Minimum Standards for Higher Agricultural Education (MSHAE)

DAIRY TECHNOLOGY

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

PREFACE

The exemplary initiative taken up by the Indian Council of Agricultural Research to develop Minimum Standards of Higher Education in several disciplines of Agriculture is aimed at harmonizing standards of education cutting across the chosen field of Agricultural sciences. Such an attempt will enforce academic standards and discipline in the institutions offering both the undergraduate and postgraduate programs and ensure that the graduating students are adequately equipped to face the challenges of Indian agriculture. The prescribed standards will also help in identifying the shortfalls of the colleges who fail to qualify the set norms and thus help the universities to facilitate its improvement.

At the outset I take this opportunity to express my sincere thanks to the Indian Council of Agricultural Research for identifying the expert group who have vast experience of guiding dairy education in the country. The council reposed faith in the committee and the members rose to the expectations of the Council by deliberating at length various issues that are critical for strengthening the academic programs. The human resources and the support infrastructure in terms of space, buildings, machineries, analytical equipment, etc. required for operationalizing Dairy Technology education at undergraduate & postgraduate level were identified and specific details worked out in consultation with the faculty involved in running such a program.

I place on record contributions of the members of the committee namely Dr. G. R. Patil, Joint Director (Academic), NDRI, Karnal; Dr. B. V. Venkateshaiah, Former Dean, Dairy Science College, Bangaluru; Dr. B. P. Shah, Dean, SMC College of Dairy Science, Anand, Dr. R. R. B. Singh, Dean, Faculty of Dairy Technology, SGIDT, Patna; Dr. K. L. Khurana, Principal Scientist Education Division, ICAR, KAB-II Pusa, New Delhi – 110012 and Dr.Satish Kulkarni Head, SRS of NDRI, Bangaluru (Special Invitee) in formulating the strategic work plan to develop the document. The contributions of the faculty members of the Sanjay Gandhi Institute of Dairy Technology at Patna are praiseworthy. The support extended by the Vice Chancellor of the Bihar Agricultural University, Sabour in facilitating conduct of the meeting at its Patna based constituent college is duly acknowledged by the committee.

I am sure that framing of the Minimum Standards of Higher Agricultural Education in the field of Dairy Technology will trigger the much needed improvement in the quality of Dairy Technology education and set in motion realization of set objectives of ensuring nutritional security and rural prosperity in the country.

(A. K. Srivastava)
Chairman
Expert Committee

INTRODUCTION

Milk is the largest agricultural commodity in India both in quantitative and value terms. The long strides Indian dairying has made over the last five decades, particularly since the beginning of Operational Flood in 1970, is a success story recognized worldwide and being emulated in many parts of Asia and Africa. India today takes pride in claiming the first place among the milk producing nations (129 MT in 2012) which is anticipated to touch the figure of 170 MT by 2020. This has been made possible by involvement of nearly 14 million farmers who are linked through a strong network of more than 1 lakh village dairy cooperative societies spread across nearly 350 districts of the nation. Indian dairy industry with an estimated size of 70 billion US$ contributes to about 17% of global milk production. The industry has been consistently growing @ 3-4%. Last few years have witnessed the growth rate of around 5%. In India the level of milk processing is around 34% which is highest among all food categories. With expected rise in milk production, more new processing units will come into operation. It is, therefore, estimated that the processed dairy segment will grow at around 15% during the next five years. There has been consistent rise in demand for value added products such as yoghurt, dairy beverages, ice creams & cheeses thereby encouraging the organized dairy industry to go for diversification of product profile. With expected rise in the number of new dairy units and capacity expansion of the existing one's more human resources would be needed. At the moment, there are 19 dairy technology colleges producing less than 300 dairy graduates every year. It is estimated that the demand for qualified dairy graduates would be around 25000 by 2020. This indicates huge gap in capacity of educational institutions offering Bachelor programme. The employment opportunities for these graduates exist primarily in dairy and food processing plants/companies, manufacturing units of dairy equipment, quality control and analytical laboratories, government organizations related to dairying & food processing, teaching and research organizations, consultancy and entrepreneurship agencies, nationalized, private and developmental banks, production, processing and marketing wings of multinational dairy companies. It is, therefore, envisaged that more Dairy Technology Colleges will be needed in near to medium time frame.

Vision

College/Institute of Dairy Technology will catalyze socio-economic change in the state where it is set up through development of highly skilled human resource in all spheres of Dairy Technology endowed with high integrity, work values and entrepreneurial orientation.

