Minimum Standards for Higher Agricultural Education (MSHAE)

Food Science & Technology

Education Division

Indian Council of Agricultural Research

PUSA, New Delhi 110 012

PREFACE

Education Division of the ICAR has taken a praiseworthy initiative to develop Minimum Standards of Higher Agricultural Education in 12 disciplines of agricultural education programmes operational in the country under the patronage of the ICAR. These standards, once in place, will help in the establishment of new college/programme to build up capability/capacity to award quality education in all spheres of agricultural sciences. Delineation of educational standards is pre-requisite for uniformity in streaming educational norms, enforcing academic discipline and quality output of professionals. The standards are required to enable the identification of sub-standard institutions/programmes.

On behalf of the committee, I thank the ICAR for having reposed faith in us in assigning the important academic task of formulating Minimum Standards of Higher Agricultural Education in Food Science & Technology discipline in terms of infrastructure, laboratories/instructional facility, faculty, man-power and other support so as to firm up guidelines for establishing colleges in the field of Food Process Engineering & Technology in Agricultural University / ICAR institutes / Deemed University / MoFPI / AICTE / MHRD etc.

I express my sincere thanks to the members of the committee, namely Dr. T.V. Satyanarayana, Dean (AgrilEngg& Tech), ANGRAU, Hyderabad; Dr. V.S. Shinde, Dean (Agric), MKV, Parbhani; Dr. C.S. Chopra, Head, Department of Food Science & Tech, College of Agriculture, GBPUA&T, Pantnagar and Dr. K.L. Khurana, Principal Scientist, Education Division, ICAR, New Delhi for their immense contribution in finalization of the standard. Also thank to special invitees, namely, Dr. R.K. Jain, Principal, AD Patel Institute of Technology, Anand and Dr. R.F. Sutar, Head, PHE&T, College of Food Processing Tech & Bioenergy (CFPT&BE), AAU; Dr. S.S. Kapdi, Head, BE, CFPT&BE, AAU; Dr. R.V. Prasad, Head, FQA, CFPT&BE, AAU; Dr. H.G. Bhatt, Head, FBM, CFPT&BE, AAU; Dr. H. Pandey, Head, FPT, CFPT&BE, AAU; Dr. A.K. Sharma, Head, FE, CFPT&BE, AAU; Dr. S.H. Akbari, Asso. Prof., PHE&T, CFPT&BE, AAU; Dr. S. Dutta, Asso. Prof., FBM, CFPT&BE, AAU for their valuable expert suggestions and made the task of the committee in framing the Minimum Standards of Higher Agricultural Education in the field of Food Science & Technology discipline.

My special thanks are for university authorities for their encouragement and college faculties support for collecting and consolidating the desired information for making the meeting success.

I wish that from the contemplated temples of quality education in Food processing, qualified human resource is generated that will work on reducing produce losses, value addition, quality food processing, new product development, maintaining plant and processing & product's problems.

(D.C. Joshi)
Chairman
Expert Committee

INTRODUCTION

Advancement of any industry depends upon availability of skilled human resource. Food processing industry is no exception. The industry is in dire need of highly skilled and trained manpower across different levels to handle various operations. The human resource requirements for the food processing units in India vary according to the nature of the industry in which it operates. It is very essential to design and develop a mechanism addressing to the manpower development at different levels of responsibilities. Thus human resource development needs to cover the entire gamut, from basic infrastructure, education, vocational and technical guidance to professional qualifications.

There are plenty of job opportunities for food technologists in the country. They are in demand in the sectors such as grain mills, bakery units, confectionery industry, fruits & vegetables pack houses, canning factories, beverages industries, dehydration industries, frozen foods units, soft drinks factories, packaging industries, distilleries & wineries, dairy industry, equipment manufacturers, R & D centres, regulatory organizations, academic institutions, government departments & ministries, and others.

The academic programmes of graduation as well as post-graduation in different disciplines of Food Science & Technology are available at many universities and institutions. The institutions have been working under different systems such as UGC, MHRD, CSIR, ICAR, SAUs, MoFPI, etc. In India, there are more than 65 institutions offering under graduate (UG) and 34 institutions offering post-graduate (PG) program in the subjects of Food Science & Technology or directly related areas. Out of above, about one-third for UG and two-thirds for PG are in the traditional universities and in science and engineering colleges under UGC/AICTE. Another one-third institutions offering UG degree are under self-financed system, mainly by the engineering colleges. Only about 20 % institutions are under the SAU/ICAR system.

