SYLLABI

FOR
STANDARDS XI AND XII
(For the Higher Secondary Certificate Examination)

H. S. C. VOCATIONAL SUBJECTS
(Volume II)

FISHERIES GROUP
PARA MEDICAL GROUP
CATERING AND FOOD TECHNOLOGY GROUP
AGRICULTURAL GROUP

Maharashtra State Board of Secondary and Higher Secondary Education,

Pune – 411004

SYLLABI

FOR

STANDARDS XI AND XII
(For the Higher Secondary Certificate Examination)

(To be implemented in Standards XI and XII from the academic year 2015-2016 and 2016-2017 respectively)

H. S. C. VOCATIONAL SUBJECTS
(Volume II)

1. Fisheries Group
2. Para Medical Group
3. Catering and Food Technology
4. Agricultural Group

As sanctioned under Government of Maharashtra School Education and Sports Department. Letter No.

Maharashtra State Board of Secondary and Higher Secondary Education, Pune – 411004

Minimum Competency Vocational Subjects

STANDARDS XI AND XII

SCHEME OF TEACHING

Sr. No.	Subjects	Periods per week		Total
		Theory	Practical	
1.	English	5	--	5
2.	A Modern Indian Language Or A Modern Foreign Language Or A Classical Language	5	--	5
3.	Environmental Education	2	--	2
4.	General Foundation Course	5	--	5
	VOCATIONAL SUBJECT For subjects under - Fisheries Group Para medical Group Catering and Food Technology Group			

FISHERIES GROUP

FISHERIES TECHNOLOGY (S4, S5, S6)

Scheme of Examination

Std. XI

Paper	Title of the Paper	Theory		Practicals		Term work	Project work	Educational Visit	Total Marks
		Marks	Time (Hrs)	Marks	Time (Hrs)				
I	General Fisheries	80	3	80	3	20	10	10	200
II	Fish Breeding & hatchery Management	80	3	80	3	20	10	10	200
III	Ornamental Fisheries	80	3	80	3	20	10	10	200

* EV = Educational Visits

Scheme of Examination

Std. XII

Paper	Title of the Paper	Theory		Practicals		Term work	Project work	OJT	Educational Visit	Total Marks
		Marks	Time (Hrs)	Marks	Time (Hrs)					
I	Aquaculture	80	3	80	3	10	10	10	10	200
II	Fish Farm Management	80	3	80	3	10	10	10	10	200
III	Fish Preservation and Processing	80	3	80	3	10	10	10	10	200

* EV = Educational Visits

** OJT = On the Job Training

INTRODUCTION

Since time immemorial, fish has enjoyed a special consideration in human diet. To meet the demand of protein-rich food for ever growing population, it has become essential to exploit water resources, which are increasing rapidly due to our water conservation policy. After the success of 'Green Revolution' and 'Operation Flood', our country is marching towards a 'Blue Revolution'.

Fishery today, is no longer traditional mode of earning a livelihood for a particular section of our people. With its vast, but partially exploited resources, it represents one of the important developing sectors contributing towards the growth of our national economy.

In general, our present day **fishery** comprises of the following sectors-

- Fish production through capture and culture fisheries.
- Fish processing
- Fish marketing & fisheries management.
- Ornamental fish production.

The above core-constituents of modern fishery are interlinked with each other, each sector being capable of influencing the efficiency and performance of the others. Therefore in order to derive maximum benefits from each sector, scientific knowledge of modern fishery must be disseminated from research laboratories to the people engaged in fishery. The best way to achieve this target is through an organized training of the youth.

There exists a very high potential for generating employment by developing Fisheries in our country. Therefore vocational education in Fisheries Technology assumes great significance.

While framing the present syllabus of Fisheries Technology, an attempt has been made to identify the Practicals to generate skills in Fisheries practices. Care has also been taken to include all relevant topics which a student at the +2 level can comprehend. The syllabus is essentially designed to develop basic vocational expertise needed in Practical Fisheries as well as aquarium fabrication and maintenance, ornamental fish production & fish processing.

GENERAL OBJECTIVES

- Train the man power in different aquaculture aspects so as to utilize the available resources
- Generate employment and self employment potential in various areas in fisheries such as seed production, culture, capture and processing.

- Generate skilled manpower to take up jobs such as field technicians, supervisors and hatchery operators, laboratory assistants, marketing assistants, net makers etc in fisheries activities.
- Increase production and utilization of fish and fish products to overcome protein malnutrition.
- Increase socio-economic development of fishermen through fisheries co-operative movement.
- Increase national income through export of fish & fish by products.
- Realize the dream of the Blue Revolution.

SPECIFIC OBJECTIVES

1. Impart knowledge about fundamentals of inland fisheries practices so as to increase fish production to meet protein malnutrition as well as providing job opportunities.
2. Train manpower for the development of inland fisheries.
3. Impart knowledge for developing proficiency and management practices in food fishes and ornamental fishes.
   a. Maintaining brood stock
   b. Fish seed production
   c. Rearing fish seed up to fingerling stage
   d. Packing and transportation of seed.
   e. Production of seed.
   f. Maintaining farm for fish production.
4. Train personnel in natural seed collection and bundh breeding.
5. Train personnel for improving reservoir fisheries.
6. Develop young entrepreneurs for self employment through different farming schemes.
7. Develop organizational capabilities in fisheries workers for assisting fishermen co-operative societies.
8. Develop facilities for production and sale of fish food, manure, nets, ornamental fish and other fisheries requisites.
9. Develop fishery worker as a link between fisheries supporting organizations/institutions and the farming community.
10. Develop competence for assisting scientific investigations and laboratory experiments.
11. Develop competence for resource utilization through fishery estate.
12. Train individuals in fishery activity like surveying, exhibitions.
13. Prepare fishery workers as capable organizers/supervisors/assistants for fishery oriented activities.

14. Inculcate awareness about conservation of aquatic resources and production of aquatic organisms.
15. Develop awareness of computer applications in modern fisheries.
16. Ornamental fish keeping is a fast growing business providing self employment on large scale. There is a high demand of skilled persons in this field.

Job Opportunities

Wage Employment

1. Field Assistant/Field Technician
2. Laboratory Assistant/Technical Assistant
3. Fishery Development Assistant
4. Seed Production Assistant/Fish Breeder
5. Hatchery Operator
6. Aquarium maintenance
7. Processing Assistant
8. Marketing Assistant

Self Employment

1. Fish Seed producer
2. Ornamental Fish Trader
3. Seed Collector
4. Bundh Operator
5. Fish Seed Supplier/Transporter
6. Fish Breeder
7. Fish Feed Supplier (Live/Processed)
8. Ornamental Fish Breeder
9. Supplier of Fish & Prawn (Marketing)
10. Aquarium Fabrication
11. Production of by products from fish
12. Production of value added products from fish.

Std. XI
Paper I: General Fisheries (S4)
Theory

Sr. No.	Unit	Sub-Unit	Periods
1.	Introduction to Fisheries	1.1 Brief Introduction to Fisheries 1.2 Importance of fish 1.3 Potential of Fisheries.	05
2.	Types of fisheries	2.1 Fresh Water Fisheries 2.2 Brackish water Fisheries 2.3 Marine fisheries 2.4 Capture and Culture fisheries	10
3.	Present status of Inland fisheries in India	3.1 Present status of fresh water fisheries 3.2 Present status of brackish water fisheries	15
4.	A general account of commercially Important fishes and Shell fishes.	4.1 Fresh Water Fishes 4.2 Brackish water fishes 4.3 Shell-fishes 4.4 Marine fishes	35
5.	Different methods of fishing in Fresh water	5.1 Hooks & Lines used in fishing 5.2 Different types of Traps used 5.3 Common fishing gears in India and their operation	20
6.	General characteristics of lotic and lentic waters	6.1 Introduction to lotic and lentic water bodies. 6.2 Characteristics of lotic and lentic waters.	15
7.	Growth And age Determination	7.1 Importance of growth and age studies 7.2 Methods of age and growth determination	20
		Total	**120**

Practicals

Sr. No.	Unit	Sub-Unit	Periods
1.	Classification	1.1 Classification of Animal Kingdom	15
2.	General Morphology And Morphometry	2.1 General Morphology and Morphometry of a typical Bony fish 2.2 General Morphology and Morphometry of a	30

		typical prawn.	
3.	Identification of Common fishes, Prawns and Molluscs	3.1 Identification of common fishes. Preparation of biological records. 3.2 Identification of common prawns. Preparation of biological records. 3.3 Identification of common molluscs and preparation of biological records.	40 15
4.	Fabrication of various types of gear used for Fishing	4.1 Study of different knots 4.2 Study of design of common fishing nets.	35
5.	Collection of scale and determination of age		15
6.	Visit	6.1 Visits to fish market. 6.2 Visits to fish farms.	20 20

Projects:

1) Comparison of morphological & morphometrical data of different species of fishes. (Different species for each group of 3 students) (10)
2) Preparation of common nets & Study of different types of Knot. (10)
3) Collection of different types of nets. (15)
4) Collection of different types of scale. (15)

Total **240**

Paper II: Fish Breeding and Hatchery Management (S5)
Theory

Sr. No.	Unit	Sub-Unit	Periods
1.	Natural spawning of carps	1.1 Natural spawning of carps in India	15
2.	Bundh Breeding	2.1 Introduction to Bundh breeding 2.2 Wet bundh breeding 2.3 Dry bundh breeding 2.4 Mogara bundh	20
3.	Different	3.1 History of hypophysation	15

	Methods of Induced Breeding	3.2 Modern methods of Induced Breeding 3.3 Spawn collection	
4.	Common carp Breeding	4.1 Technique of Common carp Breeding in pond	15
5.	Selective Breeding and hybridization	5.1 Importance of selective breeding 5.2 Stripping Methods (wet & dry)	15
6.	Hatchery Environments	6.1 Different hatchery environments	15
7.	Reproductive Biology of fish	7.1 Reproductive organs 7.2 Different stages of gonads	15
8.	Seed Measurement, Conditioning, Packing and Transport.	8.1 Methods of seed measurement, conditioning, packing and transport.	10
		Total	**120**

Practicals

Sr. No.	Unit	Sub-Unit	Periods
1.	Identification of brooders		05
2.	Selection of good spawner & fecundity study		10
3.	Administration of Synthetic Hormones		25
4.	Collection of eggs. Identification of Fertilized and Unfertilized eggs. Calculation of Fertilization Percentage.		30
5.	Hatchery Operations	5.1 Observations on hatchery operation. 5.2 Calculation of hatching percentage.	40
6.	Demonstration on hybridization and stripping.		20
7.	Seed, Conditioning, Packing and	7.1 Handling of seed 7.2 Conditioning methods	30

	Transport.	7.3 Packing of seed 7.4 Transport	
8.	Preparation of field and Practicals record books.		20

Projects:

1. Field visits to a nearby Farm Hatchery Sites and submission of report. (30)
2. Project on Fish seed production unit. (30)

Total **240**

Paper III: Ornamental Fisheries (S6)
Theory

Sr. No.	Unit	Sub-Unit	Periods
1.	Ornamental fish Trade in India	General Information of fish trade.	8
2.	Different species of ornamental fish (Fresh & Marine)	2.1 Live bearers 2.2 Egg layers	24
3.	Aquarium Fabrication	3.1 Material used 3.2 Required Tools 3.3 Fabrication	14
4.	Aquarium Maintenance	4.1 Balanced Aquarium 4.2 Unbalanced Aquarium	20
5.	Ornamental fish diseases & control	5.1 Common diseases 5.2 Preventive measures and control	14
6.	Breeding & rearing of Ornamental fish	6.1 Ornamental brood stock 6.2 Identification of Brooders 6.3 Breeding Techniques	20
7.	Aquarium fish feed	7.1 Different types of fish feed	10
8.	Ornamental Fish Marketing	8.1 Concepts of ornamental fish marketing	10
		Total	**120**

Practicals

Sr. No.	Unit	Sub-Unit	Periods
1.	Identification of Common Ornamental Fish & Aquarium Plants.	Identification of Common Ornamental Fishes & Aquarium Plants.	40
2.	Aquarium Tools & Accessories	Common aquarium tools & accessories	20
3.	Fabrication of all glass aquarium		20
4.	Setting of an aquarium		20
5.	Maintenance of an aquarium		10
6.	Preparation & formulation of fish feed (fresh & Marine)		15
7.	Packing and transport of ornamental fish		20
8.	Aquarium Fish breeding	8.1 Egg layers 8.2 Live bearers 8.3 Bubble nest builder	25

Projects:

1. Preparation of all glass aquarium (25)
2. Setting of an aquarium (25)
3. Collection of aquarium plants (20)

Total **240**

Std. XII
Paper I: Aquaculture (S4)
Theory

Sr. No.	Unit	Sub-Unit	Periods
1.	Introduction to Aquaculture	1.1 Classification of aquaculture 1.2 Types of fish farm 1.3 Types of Ponds	5 5 5
2.	Design, Construction and Maintenance of pond	2.1 Design of a typical fish pond 2.2 Excavation and Construction of a fish pond. 2.3 Maintenance of Fish pond.	30
3.	Village tanks and their improvement	3.1 Village tanks and their improvement 3.2 Steps to improve village tanks for Fish culture	5
4.	Principles of Fish selection for culture	4.1 Criteria for selection of Species	5
5.	Culture of cat fishes and air breathing fishes	5.1 Importance of culture of cat fish and air breathing fishes 5.2 Culture method	15
6.	Aquaculture in running water	6.1 Importance of culture in running water 6.2 Methods of culture	10
7.	Principles of brackish water fish culture	7.1 Principles of brackish water fish culture 7.2 Sites & water resources. 7.3 Cultivable Species and their culture methods	20
8.	Culture of fresh water prawns	8.1 Importance of the culture of fresh water prawn 8.2 Monoculture of the prawn and its combination with carps.	5
9.	Culture of live fish food	9.1 Importance of culture of live fish food in modern aquaculture 9.2 Culture of various plankton	10
10.	Pearl Culture	10.1 Culture of fresh water bivalve 10.2 Brief account of pearl culture	5
		Total	**120**

Practicals

Sr. No.	Unit	Sub-Unit	Periods
1.	Drawing cross section of a typical pond and dyke.		10
2.	Field methods of soil analysis		40
3.	Various designs & models of sluice gate		20
4.	Fabrication of cages (models)		25
5.	Collection of brackish water fish & prawn seed		20
6.	Larval rearing of fresh water prawn		20
7.	Culture of live fish food organisms		20
8.	Demonstration of pearl culture		15

Projects:

1. Visit to fish farms. Tanks for survey and management. (40)
2. Preparation of different cage models. (30)

Total **240**

Paper II: Fish Farm Management (S5)
Theory

Sr. No.	Unit	Sub-Unit	Periods
1.	Identifying characters of fry and fingerlings		25
2.	Types of nursery and rearing pond	2.1 Nursery ponds 2.2 Rearing ponds	10
3.	Management of	3.1 Prestocking management of nursery and	30

	nursery and rearing ponds.	rearing ponds. 3.2 Stocking management. 3.3 Post stocking management of nursery and rearing ponds.	
4.	Fish nutrition	4.1 Nutritional requirement of fish	15
5.	Fish diseases	5.1 Non parasitic diseases 5.2 Parasitic diseases	25
6.	Harvesting		15
		Total	**120**

Practicals

Sr. No.	Unit	Sub-Unit	Periods
1.	Identification of fry and fingerling of Indian major carps, exotic fishes, air breathing fishes, brackish water fishes and shell fishes.	1.1 Indian Major carps 1.2 Exotic fishes 1.3 Air breathing fishes 1.4 Brackish water fishes 1.5 Shell fishes	40
2.	Identification of aquatic weeds and their control	2.1 Classification 2.2 Methods of control	10
3.	Identification and eradication of predatory insects	3.1 Classification 3.2 Methods of control	10
4.	Identification of common predatory and weed fishes	4.1 Predatory fishes 4.2 Weed fishes	10
5.	Identification of natural food	5.1 Phytoplankton 5.2 Zooplankton 5.3 Detritus 5.4 Insect and crustacean larvae	30
6.	Qualitative and quantitative estimation of fish food organisms.		15
7.	Study of		15

	behavioral changes in a diseased Fish. Identification of common fish parasites, diseases & their control.		
8.	Water Analysis	8.1 Estimation of temp., pH, turbidity, DO, free CO_2, total alkalinity etc	20
9.	Calculation of doses of manures and fertilizers		10
10.	Formulation of artificial feed and feed mixtures.		5
11.	Calculation of doses of supplementary feed and their application.		10
12.	Harvesting		10

Projects:

1. Collection of aquatic weeds from different water bodies. (10)
2. Collection of aquatic Insects from different water bodies. (10)
3. Collection of weed fishes from different water bodies. (15)
4. Visit to fish farm to record the management practices. (20)

Total **240**

Paper III: Fish Preservation and Processing (S6)
Theory

Sr. No.	Unit	Sub-Unit	Periods
1.	Introduction to processing	1.1 Definition and necessity of processing 1.2 Causes of fish spoilage	10
2.	Handling & transport of fresh fish	2.1 Handling & transport of fresh fish 2.2 Use of ice for preservation.	10
3.	Fish preservation	3.1 Principles of fish Preservation	30

		3.2 Traditional methods 3.3 Artificial dehydration of fish 3.4 Vapour compression system 3.5 Refrigerants 3.6 Method of freezing 3.7 Fish canning	
4.	Fish Byproducts	Methods of Preparation & Importance of 4.1 Routine byproducts 4.2 Value added products 4.3 Ornamental articles	20
5.	Packaging	5.1 Packing materials for frozen & canned fish 5.2 Labeling aspect	5
6.	Quality Control	6.1 Objectives 6.2 Steps in quality control 6.3 Common quality defects 6.4 Microbiological Standard 6.5 ISI standards	10
7.	Fish Marketing	7.1 Concepts of fish marketing 7.2 Types & functions 7.3 Co-operative marketing	15
8.	Fish Microbiology	8.1 Bacterial cell 8.2 Classification of bacteria on the basis of O2 requirement, temperature tolerance, nutritional requirement & Gram's staining 8.3 Introduction to Salmonella, Shigela, Clostridium, Staphylococcus	20
		Total	**120**

