member Secretary of Academic Council and all other functions prescribed in the Model Act.

Duties of Dean

- Chairman of Faculty / Board of Studies, Management of all campus academic programmes (including PG education, campus research and extension education)

Composition of Statutory Academic (including research and extension education) authorities is as under

Composition	Academic Council	Research Council	Extension Education Council
Chairman	Vice Chancellor	Vice Chancellor	Vice Chancellor
Member Secretary	Director of Instruction	Director Research	Director Extension
Ex-officio Members	Director research and Director Extension Education	Director Instruction and Director Extension Education	Director Instruction and Director Research
Other Members	As per Model Act	As per Model Act	As per Model Act

Delegation of Powers: Despite the fact that under AHRD as well as under NATP efforts were made for delegation of powers and empowerment at various levels, the success has been limited. This is mainly because change is a must but change is difficult. It requires change of mind set. The Committee strongly recommends full delegation of powers in university hierarchical system. Once the budget is allotted, Deans and Directors should have full powers to sanction recurring and non-recurring expenditure. Even Head of the Department should also be delegated powers upto Rs. 25,000/- each. Chief scientists of KVK should enjoy same powers as enjoyed by Heads of Department. Principal Investigators of the research schemes be delegated full powers in respect of their scheme (project) budget. Heads of Departments / Chief Scientists should have powers to depute their staff for training where there is no expenditure involved by SAU. Deans of the colleges should have powers upto the HRD budget available for deputing scientist under faculty competence improvement programmes. Tour programmes of the scientists in department as well as KVK be approved by Head or Chief Scientist or PI for the staff working under them. Of course with the delegation every one need to follow the defined rules. It is also equally important that procurement rules be revisited so as to make it project performance friendly, avoid implementation delays, promote efficiency and work performance. Authority with accountability should be the yardstick at all levels.

Financial Health: During the early phase of establishment of state agricultural universities funding from state and center was liberal and that helped development of excellent infrastructure in terms of laboratory facilities, equipments, library, research farms and sports facilities. Additionally Central Govt. provided funds for training of the faculty in the best universities overseas. This contributed to the competence of the faculty and resulted in quality assurance. However, with passage of time the number of state agricultural universities has increased whereas the budgetary allocation did not increase proportionately resulting in decline in funding and most universities are now facing acute financial crunch. With the implementation of Fifth Pay Commission recommendations the situation turned from bad to worse in respect of operational support. Today almost in all SAUs about 80-85% of the budget goes towards salary and other establishment costs. The ICAR share also has dwindled and varied from 33% in V Plan to almost 9% in VIII Plan. The situation has improved some

what in IX and X Plan but is still far from ideal. With the severe resource crunch there is hardly any support available specially from state budget towards contingency and maintenance and what to talk of state of the art facilities. The stark reality is that in all SAUs 25-30% posts are not filled on account of squeeze in budget and this has seriously impacted quality of instruction. The Committee therefore recommends proactive role for ICAR in bringing message home to the states that agricultural universities need to be funded liberally for agricultural development in their state. ICAR on its part should support SAUs liberally for curriculum delivery, updation of faculty competence, library upgradation, networking, procurement of the state of art equipments in new and emerging areas, infrastructure for student and faculty amenities, faculty exchange and vocational education programmes. With the limited possibility of any increase in the allocation by respective states, development funds under ICAR Plan need to be provided for modernization of laboratories, class rooms, library strengthening, access to information, equipments, faculty training and exchange etc.

Movement of Faculty: Despite the efforts made under AHRD project from 1996 to 2000, there has been practically no faculty exchange or movement of faculty across universities. In order to share the experiences and effect improvement it is essential that a system is developed for the exchange of faculty by making Sabbatical leave and Visiting Scientists Schemes more attractive. It is recommended that the honorarium under Sabbatical Leave scheme be raised to Rs. 20,000/- per month. ICAR need to make provisions for the same under developmental grant for allowing at least four visiting scientists per university.