There is a huge gap between the supply and demand of the qualified personnel for the industry. The gap is big particularly for the graduates in the discipline as compared to the post-graduates. In the large processing units and the organised sector, a typical ratio of employment from education level point of view for post-graduate: graduate: diploma/ certificate holder is 1:2:4.

For quality assurance in higher education, it is essential to develop norms and standards for the colleges and the academic programmes being offered by them. The ICAR has appointed different committees to deliberate and recommend the minimum standards required for starting and operating a college under different subjects. The committees are expected to deliberate on the minimum norms and standards for the colleges and give recommendations.

The committee on MSHAE in Food Science & Technology discipline are to work out the minimum standards of higher education in terms of infrastructure, laboratories, field facilities, faculty, man-power and other support so as to firm up the guidelines for establishing a college in the SAUs/DUs/CAUs.

Proceedings of the lCAR Committee Meeting on Minimum Standards of Higher Agricultural Education for Food Science & Technology held at College of Food Processing Technology & Bioenergy, Anand, Gujarat on May 20th – 21th, 2014

The inaugural session of the meeting was chaired by Dr. K B Kathiria, Hon. Vice Chancellor, Anand Agricultural University, Anand.

The following committee members were present:

1. Dr. D.C. Joshi — Chairman
   Dean, Faculty of Food Processing Tech & Bioenergy, AAU, Anand
2. Dr. K.L. Khurana — Member Secretary
   P.S. (EQR) for ADG (EQR), ICAR, New Delhi
3. Dr. T.V. Satyanarayana — Member
   Dean (AgrilEngg& Tech), ANGRAU, Hyderabad
4. Dr. V.S. Shinde — Member
   Asso. Dean (Food Tech), UNMKV, Parbhani
5. Dr. C.S. Chopra — Member
   Head, Department of Food Science & Tech, College of Agriculture, GBPUA&T, Pantnagar

Special Invitees:

1. Dr. R.K. Jain, Principal, ADIT, Anand
2. Dr. R F Sutar, Head, PHE&T, College of Food Processing Tech & Bioenergy, AAU
3. Dr. S SKapdi, Head, BE, College of Food Processing Tech & Bioenergy, AAU
4. Dr. R V Prasad, Head, FQA, College of Food Processing Tech & Bioenergy, AAU
5. Dr. H G Bhatt, Head, FBM, College of Food Processing Tech & Bioenergy, AAU
6. Dr. H Pandey, Head, FPT, College of Food Processing Tech & Bioenergy, AAU
7. Dr. A K Sharma, Head, FE, College of Food Processing Tech & Bioenergy, AAU
8. Dr. S H Akbari, Asso. Prof., PHE&T, College of Food Processing Tech & Bioenergy, AAU
9. Dr. S Dutta, FBM, College of Food Processing Tech & Bioenergy, AAU

Dr. R.F. Sutar, Prof & Head, PHE&T, College of Food Processing Technology & Bioenergy, AAU welcomed and introduced the committee members, university officers and invitees.

Dr. K.L. Khurana elaborated the initiatives taken by ICAR by constituting twelve discipline wise expert committees to work on improving the standards of higher agricultural education in India. He also acknowledged AAU for providing full support in hosting this committee meeting at its campus.

Dr. D C Joshi, Chairman, MSHAE committee for Food Science & Technology briefed the forum about the present status of food industry, employment opportunities, functional distribution of food processing technology professionals currently working in Indian food industry and their education level. He also presented the current scenario of food processing technology education in the country. He stressed upon the demand of human resource with processing skills in the food industry.

Dr. R K Jain, Principal, ADIT, Anand shared his thoughts on the urgent requirement for setting up of minimum standards for higher education for food processing technology in line with the requirement of the industry.

Dr. K.B. Kathiria, Hon Vice Chancellor of AAU also welcomed the committee and acknowledged ICAR for providing opportunity to host this meeting at AAU, Anand. He expected that the two days deliberation will come up with a concrete recommendation, which will be helpful in improving the standards of higher agricultural education in general and food science and technology in particular.