Practicals

Sr. No.	Unit	Sub-Unit	Periods
1.	Determination of freshness of fish by organoleptic method		20
2.	Handling of fresh fish		10
3.	Sanitation of containers		10
4.	Method of Icing		10
5.	Preservation methods drying & salting		20

6.	Study of refrigeration cycle		20
7.	Preparation of fish liver oil.		20
8.	Preparation of fish flour		20
9.	Preparation of fish value added products		20
10.	Estimation of TPC (total plate count)		15
11.	Gram staining technique		10

Projects:

1. Visit to landing center. (20)
2. Visit to canning unit. (20)
3. Fish salting. (10)
4. Project on fish meal production unit. (15)

Total **240**

REFERENCES

Name of the book	Author
1] Fish and Fisheries of India	Jhingran
2] Aquaculture	Bardach
3] Advances in aquaculture	Pillay
4] Diseases of Fish	Van Dujan
5] Fish culture in India	Alikunhi
6] Fisheries of India	Francis Day
7] An Introduction to fishes	Khanna
8] Fresh water fishery biology	Lagler
9] Limnology	Welch
10] Limnological Methods	Welch
11] Prawn & Prawn fisheries of India	Kurian & Sebastian
12] Fish and Fisheries of India	Srivastava
13] Fresh water fish culture	A.N. Kulkarni
14] Fish Pathology	Roberts
15] Pond Fisheries	F.G.Martyshev
16] Fish Processing Technology	ICAR New Delhi
17] Air breathing fishes, their structure, function, life history	J.S.Dutta, Munshi, G.M.Huges
18] How to make net and set net	Garner
19] Fish handling and Processing	Burgers
20] Tropical Aquarium fish	inns
21] Aquarium fishes	Chapghar
22] Inland fisheries	Ranade, Sathe, Ratan, Wankhede Kulkarni,
23] NCERT Practicals manuals in fisheries.	NCERT, New Delhi

24] Principles of Aquaculture	S.B.Zade., C.J. Khune, S.R. Sitre, R.V. Tijare
25] Aquaculture	Dr. Phale
26] Text book of Microbiology	Anant Narayan
27] General Microbiology	Pelczer, Reid and Chan
28] Fish byproducts	Tresellor & Lemon

List of Tools and Equipments

Sr. No.	List of tools/Equipments	Required Quantity	
1	Dissecting microscope	05	
2	Compound Microscope	05	
3	Secchi Disc	03	
4	Thermometer	05	
5	Aerator	02	
6	Aquarium Heater	02	
7	Refrigerator	01	
8	Thermostat	01	
9	Slide stand	02	
10	Gram staining kit	01	
11	Mono Pan Balance/ Digital balance	01	
12	Spring Balance	05	
13	Trays	05	
14	LCD projector	01	
15	Plate count agar	As per requirement	
16	Museum jars	As per requirement	Minimum 30.
17	Buckets	05	
18	Mugs	05	
19	Plastic pool (2 meter diameter)	01	
20	Dissection box	05	
21	Hypodermic Needles	2 dozen	
22	Centrifuge Machine	01	
23	Tongs	10	
24	Bone Cutter	02	
25	Butchers knife+ Sharpening stones	4	
26	Cast net model	01	
27	Gill net model	01	

28	Hooks and line	01	
29	Model of fish trap	01	
30	Spades	02	
31	Khurpi	02	
32	Sprayer pump	01	
33	Torch light	01	
34	Pastel and mortar	01	
35	Autoclave	01	
36	Sieve	01	
37	Petri dishes	12	
38	Seed Packing material	05	
39	Polythene bag for seed packing	20	
40	Spawn measuring cup	05	
41	Glass cutter	02	
42	Digital pH meter	01	
43	Filter for aquarium	04	
44	Nichrome wire loop	06	
45	Hand net	04	
46	Hapa – various type and sizes	02	
47	Aquarium sealant	As per requirements	
48	Silicone gun	01	
49	Mixer/Grinder	01	
50	Net weaving needle	1 set.	
51	Compute r(latest configuration.)	01	
52	Printer	01	
53	Necessary laboratory glassware	As per requirement.	
54	Gas stove	01	
55	Hygrometer	01	

Laboratory Furniture

Sr. No.	Article	Required
1]	Lab Table	8
2]	Stools	25
3]	Almirahs	4
4]	Museum racks	6
5]	Staff table	4
6]	Chairs	4

PARA MEDICIAL GROUP

1: MEDICAL LABORATORY TECHNICIAN (P1, P2, P3)

Scheme of Examination

Std. XI

Paper	Title of the Paper	Theory		Practicals		Term work	Project work	I.V.	Total Marks
		Marks	Time (Hrs)	Marks	Time (Hrs)				
1	Anatomy & Physiology	80	3	80	3	20	10	10	200
2	Laboratory Management & Ethics	80	3	80	3	20	10	10	200
3	Microbology	80	3	80	3	20	10	10	200

* IV = Industrial Visit. Visit to minimum five labs or diagnostic centers and blood banks (Any one blood bank)

Std. XII

Paper	Title of the Paper	Theory		Practicals		Term work	Project work	I.V. *	OJT **	Total Marks
		Marks	Time (Hrs)	Marks	Time (Hrs)					
1	Clinical Pathology, Hematology & Blood Bank	80	3	80	3	10	10	10	10	200
2	Histotechnology	80	3	80	3	10	10	10	10	200
3	Clinical Biochemistry	80	3	80	3	10	10	10	10	200

** OJT = On Job Training

* IV = Industrial Visit. Visit to minimum five labs or diagnostic centers and blood banks (Any one blood bank)

INTRODUCTION

Diagnostics play prominent role in the field of Medicine. Without proper diagnosis, proper conclusions regarding Medical treatment cannot be given. Thus Medical Lab Technician Course is gaining importance. This course is designed to train manpower to carry out medical laboratory technical work in various departments in medical and pharmacy colleges, peripheral laboratories, research and diagnostic centers, etc.

The healthcare industry is always changing, so as the Laboratory Medicine. The old manual methods used before are replaced by modern technologies. Automation has become an integral part of every laboratory. The diseases which were common before are obsolete now. At the same time many new diseases are emerging. There are new pieces of equipment or new tests to deliver better care. Hence it was absolutely essential to update the syllabus so as to make the students knowledgeable and efficient to work in the advanced laboratories.

OBJECTIVES

This course aims to educate and train students who have passed Std. 10th or equivalent examination.

1. To fulfill the manpower need of the health service in the country.
2. To carry out routine laboratory test on blood, urine, stool, sputum, etc. and various bacteriological, serological and biochemical tests.
3. To assist physician in the diagnosis and prognosis of a disease.
4. To carry out technical work in various departments of medical colleges, peripheral laboratories, research and diagnostic centers.
5. To understand principles of Laboratory Management and Ethics.
6. To handle, use and care of various laboratory equipments.
7. To develop expertise to perform and interpret various tests.
8. To understand organization of hospitals, research institutes, manufacturing companies of various reagents, laboratories of Primary Health Centers and District Hospitals to avail employment opportunities.

JOB OPPORTUNITIES

1. Lab technician in Biochemistry, microbiology, pathology, blood banking department.
2. Lab Assistant in Municipal hospitals.
3. Lab technician in Home science teaching college laboratory.
4. Lab technician/lab assistant in Dental college, Pharmacy college, Veterinary college, Fisheries college.
5. Laboratory technician in primary health center.

6. Laboratory technician in district hospitals.
7. Laboratory technician in private hospitals, nursing homes and diagnostic labs.
8. Technicians in various firms manufacturing vaccines, antisera and diagnostic kits.
9. Technician in dairy industries.
10. Technician in Municipal water labs.
11. Technician in Pharmaceutical labs.

SELF EMPLOYMENT

1. Diagnostic laboratory /collection center after completing govt. norms.
2. Preparation and sale of ready-made reagents/kit/media.
3. Distributor of laboratory chemicals.
4. Distributor of laboratory wares, equipment and spare parts.

FURTHER EDUCATION:

If student desires, he can take admission to First year of Bachelor of Science (B.Sc.) with Chemistry, Botany and Zoology.

Std. XI
Paper I: Anatomy and Physiology (P1)
Theory

Sr. No.	Unit	Sub-Unit	Periods
1	Introduction to Anatomy	a) Different Parts of Human Body. b) Anatomical Position & Planes. c) Common Anatomical terms.	04
2	Human Cell	a) Structure. b) Functions.	04
3	Tissue	a) Classification b) Functions of different tissues.	04
4	Skeletal System	a) Definition and Classifications of Bones. b) Location of Bones in human body. c) Skull	06
5	Blood	a) Composition and General Functions of Blood. b) Haemopioesis. c) Different types of Blood Cells and their functions. d) Compositions of Lymph e) Blood group	16

6	Cardio Vascular System.	a) Heart – Anatomy and functions. b) Circulation-Systemic, pulmonary and Portal. c) Cardiac Cycle. d) Definition of cardiac output, pulse, Blood Pressure, ECG. e) Explanation of Types of Blood vessels and their functions.	16
7	Respiratory System	a) Anatomy of respiratory system and functions. b) Definition of External & internal respiration. c) Mechanism of respiration and lungs. d) Definition of Respiratory rate, Tidal Volume, vital capacity, cyanosis, hypoxia, PCO2. e) Blood Gas Analysis.	12
8	Digestive System	a) Definition of Digestion. b) Parts of Digestive System i. Mouth and pharynx. ii. Salivary Glands. iii. Oesophagus and stomach. iv. Intestine – Small & large. v. Liver, Gall bladder and Pancreas. c) Process of Digestion.	16
9	Excretory System	a) Urinary system –Anatomy and functions of Kidneys, Ureter, Urinary Bladder and Urethra. b) Skin – Structure and Function	12
10	Reproductive System	a) Anatomy and functions of Male reproductive System. b) Anatomy and functions of Female reproductive System	12
11	Endocrinology	a) Definition of Endocrine glands, b) Name of Glands and their hormones. c) Functions and Significance of different Hormones.	12
12	Nervous system	a) Anatomy of Brain, Spinal cord and nerves and their Functions. b) C.S.F.-formation and its Functions.	06
		Total	**120**

Practicals

Sr. No.	List of Practicalss	Periods
	A) ANATOMAY PRACTICALS (Charts and Models) **(Practicals notebook, Drawing Diagrams, Labeling). Demonstration of parts of**	

	body and bony landmarks on body surface.	
1.	Identification of cells and basic tissues.	8
2	Respiratory System.	8
3.	Heart and Great vessels.	8
4.	Digestive System	16
5.	Hepato biliary system	12
6.	Urinary System.	8
7.	Male Genital System.	10
8.	Female Genital system.	10
9.	Central Nervous System.	10
	Practicalss may be by	
1.	Demonstration of specimen	
2.	Drawing diagram and labeling.	
3.	Demonstration of models.	
	B) PHYSIOLOGY PRACTICALS.	
1.	Microscope- Use, maintenance, cleaning and types.	14
2.	Identification of Blood cells focused under microscope and report writing. 10 Samples - a) RBCs, b) WBCs-Different types, c) Platelets, d) Reticulocytes.	20
3.	Blood Collection – 10 subjects. (Patients)	12
4.	Obtaining Sample of Plasma and serum (10-Samples)	6
5.	Behaviour of RBC in Isotonic, Hypertonic and Hypotonic solutions.	16
6.	Preparation of Anticoagulants-Double Oxalate, Sodium Citrate, EDTA, Fluoride, Heparin bulbs.	18
7.	Haematocrit (PCV) determination, methods, Normal values and Significance.	16
8.	Identification of ruling areas in Neubaeur's chamber- RBC and WBC diluting pipette, Westergreen's pipette.	20
9.	Hb. Estimation by Sahli's method and Drabkin's method with its normal range and significance.	20
10.	Demonstration of blood Pressure recording and Pulse. (10 Patients).	8
	Total	**240**

Paper II: Laboratory Management and Ethics (P2)
Theory

Sr. No.	Unit	Sub-Unit	Periods
1	Human Health and Disease.	a) Definition of Health-Given by WHO. b) Dimension of Health-Physical, Mental,	20

		Social and spiritual. c) Disease- i. Concept of disease. ii. Classification or types of disease iii. Mode of Disease transmission. d) Disease Agent- Definition, Types- Biological, Nutritional, Physical, Chemical, Mechanical, social etc. e) Diagnostic procedures - History, physical examination by physician, Lab investigation like blood, urine, stool, etc. and other investigation like CT , MRI, Ultrasound, etc.	
2.	Health Care system in India.	a) Public health Sector-Elementary Knowledge of Government, Municipal Hospital, PHC, etc. b) Private Sector-GPs, Polyclinics, Private hospitals etc. c) Indigenous systems of medicine, Ayurveda, Homeopathy, Unani etc. d) Voluntary Health agencies e) National Health Programmes.	08
3.	Laboratory System in India	a) Taluka Level-PHC lab. (Community based lab) b) District Hospital lab at district level. c) Regional Level –Regional Hospital Lab d) National Level Lab.	08
4.	Ethics	a) Definition of Ethics. b) Definition, Qualification and subject knowledge of medical lab technician. c) Professional code of Conduct for Technician. d) Do's or Don't of Lab technicians. e) Maintaining relations with other staff of Lab & Patients. f) Communication Skills written spoken, action.	04
5.	Laboratory Planning	a) Definition of Laboratory and its Legal aspects. b) General Principles of Laboratory including space, ventilation, light, water, working benches etc. c) Various sections or working components of a Laboratory. d) Different labs in major Hospitals.	08

		e) Staffing pattern of the Lab. depending upon the size and types of a lab. f) Work schedule-Depending upon type of lab example, Sample receiving, recording, processing, reporting etc. g) Develops specific goals and plans to prioritize, organise and accomplish work.	
6.	Equipments, Glass - ware, Reagents, Chemicals of a lab and its care and use.	a) List of Equipments, Glass wares, Chemicals etc. Principle, Use, and maintenance of Microscope, Centrifuge, Oven, incubator autoclave etc. b) Need to understand the parts replacement process of Equipments. c) Care and Cleaning of Glass ware- Used, Infected, Unused (New). d) Use of Micropipettes e) Making simple glass ware in Lab. (e.g. stirring rods, Pasteur Pipettes etc). f) Care of Chemicals, storage, and labelling, classification (Organic, inorganic, toxic and non toxic, carcinogenic, flammable etc.)	12
7.	Specimen Handling	a) Types of Specimens b) Collection, Precautions and Containers for specimens. c) Specimen packing, transport and storing. d) Receiving specimen in lab e) Acceptance and rejection criteria for specimen. f) Specimen preservation g) Disposal of specimen	08
8	Bio-medical Waste Management	a) Definition b) Source of health care waste (bio-waste) c) Classification of hazardous wastes- infectious waste, biochemical, pharmaceutical, Genotoxic, radioactive etc. d) Personnel at risk of Bio-waste. e) Treatment and disposal technology for bio-waste- segregation storage, transport treatment (Incineration, chemical disinfection, wet and dry thermal treatment and land disposal) f) Storage of biomedical waste categories and colour coding.	12
9	Laboratory Safety	a) General principles	12

		b) Lab hazards i. Mechanical ii. Electrical iii. Chemical iv. Radioactive v. Bio waste etc. c) Safety measures i) Designing safe lab ii) Fire extinguisher iii) following professional code of conduct iv) Displaying safety charts v) Personal care, hygiene and immunisation. d) First Aid – i) Definition ii) Contents of first aid box e) First Aid measures in case of accident in a lab e.g. i) Cuts ii) Burns iii) Electric shock	
10	Quality Control	a) Definition of quality control and quality assurance b) Quality assurance stages – pre analytical, analytical, post analytical. c) Pre-analytical- preparation of patient, requisition form, specimen collection, use of computer network for sample acceptance. i. Analytical- error due to mixing of samples, interference due to washing, explain quality control – principle and standardisation of the test method, quality control of quantitative and qualitative reagents, error of imprecision or scatter error, error of inaccuracy or biased error, use of quality control charts (Levey-Jennigs charts and Cusum curve) ii. Post-analytical – reporting, checking (verifying), and interpretation of test results d) Definition – Reliability, accuracy, specificity, Sensitivity, Precision with one suitable example.	12
11	Material Management	a) Procurement – where to obtain, supplies reagents, kits, chemicals, reusable parts. b) Purchase (cost control) c) Utilisation of supplies (voucher of supplier) d) Inventory control and analysis (stock card) e) inspection of storage	08

		f) maintaining records and reports g) Use of computer – storing records reports and other data. h) Usage of LMIS (Laboratory Management Information System)	
12	Multi-skills for laboratory technician	a) Phlebotomist-Blood collection centers. b) E.C.G. Technician-Knowledge of different types of Leads, Procedure of recording E.C.G. c) Hospital record Technician-Maintaining information of patients. (Personal information, Health status, List of test, reports, billing) d) Preparation and distribution of reagents, Kits, chemicals etc.	08
		Total	**120**