Mission Statement

- College/Institute of Dairy Technology to emerge as a Centre of Excellence in education and research in Dairy Technology committed to providing quality education at undergraduate and postgraduate levels.

- The College/Institute will strive to offer world-class academic programme having sound technical knowhow and rich experiential learning as the critical components and make innovative application of research and new technologies in Dairy Technology a tool for improving sustainability in dairy processing system in the state and the country.
- It will also use education and research to stimulate industrial innovation and entrepreneurial culture among the graduates and provide knowledge based opportunities to the state based Dairy Processing Industries for using value addition as a vehicle for economic prosperity.

Objectives:

- To develop skilled technical and managerial manpower in Dairy Technology for the Industry, and Research and Development institutions.

- To develop trained manpower with entrepreneurial skill required to establish, manage and direct small and medium dairy processing enterprise in line with the institutions priority to follow 'Technology for Self Reliance' and "Creation of Rural Employment".

- To train graduates with adequate knowledge of design and fabrication of dairy processing equipments aimed at mechanizing traditional technology.

- To develop graduates with potential for higher education and dissemination of knowledge at various academic institutions of higher learning.

Proceedings of the Meeting of the ICAR's Expert Committee to work out the Minimum Standards of Higher Agricultural Education (MSHAE) held at Sanjay Gandhi Institute of Dairy Technology, Patna

Proceedings of the meeting of the ICAR's Expert Committee to work out the Minimum Standards of Higher Agricultural Education (MSHAE) in terms of manpower, infrastructure, laboratories, and other support so as to firm up guidelines for establishing Institute/College of Dairy Technology in SAUs/ICAR Institutes/Deemed Universities, in the Committee Room at Patna on March 22, 2014. The members present were: Dr. G. R. Patil, Joint Director (Academic), NDRI, Karnal; Dr. B. V. Venkateshaiah, Former Dean, Dairy Science College, Bangaluru; Dr. B. P.Shah, Dean, SMC College of Dairy Science, Anand, Dr. R. R. B. Singh, Dean, Faculty of Dairy Technology, SGIDT, Patna; Dr. K. L. Khurana, Principal Scientist, Education Division, ICAR, KAB-II Pusa, New Delhi – 110012 and Dr. Satish Kulkarni Head, SRS of NDRI, Bangaluru (Special Invitee).

The chairman of the committee Dr. A. K. Srivastava could not attend the meeting as he was indisposed due to illness. In his absence Dr. G. R. Patil, Joint Director (Academic), NDRI, Karnal chaired the meeting. He extended warm welcome to the learned members of the committee and explained the need to engage in such an exercise.

Dr. R. R. B. Singh, Dean of the host institute greeted the members and expressed sincere thanks to the ICAR and the committee to provide SGIDT an opportunity to organize the meeting. Dr. K. L. Khurana, Principal Scientist, Education Division, ICAR briefed the committee about the different information that need to be incorporated in the document and how it should be deliberated. Dr. R. R. B. Singh made a presentation on the subject and it was discussed threadbare over the whole forenoon session. Subsequently, faculty members of the Sanjay Gandhi Institute of Dairy Technology, Patna joined the committee members to present their points of views. Those present were: Dr. C. Prasad, University Professor-cum- Chief Scientist (DT); Dr. M. N. Singh, University Professor-cum-Chief Scientist (DT), Dr. J. Badshah, Univ. Prof.–cum-Chief Scientist (DE); Dr. A. K. Thakur, Assoc. Prof. cum – Senior Scientist (D. Extn); Dr. K. Murari, Asstt. Prof. (Selection Grade, DE); Dr. A. Kumar, Asstt. Prof. (Senior Scale, DH); Dr.Upendra Singh, Asstt.Prof. (Senior Scale, DT); Dr. (Mrs) Sonia Kumari, Assistant Prof.-cum-Jr.Scientist (DM); Dr. A.K. Jha, Asstt. Prof.–cum-Jr Scientist (D.Econ); Sh. B. K. Bharti, Asstt. Prof.-cum-Jr.Scientist (DC) & Sh. Suryamani Kumar, Asstt. Prof.–cum-Junior Scientist (DT). The chairman informed about the background of constitution of the committee and requested the faculty members to express their views freely on the document being developed. Faculty members were very emphatic about the need for prescribing minimum standards particularly in terms of adequate numbers of faculty, facilities for experiential learning and sufficient floor area for accommodating the laboratory and class rooms. They were of the opinion that any university or private body proposing to start such a college should make sufficient budgetary provisions in the beginning itself rather than following a piecemeal approach. Dr. B. V. Venkateshaiah, Former Dean, Dairy Science College, Bangaluru and Dr. B. P. Shah, Dean, SMC College of Dairy Science, Anand not only made valuable contributions but made available to the committee supplementary draft paper. The final report being presented here is an amalgamation of the views of all those who participated in the deliberations.