Thereafter, Dr. D C Joshi, initiated the discussion on various agenda items on point by point basis. After detailed deliberations, the Minimum Standards of Higher Agricultural Education in terms of infrastructure, laboratories / field facilities, faculty, man power and other support so as to firm up the guidelines for establishing a college of food science and technology worked out by the committee are enclosed as Annexure – I.

Dr. C.S. Chopra
Member

Dr. V.S. Shinde
Member

Dr. T.V. Satyanarayana
Member

Dr. K. L. Khurana
Member Secretary

Dr. D. C. Joshi
Chairman

Annexure - I

1. Names of the constituent departments of the college

The academic programme should be governed through a separate college having different departments and sections.Looking to the courses and subjects covered, the following can be the departments in the college;

(i) Department of Food Technology
(ii) Department of Food Engineering
(iii) Department of Food Quality Assurance
(iv) Department of Food Processing Plant Operations
(v) Department of Food Business Management

In addition to above, the college can have a few more related departments / sections (optional) such asDepartment of Post Harvest Technology, Department of Basic Sciences, Humanities & Engineering, Department of Bio Energy, Food Testing & Analytical Laboratory (NABL accredited), Technology Transfer / Consultancy Cell, Training & Placement Cell and others.

2. Degree nomenclature

Keeping in view the wide opportunities available worldwide, the names of the degrees recommended are;

UG program : B.Tech (Food Process Engineering & Technology)

PG program: M.Tech & Ph. D (Food Process Engineering & Technology) with specializations in Food Technology, Food Engineering, Food Quality Assurance and others depending upon the facilities and faculty available.

3. System of education and program duration

Formal education with semester and credits system through English medium involving theory and practicals is recommended.

B Tech program : Minimum 8 semesters (4 academic years) after 10+2 or
Minimum 6 semesters (3 academic years) after 10+3(Lateral entry for diploma holders).

M Tech program: Minimum 4 semesters (2 academic years)

Ph D program : Minimum 6 semesters (3 academic years)

The semester should be of minimum duration of 110 working days.

4. Eligibility criteria for admissions

The present criteria for UG admissions having 10+2 higher secondary pass with PCM/PCMB subjects can remain unchanged. Lateral admission for diploma holders (10+3) in relevant fields may be considered in the second year. Similarly, for the admissions to the master's degree, the bachelor degree in the relevant faculty should be considered.

5. Intake capacity

A normal intake of 40 students per yearshould be ideal for under graduate program. However, the Universities will be at liberty to enhance intake up to maximum 60 subject to the availability of human resources, equipment, facilities, etc.

The intake of the PG programmes should be commensurate with the availability of qualified faculty, laboratories and research facilities.

6. Manpower requirements

- The college may be headed by a Dean/Assoc Dean/Principal.
- Each department be headed by a Head of Department normally professor but not below the rank of Associate Professor.
- In deciding manpower norms, the characteristic feature of SAUs has been taken into consideration. This relates to trinity of function (teaching, research and extension education) where every faculty member has to be involved in more than one function.
- Actual faculty needs of a college/department should be based on the academic programs and student strength.

The total minimum manpower requirement of a college is sub-divided into following three categories;

A. Administrative and support staff

Office	Position	Number	Remarks
Dean / Principal	Administrative-cum-Accounts Officer or equivalent	1	
	Office Superintendent	1	
	PA to Dean/Principal	1	
	Senior Clerk	4	1 Administration, 1 Establishment , 1 Accounts& 1 Academic
	Junior Clerk	5	1 Administration, 1 Establishment , 1 Examination, 1 Accounts& 1 T&P
	Store keeper	1	
	Attendant	1	
	Messenger	2	

	Driver	2	1 for Light vehicle, 1for Heavy vehicle
Hostel	Hostel Warden	1	nominated faculty member
	Hostel Assistant Warden	2	Full time, 1 Male & 1 Female
	Hostel attendant	4	2 Male &2 Female
	Hostel clerk	2	1 Male & 1 Female
Students Welfare	Physical Instructor	2	1 Male & 1 Female
	Sports Assistant	3	1 Indoor; 1 Outdoor; 1 Gymnasium
	Training & Placement Officer	1	(nominated faculty member)

Note: Medical/health facilities, security, housekeeping, maintenance and other services wherever possible could be outsourced or should be made available from the existing university setup.