Practicals

Sr. No.	List of Practicals	Periods
1.	Drawing an ideal clinical lab.	16
2.	Learning different equipments and its maintenance-Microscope, Centrifuge, Oven etc.	28
3.	Learning different chemical, Reagents and the Glassware and its uses e.g. Beaker, Conical flask, test tubes, volumetric flask, measuring cylinder.	24
4.	Washing of glassware used (Dirty and infected) and unused (new).	16
5.	Preparing reports of Lab. Test (Urine, Stool, CSF, Sputum, Semen, CBC, ESR, VDRL, HIV, Biochemistry etc).	20
6.	Learning First Aid Box (Its contents).	20
7.	Learning First Aid Procedure for accidents. e.g. Cuts, burns, electric shock, inhalation of gases, swallowing infected material, acids, alkali etc.	20
8.	Learning Vaccutainers.	12
9.	Identifying of colour code for a Bio-waste disposal bags.	8
10.	Learning Vouchers of supplier.	12
11.	Maintaining stock cards.	12
12.	Learning parts of computers and its operations. (MS-office, Excel, Power point)	28
13.	Visit to PHC, Clinical Labs etc.	24
	Total	**240**

Paper III: Microbiology & Parasitology (P3)
Theory

Sr. No.	Unit	Sub-Unit	Periods
1.	Introduction to Microbiology	Introduction to Microbiology and Various definitions.	02
2.	Sterilization and disinfection.	a) Dry heat-Flamming, hot air oven. b) Moist heat-Below 100°C at 100°C and above 100°C (Autoclave in detail). c) Filtration- Sand Filter, Seitzfilter, Sinterted glass and membrane filters. d) Use of Hand wash solution and sodium hypochloride.	04
3.	Requirement and use of common Lab. equipments.	a) Microscope-Types and uses. b) Incubator c) Hot air oven. d) Autoclave-Different types. e) Anaerobic jar. f) ELISA Micro plates reader. g) Laminar air Flow and types.	04
4.	Bacterial Anatomy	Classification and morphology of bacteria. Structure of Bacterial cells, Capsule, Flagella and spore.	08
5.	Staining of Bacteria	a) Smear-Fixation-Staining. b) Grams staining in detail. c) ZNCF stain in detail. d) Albert's staining for granules. e) Negative staining for capsule. f) Silver impregnation staining for Flagella.	08
6	Bacterial Physiology	Bacterial growth requirements –pH, food, oxygen, CO2, temp. Symbiosis, bacterial growth curve.	04
7.	Cultivation of Micro organism.	a) Culture media-requirement and classification. (Solid, Liquid, semi solid) b) Composition of common lab culture media. i. Nutrient Agar ii. MacConkey's Agar	08

		iii. Blood Agar iv. Selective media. (DCA, L.J, EMB media) c) Transport Media(AMIES, Stuarts) d) Anerobic media (Robertsons Cooked meat medium).	
8.	Culture Methods.	Various Culture methods. Techniques of Inoculation and Isolation.	04
9	Identification of Bacteria.	a) Staining b) Motility. c) Cultural characteristics. d) Biochemical reactions. (Catalase, Oxidase, Urease TSI, Gelatin liquefaction IMVP and Citrate Principle, procedure and observation).	08
10	Gram Positive Bacilli.	Corynebacterium, (Classification, morphology, Cultural characteristics, Biochemical Reactions, Pathogenecity and Lab diagnosis.)	04
11	Gram Negative Bacilli.	Salmonella, Shigella, E.coli, Proteus, Vibrio, (Classification, morphology, Cultural characteristics, Biochemical Reactions, Pathogenecity and Lab diagnosis.)	08
12	Gram Positive and Gram Negative cocci.	Staphylococci, streptococci, Pneumococci and Neiseria. (Classification, morphology, Cultural characteristics, Biochemical Reactions, Pathogenecity and Lab diagnosis.)	08
13	Mycobacteria,	Mycobacterium tuberculosis and leprae.	06
14	Spirocheates.	Treponema Pallidum	02
15	Leptospira	Introduction and Lab Diagnosis.	02
16	Gram Positive Anaerobic Bacilli.	Clostridia spp.	02
17	Antibiotic Sensitivity Test	Principle and method of determination of Sensitivity and drugs resistance.	02
18	Virology	Disease wise classification, Structure, capsid, nucleocapscids, capsomere, virion. HIV-I & II- Morphology, Clinical features, diagnosis, spread and control (ELISA, W.B., and PCR.) Hepatitis, Polio – Morphology, Clinical features, diagnosis, spread and control Elementary knowledge of H1N1, Dengue and Chikungunea.	12

19	Immunity	Concept of Immunity - Active and Passive. Primary and secondary response. Antigen Antibody (Immunoglobulin Five types). Concept of Monoclonal and Polyclonal antibodies.	04
20	Serology	Principle, Procedure and Diagnostic significance of Agglutination, Precipitation, Neutralization, Complement fixation.	08
21	Collection and Processing	Specimen like Urine, stool, sputum, Blood, CSF, Aspiration and swabs.	08
22	Parasitology	Introduction, Classification, Protozoal Parasites, Nematodes & Helminths.	04
		Total	**120**

Practicals

Sr. No.	List of Practicals	Periods
1.	Handling and care of microscope.	4
2.	Operation of autoclave, incubator, water bath, serological water bath, pH meter, hot air oven, sterilisation, packing, loading of materials in autoclave, hot air oven, inspissator.	34
3.	Preparation of culture media – nutrient agar, Mac Conkey's agar, blood agar (Pouring, quality control, storage)	22
4.	Hanging drop method (2 samples)	18
5.	Specimen collection - blood, urine, stool, swabs (nasal, throat, vaginal).	16
6.	ZNCF staining, Gram's staining, Alberts staining	20
7.	Inoculation of Clinical materials into media.	12
8.	Isolation of Organism in Pure culture.	16
9.	Morphology, Cultural characteristics and Identification, Biochemical reaction of common micro organisms.	18
10.	Bacteriological Examination of water, milk, air.	16
11.	Antibiotic Sensitivity test.-Disc method, automated method.	16
12.	Fungal Examination by wet mount – Lactophenole cotton blue.	16
13.	Serology: Widal test (Slide and tube method, report preparation), VDRL (RPR method), R.A. test, CRP test. ASO test, Beta-HCG in Urine (Pregnancy test).	32
	Total	**240**

Std. XII
Paper I: Clinical Pathology, Haematology & Blood Banking (P1)
Theory

Sr. No.	Unit	Sub-Unit	Periods
1	Introduction to Haematology	1.1 Definition 1.2 Components 1.3 Cells-their structure & functions 1.4 Lymph	02
2	Collection of blood	2.1 Collection of capillary blood by skin puncture 2.2 Collection of blood by veni puncture 2.3 Collection of arterial blood 2.4 Vaccutainers & colour coding. 2.5 Criteria for sample collection	04
3	Anticoagulants	3.1 Definition, Action of E.D.T.A., Oxalates, Double Oxalates, Fluorides, Acid citrate dextrose, Tri sodium citrate, Heparin. 3.2 Effect of anticoagulants on blood cell morphology.	02
4	Haemoglobin	4.1 Normal structure & various haemoglobins 4.2 Determination of haemoglobin by Cyanmethemoglobin method & other method of Hb. 4.3 Anemia	08
5	Study of blood cell counts	5.1 Total WBC count 5.2 RBC count 5.3 Platelet count 5.4 Absolute Eosinophil count 5.5 Reticulocyte count	10
6	Study of blood smear for differential WBC count	6.1 Preparation & staining of smears, Romanowsky stains 6.2 Counting methods 6.3 Morphology of white cells, types of white cells. 6.4 Abnormalities in morphology of blood cells & related diseases.	10

7	Erythrocyte sedimentation rate	7.1 Westergreen's method 7.2 Wintrobe's method 7.3 Landau method 7.4 Factors affecting ESR 7.5 Normal range, clinical significance & limitations	04
8	Packed cell volume (Haematocrit)	8.1 Packed cell: Principle, Procedure, Normal values, Clinical significance. Macro & micro haematocrit.	02
9	Red cell indices	9.1 Red cell indices. Determination of MCV, MCH, MCHC i.e., Colour index. Automatic cell counter, its parameters.	03
10	Sickle cell preparation	10.1 Screening for sickle cell anemia	02
11	Coagulation Tests	11.1 Mechanism of coagulation 11.2 Factors of coagulation 11.3 Determination of bleeding time 11.4 Determination of clotting time 11.5 Determination of Prothrombin time	10
12	Preparation of Bone marrow smears	12.1 Types 12.2 Collection methods 12.3 Preparation & staining of smear 12.4 Clinical significance 12.5 Detection of presence of iron in bone marrow. 12.6 Clinical significance	03
13	Urine Analysis	13.1 Collection & preservation of sample 13.2 Normal & Abnormal constituents 13.3 Physical examination 13.4 Chemical examination for abnormal constituents 13.5 Microscopic Examination 13.6 Urine report preparation	12
14	Stool examination	14.1 Physical 14.2 Chemical 14.3 Microscopic	03
15	Semen Analysis	15.1 Specimen collection 15.2 Precautions during collection. 15.3 Physical examination 15.4 Chemical examination 15.5 Microscopic examination	04
16	Sputum Examination	16.1 Method of collection, Specimen collection 16.2 Precautions during collection. 16.3 Physical examination	02

		16.4 Chemical examination 16.5 Microscopic examination	
17	C.S.F. Examination	17.1 Method of collection 17.2 Physical examination 17.3 Chemical examination 17.4 Microscopic examination. 17.5 Interpretation related with types of meningitis.	06
18	ABO Blood group system	18.1 Introduction to ABO Group System. 18.2 Types of Blood Groups and Their Antigen and Antibody. 18.3 Methods of Detection of ABO group System. i. Slide ii. Tube method. iii. Bovine Method 18.4 Applications of ABO system	06
19	Rhesus blood group system	19.1 Clinical significance 19.2 Detection of Rh antigen by Slide method & tube method 19.3 Rh confirmation test & Bombay blood group	08
20	Cross matching	20.1 Major & Minor by slide & tube method	02
21	Coomb's test	21.1 Direct & Indirect Coomb's test Principle, importance, procedure, interpretation	04
22	Blood bank	22.1 Definition, layout of blood bank 22.2 Equipments 22.3 Maintenance of records operation	03
23	Blood Transfusion	23.1 Principle, selection & screening of donor 23.2 Collection of blood 23.3 Anticoagulants used in blood bank 23.4 Testing of blood for H.I.V., HBsAg, V.D.R.L. & malaria. 23.5 Storage of blood	06
24	Complications of blood transfusion	24.1 Definition, types of blood transfusion reaction	02
25	Cell separation & transfusion of various blood components	25.1 Name of different Blood Components. Methods for Separation. Instrument used for Separation. (Differential Centrifuge).	02
		Total	**120**

Practicals

Sr. No.	List of Practicals	Periods
1.	Collection of blood.	16
2.	Estimation of hemoglobin	16
3.	Differential WBC Count	18
4.	Examination of peripheral blood smears	12
5.	Total RBC count	12
6.	Total WBC count	12
7.	Platelet count	12
8.	Reticulocyte count	12
9.	Estimation of ESR	8
10.	Determination of PCV	8
11.	Bleeding Time	8
12.	Clotting Time	8
13.	Prothrombin time	4
14.	Sickle cell preparation	6
15.	Urine analysis	25
16.	Stool Examination for ova and Cyst.	6
17.	Semen analysis	4
18.	Sputum examination	4
19.	C.S.F. Examination	4
20.	ABO blood grouping by slide method.	4
21.	ABO blood grouping by tube method.	4
22.	Rh typing by slide method	4
23.	Rh typing by tube method	4
24.	Cross matching (Major & Minor)	5
25.	Coombs Test Direct and Indirect.	6
	VISITS	
1.	For Automatic blood cell counter	8
2.	Blood Bank	10
	Total	**240**

Paper II: Histotechnology (P2)
Theory

Sr. No.	Unit	Sub-Unit	Periods
1	Introduction	a) Definition of Histotechnology. b) Different terms used in histotechnology	02
2	Cell, Tissues and their functions	a) Definition of cell. b) Different parts of cell and their functions c) Classification of different tissues of body and their functions	04
3	Methods of examination of tissues and cells	a) Collection and labeling of specimens, b) Methods of preparation and examination of tissues-Fresh and Fixed tissue. c) Types of biopsy	04
4	Fixation of Tissue	a) Definition b) Criteria for an Ideal fixative c) Classification of fixative-simple and compound d) Properties of simple fixatives e) Compound fixatives and their properties - Microanatomical, Cytological and Histochemical	16
5	Decalcification	a) Definition and significance b) Different decalcifying fluids c) Detection of end point of decalcification	12
6	Tissue Processing	a) Types of tissue processing-Manual and Automatic. b) Different embedding media c) Steps of tissue processing-Dehydration, Clearing, Impregnation , d) Embedding. - Methods of embedding, embedding medium, names of Medium and moulds. e) Automatic tissue processor - Structure and working - Advantages and disadvantages	16
7	Section cutting	a) Types of microtome b) Rotary microtome - parts and their functions. c) Microtome knives – - Types - Care and maintenance - Technique of Sharpening	12

		d) Automatic knife sharpener e) Technique of section cutting f) Preparation of an adhesive mixture g) Mounting	
8	Frozen section	a) Definition b) Advantages and disadvantages c) CO_2 freezing microtome d) Cryostat	04
9	Staining	a) Definition and significance b) Sensitivity and specificity of stain c) Theory of staining d) Methods of staining – - Direct and Indirect staining, - Progressive and Regressive staining e) Mordants and Counter stain. Accentuators-Role in staining. f) Haematoxylene and Eosin staining. g) Special stains- (i) Connective tissue stains- - Collagen and collagen fibres -Weigert's von Gieson stain - Reticular fibres-Silver Impregnation method - Elastic fibres -Verhoeff's stain (ii) Stains for particular Substances - Carbohydrates-PAS stain - Amyloid-Congo Red stain - Pigments and Minerals Haemosiderin and Iron-Prussian Blue method. - Calcium- Von Kossa stain - Melanin-Negative Prussian Blue Reaction (iii) Stains for Microorganisms - Bacteria – Gram's Stain, Giemsa's stain - Myco. tuberculosis and Myco.leprae-Acid Fast Stain - Fungi- Grocott'smethenamine silver stain(GMS)	20
10	Exfoliative Cytology	a) Introduction and significance	14

		b) Types of specimens& preservation c) Preparation smear d) Use of cytocentrifuge e) FNAC technique f) Different cytological fixatives g) Papanicoloau staining h) DNA isolation Karyotyping i) Barr body staining- i) Introduction and significance ii) Morphology of Barr Body iii) Staining of Barr Body- • Cresyl fast violet stain • Orcein stain • Carbol Fuchsin stain	
11	Museum Technique	a) Definition and significance b) Steps of storage of specimen in pathology museum- • Reception and Preparation of specimen • Fixation - Kaiserling solution No. 1 • Color Restoration - Kaiserling solution No. 2 • Preservation - Kaiserling solution No. 3 • Presentation (Mounting in Museum jar)	08
12	Waste disposal	Types of waste Methods of disposal	08
		Total	**120**

Practicals

Sr. No.	List of Practicals	Periods
1.	Preparation of 10% formalin.	16
2.	Preparation of 5% formic acid and Detection of end point of decalcification by chemical method.	22
3.	Manual and automatic tissue processing.	28
4.	Technique of embedding.	20
5.	Rotary microtome (Demonstration of different parts & working.)	20
6.	Sharpening of microtome knife. (Honing & stropping.)	16
7.	Preparation of an adhesive - Mayer's egg albumin and glycerol.	14
8.	Technique of section cutting.	12
9.	Haematoxylene and Eosin staining and mounting.	22
10.	Preparation of cytology smears.	18

11.	Preparation of cytological fixatives: i) 95% ethyl alcohol ii) Ether-alcohol	16
12.	Papanicolaou staining.	20
13.	Visit to Histotechnology laboratory.	16
	Total	**240**

Paper III: Clinical Biochemistry (P3)
Theory

Sr. No.	Unit	Sub-Unit	Periods
1	Elementary knowledge of Organic Chemistry	Organic Compounds – Alcohols, Aldehydes, Ketones, Esters and Carboxylic Acids.	04
2	Glass wares used in Biochemistry laboratory.	a) Types of glass b) Uses, their identification and application c) Cleaning, drying, maintenance and storage of glassware	04
3	Instrumentation	a) Colorimetry: Photo electric methods. Instrumentation, Principle, working, care & maintenance and application. Beer – Lambert law, Filters and choice of filter b) Spectrophotometry: Principle, types, construction and application c) Flame Photometry d) Paper Chromatography e) Electrophoresis – Principle, Types and application	12
4	Basic Laboratory Techniques	a) Methods of measuring liquid b) Separation of solids from liquids c) Centrifugation – Principle, different types of centrifuge, care & maintenance, application d) Filtration using funnel e) Weighing – Different types of balances used, care & maintenance	08
5	Carbohydrates	Importance, definition, classification and some properties (Reducing properties, osazone formation, etc). Dietary sources of Carbohydrates.	08
6	Proteins	Classification (Simple, compound and derived proteins), Amino acids- Names, tests and	08

		application, Essential amino acids, Denaturation of proteins, Functions of plasma proteins. Dietary Sources of Proteins.	
7	Lipids	Definition, Classification, Sterols particularly cholesterol, Functions. Dietary source of lipids.	08
8	Nucleic acids	DNA and RNA	04
9	Enzymes	Definition & Classification, properties, mechanism of enzyme action, diagnostic value of serum enzymes. (SGOT, SGPT, acid and alkaline phosphatase, lactate dehydrogenase, creatinine phosphokinase, amylase, lipase)	08
10	Vitamins	Classification, Functions and deficiency diseases. Dietary sources of Vitamins.	08
11	Carbohydrates metabolism	Elementary aspect, definition of glycolysis, glycogenolysis, ketosis, glycosuria, renal glycosuria, ketonuria	04
12	Lipid Metabolism	Elementary aspects, Triglycerides, Cholesterol, Plasma lipoproteins, ketone bodies. Lipid Profile	04
13	Protein Metabolism	Proteinuria, Transaminases, Renal Function Test.	04
14	Water and mineral metabolism	Dehydration; Calcium, Phosphorus, Iodine: Their physiological functions and disease.	08
15	Renal Function Test	Definition, Importance of test like, Blood urea, BUN.Creatinine, Uric Acid, Proteins. Importance of Dialysis.	08
16	Liver function test	Serum Bilirubin, SGOT, SGPT, alkaline phosphates, Total proteins, serum albumin and serum globulin, serum cholesterol, prothrombin time.	08
17	Automation in Clinical Biochemistry	Principle, types Like Semi, Fully, Sequential and batch mode Auto analyzers – Role of computers in laboratory	08
18	Blood Gas Analyzer	Laboratory determination of PCO2, PO_2, pH, Bicarbonates. Components of Blood Gas Analyzer. Use and working of Blood gas Analyzer.	04
		Total	**120**