Linkages

ICAR Institutes: In 1997 under the joint meeting of Vice chancellors of SAUs and Directors of ICAR Institutes it was resolved that Scientists of ICAR institutes after due accreditation by the academic bodies of SAUs will be taken on faculty and be eligible for guidance of Ph.D. students as co-Chairman. Facility at ICAR institutes will be open for such students research. While some SAUs have taken benefit it has not been formalized in most cases. Therefore the Committee recommends that it should be mandatory for each SAU to have linkages with at least one ICAR Institute for joint research guidance. Similarly it should be made mandatory for each ICAR Institute to have linkage with at least one SAU depending upon commonality of research thrust, geographic location and faculty capability for guidance and facilities for research. For the students who move for joint research to ICAR Institutions contingency grant of Rs. 15,000/- be additionally provided per annum per student.

Private Institutions, General Universities and IITs: Over the years India has developed sound educational system, which in the last decade or so has shown fatigue and decline largely due to financial constraints, poor governance and lack of partnership and linkages with institutions. Era of individual research has given way to teamwork. Globally institutions are partnering and institutions under NARS are no exception. In order to capitalize on the strength, which exists among private R&D institutions, IITs and general universities, it is necessary to open a dialogue with national institutions and private R&D institutions, which have proven track record. In fact, the quality of our education programmes will improve substantially with such a linkage. The major question is how to operationalise? In this regard SAUs must change their policy and aggressively initiate dialogue with institutions, outside NARS, which have proven national and international standing. This would be mutually rewarding. For SAUs, which open such a dialogue and sign MOU for effective quality improvement, a provision of Rs. 10 lakh is recommended under development grant. A national level committee consisting of DDG Education as Chairman, one Vice Chancellor, one Director of DU, one representative from reputed private R&D

institute and ADG accreditation as Member secretary be constituted to work out the modalities.

Overseas Universities: During the early phase of SAUs establishment there was tie up with land grant universities in USA which helped tremendously not only in establishment of integrated education, research and extension education programmes but also in development of skilled faculty which was instrumental in successful implementation of the new initiative. There is a need once again to have such a tie up and linkage for major rejuvenation of our agricultural education taking advantage of Indo-US Knowledge Initiative and National Agricultural Innovation Project. ICAR need to help in operationalisation of this which the Committee considers most crucial for leap fogging. To begin with, the collaboration can be in the specialized areas like biotechnology, processing and value addition, water management, integrated natural resource management and development of curriculum and delivery. The collaboration should not only be in respect of joint research work but also exploring the possibility of sandwich post graduate programmes leading to Ph.D degree as also post doctoral research. Cornell University, Michigan State University, University of California, Davis, Ohio State University, A&M Texas University and California State University could be considered for linkages. From Indian side in the first phase Universities which were established upto 1965 be included and in the second phase remaining Universities be made partner for this joint programme.

Line departments of State Governments: Despite the fact that country has developed excellent national agriculture education research and extension education system, the linkage between NARS and line department is weak and varies from state to state. In order to have the major impact of the initiatives taken under NARS system it is necessary to develop a mechanism of continuous dialogue and synergy among SAUs, ICAR institute and line departments of the states. It is true that SAUs have been established to develop region specific technologies, yet there are ICAR institutes in almost all disciplines, which have strength for excellence in research and development of technology, which could be boom for different regions. Presently the mechanism of Regional Committee meeting is too institutionalized and there is a gap in communication and adoption of technology. It is recommended that the mechanism be developed for regularly holding at least two meetings in a year at state level for bringing together SAUs, ICAR institutes and line-departments in the state. In these meetings the representation of ICAR should not only be of the institute level but also from ICAR head quarter. With this there will be synergy and complementation in the efforts of the three major institutions.

Faculty Recruitment

Entry level: The essential requirement of NET for entry-level post in teaching is again emphasized. In addition Ph.D. be made as essential requirement for recruitment at entry level, except for Veterinary and Technology disciplines, where Master degree holders may be considered eligible till the time Ph.D. degree holders are available in sufficient numbers. For posts funded 100% by ICAR, no permission be required from States for filling and this be made part of MOU.