B. Library

Library facilities will be needed to support, encourage, and stimulate independent study and research by both students and faculty. There should be a central library located centrally on the campus for the convenience of students, teachers and scientists. Colleges should have a separate library. The facility should have sufficient text & reference books, journals, magazines, internet access and e-library. Library must offer sufficient day-to-day management space for required stacking, printing and photocopying, reading, etc. The minimum staff for the college library should be;

Designation	Number
Assistant Librarian	1
Library Assistants	2
Clerk	1
Shelf Assistants	2

C. Department wise faculty & supporting staff

Department	Faculty			Supporting staff				
	Prof-cum-Head	Asso Professor	Assistant Professor	Office Assistant/ PA	Clerk	Messenger	Lab Technician	Lab Attendant
FT	1	2+1*	5+1*	1	1	1	5	2
FE	1	2+1*	5+6*	1	1	1	3+3*+3**	3
FQA	1	2	5+2*	1	1	1	3	2
FPO	1	2	4	1	1	1	2+6***	6
FBM	1	2	4+4*	1	1	1	2	2
Total	5	10+2*	23+13*	5	5	5	27	15

* For associated subjects such as English, Mathematics/Statistics, Chemistry, Agriculture, Post Harvest Technology, Mech. Engg., Electrical Engg., Electronics & Instrumentation, CivilEngg, Bio Energy etc.

** ITI trade man such as turner, fitter & welder.

*** Plant operators including boiler operator, refrigeration plant operator, mechanic, electrician, etc.

7. Faculty Expertise

Department	Faculty Expertise	
	Core	Associated
Food Technology	Food Technology	• Dairy Technology • Livestock Products Technology • Post Harvest Technology
Food Engineering	Food Engineering	• Mechanical Engineering • Electrical Engineering • Instrumentation & Process Control Engineering • Civil Engineering • Electronics Engineering • Bioenergy/Environment/industrial Engineering
Food Quality Assurance	• Food Quality Assurance • Food Chemistry • Food Microbiology • Food Biotechnology	• Biochemistry • Analytical Chemistry
Food Processing Plant Operations	• Food Technology • Food Engineering	• Food Chemistry • Food Microbiology • Food Business Management
Food Business Management	• Food Business Management • Project Management • Operations Management	• Computer Science & Engineering • English Language • Mathematics/Statistics • Agricultural Science

- Minimum qualification for faculty recruitment be as notified by the ICAR from time to time. All the vacancies shall be filled by open competition and NET, whereever available, should be compulsory for recruitment at Assistant Professor and equivalent level.
- The condition of minimum two publications in NAAS rated journals may be replaced with two publications in reputed journal, because very few number of journals in this disciplines are having NAAS rating.

8. Laboratories

The following can be the nomenclature of the teaching laboratories;

Sr.	Name of Department	Name of Laboratory
1	Food Technology	Food Processing Technology Lab Food Product Development Lab Packaging Technology Lab Post Harvest Technology Lab Sensory Lab
2	Food Engineering	Thermal engineering Lab Fluid Mechanics Lab Electrical, electronics & process control lab Workshop Food Process Engineering Lab Engineering Properties Lab Storage Engineering Lab Environment & Bio Energy Lab
3	Food Quality Assurance	Food Chemistry Lab Food Microbiology Lab Food Biotechnology Lab
4	Food Processing Plant Operation	Experiential Learning Units / Pilot plants / Incubation center
5	Food Business Management	Language Lab Computer Lab Training and technology demonstration Lab

9. Hands on training/instructional processing facility:

Area specific working pilot-plant facilities should be available to have hand on practice of principles of unit operations, product processing and unit processes involved in food processing technology. This facility will be essential for the experiential learning courses of the degree program besides for use as PG researchfacility. This should also serve as incubation center for the prospective entrepreneurs in the region for food processing.