Practicals

Sr. No.	List of Practicals	Periods
1.	Preparation of Saturated solutions, Percent solutions, Normal solutions, Molar solutions, Buffer Solutions.	20
2.	Normal constituents – (a) Qualitative test for urea, uric acid, creatinine, calcium, phosphorous. (b) Creatinine Clearance	26
3.	Abnormal constituents of urine: (a) Qualitative test for: sugar, albumin ketone bodies, blood, bile salts and bile pigments. (b) test for phenylketonuria ($FeCl_3$)	30
4.	Estimation of plasma glucose (GOD-POD method)	16
5.	Glucose tolerance test.	18
6.	Non protein nitrogenous compounds: - Estimation of serum urea by (DAM/Enzymatic method), uric acid and ceratinine (Endpoint method/Kinetic/Enzymatic).	30
7.	Determination of serum proteins and AG ratio.	12
8.	Serum Electrolytes :- Determination of Sodium, Potassium and Chlorides (Flame Photometry/Colorimetry)	12
9.	Determination of Inorganic phosphorus (Principle, Normal value, increase and decrease)	12
10.	Determination of Calcium (Principle, Normal value, increase and decrease)	16
11.	Determination of transaminase – SGOT and SGPT (Principle, DNPH method)	12
12.	Determination of Alkaline Phosphatase and Acid phosphatase.	12
13.	Serum Bilirubin: Determination of total and direct bilirubin.	8
14.	Serum Lipids: Determination of serum Cholesterol (enzymatic) Determination of HDL, LDL, VLDL and Triglycerides.	16
	Total	**240**

List of Books

Sr. Number	Title
1.	Fundamental of Biochemistry by A. C. Deb.
2.	Fundamentals of Chemistry by J. L. Jain.
3.	H. B. of Medical Technology by Dr. Mrs. Chitra.
4.	Medical Laboratory Technology by A. Ananthanarayan.
5.	Text book of Microbiology by Dr. Ramnik Sood.
6.	Parasitology Protozoology Helminthology by K. D. Chatterjee.

7.	Human Physiology I by C.C. Chatterjee.
8.	Human Physiology II by C.C. Chatterjee.
9.	Grays Anatomy by Peter C. Williams.
10.	Interpretation of common Investigation by L.C. Gupta.
11.	Anatomy & Physiology for Nurses Evelyn C. Perce.
12.	Clinicians Pocket References Leonard G. Gomellar.
13.	Notes on Chemical Lab Techniques by K. M. Samuel.
14.	Introduction of Transfusion Medicines by Zarin Bharacha.
15.	Textbook of Parasitology by S.S. Kelkar
16.	Manual of Medical Lab. Technology by A.V. Naigaonkar
17.	Practicals Clinical Biochemistry by Harold Varley.
18.	Principles & Techniques of Practicals Biochemistry by Keith Wilson.
19.	Synopsis of Pathology & Microbiology by K. Chaudhary.
20.	Viva & Recent Advances in Medical Microbiology by Satish Gupta.
21.	Parasitic Diseases in man by Richard Knight.
22.	Laboratory Manual of Clinical Biochemistry by Praful B. Godkar.
23.	Bacteriology Illustrated by R. R. Gillies.
24.	Atlas of Haematalogy by G. A. Donald.
25.	Medical Laboratory Technology by Ramnik Sood.
26.	Medical Lab Technology V-I by Kanai Mukherjee.
27.	Medical Lab Technology V-II by Kanai Mukherjee.
28.	Medical Lab Technology V-III by Kanai Mukherjee.
29.	Human Anatomy I by B.D. Chaurasiya.
30.	Human Anatomy II by B.D. Chaurasiya.
31.	Human Anatomy III by B.D. Chaurasiya.
32.	Anatomy & Physiology in Health and Illness by Kathleen Wilson.
33.	Introduction to Medical Lab Technology by F.J. Baker.
34.	Textbook of Microbiology R. Ananthanayan.
35.	Biochemistry for Students by V. K. Malhotra.
36.	Practicals Heamatology by V. Dacie.
37.	Clinical Diagnosis & Management by J.B. Henry.
38.	Manual for Laboratory Technician at the Primary Health Center by Ministry of Health.
39.	Physiology & Anatomy for Nurses by Dr. Vijaya Joshi.
40.	HB of Medical Lab Technology by Dr. Chitra Bharucha.
41.	Viva & Recent Advance in Medical Microbiology by Satish Gupta.
42.	Viva in Biochemistry by V. K. Malhotra.
43.	A HB of Clinical Pathology by Chakravati.
44.	Textbook of Medical Biochemistry by S. Ramakrishnan.
45.	Medical Dictionary by Dauglar M. Anderson.
46.	Clinical Pathology by S. S. Kelkar.
47.	Short Textbook of Medical Microbiology by Satish Gupta.
48.	Human Histology by Inderbir Singh.

49.	Mosby's Medical Dictionary by Mosby's.
50.	A Textbook of Human Anatomy by T.S. Ranganathan.
51.	A Textbook of Human Physiology by K.M. Kutty.
52.	Text Book of Medical Lab Technology (By Ghodkar).
53.	Text Book of Biochemistry by Sattaynarayan.

Note: Text Book of Medical Lab Technology by B. Mukerjee and Text Book of Medical Lab Technology by P. B. Godkar at least 5 copy of each should be available in the Library .

List of Tools and Equipments

Power Supply – 5 Phase K W.

List of Tools and Equipments

1.	Autoclave	01
2.	Hot Air Oven	01
3.	Colorimeter	01
4.	37° C Incubator	01
5.	Table Centrifuge (Swing out with 6 to 8 buckets)	01
6.	Refrigerator – 165 liter	01
7.	Water bath	01
8.	Analytical Balance	01
9.	Gas Cylinder (1 with 10 burners)	01
10.	Microtome	01
11	Tissue Floating bath	01
12	Microscopes	20
13	Slide warmer	01
14	pH meter	01
15	Thermometer	01
16	Blood Pressure apparatus	01
17	Stethoscope	01
18	Weighing machine	01
19	Voltage stabilizer	01
20	Computer with printer	01
21	Fire Extinguisher	01
22	Anatomical charts and models	10
23	Human Skelton	01

LIST OF LABORATORY WARES

1.	Test Tubes	18 x 75 mm	50
		10 x 100 mm	50
		15 x 150 mm	50
2.	Centrifuge tubes	16 x 100 mm	30
3.	Beakers (Glass and Polypropylene)		
		50 ml	05
		100 ml	05
		250 ml	05
4.	Measuring cylinders (Stoppered)		
		50 ml	02
		100 ml	02
		250 ml	02
		500 ml	02
5.	Measuring cylinders (Non-Stoppered)		
		100 ml	02
		250 ml	02
		500 ml	02
6.	Pipettes		
	A) Volumetric capacity,		
		1 ml	10
		5 ml	10
		10 ml	10
	B) Serological blow out type-		
		1 ml in 1/100 ml	10
		2 ml in 1/100 ml	10
		5 ml in 1/100 ml	10
		10 ml in 1/10 ml	06
		1 ml in 1/10 ml	04
		2 ml in 1/10 ml	04
		0.1 ml in 1/100 ml	04
		0.2 ml in 1/100 ml	04
7.	Burette		02
8.	Reagent bottles Capacity:		
		60 ml	10
		120 ml	10
		250 ml	10
		500 ml	05
9.	Volumetric flasks		
		25 ml	02
		50 ml	04
		100 ml	04

		250 ml	04
10.	Dropper bottle	30 ml	05
11.	Pasteur pipettes		50
12.	Syringes and needles	2 ml	20
		5 ml	20
		10 ml	10
13.	Blood lancets		1 boxes
14.	Tourniquet		5
15.	Micro slides		5 packs of 50 each
16.	Microscope cover slips		10 small pcks
17.	Microscope lamps		10
18.	Blood cell counters (Manual for counting)		01
19,	Haemoglobinometer (Sahli's)		10
20.	Haemocytometer		10
21.	ESR tubes (Westgren)		20
22.	ESR stands		04
23.	Wintrobes tubes		10
24.	Plain tubes		50
25.	Anticoagulant (EDTA/Oxalate) bulb		50
26.	ACD bottles		01
27.	Donor bleeding set		01
28.	Lumbar puncture needle		01
29.	Bone marrow biopsy needle		01
30.	Filter paper-ordinary		01 Ream
31.	Whatman filter paper		
		46 x 57 cm,	
		No. 1	10 Sheets
		No. 2	10 Sheets
32.	Glass rods/Stirrer		10
33.	Rubber teats		20
34.	Cotton absorbent		1 Roll
35.	Block holder		02
36.	L-moulds		3 pairs
37.	Knife & knife sharpener		01
38.	Needle holder		02
39.	Forceps		05
40.	Petri dishes	(100 x 17)	20
41.	Cavity slides		05
42.	Nichrome loop/Platinum loop		10
43.	Loop holder		24
44.	Durham's tubes		24
45.	Urinometer		01
46.	Porcelain tiles		02
47.	Test tube rack		10

48.	Test tube holder	20
49.	Pipette stand	02
50.	Glass / Plastic funnel	04
51.	Spirit lamps	05
52.	Litmus paper blue (Book)	10 pcks
53.	Litmus paper red (Book)	10 pcks
54.	Gloves	10
55.	Gauze	½ kg
56.	Stop watch	02
57.	Scissors	02
58.	Glass marking pencils (RED)	05
59.	Tripod Stands	05
60.	Kidney tray	02
61.	Waste paper basket	02
62.	Brush (bottle cleaning)	10
63.	Phenyl (As per Use)	5 litres

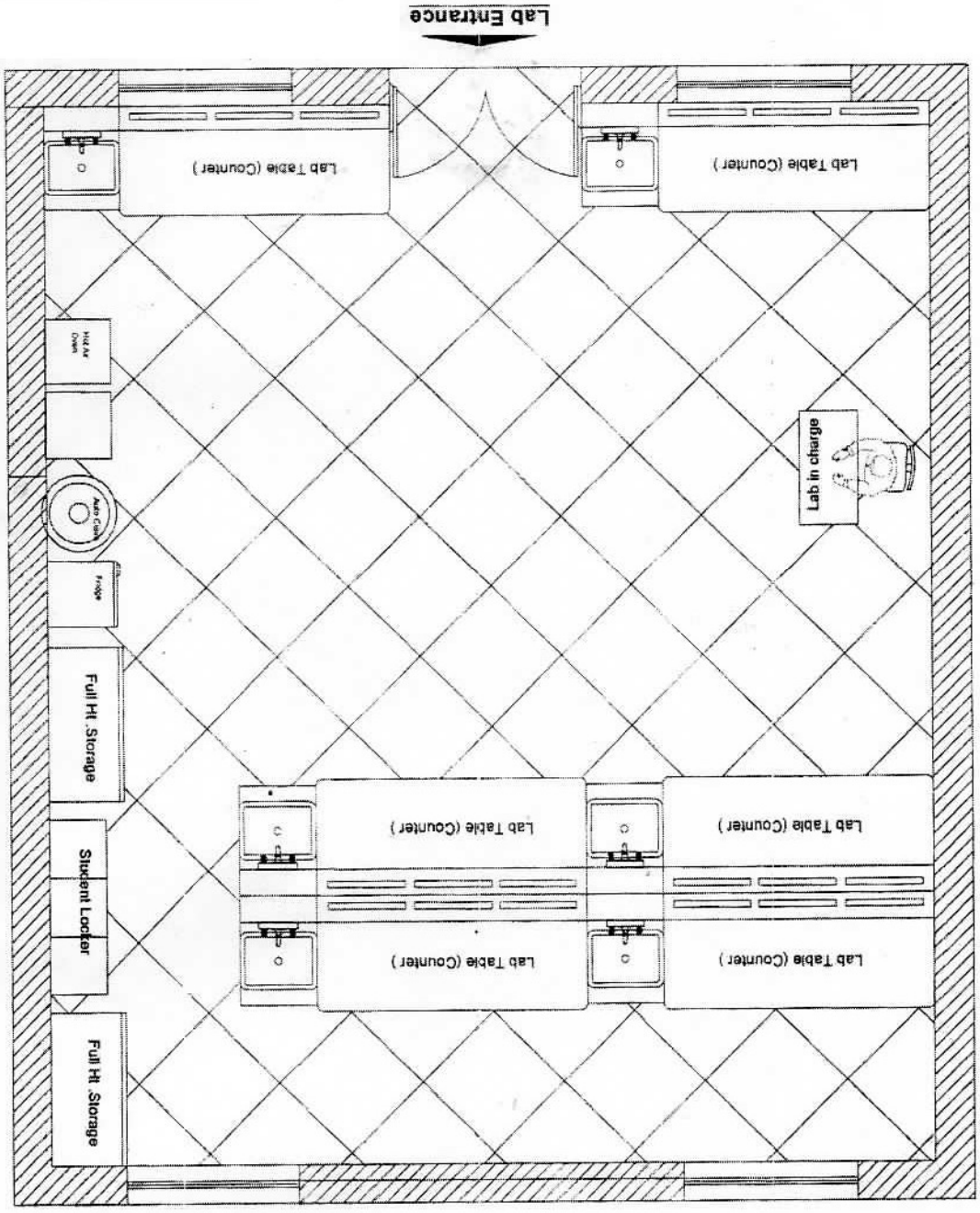
Note:

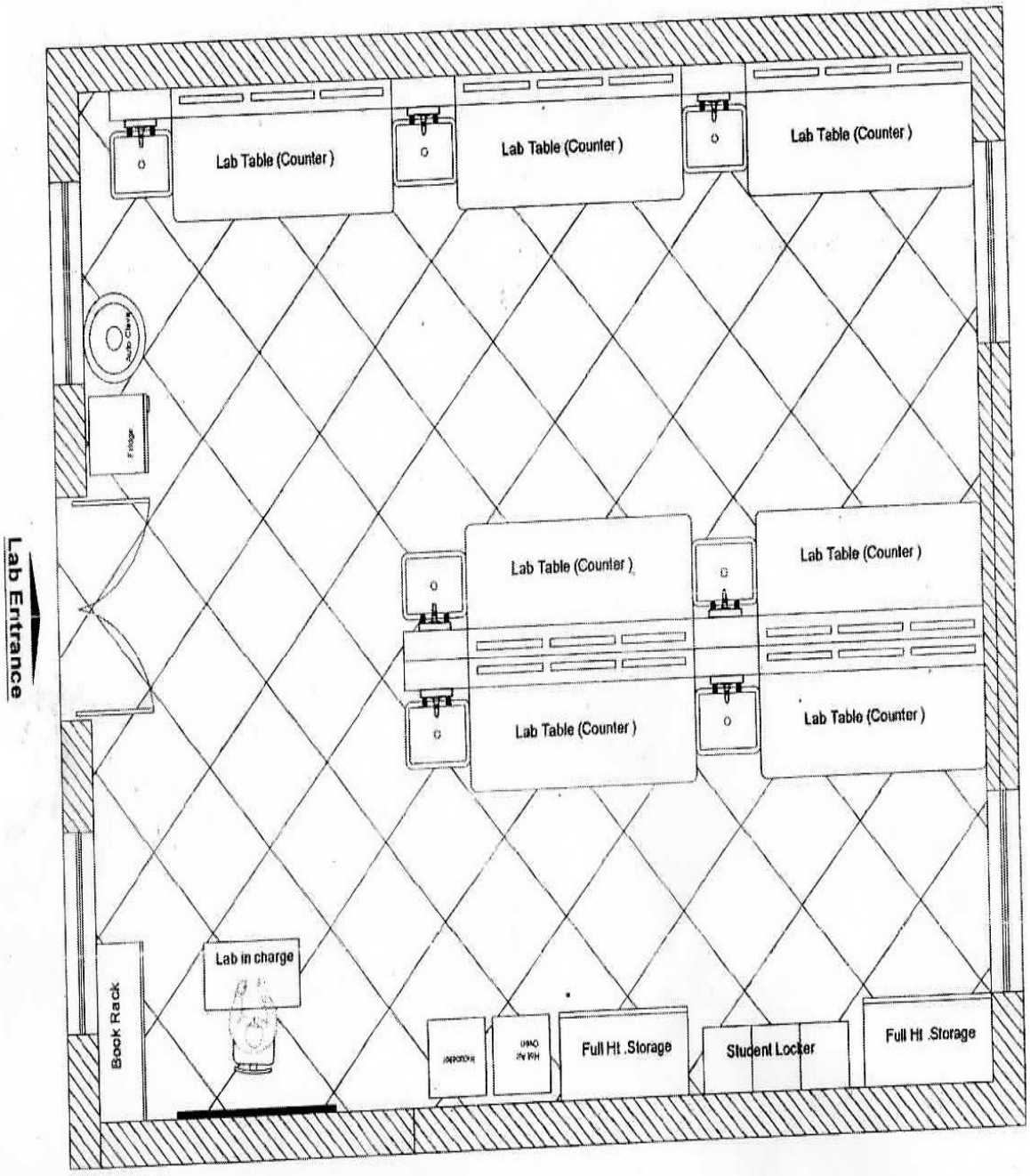
Work benches to be fitted to the side of wall with electric switch at the bottom of the bench to the connected on the top of the bench for microscope lamp. There should be 2 wash basin with running water one in between the work bench, one on the side of the work bench, one separate wash basin with running water. One distilled water plant of 5 Liters to be fitted, 4 Nos. 3 pin plug to be fitted at the suitable place/kept the hot air oven, incubator and centrifuge etc.