Annexure-I

Minimum Standards for Establishing a College/Institute of Dairy Technology in State Agricultural Universities/ICAR Institutes/Deemed Universities

1. Divisions/Section: Five Divisions and One Section

Sr. No.	Departments
1.	Dairy Technology
2.	Dairy Engineering
3.	Dairy Chemistry
4.	Dairy Microbiology
5.	Dairy Trade and Dairy Business Management
6.	Pilot Dairy Unit cum Business Process Development Centre

2. Undergraduate and Postgraduate Degrees Nomenclature

Level of Program	Nomenclature
Undergraduate	B.Tech (Dairy Technology)
Postgraduate Degrees	M.Tech (Dairy Technology)
	M.Tech (Dairy Engineering)
	M.Tech/M.Sc.(Dairy Chemistry)
	M.Tech/M.Sc.(Dairy Microbiology)
Doctoral Degrees	Ph.D (Dairy Technology)
	Ph.D (Dairy Engineering)
	Ph.D (Dairy Chemistry)
	Ph.D (Dairy Microbiology)

3. Eligibility Criteria

B.Tech. (Dairy Technology)	The eligibility for admission is 10+2 or its equivalent examination with Physics, Chemistry, Mathematics and English from a Board/ University recognized by the Institute. Only those candidates who have obtained at least 50% marks or equivalent G.P.A. in the aggregate of Physics, Chemistry and Mathematics are eligible for admission to B.Tech. (Dairy Technology).
M.Tech. (Dairy Technology)	B.Sc. Dairying/B.Sc. Dairying (DT)/B.Tech. (DT) B.Sc. Food Tech./B.Tech. Food Tech. (4 years degree) B.Sc. (Microbial & Food Tech.) - 4 years degree
M.Tech. (Dairy Engineering)	B.E./B.Sc.(Engg.) B. Tech./(Agricultural/AMIE, Chemical, Electrical/Mechanical B.Sc. Dairying/B.Tech. (DT) B.Tech. (Food Engineering & Technology/Food Process Engineering/ Food Technology- with 4 year degree
M.Tech./M.Sc.(Dairy Chemistry)	B.Sc. Dairying/ B.Sc. Dairying (DT)/B.Tech. (DT) B.Tech/B.Sc. Food Tech./ Food Sci.and Technology

	B.V.Sc. & A.H. / B.Sc. (Ag.) B.Sc. Honours(Chemistry) B.Sc. Microbiology/ Biotechnology/ Biochemistry B.Sc. with Chemistry and any two of the following: Botany, Zoology, Genetics, Microbiology, Mathematics, Physics and Dairy Science, Biotechnology, Industrial Microbiology, Food Science & Quality Control, Biochemsitry
M.Tech./M.Sc.(Dairy Microbiology)	B.Sc. Dairying/ B.Sc. Dairying (DT) B.Tech. (DT) B.V.Sc./B.V.Sc. & A.H./ B.Sc. (Ag.) B.Sc. Microbiology/Industrial Microbiology/Medical Microbiology. Microbial & Food Technology/Food Tech./Food Science (from SAUs only) B.Sc. (Hons.) Microbiology/ Biotechnology B.Sc. with Zoology and any two of the following: Chemistry, Genetics, Microbiology, Biochemistry
Ph.D. (Dairy Microbiology)	• M.Sc./M.Tech. Dairying (Dairy Bacteriology/ Dairy Microbiology) • M.Sc. (Microbiology/Microbial Technology/ Applied Microbiology and Biotechnology/ Medical Microbiology/Industrial Microbiology/Microbial& Food Technology//Biotechnology) • M.Sc. (Ag). Microbiology • M.V.Sc. (Bacteriology/Microbiology) • M.Sc. Hons. (Microbiology)
Ph.D. (Dairy Chemistry)	• M.Sc. Dairying/M. Tech. Dairying (Dairy Chemistry / Quality Control/Dairy Technology) • M.Sc. Agric. (Dairy Sci./Animal Husbandry & Dairying) • M.Sc. Chemistry/Applied Chemistry • M.Sc./M.Tech (Food Science/Food Technology/Food Science & Technology). • M.Sc. Animal Biotechnology • M.V.Sc. (APT/LPT) • M.V.Sc. Biochemistry/Biotechnology
Ph.D. (Dairy Technology)	• M.Sc. Dairying/M.Tech. Dairying (Dairy Tech./ Dairy Engg./ Dairy Chemistry/ Dairy Microbiology) with B.Tech./ B.Sc. (Dairy Technology) • M.Sc./ M.V.Sc. (Dairy Science/ Dairy Technology) • M.Sc. Agri. (Dairy Science) with at least 5 years experience in teaching dairy technology) • M.Sc. (Food Sci.)/M.Sc. (Food Tech.) with UG Degree in Dairy Tech./Food Tech./ Food Sci. • M.Sc. (Dairy Sci.)/M.Sc. Agric. (AH&D) with specialization in Dairy Sci. with at least 5 years experience in teaching Dairy Technology or working in a dairy plant.
Ph.D. (Dairy Engineering)	• M.Tech. Dairying (Dairy Engineering) • M.Tech. (Agril./Agril. Process, Chemical, Dairy,Dairy & Food,