10. National Accreditation Board for Laboratory (NABL) accredited food testing laboratory

The exposure of the students to the commercial sample testing in the industrial environment is essential. A separate food quality testing laboratory duly accredited by NABL should be the integral part of the college / university.The laboratory should be appropriately equipped with sophisticated instruments needed for food analysis as per the national food standards.The necessary infrastructure including floor space and equipment should be created. The lab should be manned as under

Sr	Designation	Number
1	Professor (Quality management)	1

2	Associate Professor (Technical management)	1
3	Assistant Professor (Chemistry, Microbiology, Biotechnology)	3
4	Laboratory technician	5
5	Laboratory attendant	2
6	Store keeper / clerk	2

11. Land requirement

Adequate land for constructing offices, departments, laboratories, pilot plants, hostels and other necessary infrastructure will be required. Minimum 5 ha land will be needed. Additional land will be needed for research projects etc.

12. Floor space requirement

Sr.	Description	Number	Dimension/Remarks
1	Dean/Principal office	01	20'x40'
2	Main administrative office	01	20'x40'
3	Head of department	07 (one for each department)	15'x 20' each
4	Dept. Admin. Office	07	15'x20'
5	Faculty room	-	10'x12' each faculty
6	UG smart class room	04	Sitting capacity of 60
7	PG smart class room	As per requirement	
8	Examination hall	02	Sitting capacity of 120
9	Food technology information center		
10	Laboratories	20	30'x40' each
11	Workshop	01	40x60’
12	Cold Storage	01	20’x20’
13	Drawing hall	01	40'x60'
14	Seminar room	01	Sitting capacity of 150
15	Meeting room	01	Sitting capacity of 50
16	Common room for students	02	15'x 20' each
17	Auditorium	01	Sitting capacity of 400
18	Store room	02+05(for dept)	15'x 20' each
19	NCC/NSS office	01	15'x 20' each
20	Library	01	-
21	ELP Building	01	As per the requirement of pilot plants
22	NABL Food Testing Lab	01	As per the requirement
23	Gymnasium, indoor games	01	-
24	Canteen	01	-
25	Toilets	02 sets (one each for Ladies/ Gents)	At every wing/floor
26	Parking space	As per requirement	For college and hostels
27	Hostel	2	1 for Boys (150 residents)

			1 for Girls (150 residents)
28	DG set shed	As per requirement	

13. Funds

The degree program will preferably be administered by an independent administrative unit, a separate organized college with an identifiable budget that can adequately sustain a quality academic activity.

Sufficient stipend should also be paid to the students during in-plant training.

14. Equipment/ Instrument

The college should be equipped with modern instruments, equipment, machinery and other necessary items as listed in Annexure-II.

15. General strategies for development of Human Resource in Food Processing

a) To achieve the demand of the technical manpower for the Food Industry, it is imperative that the necessary support infrastructure for human resource development is in place and the competent and relevantly trained manpower is made available.

b) As various statutory bodies (UGC, AICTE, CSIR, ICAR, IIT, NIT) and different ministries (MHRD, Agri& Coop, MoFPI, MST) are involved in imparting education in the areas directly related to Food Science & Technology, the committee is of the view that a common apex / nodal body be formed, for example, All India Council for Education & Research in Food Processing. ICAR should initiate necessary action in this regard.

Such an apex body can act as central monitoring agency for all institutions across the country and be given mandate of establishing and enforcing minimum standards of higher education so as to generate competent human resource for the important field having direct relevance to human health and food security. The apex body can also play important role in streamlining Research & Development in Food Processing. The body will also collaborate with agri-research institutions.

c) The shortage of Production, Quality and R&D specialists is one of the major bottlenecks hampering the food processing industry, and therefore the government should immediately create a roadmap revising the curriculum and intake in relevant degree program involving concerned industry people. The issue may be taken up in the next Deans' Committee.

d) Establishment of Centres of Excellence in Food Processing Technology with state of the art facilities, preferably in PPP mode, should be encouraged.

e) To attract students towards food processingtechnology programmes, more fellowships / scholarships be created.

f) The food processing technology colleges should also take up relevant vocational courses as per the regional demand of the industry.

g) For appropriate In-plant training of the students, reputed industries be selected. A

list of such industries be prepared in consultation with the industry and approved by the competent authority.