STAFF

A. Lecturer: **Qualification**	He/She will be a 'Full Timer'. M.B.B.S. Degree **OR** Two Part Time Lecturers.
B. Instructors: **Qualification**	He/She will be a 'Full Timer'. D.M.L.T. Degree (Affiliated with University/Govt. Board) Minimum 1 year of Laboratory Service Experience.
C. Laboratory Attendant **Qualification**	Minimum 1 will be required for the establishment. As per State Govt. Rules and Regulations The post will be 'Full Time'.

Suggested Plan of Lab




Lab Table (Counter)
Lab Table (Counter)
Lab Table (Counter)
Lab Table (Counter)
Lab Table (Counter)
Lab Table (Counter)
Lab Table (Counter)
Lab Entrance
Book Rack
Lab in charge
Full Ht .Storage
Student Locker
Full Ht .Storage

2: RADIOLOGY TECHICIAN (S7, S8, S9)

Scheme of Examination

Std. XI

Paper	Title of the Paper	Theory		Practicals		Term work	Project work	I.V.	Total Marks
		Marks	Time (Hrs)	Marks	Time (Hrs)				
1	Anatomy & Physiology	80	3	80	3	20	10	10	200
2	Radiology Equipments	80	3	80	3	20	10	10	200
3	Basic Imageology	80	3	80	3	20	10	10	200

* IV = Industrial Visit.

Scheme of Examination

Std. XII

Paper	Title of the Paper	Theory		Practicals		Term work	Project work	I.V. *	OJT **	Total Marks
		Marks	Time (Hrs)	Marks	Time (Hrs)					
1	Radiography	80	3	80	3	10	10	10	10	200
2	Special Equipments and Procedures	80	3	80	3	10	10	10	10	200
3	Imageology	80	3	80	3	10	10	10	10	200

* IV = Industrial Visit.

** OJT = On Job Training

Introduction

The Govt. of Maharashtra has specially designed Vocational courses (HSCV) to diversify a sizeable segment of students at the senior secondary stage to world of work, so that the students after XII can start earning. Various trades come under this stream. One of the trade is "Radiology Technician" which comes under paramedical Group.

As per the Latest modern medical sciences X-ray, CT scan, MRI Scan, USG, Cath lab, Digital radiography, Computerised radiography is being used daily for the diagnosis of diseases. To work on above said equipments technical personnel are required with theoretic trained knowledge and operating knowledge. The thoroughly trained personnel will help in providing better radiological services leading to complete utilization of available resources. These trained personnel will be the member of multidisciplinary team of a hospital.

The course of Radiology Technician fulfills this need of present day. These trained candidates have necessary skills of Radiological technology required in Radiological Services of a hospital.

When learning deals with performance type activities it is necessary to have an analysis of each job to be performed. Hence the subject expert committees has discussed this aspect while revising the Curriculum & prepared for STD XI & XII.

Hope that the present Curriculum of this course of Radiology Technician will prove useful to students, teachers & employees & will help the programme of vocationalization very useful & meaningful & will reduces the large gap between supply & demand of paramedical staff in Radiology Technology.

OBJECTIVES

1. The Main objectives of HSCV Radiology technician course is to teach and train the students about the techniques, in radiology, dark room technique special radio-diagnostic procedures recent modalities in Imaging & to give basic knowledge of radio therapy and related pathology.
2. To train students to acquire the techniques of latest sophisticated modern imaging modalities such as CT scan, MRI Scan, USG, Digital and Computerized Radiography & Nuclear Imaging.
3. To train the students to take good and clear radiographic images of any part of human body, so that they will offer the help to patient's quick & better care.
4. To provide basic knowledge of radiotherapy so that after one year special training in Radiotherapy dept. they can work as Radiotherapy Technician
5. To train the students about radiological emergencies & radiation hazards, radiation protection and first aid. So that these trained personnel will help in providing better radiological services leading to optimum utilization of available resources.

SKILLS TO BE PROVIDED

1. To follow the instructions of Doctors.
2. Maintenance of equipments used in Radiography.
3. Darkroom procedure-loading & unloading of X-ray films, film processing, care of unexposed & exposed X-ray films.
4. Maintenance of registers like registration register, dispatch register, chemical's register, film register, X-ray equipments register and accessories register.
5. The comparative use of-various imaging techniques.
6. Proper knowledge of careful choice of beam parameters, methods to reduce scattered radiation, reaction of part of the body to be radiographed.
7. To prepare the patient for special radio diagnostic procedures.
8. Technique of modern diagnostic modalities e.g. - CT scan, MRI, USG, Cath-Lab., Digital Radiography, computerised radiography.
9. Radiation protection.
10. Use of equipments and drugs to be used in emergencies in X-ray dept.
11. Basic knowledge of Radiotherapy.
12. Preparation of film processing chemicals.

JOB OPPORTUNITIES

Students who have passed the H.S.C. Vocational Radiology Technician course can get employment in Govt. Hospital, Central Govt. Hospitals, Municipal Hospitals, Railway Hospitals, Military Hospitals, P.H.C., Rural Hospitals and Private Hospitals as a member of multi disciplinary team.

1. Radiographer (X-ray Technician)
2. Dark room Technician
3. Radiotherapy Technician
4. CT scan Technician
5. MRI Technician
6. Cath-Lab Technician

Self Employment

1. Radiography Clinic (In Collaboration with Radiologist)
2. Provider of X-ray films.
3. Provider of X-ray film processing chemicals.
4. Silver Recovery from user fixer.

Std XI
Paper I: Anatomy & Physiology (S7)
Theory

Sr. No.	Unit	Sub-Unit	Periods
1.	Introduction	1.1 Definition of Anatomy, Physiology, Pathology. 1.2 Cell, Tissue 1.3 Radiological Services	8
2.	Musculoskeletal System	2.1 Skull 2.2 Vertebral Column 2.3 Pectoral Girdle 2.4 Bones of Upper Extremity 2.5 Bones of Lower Extremity. 2.6 Thoracic Cage 2.7 Pelvic Girdle 2.8 Joints & its types	32
3.	Cardio-Vascular System	3.1 Heart 3.2 Arterial System & venous System 3.3 Cardiac Cycle 3.4 Blood-Content & Function 3.5 Circulation of Blood 3.6 Blood Groups	8
4.	Lymphatic System	4.1 Lymphatic glands and vessels 4.2 Circulation of Lymphatic, Thoracic duct.	6
5.	Digestive System	5.1 Anatomy & Physiology of digestive system 5.2 Necessary Organs 5.3 Dental formula & Structure of tooth.	12
6.	Respiratory System	6.1 Anatomy of Upper Respiratory Tract 6.2 Lower Respiration Tract 6.3 Physiology of Respiration	8
7.	Nervous System	7.1 Anatomy of Brain Ventricles - Spinal cord.	10
8.	Urinary System	8.1 Anatomy of Urinary Tract 8.2 Functions of Urinary Organs – Kidney, Ureters 8.3 Formation of Urine	8
9.	Reproductive System	9.1 Anatomy of Female Reproductive System 9.2 Physiology Female Reproductive system 9.3 Physiology of menstruation. 9.4 Anatomy of Male Reproductive system 9.5 Physiology of Male Reproductive system 9.6 Spermatogenesis	16
10.	Endocrine System	10.1 Anatomy of Enodcrine glands and	8

		functions of Hormones 10.2 Pituitary gland 10.3 Thyroid glands 10.4 Parathyroid gland 10.5 Adrenal gland 10.6 Testies 10.7 Ovaries 10.8 Pancreas	
11.	Sense Organs	Structure and Function of 11.1 Eye 11.2 Ear 11.3 Skin	4
		Total	**120**

Practicals

Periods

1. Radiological Anatomy of all parts of the body. 26
   a) Introduction
   b) Bones of body

2. Digestive System 28
   a) To show charts & models of Alimentary Canal
   b) Function of Digestive System.

3. Respiratory 26
   a) To show charts and models of respiratory system
   b) Function of respiratory system.

4. Cardiovascular System 24
   a) To show charts and models of cardiovascular system
   b) Functions of Heart
   c) Physiology of conducting system of Heart

5. Urinary System 26
   a) Anatomy and functions of urinary system.

6. Reproductive System 28
   a) To show male and female reproductive system by chart and models.
   b) Function of both system.

7. Endocrine System 28
   a) To Show chart and model of endocrine glands
   b) Function of endocrine glands

8. Nervous system 26
   a) To show charts and model of brain

9. Sense organs 28
   a) Show anatomy of eye, ear skin & its functions

Total **240**

Paper II: Radiography Equipment (S8)
Theory

Sr. No.	Unit	Sub-Unit	Periods
1.	Fundamentals of Electricity	1.1 Basic Concept of Electricity 1.2 Transformer	8
2.	Electrical Safety Measures	2.1 Electrical Hazards 2.2 Safety Precautions	8
3.	Diode Tube	3.1 Vaccum Diode Tube 3.2 Rectification	8
4.	X-ray Tube	4.1 Structure & characteristics of various X-ray tubes 4.2 Care of X-ray Tubes 4.3 Faults in X-ray Tubes	12
5.	X-ray Circuits & Control Panel	5.1 X-ray Circuit 5.2 Control Panel	8
6.	X-ray Machines	6.1 Conventional X-ray machine 6.2 Portable X-ray machine 6.3 Digital X-ray machine 6.4 Computerised Radiography machine 6.5 Mammography Unit 6.6 X-ray Genesis, focal Spot, Central rays	36
7.	Fluoroscopic Unit	7.1 Fluoroscopic Equipments 7.2 Standard Fluoroscopic Table 7.3 Table for Myelography	8
8.	Image Intensifier	8.1 Image Intensifier Tube 8.2 C-Arm Image Intensifier	6
9.	Ionization	9.1 Measuring Radiation Dose	8

	Chamber GM & Scintillation Counter Dosimeter	9.2 MPD 9.3 Pocket Ionization Chamber 9.4 GM & Scintillation Counter 9.5 Film Badge, TLD 9.6 Simple Principles of Dosimeter	8
10.	Dental Radiographic Equipments & X-ray Beam Restrictors	10.1 Conventional Dental X-ray Unit 10.2 OPG Unit 10.3 Grid 10.4 Collimators 10.5 Cones 10.6 Filters	10
		Total	**120**

Practicals

1. X-ray Machines 24
   a) Identification and Operation of parts of X-ray machines
   b) Demonstration of all parts of X-ray machines

2. Fluoroscopic equipment 26
   a) Explanation of the fluoroscopic equipment and its uses.
   b) Operation of fluoroscopic equipment

3. Image Intensifier 24
   a) Explanation and its use of Image intensifier
   b) Operation of image intensifier

4. Explain 24
Dental Radiographic Equipment & its Operation

5. Operation of Portable X-ray Machine 24

6. Digital X-ray machine 30
   a) Basic knowledge of computer
   b) Explain the difference between Conventional and Digital and Computerised radiography
   c) Operation of Digital X-ray machine.

7. Computerised X-ray Machine 24
   a) Basic Knowledge.
   b) Operation of computerised radiography.

8. X-ray Tube 24
   a) Care, maintenance of X-ray tubes.

b) Common failure in X-ray tube.

9. Radiation measuring device 26
   a) Explain and its use of radiation measuring devices.

10. X-ray beam restrictor. 24
    a) Explain and uses of
       i. Grid
       ii. Cones
       iii. Filters
       iv. Collimators

Total **240**

Paper III: Basic Imageology (S9)
Theory

Sr. No.	Unit	Sub-Unit	Periods
1.	Radiation and Radiation Measuring Units	1.1 Definition of Radiation & its Types 1.2 Electromagnetic Radiation 1.3 Sources of Radiation 1.4 Roentgen, Rad, Rem, Sievert 1.5 Cathode rays & X-rays	12
2.	Radioactivity	2.1 Atomic & Nuclear Structure 2.2 Atomic Number, mass Number 2.3 Isotopes & Radioisotopes 2.4 Radioactive Decay 2.5 Radioactive Substances & their properties 2.6 Uses of Radioactive substances in medical field 2.7 Artificial and Natural Radioactivity, it's Units	18
3.	Interaction of X-rays with matter	3.1 Interaction of X-rays with matter 3.2 Ionization & Attenuation 3.3 Absorption coefficient 3.4 Modes of Interaction 3.5 Energy Absorption from X-ray 3.6 Half Value Layer 3.7 Fluorescent and photographic effect	12
4.	Radiation Protection	4.1 Radiation hazards: Local, Systemic & Genotic 4.2 Acute Radiation Syndrome 4.3 Code of Practice for the Radiation 4.4 Protection Guide lines from AERB 4.5 Lead shielding	16

		4.6 Personal Radiation Protection	
5.	Ultra Sonography	5.1 Ultra Sonography, it's Principles 5.2 Ultrasound System 5.3 Colour Doppler, Basics of Doppler	8
6.	C. T. Scan	6.1 Conventional C. T. 6.2 Spiral C. T. 6.3 Basic Principles & Equipments 6.4 C. T. Artifacts 6.5 Contrast Medium Used	14
7.	M R I	7.1 Basic Principles & Equipments 7.2 MRI Artifacts 7.3 Magnets, Powers, Nuclear Spin Proton Density, Larner equation 7.4 Radio Frequency 7.5 Contrast medium Used	14
8.	P E T Scan and Nuclear Medicine	8.1 Definition 8.2 Radionuclide's 8.3 Basic Principles & Equipment description	12
9.	Inter Ventional Radiology	9.1 Definition 9.2 Names of different type of procedures 9.3 Equipments required for various procedures 9.4 Orientation of Cath-Lab	14
		Total	**120**

Practicals

Periods

1. Study of X-Ray Machine — 26
   a) Mechanism of X-ray machine
   b) Study the interlock mechanism of X-ray machine

2. Radioactivity — 20
   a) Explain the effect of
      i. Exposure Factors.
      ii. KV
      iii. mAs

3. Interaction of X-rays with matter — 28
   a) Explain the use of aprons.
   b) Checking the lead apron for any cracks.

4. Radiation Protection — 28
   a) Explaining Various Radiation Protection measures (Guidelines)

b) Explaining various personal radiation protection

5. Ultra Sonography 28
   a) Explaining Operation of Ultrasound machine

6. CT Scan 28
   a) Explaining Basic Principles and equipment of CT scan machine.
   b) Explain difference both conventional and spiral CT.
   c) Operation of CT scan machine.

7. MRI 18
   a) Explain basic principle and function of MRI
   b) Operation of MRI

8. Pre Scan and nuclear medicine 18
   a) Explain basic principle and function of PET and nuclear medicine

9. Primary beam radiation 16
   a) Centering
   b) Effect of improper centering

10. Verification of Optical Radiation 20

11. X-ray Machine Circuits 10
   a) Control Panel
   b) Centre of difficult parameter

Total **240**

Std. XII
Paper I: Radiography (S7)
Theory

Sr. No.	Unit	Sub-Unit	Periods
1.	Photographic materials X-ray films	1.1 Image Produced by X radiation 1.2 Latent Image 1.3 Structure of X-ray Films 1.4 Sensitivity and Contrast of Films 1.5 Types of X-ray Film 1.6 Storage of Unexposed X-ray Film	4

		1.7 Care of Radiographs	
2.	Screens and Cassettes	2.1 Construction of Intensifying Screen 2.2 Choice of Fluorescent material 2.3 Care of Screen 2.4 Types of Screen 2.5 Structure, Types and care of cassette 2.6 Testing & Providing good film screen contact 2.7 Intensification factor, speed of Screen.	6
3.	Dark room Design, Health hazards & Safety in the dark room	3.1 Location & building 3.2 Entrance, Ventilation & pass box 3.3 Wiring and Lights (Illuminations) 3.4 Equipments 3.5 Health hazard & safety	6
4.	Film Processing	4.1 Definition, Types 4.2 Manual - Stages & diagram 4.3 Automatic - Stages, working and diagram 4.4 Processing Chemicals, affecting factors, Replenishments 4.5 Silver recovery methods	10
5.	Services by Radiology Technician	5.1 Duties of Radiology Technician 5.2 Medicolegal Importance of X-ray Film 5.3 Trimming, Enveloping Record and Distribution 5.4 Identification of X-ray Films	4
6.	Digital Radiography	6.1 Principle & Basics 6.2 Technique, Films used 6.3 Advantages of digital radiography	6
7.	Computerised Radiography	7.1 Principle & Basics 7.2 Technique, Films used 7.3 Advantages of Computerised Radiography (C R)	6
8.	Radiography of a. Upper limb	8.1 Fingers 8.2 Hand 8.3 Carpal 8.4 Wrist 8.5 Forearm 8.6 Elbow 8.7 Humerus 8.8 Shoulder 8.9 Scapula 8.10 ACJ 8.11 SCJ 8.12 Clavicle	20
	b. Lower limb	8.1.1 Toes 8.1.2 Foot 8.1.3 Calcaneum	14

		8.1.4 Ankle 8.1.5 Tibia Fibula 8.1.6 Patella 8.1.7 Knee 8.1.8 Femur	
	c. Hip and Pelvis	8.2.1 Pelvis 8.2.2 SIJ 8.2.3 Hip bone, Acetabulum	8
	d. Vertebral Column	8.3.1 Atlanto axial Joint 8.3.2 Odentoid process 8.3.3 Cervical spine 8.3.4 Thoracic spine 8.3.5 Lumbar spine 8.3.6 Lumbo sacral spine 8.3.7 Sacrum Coccyx 8.3.8 Spinal deformities - Scoliosis, Kyphosis, Lardosis	8 4
	e. Bones of Thorax	8.4.1 Thoracic Cage 8.4.2 Sternum 8.4.3 Ribs	4
	f. Skull	8.5.1 Basic guidelines for radiography of skull 8.5.2 Bony land marks, planes 8.5.3 Oesteology and all radiographic basic views of cranial bones, facial bones, paranasal sinus (PNS) TM joint, mastoid bones, sella turcica, optic foramen	4
9.	Chest	9.1 Chest P A view 9.2 AP view 9.3 Lat. view 9.4 Apical view 9.5 Lordotic view	4
10.	Abdomen	10.1 Anatomical regions 10.2 Radiographic views of Abdomen in supine and erect position 10.3 X-ray KUB 10.4 Indications, Contra indications for radiography of Abdomen	6
11.	Ward and Theater Radiography	11.1 Ward Radiography 11.2 Theater Radiography Technique Care in case of sterile O.T.	4
12.	Dental Radiography	12.1 Dental Formula, 12.2 Dental Xray 12.3 OPG	2
		Total	**120**

Practicals

1. Photographic material 30
   a) Study of various x-ray films
   b) Study of Dental x-ray film

2. Screen and Cassettes. 30
   a) Care and Maintenance of Screen and Cassettes.

3. Processing chemicals 30
   a) How to prepare developer?
   b) How to prepare fixer?

4. Loading and unloading of x-ray films. 30
   a) Loading of unexposed films
   b) Unloading of exposed films

5. Dark Room Design. 30
   a) Designing an 'Ideal Darkroom'
   b) Testing of darkroom light for safety

6. Silver Recovery 30
   Procedures of silver recovery from the fixer solution

7. Record keeping 30
   a) Keeping record of x-ray films
   b) Keeping record of processing chemicals

8. Skeletal Radiography 30
   a) Radiography of various human bones in various position
   b) Setting exposure factors for such radiography.