	Electrical, Mechanical, Post Harvest Engg.) • M.Sc./M.Tech. Biotechnology with Bachelor's Degree in Engineering

4. Medium of Instruction: English

5. In order to get quality students for B.Tech (DT) course, it is necessary to have common criterion for admission of students. It is suggested to admit the students using AIEEE merit list.

6. Minimum Intake

Degree	Discipline	Minimum Intake/Year
B.Tech	Dairy Technology	40
M.Tech	Dairy Technology	5
M.Tech	Dairy Engineering	5
M.Tech/M.Sc.	Dairy Chemistry	5
M.Tech/M.Sc.	Dairy Microbiology	5
Ph.D	Dairy Technology	5
Ph.D	Dairy Engineering	5
Ph.D	Dairy Chemistry	5
Ph.D	Dairy Microbiology	5

7. Land Requirements

- Main building and hostels**:** 4 ha
- Field area: 10 ha
- Play grounds: From common facility of the institute
- **Total: 14 ha**

8. Manpower Requirements of Dean's Office

Designation	**No. of position**
Dean	1
A. Establishment	
PA to Dean	1
Administrative Officer	1
Assistant Comptroller/Assistant Accounts Officer	1
Superintendent	1
Steno/Computer operator	4
Assistant	1
Operator (Audio Visual)	1
Attendants/Messengers	4
Clerk (LDC)	4
Electrician	1

Store Keeper	1
Driver	4
B. Dairy Plant and Business Incubation Centre, Laboratories,	
Manager, Pilot plant/ Business Incubation Centre	01
Laboratory Technician for the college	06
Plant Supervisors/Technical Assistants (Dairy Processing-10, Refrigeration-2, Electrical-2)	14
Plant Operators (Processing-6, Boiler-2Refrigeration-2,)	10
Mechanical Draftsman	1
Jr.Mechanic/wireman	1
Fitter	1
Steno/PA	01
Assistant	01
Computer operator	02
LDC	01
Attendants	02
C. Library	
Assistant Librarian	1
Library Assistants	1
Clerks	1
Shelf Assistants	1
D. Students Welfare	To be provided by the University as Central Facility
E. Hostel Staff for Two Hostels	
Warden	1+1
Hostel Superintendents	2
Clerks	2
Attendants	8
Security, Sanitation and Landscaping	To be outsourced

Faculty Requirements for the Departments

Division/Section	**Faculty**			**Total**
	Professor	**Associate Professor**	**Assistant Professor**	
Dairy Technology	1	2	6	**9**
Dairy Engineering	1	2	6	**9**
Dairy Chemistry	1	2	3	**6**
Dairy	1	2	3	**6**

Microbiology				
Dairy Business Management	1	2	2*	**5**
Total	5	10	20	**35**

*One each in Dairy Economics and Dairy extension; Supporting subjects will be taught by other faculty in the university

9. Administrative and Supporting Staff for Divisions/Section

Sr. No.	**Division/ Section**	**Steno/PA/ Computer Operator (**9,300-34,800 +GP 4,200)	**Assistant (**5200-20200 +GP 2800**)**	**Attendant/ Messenger (**5200-20200 +GP 2800**)**	**Clerk (**9,300-34,800 +GP 4,200)	**Laboratory Assistant/ Attendant (**5200-20200 +GP 2800**)**
1	Dairy Technology	2	1	2	1	2
2	Dairy Engineering	2	1	2	1	2
3	Dairy Chemistry	2	1	2	1	2
4	Dairy Microbiology	2	1	2	1	2
5	Dairy Business Management	2	1	2	1	2
	Total	10	5	10	5	10

10. Faculty Expertise

Division/Section	**Faculty Expertise**	
	Core	**Associated**
Dairy Technology	Dairy Processing Food Technology	Cheese and Fermented Dairy Products Traditional Dairy Products Packaging Sensory Science Rheology
Dairy Engineering	Dairy Engineering	Food Process Engineering Thermodynamics Civil Engineering Mechanical Engineering
Dairy Chemistry	Dairy Chemistry	Analytical Techniques
Dairy Microbiology	Dairy Microbiology	Microbial Techniques
Dairy Business Management	Dairy Economics Dairy extension	Business Management

11.