Higher level: All management positions should be filled laterally by open competition on tenurial basis initially for 5 years, extendable for another two terms based on transparent assessment of their work performance. To attract outside candidates the parent university should have provision to maintain lien for substantive posts of concerned employees.

For national integration and reducing current extensive inbreeding, the Committee strongly recommends recruitment of at least 15% of the posts at entry level on the basis of open national selection from outside the state. This condition be made mandatory for appointments from 2007 for receiving full development grant from ICAR. Faculty joining from outside should be given full benefit of transfer of service including post retriial benefits.

Honorary, Adjunct & Visiting Professorship: The faculty competence is the determining factor for quality assurance. With the freeze on faculty recruitment over the years, quality faculty is not available in many institutions. To overcome this, it is essential that at National level the scheme for Honoary, Adjunct & Visiting Professorship be developed and adopted SAUs need to identify the outstanding teachers, researchers, and R&D managers with proven track record and invite them to join University as Honorary / Adjunct Professor. The only condition should be to deliver at least 20 lectures per annum for continuance. For initiating this programme each SAU / DU be provided annual support of Rs. 10 lakh for meeting TA / DA & honorarium. Such experts could be requested to come twice in a year with local hospitality and office facility to be provided by the University. The details of the scheme could be worked out by Accreditation Section of Education Division by involvement of concerned Sectoral Committee of the Accreditation Board.

Information Technology: India has emerged as world leader in Information Technology. ICAR has also invested considerably under NARP & NATP to develop connectivity. IT can make substantial difference in curriculum delivery and quality of instruction. The entire system could take advantage of pockets of excellence that exist among our Universities. The Committee recommends providing at least 2 Mbp connectivity to each SAU and major institutes of ICAR with separate transponder and dedicated servers for information storage, sharing, retrieval and management. Each SAU also should have video conferencing facility with up link to a common control system. It would also be used for effective and quicker communication of technologies to different clientele. Development of content and sharing will help substantially skill upgradation. IT could lead to improved governance efficiency and make the system more responsive to the needs and aspirations of different stakeholders

HRD & HRM: HRD & HRM are important not only for bringing efficiency in the organization but also for qualitative improvement in education. The HRD should consist of training need assessment, developing action plan for training and impact assessment. It is proposed that each faculty member including management position incumbents should undergo compulsory need based need based training programme / workshop (Asst. Prof. 21 days, Assoc. Prof. 10-14 days, Heads & equivalent 7 days, Deans / Directors 3-5 days and a two day retreat for VC/DU-Directors). Such trainings are considered necessary and should be undergone for the release of annual increment once in five years. For this necessary budget provision be made. Committee recommends that 10% of the total budget of Education Division be earmarked for HRD / HRM. This should include exposure visits / training overseas in new and emerging areas to bridge technology gap and acquaintance with latest technological developments in the field.

The Committee is of the strong view that ICAR should accord priority in bringing amendment / modification / addition to the Model Act of (1994).