Total **240**

Paper II: Special Radiological Procedures (S8)
Theory

Sr. No.	Unit	Sub-Unit	Periods
1.	General Pathology	1.1 Definition of Pathology, Cell 1.2 Cell Growth, Cell Damage 1.3 Cell repair, Cell deformities 1.4 Health and Disease	6

		1.5 Inflammation 1.6 Immunity, Immunization Schedule 1.7 Causes of Diseases	
2.	Tumors	2.1 Definition, Classification 2.2 Causes 2.3 Metastasis 2.4 General effects 2.5 Methods of diagnosis	5
3.	Blood Diseases	3.1 Leukemia 3.2 Anaemia 3.3 Complete Blood Count	6
4.	Radio therapy	4.1 Definition 4.2 Methods of Radiotherapy Teletherapy, Brachytherapy 4.3 Radiotherapy machines, Telecobalt, Linear Accelerator 4.4 Radiotherapy in Cancer of Various organs	6
5.	First aid	5.1 First aid in shock 5.2 First aid in Convulsion 5.3 First aid in Asphyxia 5.4 First aid in Wound 5.5 First aid in Electric shock and Burns 5.6 First and in Injuries to Bones and Joints 5.7 First aid in Poisoning	8
6.	Contrast Medium	6.1 Definition and Types 6.2 Criteria for selection of contrast medium 6.3 Routes of administration of contrast medium	6
7.	Emergencies in X-ray department	7.1 Signs and Symptoms of Various emergencies in X-ray dept. 7.2 Equipments & drugs needed to treat them. 7.3 Emergency drug box	6
8.	Special Radiological Procedures 1. IVP 2. RUG 3. MCU 4. T – Tube Chalangiography 5. Barium Swallow 6. Barium meal 7. Barium meal follow through 8. Barium Enema	Each procedure should be explained in detail with the help of following points • Definition • Indication • Contraindication • Contrast medium & it's dose • Preliminary films • Preparation • Premedication • Equipment • Film Services	8 4 4 4 4 4 4 4 7 7

	9. HSG 10. Coronary Angiography 11. Bronchography 12. Dacrocystography 13. Sialography 14. Myelography 15. Mammography & Soft tissue Radiography	• Complications • After Care of the Patient	8 4 3 4 6 6
		Total	**120**

Practicals

1. SUB-SPECIAL RADIOLOGICAL PROCEDURES 50
   a) Radiography in various positions for all the special radio diagnostic procedures using different contrast media.

2. Medical Emergencies 52
   a) Preparation of Medical tray in medical emergencies.
   b) Handling of emergencies

3. Medical Equipments. 38
   a) Practicals applicability of medical equipments used in emergencies

4. Basic Body Parameter (Vitals) 50
   a) Measurement of Basic Body Parameters (Vitals)
      i) Pulse ii) Temperature iii) Orientation iv) Blood Pressure

5. First Aid 50
   a) How to give first aid in shock
   b) How to assist medical and paramedical staff in
      i. Shock
      ii. Convulsions
      iii. Asphyxia
      iv. Electric shock
      v. Injuries to bones & Joints

Total 240

Paper III: Imageology (S9)
Theory

Sr. No.	Unit	Sub-Unit	Periods
1.	Ultra Sound	1.1 Conventional Doppler and Colour Doppler 1.2 Preparation of patient 1.3 Indications 1.4 Clinical application 1.5 Main differences in Ultra Sound and X-rays	16
2.	C. T. Scan	2.1 Conventional C. T. 2.2 Spiral C. T. 2.3 Preparation of Patient 2.4 Contrast Media 2.5 Indication & Contraindication 2.6 Technical aspects of various Procedures in CT Scan	18
3.	M R I	3.1 Preparation of Patient 3.2 Contrast media 3.3 Indication & Contra indication 3.4 Clinical Applications 3.5 Procedures 3.6 M.R.I Angiography 3.7 Image Characteristics 3.8 Functional MRI 3.9 Precaution to be taken	20
4.	Nuclear Medicine	4.1 Preparation of Patient 4.2 Indications & contra indication 4.3 Clinical application and Procedures 4.4 Brain Scan 4.5 Bone Scan 4.6 M N G A 4.7 R N U Study 4.8 Thyroid Perfusion Scan 4.9 D T P A 4.10 Renogram 4.11 Bullido Scan	30
5.	Interventional Radiology	5.1 Preparation of Patient 5.2 Indication & Contra Indications. 5.3 Techniques of various Procedures and Various System in the body 5.4 Cath Lab Techniques	20
6.	PET Scan	6.1 Preparation of patient	16

		6.2 Indication & Contra indication. 6.3 Technique of chemical application	
		Total	**120**

Practicals

1. Visit and observation of various Radiographic Technology in hospital setups 140
   a) Interventional Radiography
   b) CT scan
   c) MRI
   d) USG
   e) Cath – Lab
   f) PET
   g) Nuclear Medicine

2. Power point presentation of visit and observation of Radiographic Technology seen (above a to g) 40

3. Computer 60
   a) Basics of computer
   b) Applied knowledge of computer related to Medical Imaging Technologies.

Total 240

RADIOLOGY TECHNICIAN
REFERENCE BOOKS

1. Anatomy & Physiology - by Gray, Kumber, Stacpoles
2. Surface and Radiological Anatomy by Halim, Das
3. Fundamentals of X-Ray and Radium Physics by Joseph Selman
4. Basic Physics in Radiology by Kemp & Oliver
5. X-Ray Equipments for Students, Radioprapher - by Chesneys
6. Radiographic Positioning - by R.C. Clerk
7. Advanced Imageology
8. Anatomy & Physiology For Nurses - by Pearce
9. Human physiology - by chattarjee
10. A text Radiology - by S. Bhargava A text of Radiology by S. Bhargava

11. Text book of Human Osteology - Singh
12. Radiology of Positioning and - G.S. Garkal applied anotomy
13. Guide to Radiological Procedures - Chapman
14. Hand book of Ultrasound - Garkal
15. Radiophysics and Darkroom cetabulum
16. Synopsis of Radiology and Imaging - Sidhwa
17. Aids to Radiological differential - Chapman
18. X-ray Diagnosis and Imaging – Gupta

LIST OF TOOLS AND EQUIPMENTS
Std. XII
Paper – I: Radiography (S7)

Sr. No.	Instrument/Equipment	No. of Quantity
1.	X-ray machine with bucky table (Desirable)	01
2.	Portable x-ray machine	01
3.	Dark room accessories	
	SS Tank (Processing Tanks)	03
	Safe Light	02
4.	Processing chemicals	02
5.	Cassettes - 4 type size 8''x10'', 10''x12''	04
6.	Hangers - 4 types size 12''x15'', 14''x17''	08
7.	X-ray film - 4 types size	
8.	Lead Apron	1
9.	Lead divider	1
10.	Lead Markers	2 Set
11.	Fluoroscopy Unit (Desirable)	
12.	Computer with Printer	01
13.	Lead Goggle	01
14.	Lead Gloves	01 (Pair)
15.	Dental Films	

Std. XII
Paper – II: Special Radiological Procedures (S8)

Sr. No.	Instrument/Equipment	No. of Quantity
1.	Equipments required for special radiological procedures such as in HSG, IVP etc.	01 Each
2.	Different Contrast media	As per requirement
3.	Emergency drug box.	01
4.	First Aid Box	01
5.	B. P. Apparatus	01
6.	Stethoscope	01
7.	Syringes with needles	As per requirement

Std. XII
Paper – III: Imageology (S9)

Sr. No.	Instrument/Equipment	No. of Quantity
1.	CT Scan machine (Desirable)	01
2.	USG, Colour Doppler (Desirable)	01
3.	MRI Machine (Desirable)	01
4.	Computer with printer	01
5.	PET Scan Machine (Desirable)	01

LIST OF EQUIPMENTS, TOOLS MACHINES AND MATERIALS
Std. XI
Paper – I: Anatomy and Physiology

Sr. No.	Instrument/Equipment	No. of Quantity
1.	Human Skelton	01
2.	Various coloured charts depicting various system	10
3.	Various anatomical models of the organs of the body	16
4.	Human bones set	01

Std. XI
Paper – II: Radiography Equipments

Sr. No.	Instrument/Equipment	No. of Quantity
1.	X-ray machine with Bucky Table	01
2.	Portable x-ray Machine (Desirable)	01
3.	Cassettes with intensifying screen of various sizes	01 Each
4.	Hangers of various sizes	01 Each
5	Digital x-ray Machine (Desirable)	01
6	Lead divider	01
7	Lead Marker (Letters & Number)	01 Set Each
8	Dental radiography Unit (Desirable)	01
9	Fluroscopic Unit (Desirable)	01
10	Image Intensifier (Desirable)	01
11	Computer with Printer	01

Std. XI
Paper – III: Basic Imegeology

Sr. No.	Instrument/Equipment	No. of Quantity
1.	C. T. Scan Machine (Desirable)	01
2.	U.S.G. (Desirable)	01
3.	M.R.I. Machine (Desirable)	01
4.	P.E.T. Scan Machine (Desirable)	01
5	Film badge	01
6	T.L.D.	01
7	Lead Apron	02
8	Lead gloves	01 Pair
9	Computer with Printer	01

INFRASTUCTURE

1. Class Rooms 20 ² 20 = 400 Sq.-ft. with Charts, Display Board, Black - Board, LCD PROJECTOR
2. Laboratory - 50 ² 20 = 1000 sq...ft. (including X-ray Room) with required appliances
3. Electrical Power Supply - At - least 8 KVA with 3 - phase Connection
4. Pure Drinking Water Facility
5. Library may be Common

Sr. No.	Designation	No.	Qualification
1	Full Time Teacher	01	1. D.M.R.D or M.D. (Radiology) Or 2. M. B. B. B. Or 3. B. A. M. S. with five years Teaching experience in HSCV Concern Subject
2	Full Time Instructor	01	1. B. A. M. S. Or 2. B. Sc. (MIT) with five years experience Or 3. HSC Vocational, X-ray or Radiology Technician with five years experience

3: OPHTHAIMIC TECHNICIAN (P7, P8, P9)

Scheme of Examination
Std. XI

Paper	Title of the Paper	Theory		Practicals		Term work	Project work	I.V.	Total Marks
		Marks	Time (Hrs)	Marks	Time (Hrs)				
1	Ocular Anatomy Physiology and Pharmacology	80	3	80	3	20	10	10	200
2	Optics, Lenses and Ophthalmic Equipments	80	3	80	3	20	10	10	200
3	Sterilization, Medical Records and Community Ophthalmology	80	3	80	3	20	10	10	200

* IV = Industrial Visit.

Std. XII

Paper	Title of the Paper	Theory		Practicals		Term work	Project work	I.V. *	OJT **	Total Marks
		Marks	Time (Hrs)	Marks	Time (Hrs)					
1	Common ocular Disease, special Investigation and OT Procedures.	80	3	80	3	10	10	10	10	200
2	Refractive Errors, Squint and Contact Lenses	80	3	80	3	10	10	10	10	200
3	Special Lenses grinding and Dispensing of spectacles	80	3	80	3	10	10	10	10	200

* IV = Industrial Visit.

** OJT = On Job Training

Introduction

Medical field has been changed a lot from the beginning of this course. It was necessary to revise the entire syllabus in order to meet the required targets and respond to the emerging challenges in ophthalmic science.

All the topics in Ophthalmic Technician course have been revised, taking in the consideration the rapid change in the field of Ophthalmic practice, both diagnostic and in the therapy, medical and surgical.

The contents of the revised syllabus not only stimulate but will also help the students learn the latest developments in technology and applications.

The syllabus has been revised to provide knowledge and skills necessary for self employment either as Ophthalmic Technician or as an Optician.

A] General Objectives

1. To train the student to assist the eye specialist in medical & surgical care of the eye.
2. To acquire certain techniques to carry out early detection of visual defects.
3. To train the student in power checking, ophthalmic lens grinding, dispensing of spectacles etc.

B] Specific objectives

1. The student is trained to get the knowledge of morphology of eye, errors of refraction & common eye diseases.
2. The student must know the knowledge of lenses, ophthalmic blanks, frames etc.
3. To train the student in fitting & checking of prescribed glasses according to power.
4. To prepare the student to conduct ophthalmic survey in community.
5. To make the student to participate in Health Education Programmes for prevention of eye diseases & early detection.
6. To train the student in cleaning, taking care, maintenance of ophthalmic instruments.
7. To train the student in taking patient care, ophthalmic nursing.
8. To train the student in counseling of the patient, attitude and verbal communication towards patients.
9. To train the student in O.T. sterilization, instruments sterilization & aseptic precautions & asepsis.
10. To give students the supervisory skills.
11. The student must know about I.T., hospital information system.

Skills to be provided to students

1. To test errors of refraction, visual defects.

2. To handle the equipment carefully
3. To sterilize equipments
4. To arrange instruments for operation
5. Dressing & Medication
6. Maintenance of records
7. Checking of the Prescription
8. Identify & verify Power of glasses
9. Fitting & dispensing of spectacles

Job Opportunities

Wage employment

1. Ophthalmic Technician at all levels in the National programme for the control of Blindness.
2. Ophthalmic Technician in Medical colleges, Districts Hospitals, Rural Hospitals etc.
3. Assistant of Eye Specialist in private set up.
4. Refraction Technician.
5. Instructor in Ophthalmic glass grinding workshop.
6. Supervisor in Ophthalmic glass grinding workshop.

Self Employment

1. Setting up glass grinding workshop.
2. Setting up Ophthalmic glass fitting shop (Ophthalmic shop).
3. Fabricating Ophthalmic Trial sets.
4. Handling the Sale of Ophthalmic equipments.

Further education

If Student desires he can take admission to first year of science (B.Sc.) or first year of B.Sc in optometry or first year of diploma in optometry.