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

Division/Section	Laboratory
Dairy Technology	Product Development Laboratory Product Characterization and Rheology Packaging Laboratory Sensory Evaluation Laboratory Central Instruments Laboratory Food Technology Laboratory
Dairy Engineering	Bioprocess Engineering Laboratory Fluid Mechanics Laboratory Heat Transfer Laboratory Refrigeration and Air Conditioning Food Engineering Laboratory Thermodynamics Laboratory Electrical Laboratory Instrumentation and Control Laboratory Dairy Engineering Workshop
Dairy Chemistry	Dairy Food Analysis Laboratory
Dairy Microbiology	Dairy Food Quality and Safety Laboratory
Dairy Business Management	Computer Laboratory Audio-Visual Laboratory Language Laboratory

13. Floor Space Requirements

Central Facilities

S. No.	Details	Number of Rooms	Dimensions
1.	Dean office	1	20′ x 24′
2.	PA room	1	20′ x 12′
3.	Committee room with video conferencing facility	1	20′ x 48′
4.	Administrative officer room	1	20′ x 12
5.	Admin. staff rooms	3	20′x36′ each
6.	Examination hall	1	20′ x 12′
7.	Evaluation room	1	20′ x 36′
8.	Faculty room	1	20′ x 12′ each
9.	Placement cell	1	20′ x 48′
10.	Smart Lecture rooms	5	Seating capacity - 50
11.	Auditorium (Optional)	1	Seating capacity-300
12.	Library/Book bank	1	30′x72′
13.	Examination hall (optional)	1	Seating capacity - 300
14.	Multipurpose room	1	20′x36′

15.	Laboratories	4	30′ x 48′ each
16.	Hostels	2	Boys and Girls
17.	Generator Shed	1	20′ x 36′
18.	Toxic chemical storage and waste unit	1	20′ x 24′
19.	Canteen	1	20′ x 12′ (kitchen) & 20 x 36′ (sitting)
20.	Toilets	-	2sets for each floor
21.	Parking space	As per requirement	Office and Hostels
22.	Vehicles: Office car Staff car/Jeep Bus Pick-up van	 1 3 1 1	-

Division/Section

Sr. No.	**Details**	**No. of rooms**	**Dimensions**
1.	Office of the Head of Division (05)	05 One for each division	20′ x 24′ each
2.	Administrative staff	05 (one for every Division)	20′ x 36′ each
3.	Faculty room	26	20′ x 24′ (05 rooms) 20′ x 12′ (21 rooms)
4.	Room for research scholar	04 (one for every Division)	20′ x 24′ each
5.	Committee room cum library	05 (one for every Division)	20′ x 36′ each
6.	Smart lecture cum seminar room	05 (one for every Division)	Seating capacity - 50 each
Laboratories (no. of laboratories as per requirement and include UG and PG teaching laboratories)			
7.	Dairy Technology	05	20′ x 60′ (one) 20′ x 36′ (four)
8.	Dairy Engineering	09	20′ x 60′ (two) 20′ x 36′ (seven)
9.	Dairy Chemistry	04	20′ x 60′ (one) 20′ x 36′ (three)
10.	Dairy Microbiology	03	20′ x 60′ (one) 20′ x 36′ (two)
11.	Dairy Business Management	04	20′ x 60′ (two) 20′ x 36′ (two)

Dairy Plant and Business Incubation Centre

Details	Dimensions
Raw Milk receiving Dock, Milk storage tank room, Milk Processing Hall, Cheese Room, Milk Condensing & Drying Plant room, Cheese Drying & Curing room, Milk Cold Store, Ice Cream Hardening Room, Dispatch Dock, Milk Bottling / Pouch Filling Room, Food processing section (Vegetable/cereal/meat processing) Boiler House, Refrigeration & Ice Bank, System room, Store room – Products, Store room – chemicals & accessories, Sales Counter, Office of the Head of the Department, Offices for the Teaching Staff - Assistant professor, Associate Professor, Offices for the Technical Staff – Boiler Attendant, Refrigeration Attendant, Fitter, Office for the Ministerial Staff & Driver, Wash rooms– Staff & Students (both for Male & Female)	200′ x 72′