SUMMARY INFORMATION ON AGRICULTURAL UNIVERSITIES

<i>Sr.</i>	<i>State/University</i>	Year of Establish- ment	Faculty/ Colleges (No.)	Current Intake Capacity	Sanctioned Faculty Strength
State Agricultural Universities					
Andhra Pradesh					
1	Acharya N.G. Ranga Agricultural University, Hyderabad	1964	10	959	786
2	Sri Venkateswara Veterinary University, Tirupati	2006	3	278	452
Assam					
3	Assam Agricultural University, Jorhat	1969	6	759	627
Bihar					
4	Rajendra Agricultural University, Pusa	1971	6	417	887
Chattisgarh					
5	Indira Gandhi Krishi Viswavidyalaya , Raipur	1987	6	2074	407
Gujarat					
6	Anand Agricultural University, Anand	2003	3	274	307
7	Junagadh Agricultural University, Junagadh	2003	3	327	235
8	Navsari Agricultural University, Navsari	2003	2	280	145
9	Sardarkrushinagar-Dantiwada Agricultural Univeristy, Banaskantha	2003	3	240	225
Haryana					
10	Chaudhary Charan Singh Haryana Agricultural University, Hisar	1970	7	633	934
Himachal Pradesh					
11	Chaudhary Sarwan Kumar Krishi Viswavidyalaya, Palampur	1978	4	337	359
12	Dr. Yashwant Singh Parmar University of Horticulture & Forestry, Solan	1985	2	178	248
Jammu & Kashmir					
13	Sher-E-Kashmir University of Agricultural Sciences & Technology, Srinagar	1982	3	222	354
14	Sher-E-Kashmir University of Agricultural Sciences & Technology, Jammu	1999	1	206	212
Jharkhand					
15	Birsa Agricultural University, Ranchi	1982	4	304	246

<i>Sr.</i>	<i>State/University</i>	<i>Year of Establish-ment</i>	<i>Faculty/ Colleges (No.)</i>	<i>Current Intake Capacity</i>	<i>Sanctioned Faculty Strength</i>
Karnataka					
16	University of Agricultural Sciences, Bangalore	1965	3	745	423
17	University of Agricultural Sciences, Dharwad	1986	7	2718	373
18	Karnataka University of Animal and Fisheries Sciences, Bidar	2005	3	220	316
Kerala					
19	Kerala Agricultural University, Thrissur	1972	10	689	722
Madhya Pradesh					
20	Jawaharlal Nehru Krishi Viswavidyalaya, Jabalpur	1964	11	1654	724
Maharashtra					
21	Mahatma Phule Krishi Vidyapeeth, Rahuri	1969	5	841	580
22	Dr. Punjabrao Deshmukh Krishi Vidyapeeth, Akola	1969	6	706	272
23	Dr Balasaheb Sawant Konkan Krishi Vidyapeeth, Dapoli	1972	6	430	249
24	Marathwada Agricultural University, Parbhani	1972	9	790	380
2325	Maharashtra Animal Science & Fisheries University, Nagpur	2000	7	598	233
Orissa					
26	Orissa University of Agriculture & Technology, Bhubaneshwar	1962	7	965	445
Punjab					
27	Punjab Agricultural University, Ludhiana	1963	4	730	1076
28	Guru Angad Dev University of Veterinary and Animal Science, Ludhiana	2006	1	72	229
Rajasthan					
29	Rajasthan Agricultural University, Bikaner	1963	5	880	471
30	Maharana Pratap University of Agriculture & Technology, Udaipur	1999	6	582	342
Tamil Nadu					
31	Tamil Nadu Agricultural University, Coimbatore	1971	10	1033	919
32	Tamil Nadu Veterinary & Animal Science University, Chennai	1989	3	513	439

<i>Sr.</i>	<i>State/University</i>	Year of Establish-ment	Faculty/ Colleges (No.)	Current Intake Capacity	Sanctioned Faculty Strength
	Uttaranchal				
33	Govind Ballabh Pant University of Agriculture & Technology, Pantnagar	1960	10	1293	711
	Uttar Pradesh				
34	Chandra Shekhar Azad University of Agriculture & Technology, Kanpur	1975	3	705	320
35	Narendra Dev University of Agriculture & Technology, Faizabad	1975	4	1014	407
36	Sardar Ballabh Bhai Patel University of Agriculture & Technology, Meerut	2000	3	192	147
37	UP Pandit Deen Dayal Upadhyaya Pashu Chikitsa Vigyan Viswavidyalaya evam Go Anusandhan Sansthan, Mathura	2001	3	550	44
	West Bengal				
38	Bidhan Chandra Krishi Viswavidyalaya, Mohanpur	1974	3	442	271
39	West Bengal University of Animal & Fishery Sciences, Kolkata	1995	1	454	81
40	Uttar Banga Krishi Viswavidyalaya, Cooch Behar	2001	1	124	105
	Central Agricultural University				
1	Central Agricultural University, Imphal	1993	5	698	111
	Deemed Universities				
1	Indian Agricultural Research Institute, New Delhi	1958	1	166	478
2	Indian Veterinary Research Institute, Izatnagar	1984	1	144	269
3	National Dairy Research Institute, Karnal	1989	1	188	181
4	Central Institute of Fisheries Education, Mumbai	1989	1	65	54
5	Allahabad Agricultural Institute, Allahabad	2000	5	894	118
	Central Universities				
1	Vishva-Bharati , Sriniketan	1901	1	78	42
2	Banaras Hindu University, Varanasi	1916	1	303	81
3	Aligarh Muslim University, Aligarh	1920	1	40	22
4	Nagaland University, Medziphema	1994	1	115	56