Annexure-II

Department wise list of Minimum Equipment/ Instruments in Laboratories

Department of Food Technology

Sr.	Name of Equipment
1	Fruit/ vegetable Blancher
2	Exhaust Box
3	Retort system
4	Kettle (steam jacketed)
5	Steam generator
6	Fruit/vegetable peelers
7	Homogenizer
8	Mixers
9	Fruit cutting/ slicing machine
10	Spice mixing machine
11	Dough Mixer
12	Dough divider
13	Table Sheeter
14	Dough moulds
15	Baking oven
16	Bread slicer
17	Pasta making machine
18	Laboratory ovens
19	Cooling chamber
20	Pouch sealing machine
21	Lab Roller dryer
22	Lab Spray dryer
23	Lab Tray dryer
24	Lab Fluidized bed dryer
25	Lab Vacuum dryer
26	Lab Cabinet dryer
27	Lab freeze dryer
28	Foam mat dryer
29	Grain dryer
30	Osmotic dryer
31	Weighing machines
32	High precision digital balance
33	Munshellcolour chart
34	Lovibondtintometer
35	Hunter colour lab meter

36	Disc colour meter
37	Portable chromameter
38	Viscometer
39	Shrink wrap packaging machine
40	Form fill and sealing machine
41	Vacuum packaging machine
42	Heat sealing machine
43	Fruit/ vegetable sorter
44	Fruit/ vegetable Grader
45	Verniercallipers of different sizes
46	Colour dictionary chart for grain
47	Angle of repose unit
48	Hardness tester
49	Soxhlet apparatus
50	Kjeldhal apparatus
51	Muffle furnace
52	pH meter
53	Refractometers for different ranges
54	Incubator
55	Germinator
56	Laboratory modern rice mill
57	Laboratory modern dhal mill
58	Flaking machine
59	Popcorn machine
60	Falling number apparatus
61	Lab oil expeller
62	Amylograph
63	Extensiongraph
64	Farinograph
65	Sieve analysis set up
66	Hammer mill
67	Modem wheat milling machine
68	Extruder
69	Meat mincer
70	Dumber and slaughtering machine
71	Defeathering machine
72	Plate freezer
73	Meat cutter/ chopper
74	Conching unit
75	Cocoa roaster
76	Cocoa tempering unit

77	Chocolate moulder
78	Rolling machine
79	S.S. utensils (pan/ fry pan/Kadhai/ spoon plates/ knife etc)
80	Basket press
81	Screw type juice extractor
82	Centrifugal Juice extractor
83	Hydraulic press
84	Fruit Pulper/ Crusher
85	Juice dispensing machine
86	Bottle filling machine
87	Bottle washing machine
88	Crown corking machine
89	Texture analyzer
90	Gas chromatography unit
91	Respirometer
92	Sensory evaluation set
93	Milkotester
94	Gerber butyrometer
95	Cream separator
96	Butter making machine
97	Ice cream machine
98	Khoa making machine
99	Multiple effect evaporator
100	Cryoscope
101	Melting point apparatus
102	Double distillation unit
103	Scavengerapparatus
104	Polarimeter
105	Ultrafiltration system
106	Water analysis unit (kit)
107	Density meter
108	TDS meter
109	Conductivity meter
110	Nephlometric turbidity unit
111	Water baths
112	Autoclave
113	Carbonation unit
114	BOD incubators
115	Bomb calorimeter
116	Rotary Shaker
117	Puncture resistance tester

118	Bursting strength tester
119	Tearing strength tester
120	Tensile testing machine
121	Box compression tester
122	Drop tester
123	Modified atmospheric storage
124	Water vapour transmission measuring unit
125	Oxygen transmission measuring unit
126	Super critical fluid extraction system
127	Rotary vacuum evaporator
128	Lab Aseptic processing system
129	Lab IQF system
130	Small Cold storage
131	Laboratory Fermenter
132	Microwave ovens
133	Moisture meters