14. Equipment required

UG/PG Laboratories

Sr. No.	Name	Number
1.	UV-Vis Spectrophotometer	02
2.	Analytical balances	04
3.	Electronic balances	04
4.	Muffle furnace	02
5.	Automatic titrator	01
6.	Soxhlet instrument	01
7.	Gerber centrifuge	02
8.	pH meter	04
9.	Autoclave	02
10.	Laminar flow/Biosafety cabinet	02
11.	BOD Incubator	02
12.	Simple microscope	01
13.	Simple oil immersion microscope	01
14.	Hot air oven	04
15.	Hot water batch	04
16.	Serological bath	02
17.	Centrifuge	01
18.	Low temperature centrifuge	01
19.	Pipette washer	02
20.	Rotary shaker	01
21.	Gas supply and burners	01
22.	Standard assembly for titrimetric analysis with indicator solutions & buffer tablets; Magnetic stirrer; Cyclomix (vortex mixer)	All items: 02 each

Central Instrument Facility:

Sr. No.	Name	Number
1.	High pressure Liquid Chromatography	01
2.	Atomic absorption spectrophotometer	01
3.	Hunter LAB Colorimeter	01
4.	Instron Texture Analyzer	01
5.	IR Moisture analyser	01
6.	Water activity meter	01
7.	Flame photometer	01
8.	Rheomat	01
9.	Viscoamylograph	01
10.	Bench-top Microfluidizer	01
11.	Rotary evaporator	01
12.	Differential Scanning Calorimeter	01
13.	Refrigerator	01
14.	Deep freezer	01
15.	Kjeltec	01
16.	Fibretec unit	01
17.	Rancimat	01
18.	Millipore water purifier	01
19.	Low temperature bath	01

Packaging Laboratory:

Sr. No.	Name	Number
1.	Weighing balance (Accuracy 0.001 g)	02
2.	Micrometre	04
3.	Mullen Bursting strength tester	01
4.	Mechanical drop tester	01
5.	Compression strength tester	01
6.	Smoothness or porosity tester	01
7.	Cobb tester	01
8.	Elmendorf tear tester	01
9.	Water absorption tester	01
10.	Head space analyser	01
11.	Universal testing machine	01

Barrier testing instruments		
12.	Oxygen	01
13.	Carbon dioxide	01
14.	water vapour transmission tester	01

Pilot Plant cum Business Incubation Centre for Dairy and Food Processing

Sr. No.	**Name**	**Number**
1.	Milk reception section	01
2.	Liquid milk processing unit	01
3.	Cream processing , butter and ghee Section	01
4.	Powder reconstitution & milk poly pack section	01
5.	Paneer section	01
6.	Curd/Lassi/Chhach Section	01
7.	Ice cream section	01

The total production line to be developed for the Dairy Unit (10,000 LPD) is illustrated in the table below

Sl.No.	**Product to be manufactured**	**Quantity of Milk**
1.	`Liquid milk (Different qualities) of milk such as full cream, Standardized milk, Toned milk, double toned, milk as per the requirement by PDP	2,500 litres
2.	Paneer/Cheese/Shrikhand/Chhana (Production and Channa based sweets packaging)	1000 litres
3.	Curd/Lassi/Chhach/Yoghurt	1000 litres
4.	Ice-cream (1000 litres mix)	1000 litres mix
5.	By-Products:casein,caseinates, whey products, etc.	500 litres (only for practical purpose)
6.	Heat desiccated products (Khoa, Khoa based sweets like Gulabjamun, Peda, Phirni, Rabri, Kurchan, Kheer, etc.)	500 litres (For practical purpose & also for marketing as per demand)
7.	Fat rich products Butter, Ghee, etc.	Regular production from cream obtained from market milk industry

Major Common Pilot Plant Equipment:

Sr. No.	**ITEM**	**Numbers**	**Capacity**
1	Milk Weighing Scale	1	0-100 kg
2	Bulk Cooling Tank	1	1000 L