ANNEXURE IIA**INDIAN COUNCIL OF AGRICULTURAL RESEARCH
KRISHI ANUSANDHAN BHAVAN II, NEW DELHI 110 012**

F.NO. 24(1)/05-ACDN./EDN.

DATED THE FEBRUARY, 2005

OFFICE ORDER

The competent authority is pleased to constitute a committee comprising of the following experts:-

(i)	Dr. S.L.Mehta Vice Chancellor Maharana Pratap Agricultural University Udaipur-313001	Chairman
(ii)	Dr. S.N.Puri Vice Chancellor Central Agricultural University, P.O. Box 23 Imphal-795004	Member (Agriculture)
(iii)	Shri M.K.Miglani Vice Chancellor CCS Haryana Agricultural University, Hisar-125004	Member (Agriculture)
(iv)	Dr. N.L.Maurya Director Resident Instruction University of Agricultural Sciences Dharwad-560065	Member (Agricultural Engineering)
(v)	Dr. Jagmohan Singh Vice Chancellor CSK Himachal Pradesh Krishi Vishvavidyalaya, Palampur-176 062	Member (Horticulture)
(vi)	Dr. S.S.Kadam Director of Research Mahatma Phule Krishi Vidyapeeth, Rahuri-413722	Member (Food Sciences & Techn.)
(vii)	Dr. J.S.Bhatia Ex-ADG (EPD) D-204, Malviya Nagar, Jaipur-302017	Member (Veterinary & Animal Science)
(viii)	Dr. M.P.S. Kohli Joint Director Central Institute of Fisheries Education Versova, Mumbai-400061	Member, Fisheries Science
(ix)	Dr. M.C. Nautiyal Dean, College of Forestry & Hill Agriculture G.B. Pant University of Agriculture & Technology Ranchauri-249199	Member (Forestry)

(x)	Dr. (Mrs.) Pushpa Gupta Dean, College of Home Science Maharana Pratap University of Agricultural & Technology, Udaipur-313001	Member (Home Science)
(xi)	Dr. N.Balaraman Vice Chancellor Tamil Nadu Veterinary & Animal Science University Chennai-600051	Member (Dairy Technology)
(xii)	ADG (Accreditation) ICAR, New Delhi 110 012	Member Secretary

The terms of Reference of the committee are as under:-

- (I) Defining UG & PG degrees for general market needs and for specialist jobs and uniformity in UG and PG degree nomenclature
- (II) Restructuring of UG programmes for increased practical and practice contents.
- (III) Central assistance for strengthening of higher agricultural education
- (IV) Guidelines for assessing training needs and performance of teaching faculties.
- (V) Reforms in governance of SAUs

The Committee will meet as per convenience of the Chairman and submit its report at the earliest. The Chairman and the members will be entitled to the sitting fee, T.A./D/A/ etc. as per standing Rules of the Government of India, I.C.A.R.

(Sodhi Singh)
Deputy Secretary (Edn.)