Std. XI
Paper I: Ocular Anatomy, Physiology & Pharmacology (P7)
Theory

Sr. No.	Unit	Sub-Unit	Periods
1.	Anatomy of eyeball	1.1 Orbit	5
		1.2 Understanding of human eyeball	6
		1.3 Eyelid	5
		1.4 Conjunctiva	3
		1.5 Cornea	3
		1.6 Sclera	2
		1.7 Limbus	2
		1.8 Anterior & posterior chambers	4
		1.9 Uveal tract	6
		1.10 Retina	6
		1.11 Optic nerve	3
		1.12 Lens	4
		1.13 Vitrous humour	3
		1.14 Muscles of eyeball	6
		1.15 Aqueous humour	2
		1.16 Lacrimal apparatus	4
2.	Physiology of the eye	2.1 Mechanism of vision	3
		2.2 Visual pathway	3
		2.3 Tears	3
		2.4 Pupillary reflexes	3
		2.5 Visual acuity	6
		2.6 Colour vision	2
		2.7 Night vision	1
		2.8 Visual field	3
		2.9 Accommodation	2
		2.10 Convergence	1
		2.11 Extra ocular muscles - actions	6
		2.12 Purkinje's images	1
		2.13 I.O.P.	6
3.	Pharmacology	3.1 Routes of administration of drugs	5
		3.2 Antibiotics	1
		3.3 Analgesics (NSAID)	1
		3.4 Miotics	2
		3.5 Cycloplegics & Mydriatics	3
		3.6 Anesthetics	2
		3.7 Antiglaucoma drugs	2
		Total	**120**

Practicals

Sr. No.	Name of the Practicals/Demonstration/Student Activity	Periods
1.	Demonstration of orbit on human skull	15
2.	Demonstration of human eyeball on an eye model	15
3.	To check visual acuity for distance	15
4.	To check visual acuity for near	15
5.	To measure Intra Ocular Pressure	15
6.	To elicit Purkinje Samson images	15
7.	To check pupillary reflexes	15
8.	To check field of vision	15
9.	To check the movements of the EOMs of an individual eye	15
10.	To check the EOMs of both eyes	15
11.	To check the colour vision	15
12.	To instill eye drops	15
13.	To instill an eye ointment	10
14.	Prepare charts of layers of eyelid, cornea, retina, middle layer, lens and lacrimal apparatus.	10
15.	Prepare charts of visual pathway.	10
16.	Prepare charts of extra ocular muscles.	10
17.	Prepare charts of actions of E.O. Ms.	10
18.	To do pin hole test.	10
	Total	**240**

Paper II: Optics, Lenses and Opthalmic Equipments (P8)
Theory

Sr. No.	Unit	Sub-Unit	Periods
1.	Optics	1.1 Light	4
		1.2 Reflection	4
		1.3 Refraction	4
		1.4 Prism	4
		1.5 Image formation by convex lens	5
		1.6 Image formation by concave lens	4
		1.7 Eye as a refracting apparatus	4
2.	Lenses	2.1 Spherical lenses	5
		2.2 Cylindrical lenses	5
		2.3 Special types of lenses	4

		2.4 Dioptre 2.5 Opthalmic lens material 2.6 Optical centre of the lens 2.7 Neutralization	3 4 2 6
3.	Opthalmic Equipments	3.1 Torch 3.2 Magnifiers 3.3 Autorefractometer 3.4 Slit lamp 3.5 Direct Ophthalmoscope 3.6 Tonometer 3.7 Geneva lens measure 3.8 Lensometer 3.9 Keratometer 3.10 perimeter 3.11 Distant vision drum 3.12 Near vision chart 3.13 Colour vision chart 3.14 Trial box 3.15 Trial frame 3.16 Edging machine 3.17 Diamond cutter 3.18 Chipping piler 3.19 Retinoscope	2 2 5 3 3 3 4 4 2 3 4 3 3 3 4 5 5 2 2
		Total	**120**

Practicals

Sr. No.	Name of the Practicals/Demonstration/Student Activity	Periods
1.	Identification of lenses & Prism	8
1.1	Identification of spherical and cylindrical lenses	8
1.2	Identification of spherical convex and spherical concave lenses	8
1.3	Identification of prism	8
2.	Refraction through glass slab	8
2.1	Refraction of oblique rays of light rays of light rays from rarer medium (air) to denser medium (glass slab)	8
2.2	Refraction of oblique rays of light from denser medium (glass slab) to rare medium (air) glass slab	8
2.3	Lateral displacement of object through glass slab	8
2.4	Refraction of light falling perpendicularly on glass slab	8
3,	Refraction through prism	8
3.1	Refraction of light through prism	8
3.2	Dispersion of light through prism	8

4.	Refraction through convex & concave lenses	8
4.1	Study of optical centre, principle axis, principal focus & focal lengh of convex lens	8
4.2	Refraction through convex spherical lens	8
4.3	Image formation by convex spherical lens	8
4.4	Study of principle focus & focal length of concave spherical lens	8
4.5	Refraction through concave spherical lens	8
4.6	Images formation by concave spherical lens	8
5.	Retinoscopy	8
5.1	Retinoscopy for detection of myopia	8
5.2	Retinoscopy for detection of Hypermetnpia	8
5.3	Retinoscopy for detection of astigmatism	8
6.	Direct ophthalmoscopy	8
6.1	Distant direct ophthalmoscopy by self illuminated ophthalmoscope	8
6.2	Direct ophthalmoscopy by moderm ophthalmoscope	8
7	Practice of cutting & edging of glass lens	8
7.1	Marking & stretching of glass lens	8
7.2	Cutting of glass lens with chipping plier	8
7.3	Edging of glass lenses	8
	Total	**240**

Paper III: Sterilization, Medical Records and Community Ophthalmology (P9)
Theory

Sr. No.	Unit	Sub-Unit	Periods
1.	Sterilization	1.1 Sterilization methods 1.2 Autoclave 1.3 Sterilization indicators	16 5 5
2.	Medical records	2.1 OPD register & billing 2.2 OT register & billing 2.3 Appointments 2.4 Mediclaim 2.5 Medical certificates 2.6 Hospital registration 2.7 Biomedical waste 2.8 Communication skill 2.9 Counseling 2.10 Consent taking	8 8 3 4 3 3 4 4 4 3

		2.11 Risk explanation 2.12 Guarded visual prognosis	3 3
3.	Community opthalmology	3.1 Publicity 3.2 School screening camp 3.3 Cataract surgery camp 3.4 Diagnostic eye camp 3.5 Blindness & its rehabilitation 3.6 Eye donation & eye bank	5 7 8 8 8 8
		Total	**120**

Practicals

Sr. No.	Name of the Practicals/Demonstration/Student Activity	Periods
1.	Cleaning of surgical instrument	15
2.	Sterilization of surgical instrument by hot air oven	15
3.	Sterilization of instrument by boiling	15
4.	Sterilization of surgical instrument by autoclave	15
5.	Sterilization of surgical instrument by chemicals (alcohol 70% and gluaraldehyde)	15
6.	Sterilization of OT by fumigation and defumigation	15
7.	Surgical hand scrubbing	15
8.	Sterilization indicator	15
9.	Study of standard sample of OPD register and its filling	15
10.	Study of standard sample of OT register and its filling	15
11.	Study of standard sample of OPD bill and its filling	15
12.	Study of standard sample of OT bill and its filling	15
13.	Study of mediclaim form and its filling	10
14.	Study of management of biomedical waste	10
15.	Filling of consent form for routind opthalmic procedure like cataract, glaucome, eye lacrimal sac etc. under local anesthesia	10
16.	Filling of consent form for high risk opthalmic procedures with inherent opthalmic and medical illness	10
17.	Arrangement and participation in eye check up camp	10
18.	Filling of eye donation registration form	10
	Total	**240**

Std. XII
Paper I: Common Ocular diseases, Special Investigations & O.T. Procedure (P7)
Theory

Sr. No.	Unit	Sub-Unit	Periods
1.	Common ocular diseases	1.1 History taking	1
		1.2 Ophthalmic examination	5
		1.3 Common symptoms	2
		1.4 Common Signs	2
		1.5 Common diseases of lacrimal sac	3
		1.6 Common diseases of eyelid	5
		1.7 Common diseases of conjunctiva	6
		1.8 Common diseases of cornea	3
		1.9 Common diseases of iris & cilliary body	3
		1.10 Common diseases of lens	6
		1.11 Glaucoma	4
		1.12 Eye injuries	3
		1.13 Toxic amblyopia	1
		1.14 Vitamin A deficiency	3
		1.15 Common systemic diseases affecting eye	3
2.	Special Investigations	2.1 Visual acuity testing	5
		2.2 Fluorescence staining	3
		2.3 Corneal sensation test	2
		2.4 Sac syringing	4
		2.5 Tonometry	6
		2.6 Keratometry	3
		2.7 Schirmers test	3
		2.8 Pin-hole test	3
		2.9 Duochrome test	3
		2.10 Friend test	3
		2.11 Perimetry	3
		2.12 B.P. estimation	5
		2.13 Urine sugar estimation	3
		2.14 Conjunctival swab taking	2
		2.15 Xylocaine sensitivity test	1
		2.16 Ophthalmoscopy	3
3.	Operation theater procedures	3.1 Asepsis in O.T.	2
		3.2 Preoperative investigations, instructions & Post operative care	4
		3.3 Common surgical instruments	1
		3.4 Surgical instruments - Care & Maintenance	2

		3.5 Scrubbing 3.6 Epilation 3.7 Cataract surgery 3.8 IOL implantation 3.9 Eye pad & bandaging 3.10 Ocular anesthesia	1 1 2 1 2 2
		Total	**120**

Practicals

Sr. No.	Name of the Practicals/Demonstration/Student Activity	Periods
1.	History taking & ocular examination of patient.	10
2.	Sac syringing.	10
3.	Schirmer's test.	10
4.	Conjunctival swab taking.	10
5.	Xylocaine sensitivity test.	7
6.	Corneal sensation test.	7
7.	Fluorescence staining.	8
8.	To test iris shadow.	10
9.	I.O.P. checking (schiotz tonometry).	10
10.	Digital tonometry.	10
11.	Distant vision checking.	10
12.	Near vision checking.	10
13.	Pin hole test.	10
14.	Duochrome test.	10
15.	FRIEND test.	10
16.	Colour vision test.	10
17.	Ophthalmoscopy.	10
18.	Perimetry.	10
19.	B.P. Estimation.	10
20.	Urine sugar estimation.	10
21.	To observe O.T. sterilization.	10
22.	To observe common surgical instruments.	10
23.	To do scrubbing.	10
24.	To observe various I.O.L.S.	6
25.	To do eye bandaging.	6
26.	To do epilation.	6
	Total	**240**

XII Spotting P7

1.	Lignocaine 4 %	
2.	Lignocaine 2 %	
3.	Atropine eye drops ointment	
4.	Drosyn eye drops	
5.	Chloromycelin applicaps	
6.	Fluroscene strips	
7.	Schiotz's tonomenter	
8.	Distant vision chart	
9.	Near vision chart	
10.	Fundoscope	
11.	Torch	
12.	Bandage eye pad	
13.	Epilation forcep	
14.	Eye speculum	
15.	Lacrimal cannula	
16.	Panctum dilator	
17.	Chalazion clamp	
18.	Chalazion scoop	
19.	Sterilization indicators	
20.	Benedict's solution	

Paper II: Refractive Errors, Squint and Contact Lenses (P8)
Theory

Sr. No.	Unit	Sub-Unit	Periods
1.	Errors of refraction	1.1 Hypermetropia 1.2 Myopia 1.3 Astigmatism 1.4 Anisometropia 1.5 Presbyopia 1.6 Aphakia 1.7 Pseudophakia 1.8 Retinoscopy 1.9 Autore fractometry 1.10 Trial box	5 5 5 2 5 4 3 5 4 2

		1.11 Trial frame 1.12 Subjective refraction 1.13 Prescription of spectacle 1.14 Computer eye syndrome	2 8 8 2
2.	Squint	2.1 Movements of extra ocular muscles 2.2 Binocular single vision 2.3 Latent squint 2.4 Concomitant squint 2.5 Paralytic squint	3 3 8 8 8
3.	Contact lenses	3.1 Contact lenses and its types 3.2 Indications for contact lenses 3.3 Fitting of contact lenses 3.4 Care of contact lenses 3.5 Contact lens solution 3.6 Contact lens related complication	5 1 10 10 3 1
		Total	**120**

Practicals

Sr. No.	Name of the Practicals/Demonstration/Student Activity	Periods
1.	Plane mirror retinoscopy.	25
2.	Streak retinoscopy.	25
3.	Subjective refraction & prescription writing.	20
4.	Refraction of presbyopia	20
5.	To do autorefractometry	25
6.	Cover - test.	20
7.	Cover - uncover test.	15
8.	Maddox rod test.	15
9.	Maddox wing test.	15
10.	Maddox test.	15
11.	Measurement of angle of squint with the help of torch.	15
12.	Study & identification of lenses in trial box.	10
13	Insertion of contact lens.	10
14	Removal of contact lens.	10
	Total	**240**

XII Spotting Paper II – P8

1	Trial frame	
2	Trial box	
3	+ Spherical lenses	
4	- Spherical lenses	
5	+ Cylindrical lenses	
6	- Cylindrical lenses	
7	Pin hole	
8	Occluder	
9	Steneopiz slit	
10	Maddox rod	
11	Maddox wing	
12	Prizm bar	
13	Lensometer	
14	Distant vision chart	
15	Near vision chart	
16	Contact lenses	
17	Plain mirror retinoscope	
18	Streak retinoscope	
19	Red glasses	
20	Green glasses	

Paper III: Special Lens Grinding and Dispensing of Spectacles (P9)
Theory

Sr. No.	Unit	Sub-Unit	Periods
1.	Grinding	1.1 Grinding machine & material 1.2 Spherical lens grinding 1.3 Cylindrical lens grinding 1.4 Bifocal lens grinding	10 10 10 4
2.	Lenses	2.1 Ophthalmic lens material 2.2 Antireflective coating 2.3 Tinted glasses 2.4 Photo chromatic lenses 2.5 A Spherical lenses 2.6 Lenticular lenses 2.7 UV inhibitors	4 4 3 4 4 3 3

		2.8 Water resistant hydrophobic coating 2.9 Unifocal & multifocal lenses 2.10 High Index lenses 2.11 Poloride lenses 2.12 Care & cleaning of lenses	2 4 2 2 3
3.	Frames	3.1 Spectacle frame material 3.2 Parts & dimensions of frames 3.3 Frame types 3.4 Spectacle types 3.5 IPD 3.6 Vertex distance	3 5 3 3 3 2
4.	Dispensing of Spectacles	4.1 Verification of spectacles 4.2 Transposition 4.3 Axis marking 4.4 Edging 4.5 Fitting of unifocal lenses in metal & plastic frames 4.6 Fitting of bifocal lenses in metal & plastic frames 4.7 Fitting of cylindrical lenses in metal & plastic frames	6 3 2 3 3 3 3
		Total	**120**

Practicals

Sr. No.	Name of the Practicals/Demonstration/Student Activity	Periods
1.	Study and Observation of grinding machine.	25
2.	Study and Observation of grinding powders.	25
3.	Study and observation of various grinding material like tool, button, gauze etc.	20
4.	Spherical grinding & polishing.	25
5.	Cylindrical grinding & polishing.	15
6.	Bifocal grinding & polishing.	10
7.	Verification of unknown lens by neutralization.	10
8.	Verification of unknown lens by Geneva lens measure.	10
9.	Verification of unknown lens by lensometer.	10
10.	Measurement of I.P.D.	6
11.	To study frames.	6
12.	Spherical lens fitting in a plastic & metal frame.	20
13.	Cylindrical lens fitting in a plastic & metal frame.	18
14.	Bifocal lens fitting in a plastic & metal frame.	20

15.	To do transposition.	10
16.	To study and observe various types of protective lenses.	10
	Total	**240**

XII Spotting Paper III – P9

1.	Blank glass	
2.	Tools - spherical, Cylindrical	
3.	Buttons - Spherical, Cylindrical	
4.	Wax	
5.	Roughing Powder (MOG 180)	
6.	Grinding Powders (MOG 2, MOG 3)	
7.	Polishing Cloth	
8.	Polishing Powder	
9.	Ral	
10.	Gauze	
11.	Executive Bifocal	
12.	D Bifocal	
13.	Photo chromatic Glasses	
14.	Multifocal	
15.	Aphakic Glass	
16.	Diamond Cutter	
17.	Chipping Plier	
18.	Frame Heater	
19.	Edging Machine	
20.	Frames	
21.	Lensometer	
22.	Geneva Lens	
23.	Frame plastic	
24.	Frame metal	

Reference Books

1. Duke Klder Refraction
   By David A Brang Churchill Livingstone
2. A Text Book of Ophthalmology
   By L. P. Agarawal
3. Human Biology and Physiology
   By Rosi and Wilson
4. Text Book of Ophthalmology
   By Chattarjee
5. Text Book of ophthalmology
   By Basak
6. Principal of Optics and Refraction
   By L. P. Agarawal
7. Theory and Practice of Optics and refraction
   By A. K. Khurana
8. Optics Dispensing and Workshop Practice
   By W. S, Topliss
9. Ophthalmology
   By A. K. Khurana
10. Textbook of Visual Science & Clinical Optometer
    By Bikas Bhattacharyya
11. Opticians Guide (a manual for optician)
    By Ajay
12. Handbook of optometry & Eye Disorders
    By SGT Prakash Nathan

List to Tools and Equipment & Raw Material

- Tonometer (Shiotz's) 03
- Focimeter / Lensometer 01
- Streak retinoscope 02
- Retinoscope (Mirror) 10
- Trial Frame 10
- Trial sets 05
- Urine testing set 05
- BP Apparatus 02
- Stethoscope 02
- Thermometer 05
- Torches 10
- Fundoscope 02
- Punctum dilator 02
- Lacrimal cannula 02
- Epilation Forcep 02
- Near vision chart 02
- Dist. vision chart 02
- Colour vision chart 02
- Instruments for eye operation 1 Set
- Skull 01
- Eye model -
- Autorefractometer 01

Optical Work Shop

- Spherical grinding m/c 02
- Cylindrical grinding m/c 02
- Spherical tools 02 Sets
- Cylindrical tools 02 Sets
- Checking gauges 01
- Furniture- As per requirement
- Geneva lens measure
- 302, 303, Carbrudum, red oxide 10 kg Each
- Chipping plier 10
- Edging machine 02
- Diamond cutter 05
- Polish powder 05 Kg
- Sph. / Bifocal blanks 15 Pairs/year
- Plano. glasses 25 Paris/year
- Plastic / Metal 30 each/year

INFRASTUCTURE

1. Space requirement
   * Classroom – 300 sq. ft.
   * Laboratory – 600 sq. ft.

2. Electrical power supply
   * Three phase 3 Kw

Staff Pattern

Sr. No.	Designation	No.	Qualification
1	Full Time Teacher	01	1. MBBS with 2 year experience 2. Doms 3. MS Ophthal 4. B. A. M. S. with five years teaching experience in HSC Vocational concern Subject
2	Full Time Instructor	01	1. B. A. M. S. 2. B. Sc. Optometry 3. HSC Vocational in ophth. Tech. with five years experience
3	Ophthalmic Assistance	01	HSC Vocational in Oph. Tech.