Department of Food Engineering

Sr.	Name of Equipment
1	Flow over notches apparatus
2	Bernoulli's apparatus
3	Reynolds apparatus
4	Flow measurement by venturi meter and orifice meter
5	Centrifugal pump (model)
6	Reciprocating pump(model)
7	Gear pump model
8	Submersible pump
9	Positive displacement pump
10	Fluid friction measurement devices
11	Minor head loss apparatus
12	Model of Lancashire boiler
13	Model of Packaged Boiler/ model
14	Model of Babcock and Wilcox boiler
15	Vertical water tube boiler
16	Solar water heater
17	Steam jet condenser: parallel flow
18	Steam jet condenser: counter flow
19	Surface condenser
20	Evaporative condenser
21	Shell and tube heat exchanger

22	Plate Type Heat Exchanger
23	Double pipe heat exchanger
24	Natural convection apparatus
25	Forced convection apparatus
26	Thermal conductivity apparatus for solid and liquid
27	Working model of belt conveyor
28	Working model of bucket conveyor
29	Working model of chain conveyor
30	Working model of screw conveyor
31	Universal testing machine
32	Ball fall viscometer
33	Capillary tube viscometer
34	Rotational viscometer
35	Model of multiple effect evaporator
36	Rotary vacuum flash evaporator
37	Cabinet drier
38	Screw gauges
39	Vernier calipers
40	Micrometers
41	B.O.D. incubators
42	Desiccators
43	Refrigerated centrifugal machine
44	Ultra filtration apparatus
45	Micro wave oven
46	Infra red moisture meter
47	Universal moisture meter
48	Hammer mill
49	Magnum mill
50	Colloid mill
51	Ball mill
52	Sieve analyzer
53	Vapour compression refrigeration cycle
54	Refrigeration tutor
55	Air-conditioning tutor
56	Model of ammonia ice plant
57	Model of cooling tower
58	Water baths
59	Ammeters
60	Voltmeters
61	Wattmeters
62	Wet and dry bulb thermometers

63	Hygrometers
64	Anemometer with digital display
65	Pressure measurement devices
66	Different manometers
67	U tube double column Manometer
68	Multimeters
69	Clamp-on meters
70	Portable energy meters
71	Pyranometer
72	Transducers
73	Flow meters
74	Particle size analyzer
75	Dielectric Properties Analyzer
76	Microwave power leakage detector
77	Industrial PID controller and PLC units
78	Agitation and mixing system
79	Crystallizer
80	CNC lathe machine
81	Grinding machine
82	Drilling machines
83	Welding machines
84	Student drawing boards
85	Electronics engineering tutor set
86	Electrical engineering tutor set
87	Process control tutor set

Department of Food Quality Assurance

Sr.	Name of Equipment
1	Different Microscopes
2	Autoclave
3	Hot Air Ovens
4	Vacuum ovens
5	Colony Counter
6	Rotary Shaker
7	Lab Centrifuge
8	Deep Freezers of different temperature ranges
9	Laminar Flow Unit
10	Water Baths
11	Oil baths
12	BOD incubators

13	Ozone washer
14	Distillation Unit
15	Lab Scale Fermentor
16	Serological water bath
17	Water distillation unit
18	Digital weighing balances
19	pH meter
20	Protein digestion unit
21	Protein distillation unit
22	Soxhlet unit
23	Desiccators
24	Digital moisture meter
25	Protein estimation assembly
26	Digital pH meter
27	Digital Thermometers
28	Muffle Furnace
29	Spectrophotometer
30	Vortex mixture
31	Colorimeter
32	Bomb calorimeter
33	Vacuum flash evaporator set
34	Paper Chromatography set
35	Thin layer Chromatography Set
36	Paper electrophoresis unit
37	Magnetic stirrer with hot plate
38	Roto-viscometer
39	Flame photometer
40	Gas chromatography system
41	HPLC systetem
42	Refrigerated centrifuge
43	Scanning Electrons Microscope

Department of Food Processing Plant Operation

Pilot plants/ processing lines appropriate to the region based on the availability of raw material. The pilot plants may selected among

a) Bakery and confectionary line
b) Fruit and vegetable canning line
c) Extruded snack processing line
d) Bottling and beverages line
e) Grain mills

The pilot plants should be complete with the required utilities such as steam boiler, DG set, cold storage, three phase electricity, water treatment and other necessary accessories.

Department of Food Business Management

1. A set of computer serve, working nodes, printer for 25 students
2. Language lab set with audio management system for 25 students
3. LCD projectors with screens and other accessories
4. LED display systems