Distribution

- (I) The Chairman and Members of the Committee
- (II) The Sr. P.P.S. to the D.G., I.C.A.R.
- (III) The P.S. to the D.D.G. (Edn.)
- (IV) Spare copies-5.



**n Council of Agricultural Research
ni Anusandhan Bhavan II
Delhi 110 012 (India)**

F. No.: 24(1)/2005-Acdn./Edn.

Dated: May 17, 2005

Office Order

In continuation to Office Order of even number dated February 8, 2005, the Competent Authority is pleased to approve the following expert to serve on the Deans Committee.

Dr. S.P. Tiwari, Director, National Academy of Agricultural Research Management, Hyderabad-500030.	Member (Management)
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The Terms of Reference of the Committee are as under: -

- (i) Defining UG & PG degrees for general market needs and for specialist jobs uniformity in UG and PG degree nomenclature.
- (ii) Restructuring of UG programmes for increased practical and practice contents.
- (iii) Central assistance for strengthening of higher agricultural education.
- (iv) Guidelines for assessing training needs and performance of teaching faculties.
- (v) Reforms in governance of SAUs.

The Committee will meet as per convenience of the Chairman and submit its report at the earliest. The Chairman and the members will be entitled to the sitting fee, TA/DA etc. as per standing Rules of the Government of India, ICAR.

(Sodhi Singh)
Deputy Secretary (Edn.)

Distribution :

1. The Chairman and Members of the Committee
2. The Sr. PPS to DG, ICAR.
3. The PS to the DDG (Edn.)
4. Spare copies –5.

**Maharana Patap University of Agriculture and Technology,
University Campus, Udaipur-313001**

**Dr. S.L.Mehta
Vice Chancellor**

Dear Dr

As you may kindly be aware that ICAR has constituted the IV Deans Committee with wide ranging terms of reference. I am enclosing a copy of the office order for your kind perusal. The Committee has primarily been constituted for addressing emerging issues and challenges concerning higher agricultural education in the light of globalization and operationalization of new provisions of WTO. There are serious concerns about the quality of graduates passing out in terms of their skill and entrepreneurship to meet new challenges. This is an opportunity, which we should utilize to reorient agricultural education as also to put in motion steps needed for strengthening higher agricultural education for quality assurance. Reforms in governance in SAUs are also overdue. We need to articulate requirements of the system so that aspirations of the stakeholders are met. The Committee in its first meeting in New Delhi decided that the entire exercise should be initiated initially at the University level. It is for this reason, I am requesting you to kindly have the input finalized at the University level. We would depend heavily on the wisdom that exists in Universities in drafting recommendations. I am enclosing a brief note on what needs to be done at the University level so that the input could directly be used by the IV Deans Committee.

There after propose to organize three day meetings, discipline-wise where all the Deans of the concerned faculty would be invited along with other stakeholders of the system. I know that you are extremely busy but I also know equally well that you are concerned and committed to bring about academic excellence in various programmes. I shall, therefore, be grateful if you would kindly take personal interest in the deliberations being organized at University level. I also request you to kindly inform us in advance the date of meetings you will organize so that one of the members of the Committee also joins you. For the discussion at the University level kindly involve the faculty, invite some distinguished alumni, representatives from the concerned industry, elite farmers, personnel from concerned State department and any other person you feel would contribute. Kindly designate the Dean of each faculty to undertake this exercise. The expenditure relating to organization of these meetings could be booked under the Development grant provided by the Education Division.

I am looking forward to having your input within next 3 to 4 weeks.