3	Can Washer	1	5 cans/hr
4	HTST Plate Heat Exchanger	1	500 L/hr
5	Batch Pasteurizer	1	500 L
6	Homogenizer	1	500 L/hr
7	Milk Storage Tank	2	1000 L each
8	Milk Bottling Plant	1	10 bottles/min
9	Butter Churn	1	100 kg
10	Ghee Boiling Vat	1	100 kg
11	Ice cream Freezer - Batch	1	20 kg/batch
12	Cheese Vat	3	200 L each
13	Cheese Cutting Frame	3	1 X 3 ft size
14	Cheese Press	1	6 block
15	Milk Condensing Unit	1	40 kg water evaporation/hr
16	Spray Drying Unit	1	5-10 kg water evaporation/hr
17	Refrigeration Plant	1	10 Ton
19	Portable Weighing Scale	2	5 kg
19	Curd Mill	1	-
20	Cheese Hoop	6	20 kg size
21	Milk Cans	50	40 kg each
22	Auto Clave	1	-
23	Ice Water Plant	1	5 Ton
24	Cheese Block Cutter	1	-
25	Sieve for Shrikhand	2	-
26	Planetary Mixer	1	10 kg
27	Hand Bottle Filler	1	-
28	Can Scrubber Tank	1	-
29	Pouch Filling Machine	1	100 pouch/hr
30	Cream Separator	1	500 L/hr
31	Butter Trolley	1	50 kg
32	Wet Casein Grinder	1	5 kg/
33	Casein Shredder	1	5 kg
34	Casein Dryer	1	5 kg/batch
35	Bottle Sterilizer	1	40 bottles/batch
36	Khoa Kettle	1	10 kg/batch
37	Colloidal Mill	1	1 kg/min
38	Crown Capping Machine	1	Manual
39	Sugar Grinder	1	5 kg
40	Tin Seamer	1	Manual
41	UF Cum RO Unit	1	50 kg/hr
42	Crates For Milk Bottles	100	10 kg each
43	Deep Freezer	4	-
44	Gerber Centrifuge	2	24 tubes
45	BOD Incubator	2	-
46	Hot Air Oven	2	-

47	Hot Plate	1	-
48	Magnetic Stirrer	1	-
49	Colony Counter	1	-
50	Weight Box	1 set	100 g
51	Paraffin Bath	1	50 kg
52	Vacuum Packaging Machine	1	5 kg/batch
53	Milk Analyser	1	-
54	Ice Cream Freezer - Continuous Type	1	50 L/hr
55	Cooling Unit For Cheese Curing Room	1	2 tonnes
56	Candy Making Machine	1	50 candy/batch
57	Candy Moulds	10	24 x 100 ml
58	Vacuum Tray Dryer	1	-
59	Extruder	1	-
60	Ice Cream Cup Filling Machine	1	100 cups/hr
61	UHT Milk Sterilization Unit with Aseptic Packaging	1	100 L/hr
62	Tray sealing machine	01	-
63	Colloid Mill	01	-
64	Hammer mill	01	-
65	Planetary mixer	01	-
66	Pin mill	01	-
67	Homogenizer	01	-
68	Steam Jacketed Kettle	03	-
69	Refrigeration System For Ice Cream Hardening Room	1	2 tonnes
70	Processed Cheese Kettle	1	5 kg
71	Steam Boiler	2	500-1000 kg steam/hr
72	Diesel power generator	01	125 KWA
73	Effluent Treatment Plant	1	-

Equipment for Fruit and Vegetable Processing:

Sr. No.	Name	Number
1.	Fruit pulper	01
2.	Screw juice extractor	01
3.	Bottle filling machine	01
4.	Mechanical peeler	01
5.	Peeling knives	Complete set
6.	Slicing knives	Complete set
7.	Mechanical slicer	01
8.	Basket press	01
9.	Plunger press	01
10.	Autoclave	01
11.	Can sealer	01

Equipment for Processing of Cereals, Pulses and Oilseeds:

Sr. No.	Name	Number
1.	Dehuller	01
2.	Screw expeller	01
3.	Paddy sheller	01
4.	Corn degermer	01
5.	Popping unit	01
6.	Flaking roller	01
7.	Mini flour mill	01
8.	Pasta making machine	01
9.	Deep fat fryer	01

Equipment for Bakery and Confectionary Products:

Sr. No.	Name	Number
1.	Moulding unit	01
2.	Baking oven	01
3.	Sugar grinder	01
4.	Biscuit baking unit	01
5.	Proofing unit	01
6.	Slicing unit	01
7.	Chocolate moulder	01

Equipment for Meat and Fish processing (Optional):

Sr. No.	Name	Number
8.	Bowl chopper	01
9.	Meat mincer	01
10.	Sausage filler	01
11.	Ice flaking machine	01
12.	Chopping table	01
13.	Combo microwave	01
14.	Tumblers	01
15.	Molds for hams	01
16.	Heating kettle	01

Equipment for Dairy Engineering Division:

Sr. No.	Name	Number
1.	Orifice and Mouthpiece apparatus	02
2.	Pipe friction apparatus	01
3.	Minor head loss apparatus	01
4.	Flow through channel apparatus	01
5.	Computerized centrifugal pump test rig	01
6.	Rotameter	02
7.	Water flow meters	02

8.	Reynolds apparatus	01
9.	Bernoulli's apparatus	01
10.	Various types of pipe fittings and valves	02 set
11.	Self priming pump	02
12.	Monoblock pump set	02
13.	Submersible pump	01
14.	Powder conductivity meter	01
15.	Computerized counter and parallel flow apparatus	01
16.	Plate Heat Exchanger	01
17.	Steam Jacketed kettle	01
18.	Stefan Boltzmann Apparatus	01
19.	Jacketed vats	02
20.	Heat Transfer through composite wall	01
21.	Heat Transfer through Natural Convention	01
22.	Critical Heat Flux Apparatus	01
23.	Heat Transfer through lagged pipe	01
24.	Digital temperature indicators with probes	05 set
25.	Multi Channel temperature indicator	02
26.	Solar water heating system	01
27.	Computerized refrigeration tutor	01
28.	Computerized air conditioning tutor	01
29.	Water cooler	01
30.	Window AC	02
31.	Split AC	02
32.	Refrigerator	01
33.	Models of sealed and open type compressor	01 set
34.	Refrigeration plant controls such as thermostat, pressure switches, solenoid valves, expansion valves	01 set
35.	Dessert cooler	02
36.	Dehumidifier	01
37.	Food Processor	01
38.	Texture Analyzer	01
39.	Laboratory scale freeze dryer	01
40.	Try dryer	01
41.	Texturometer	01
42.	Juice extractors	01

43.	Extruders	01
44.	Sulfuring chamber	01
45.	Blanching equipment	01
46.	Clinching equipments	01
47.	Jacketed kettle	01
48.	Bomb calorimeter	01
49.	Flue gas analyzer	01
50.	Bucket calorimeter	01
51.	Baby boiler	01
52.	Models of boiler mountings and accessories.	01 set
53.	IC Engine test rig	01
54.	Steam flow meter	02
55.	Water flow meter	02
56.	Models of two stroke and four stroke engine	01 each
57.	Different types of steam traps	02 set
58.	Pipes and pipe fittings	As per the requirements
59.	Oil and gas burners	01 each
60.	Water softening plant	01
61.	Boiler feed water pump	01
62.	Digital clip-on-meters	02
63.	Digital Energy analyzer	01
64.	Power measuring instruments such as volt meter, ampere meter, energy meter, meger	05 set
65.	Inverter	01
66.	Induction Motors with starters	02
67.	Variable Frequency Drive	02
68.	Single phase Transformer, 2 kVA	02
69.	Digital three phase Energy meter	02
70.	Different types of starters such as direct on line starter, star delta starter, Auto-transformer starter etc.	02 set
71.	Experimental set up for experiment in parallel & series connection, stair case wiring, tube light wiring, motor connection, speed measurement, demonstration of winding etc with necessary power, voltage, and current measuring devices.	02 set each
72.	Hand tachometer	02
73.	Non contact type tachometer	02
74.	Soft starter	02

75.	Air anemometer	01
76.	Magnetic flow meter	02
77.	Digital pocket type thermometers with different types of probes	05
78.	Multi channel data logger	01
79.	Various tutors/transducers such as Strain gauge, pressure, LVDT, Inductive, Photo cell, piezometer, etc.	01 set
80.	Water Level controller	01
81.	Pneumatic controller	01
82.	PID controller temperature controller system	01
83.	Digital Tachometer	01
84.	Lux meter	01
85.	Solar lighting system	02
86.	Lathe Machine	01
87.	CNC lathe	01
88.	Grinding machine	01
89.	Power saw	01
90.	Drilling machine	01
91.	Pipe bending machine	01
92.	Electric welding machine	01
93.	Portable welding machine	01
94.	Gas welding set	01
95.	Shear cutting machine	01
96.	Threading machine	01
97.	Universal wood working machine	01
98.	Bench vice	20
99.	Portable grinding machine	02
100.	Shaping machine	01

Dairy Trade and Business Management Division:

Sr. No.	**Name**	**Number**
1.	Desk top computers with LAN facility and Internet connection	20
2.	Photocopier	03
3.	Laser Printer	06
4.	Colour Laser Printer	01
5.	Softwares: SPSS/Metlab/Design expert	01 each with multiuse license
6.	Indian patent database	01