With kind regards,

Yours sincerely,

(S.L.Mehta)

Encl: As above

Copy to All members of the Fourth Deans Committee

Vice Chancellor

Details regarding holding of meetings relating to revision of Course Curriculum

1. The start point for discussion should be the detailing of skills that our graduates need to possess at the end of the four year programme which will enable them to be competitive in the changed employment and global market scenario.
2. After deciding about the skills we need to move backward in designing the courses that will provide these skills.
3. The details of the programme/courses should match the skill and entrepreneurship development that is expected from our graduates.
4. The skill development should remain the core of the programme.
5. Another major issue to be debated concerns value addition for the additional two years that have been added in under graduate programme. Earlier a student used to get degree in four years after matriculation. Now students spend four years after 10+2. Important question is what is the value addition that the two-year additional programme affords. It is a matter of debate whether under graduate programme should consists of three years of general study including periods spent on RAWA + one year of specialized group courses say for e.g. plant protection, crop production, social sciences, management, basic sciences, etc. This has advantage of producing graduates with some degree of specialization. The era of only generalist may perhaps is over with the demand for specialists. For meeting new market demands it is important that graduates have adequate expertise including some degree of specialization. The other alternative which also need to be deliberated concerns having general courses in agriculture completed in two years time frame and then organize two years of specialization in core areas say 4 to 5 areas. This would ensure that the graduates who come out have adequate exposure and skill to deal with problems for e.g. person specializing in plant protection would know pathology, entomology, nematology, post harvest storage, etc. at a much higher level and with skills that would enable him to be specialist even in private sector. These two options need to be discussed at length and then considered decision taken and once this is done then one could attempt organization of courses at under-graduate level. A general tendency most commonly found in the past in respect of curricular revision is to keep on adding new areas/subjects without really dropping something, which is not so relevant or avoiding overlap. IV Deans Committee is not looking forward to cosmetic changes but a reorientation of the programme in the light of new technological development taking place globally and also taking into account the fact that our agricultural growth rate has declined. The quality of our graduates holds key to reversing this trend and that is the reason why the task becomes most important and critical for all of us.
6. Once the contours are decided, the faculty then could move on to articulate the courses that need to be put in place and define the credit hours for theory and practical.
7. Issues relating to quality assurance are important. We would also like to know from the faculty information about the new infra structure and equipments that need to put in place for the skill based new course programme included. In addition, group should also give recommendation about need assessed training that need to be built.

QUESTIONNAIRE FOR COLLEGES UNDER SAUs

1. Name of the College: _____
 2. Name of the University: _____
 3. Information about the programme:

a) Pattern of degree programme being run in your college

Programme	Year of Starting	Intake

- b) Eligibility for admission
 c) Mode of admission: Entrance test /Merit
 d) Number of students enrolled and number of students graduated in last three years:

Year	No. of students enrolled	No. of students graduated
2002-2003		
2003-2004		
2004-2005		

c) Status of graduates (for last 3 years):

S.No.	Status	No.	Give details
1.	Employed (Specify)		
2.	Self Employed (Specify)		
3.	Higher Studies		
	• M.Sc. Home Science		
	• MA		
	• M.Sc.		
	• MBA		
	• Diploma		
	• Any other (Specify)		
4.	None of the above		

4. Are there adequate job avenues for the graduates? Yes/No
 If no, why?

5. Programme in Non-Agricultural Universities in your state:

- a. Does your state have UG programme in Non-Agricultural Universities?
 Yes/No If yes, number of colleges offering such programme _____
- b. Are these students eligible for M.Sc. in your college? Yes/No
- c. Do you offer them deficiency courses? Yes/No
- d. How much additional time do they take for completing M.Sc. from your College?
- Nil
 - One Semester
 - One year

6. Are our graduates preferred over graduates from Non-SAUs in jobs in universities/ ICAR/Government/NGOs/Industry? Yes/No
If no, Why?

7. Infrastructure facilities available in your college for UG Programme:

S. No.	Infrastructure facilities	Yes	No	Extent of deficiency and support needed
1.	Adequate faculty positions			
2.	Competent faculty specifically for teaching professional courses			
3.	Updated laboratories			
4.	Adequate computer facilities for professional courses			
5.	Modernization library with internet and LAN connectivity			
6.	Adequate Number of classrooms			
7.	Classrooms are equipped with AVAids			
8.	Vehicles			
9.	Adequate budget			
10.	Adequate support from ICAR			
11.	Adequate support from state Govt.			

8. RAWE:

- Duration_____
- Mention how RAWE is being implemented.
- Constraints if any.
- Suggestions to improve.

9. Inplant Training:

- Duration
- Mention how inplant training is being implemented.
- Constraints if any.
- Suggestions to improve.

10. List organizations where students were placed for inplant training since beginning:

S.No.	Discipline	Institution	Local/Outside

11. Has inplant training helped in seeking jobs in the Industries/Organizations? Yes/No
 If yes, specify.

12. Evaluation:

Examination pattern	UG	M.Sc.	Ph.D.
Total Internal			
Total External			
Both (specify proportion)			
Do you have mid term test			
• One			

• Two			
• None			

13. What is the evaluation patter for RAWE and inplant training:

1. RAWE
2. Inplant training

14. Are you following programme/syllabus suggested by ICAR

- Fully
- Partially
- Percentage of deviation and why (Please attach syllabus)

15. Deliberate on following issues in a meeting with faculty, students (alumni) and Stakeholders. Outcomes of the meeting in the form of suggestions including revised syllabus may please be sent.

- (a) How can UG programme be made more effective from the point of view of job prospects and self-employment? Should the programme be of 3+! or 2+2 pattern?
- (b) Which courses are not relevant and can be deleted and in place which new courses need to be added?
- (c) Is there overlapping in contents/courses? If so suggestion for revision be given.
- (d) What competency based skill oriented professional courses should be offered which will have market value? In which areas such specialized courses should be offered? List 3-4 such packages.
- (e) Should RAWE be continued in the present form? Can there be other substitute for RAWE?
- (f) Is implementation of inplant training effective? What modifications you consider necessary?
- (g) What are three important measures to improve quality of instruction?
- (h) What reforms are needed in examination pattern?
- (i) Are changes needed in admission procedure and eligibility for UG programme?

16. Infrastructure needs for new curriculum you suggest.

17. Faculty training you consider necessary with duration and 4-5 institutions.

18. How much Development grant needs to be provided for effective delivery of new curriculum?

MEETINGS CONDUCTED BY THE IV DEANS COMMITTEE

Sr.	Date	Venue	Purpose
1	May 24, 2005	Education Division, ICAR, New Delhi	First meeting for working out modalities to address Terms of Reference of IV Deans Committee
2	Oct. 6-7, 2005	MPUAT, Udaipur	Discussion on Home Science discipline
3	Oct. 26-27, 2006	MPUAT, Udaipur	Development of Template for discussion on degree Programmes
4	Jan. 19-20, 2006	ANGRAU, Hyderabad	Discussion on Agriculture discipline
5	Jan. 27, 2006	MPUAT, Udaipur	Preparation of IV Deans Committee Preliminary Report for placing in the Conference of Agricultural Universities Vice Chancellors held at Pantnagar
6	March 4-5, 2006	MPUAT, Udaipur	Discussion on Food Science & Technology discipline
7	Mar. 10-11, 2006	PAU, Ludhiana	Discussion on Agricultural Engineering discipline
8	April 13-12, 2006	MPUAT, Udaipur	Discussion on Central Assistance for strengthening of Higher Agricultural Education and preparation of template for Committee Report
9	April 26, 2006	TANUVAS, Chennai	Discussion on Veterinary Science requirements discipline
10	Apr. 27-28, 2006	CIFE, Mumbai	Discussion on Fisheries Science discipline
11	May 30-31, 2006	MPUAT, Udaipur	Discussion on Dairy Technology discipline
12	June 19-21, 2006	YSPUHF, Solan	Discussion on Horticulture and Forestry discipline
13	July 21-24, 2006	NAARM, Hyderabad	Preparation of Final Report of the Committee
14	Aug. 03-06, 2006	MPUAT, Udaipur	Synthesis of Report
15	August 08, 2006	Krishi Bhavan, ICAR, New Delhi	Wrap-up meeting of the Committee and submission of the Report