4: CHILD, OLD AGE AND HEALTH CARE SERVICES (T7, T8, T9)

Scheme of Examination

Std. XI

Paper	Title of the Paper	Theory		Practicals		Term work OJT	Project work	I.V.	Total Marks
		Marks	Time (Hrs)	Marks	Time (Hrs)				
1	Management of Day Care Center and Early Childhood Education	80	3	80	3	20	10	10	200
2	Mother and Child Health Care (MCH)	80	3	80	3	20	10	10	200
3	Organization and Management of Non Government	80	3	80	3	20	10	10	200

** OJT = On Job Training

* IV = Industrial Visits

Scheme of Examination

Std. XII

Paper	Title of the Paper	Theory		Practicals		Term work OJT	Project work	I.V.	Total Marks
		Marks	Time (Hrs)	Marks	Time (Hrs)				
1	Old Age Care	80	3	80	3	20	10	10	200
2	Care of Children with Special Needs	80	3	80	3	20	10	10	200
3	Organization and Management of Institutional House Keeping	80	3	80	3	20	10	10	200

** OJT = On Job Training

* IV = Industrial Visits

Introduction

National occupation standards (NOS) specify the standard performance of an individual must achieve when carrying out function in the workplace, together with knowledge and understanding they need to meet the standard consistently. Essentially NOS are benchmark of good practice. The NOS are laid down by employers. A set of NOS, aligned to a job role, called qualification pack. This would be available for every job role in each industry sector. These drive both the creation of curriculum and assessment. Thus NVQF (National vocational qualification framework) will theoretically make it possible to drive competency based training for every job role in each industry. So it will be possible for all current vocational courses.

The present curriculum in "CHILD, OLD AGE AND HEALTH CARE SERVICES" is going to take care of the human care, human health and its management with help of developing skills in various fields related to human care and its management and will open the job opportunities to the students in different sectors.

As per the directions of Sector Skill Council it will help to reduce the skill gaps and the shortage in field of early childhood care and education, old age care, mother and child health care and the care of children with special needs.

Hope the present curriculum will help to develop a workforce in the field of "CHILD, OLD AGE AND HEALTH CARE SERVICES".

GOALS

- Training in “Child, Old Age and Health Care Services” will develop the skilled work force for the field of early childhood care and education.
- Training in “Child, Old Age and Health Care Services” will develop the skilled work force for the field of Mother and Child health care.
- Training in “Child, Old Age and Health Care Services” will take the students toward employability.
- Training in “Child, Old Age and Health Care Services” will foster understanding of a student in the field of NGO.
- Training in “Child, Old Age and Health Care Services” will facilitate the knowledge, and skills in handling normal children, special children and old age people care in proper way.
- Training in “Child, Old Age and Health Care Services” will develop the skilled work force for the field of institutional housekeeping.

OBJECTIVES

- To make the student aware of the concept of Administration, Management and Organization of different institutions in the field of child care, child education, old age care, care of children with special needs.
- To inculcate knowledge and skills to understand Life- span approach.
- To develop in depth knowledge of early childhood education
- To develop skills in management and organization of different centers run for children and early childhood education
- To develop skills in promoting all-round development of children.
- To develop sector wise skills in students to start their own centers related to human care and management.
- To develop sector wise skills in students to take care of old age people at primary level.
- To make the student aware of special needs of children.
- To acquaint the student with the awareness of health care in different institutions related to human care and management

JOB PROSPECTS/OPPORTUNITIES

Self Employment

SET UP OF/Starting/Consulting

1. Early childhood care and education centers
2. Recreation centers
3. Old age homes
4. Recreation centers for old age people
5. NGO
6. Agency of Institutional housekeeping
7. Centre for children with special needs

Wage Employment

1. Employment in different centers for children: for example Crèche/day care centre/play centre/activity/play grounds/recreation centre etc
2. Early childhood education centers
   a. Anganwadi
   b. Balwadi
   c. Nursery school
   d. Montessori school
   e. Kindergarten
   f. Inclusive schools
3. Assistant to doctors and Nurses
4. Old age homes
5. Recreation centers for old age people
6. NGO

7. Agency of Institutional housekeeping
8. Centre for children with special needs
9. Shadow teacher for children with special needs
10. Primary health centers
11. Mother and child care centers
12. Housekeeping departments of institutes of old age homes, hospitals etc.

Std. XI
Paper I: Management of Day Care Center and Early Childhood Education (T7)

Objectives

To enable the students to –

1. Become acquainted with theoretical bases and principles of early childhood care and education based on child development.
2. Become skilled in planning and implementing tasks to meet children's need for health protection, nutrition, education and development.
3. Learn skills in organizing, planning and administering different centers for young children.
4. Develop skills to set activity based learning and appropriately transacting experiences.
5. Become aware and sensitive and reflect on the perspective, priorities and problems of early childhood care and education.
6. Develops administrative and managerial competencies in early childhood care supervision.
7. Become acquainted with the rights of the children.
8. Become aware about developmental needs of children from conception to the age of 8 years.
9. Become aware regarding current issues in early childhood care and education.
10. Become aware in new approaches of providing learning experiences in e-learning.

Theory

Basics of Child Development [Section – I]

Sr. No.	Unit	Sub-Unit	Periods
1.	Introduction to child development	1.1 Meaning and scope 1.2 Growth and development 1.3 Principles of development	17

2.	Developmental stages and its characteristics	2.1 Developmental stages 2.2 Characteristics of each stage	12
3.	Needs of children in each stage	3.1 Needs of children in each developmental stage	6
4.	Role of Adult	4.1 Role of adult in development of children - Care taker - Teacher	6

Centers for young children [Section – II]

Sr. No.	Unit	Sub-Unit	Periods
1.	Introduction to Mgt. of centres for young children	1.1 Introduction to concept of administration and management 1.2 Application to children's centres	13
2.	Day care and other type of centres and early childhood education centres for young children	2.1 Day care centre and different centres for children 2.2 Early childhood education centres and their philosophy	13
3.	Objectives of each type of centres for children	3.1 Objectives of each centre for children	5
4.	Play and Activities	4.1 Concept and importance of play 4.2 Stages of play 4.3 Selection of play material 4.4 Indoor and outdoor activities	12
5.	Mgt. and planning of activities	5.1 Planning of outdoor activities 5.2 Planning of indoor activities	16
6.	Management and supervision of each centre	6.1 Management and organization of each centre(Time, Financial, Reports and records) 6.2 Human resource management	16
7.	Current concerns in early childhood care and education	7.1 Children's rights 7.2 E-learning in early childhood education	4
		TOTAL	**120**

Practicals

Basics of Child Development [Section – I]

Sr. No.	List of Practicals	Periods
1.	Making a chart of key words in the journal with pictorial presentation	23
2.	Making a pictorial presentation in the journal	
3.	Make and list down observations in children's centers	
4.	Making a pictorial presentation in the journal	
5.	Makes observations in the centers for children	
6.	Prepares a checklist of characteristics of each stage of development	
7.	Make observations in children's centers with the help of prepared checklist	
8.	Prepare a cone of hierarchy of needs with the help of pictures	5
9.	Prepares a table of role of adults - Care taker - Teacher	3

Centers for young children [Section – II]

Sr. No.	List of Practicals	Periods
1.	Making a chart of administrative skills in the journal with pictorial presentation	12
2.	Making a chart of managerial skills in the journal with pictorial presentation	
3.	Preparing a checklist of administrative skills in the journal and observe them in different children's centers	
4.	Preparing a checklist of managerial skills in the journal and observe them in different children's centers	
5.	Visit each centre and writes a report on it regarding activities take place	8
6.	Visit preschool centers and writes a report on it regarding activities take place and philosophy, the school follows	
7.	Visit centers and find out the objectives are fulfilled or not (by preparing questionnaire)	3
8.	Prepare a pictorial chart in the journal of stages of play	5
9.	Prepare a checklist of play material. At the time of visits find out whether the material in centre is suitable or not	
10.	Prepare a list of indoor activity material.	
11.	Prepare a list of outdoor activity material (in the journal)	

12.	Planning indoor activities as per centre's requirement	170
13.	Plans outdoor activities as per centre's requirement (in the journal)	
14.	WORKING WITH CHILDREN IN DIFFERENT CENTERS	
15.	Make scheduling and time table for each centre	10
16.	Make a budget plan for each centre (in the journal)	
17.	Prepare a staffing pattern for own centers (in the journal)	
18.	Visit the school where the e-learning method is adapted	1
	Total	**240**

Paper II: Mother and Child Health Care (T8)

Objectives

To enable the students to –

1. Become aware to the concept of mother and child health care.
2. Become acquainted with the development during prenatal period.
3. Become aware about the characteristics and needs of infancy and childhood.
4. Get acquainted with the skills of child health care and nutritional care.
5. Become aware about current concerns, services regarding mother and child health care.

Theory

Introduction to mother and child health care [Section – I]

Sr. No.	Unit	Sub-Unit	Periods
1.	Approach of mother and child care (MCH)	1.1 Concept and approach of MCH 1.2 Need and importance of MCH 1.3 Goals and objectives of MCH 1.4 Need of MCH in present days	12
2.	Prenatal period	2.1 Female reproductive system and its health 2.2 Conception- prenatal development, stages of labour 2.3 Types of birth • Normal • Forceps • Caesarean Section • Water birth 2.4 Prenatal and postnatal care – a)health needs and health education b) nutritional needs and nutrition	34

		education	
3.	Infant care	3.1 Neonatal period- appearance, adjustment 3.2 Infancy- developmental characteristics, Needs of infant 3.3 Toddlerhood - developmental characteristics, Needs of toddler 3.4 Health care of Neonate, infant, toddler 3.5 Nutritional care of Neonate, infant, toddler 3.6 Status of Infant mortality and morbidity and malnutrition in India 3.7 Role of nursing in infant health care	20
4.	Childhood	4.1 Early childhood(preschool period) - developmental characteristics and needs of preschool children 4.2 Late childhood (school going period)- developmental characteristics and needs of school going children 4.3 Health care of preschool and school going children 4.4 Nutritional care of preschool and school going children 4.5 Role of nursing in health care of preschoolers and school going children	24

Current concerns regarding MCH [Section – II]

Sr. No.	Unit	Sub-Unit	Periods
1.	MCH services in INDIA	1.1 Services available in India 1.2 Services available in Maharashtra 1.3 Services by Government and private sectors	8
2.	Health care infrastructure in Rural India	2.1 Rural health care system in India • Sub center • Primary health care • Community health care	8
3.	Role of NGO in MCH	3.1 Different roles NGO play in MCH ➢ strengthening, ➢ supporting, ➢ financial, ➢ role in mental health care, ➢ role in ECCD, ➢ role in rural development	8

4.	MCH related schemes and programmes	4.1 ICDS 4.2 Community health programme 4.3 Community nutrition programme	6
		TOTAL	**120**

Practicals

Introduction to mother and child health care [Section – I]

Sr. No.	List of Practicals	Periods
1.	Understand role and importance of MCH in mother and child's life and write definition of MCH and goals and objectives in the journal with pictorial presentation	5
2.	Prepare a questionnaire to conduct interviews of a pregnant woman	50
3.	Prepare a health checklist for a pregnant woman	
4.	Prepare a diet plan for a pregnant woman with the help of teacher by considering nutritional requirements of a pregnant woman as per her type of work	
5.	Find out different health care schemes implemented by government for pregnant woman	
6.	Visit to the hospital to the newborn ward and write a report in the journal with pictorial presentation	65
7.	Visit to the day care centers to observe characteristics of infants and toddlers with the help of checklist.	
8.	Visit to the doctor and discuss about infant healthcare with the doctor	
9.	Collect statistics about infant mortality, morbidity and malnutrition in children and try to know the preventive methods for avoiding these things	
10.	Get information about infant nursing by observing in the hospitals	70
11.	Visit to the preschools and primary schools to observe children and write a report in the journal with pictorial presentation	
12.	Collect information about illnesses and accidents of preschool and school going children	
13.	Write about common ailments of children's illnesses	
14.	Prepare nutritional diet plan with the help of teacher	

Current concerns regarding MCH [Section – II]

Sr. No.	List of Practicals	Periods
1.	Collect information of different schemes in MCH	15

2.	Visit health centers and try to know the type of it. Understand the working system of it	10
3.	Visits NGO working for MCH and try to understand how they help women and children	5
4.	Visit to ICDS center	20
	Total	**240**

Paper III: Organization and Management of Non Government Organisations (NGO) (T9)

Objectives

To enable the students to –

1. Become aware to concept of Non Government Organizations.
2. Get acquainted with the types of Non Government Organizations.
3. Learn the skills in creating mission and vision statements for the Non Government Organizations.
4. Learn the skills in preparation of budget for the organization.
5. Become aware about sources of fundraising.
6. Become aware of steps in establishment of Non Government Organization.
7. Learn the skills in formulation of projects and management of project.

Theory

Introduction to NGO [Section – I]

Sr. No.	Unit	Sub-Unit	Periods
1.	Overview of NGO	1.1 Definition 1.2 History of NGO 1.3 Fundamental nature of NGO 1.4 Classification of NGO	11
2.	Types of NGO	2.1 As per geographical area ➢ International ➢ Regional ➢ National ➢ Local • As per focus ➢ Humanitarian ➢ Human rights ➢ Educational NGO	8

		➢ Environmental ➢ Women's NGO ➢ Children's NGO ➢ Youth ➢ NGO for Peace	
3.	Organization of NGO	3.1 Mission and Vision statement 3.2 Organizational documents for registration 3.3 Governing body 3.4 Human resource	13
4.	Financial Management and Fundraising	4.1 Budget and accounting 4.2 Sources of funds 4.3 Writing a fund raising proposal with budget 4.4 Fund raising events	23
5.	Information Management	5.1 Introduction to information management and IT 5.2 Blog writing	10
6.	Code of conduct for NGO	6.1 NGO ethics 6.2 Code of conduct for NGO	10

Setup of NGO [Section – II]

Sr. No.	Unit	Sub-Unit	Periods
1.	Establishment of NGO	1.1 What and how of successful NGO 1.2 Characteristics of successful NGO owner	11
2.	Steps in establishment of NGO	➢ Selection of target group ➢ Defining the problem ➢ Background of the problem ➢ Formulation of proposed solution ➢ Justification ➢ Defining the scope of targeted NGO ➢ Formulation of bylaws for targeted NGO ➢ Registration of NGO	10
3.	Project management	➢ Project planning ➢ Project implementation ➢ Project control ➢ Project evaluation	24
		TOTAL	**120**

Practicals

Introduction to NGO [Section – I]

Sr. No.	List of Practicals	Periods
1.	Prepare a tree chart of classification of NGO with its details	5
2.	Collect information of different type of NGO and presently working NGO	25
3.	Practice to write vision and mission statements of different type of NGO	55
4.	Work with Small NGO	
5.	Prepare a specimen budget plan	50
6.	Prepare a specimen fund raising proposal plan	
7.	Prepare a specimen plan for fund raising event	
8.	Collect, store, share, and archive information with the help of computer	25
9.	Write specimen blogs	
10.	Working with NGO	30

Setup of NGO [Section – II]

Sr. No.	List of Practicals	Periods
1.	Working with NGO and observe the Head and his working method	20
2.	Working with NGO to understand the steps they have followed to establish	10
3.	Preparation of a specimen project	20
	Total	**240**

Std. XII
Paper I: Old Age Care (T7)

Objectives

To enable the students to –

1. Get acquainted with characteristics of old age.
2. Become aware of physical health conditions and changes with ageing.
3. Become aware of mental and social health conditions and changes with ageing.
4. Become sensitive to look age old age problems.
5. Recognize the limitations of hospital – based care and value the contribution of community geriatrics in adequate health management of old age patients.
6. Become aware of the following specialties and relate their contribution to the care of old age people – old age psychology, ortho geriatrics, palliative care and common emergency services.
7. Work effectively with older people.
8. Provide support to meet personal care needs.
9. Participate in the planning and implementation of various activities as per individual and group needs.

Theory

Introduction to Old Age [Section – I]

Sr. No.	Unit	Sub-Unit	Periods
1.	Old Age	1.1 Characteristics 1.2 Developmental tasks	6
2.	Need to understand old people	2.1 Adjustments with the changes old people have to do 2.2 Factors affecting changes 2.3 Hazards in personal and social changes	8
3.	Needs of old age people	3.1 Needs of old age people, Physical, Mental, emotional	2
4.	Introduction to health conditions of old age people	4.1 Physical health conditions and the changes 4.2 Mental health conditions and the changes 4.3 Social conditions and the changes	18
5.	Care of old people	5.1 Sensitivity to look at old age problems 5.2 Different aspects of care taking	6

Management of Old Age [Section – II]

Sr. No.	Unit	Sub-Unit	Periods
1.	Maintenance and mgt of health of old age people and First Aid	1.1 Need and importance of management of old people's health 1.2 Common problems 1.3 Emergency action 1.4 First aid/ Blood pressure 1.5 Nutritional care	30
2.	Institutional care of old age people and recreational facilities available for them.	2.1 Need and importance of old age homes/day care centers 2.2 Introduction to working of old age homes 2.3 Activities for old people	20
3.	Administration and mgt. of old age homes	3.1 Procedure for set up of a old age home/Day care centre	10
4.	Different services rendered to old age people	4.1 Different services for old age people	10
5	Current concerns regarding old age	Introduction to current issues in the field of gerontology Introduction to laws and rights regarding gerontology	10
		TOTAL	**120**

Practicals

Introduction to Old Age [Section-I]

Sr. No.	List of Practicals	Periods
1.	Make a chart of developmental stages emphasize on old age and its characteristics for pictorial presentation in the journal	4
2.	Make a chart presentation in the journal	
3.	Makes a chart of Physical, social, emotional, mental changes occur during old age in the journal	9
4.	Makes a list of different factors which affect changes during old age in the journal	
5.	Makes a list of hazards in personal and social changes during old age in the journal	

6.	Prepares a checklist of needs of old age people in the journal	12
7.	Preparation of questionnaire	
8.	Observations in the old age homes	
9.	Search information from different places and write about health conditions and changes take place and makes pictorial presentation in journal	6
10.	Search information from different places and write about mental health conditions and changes take place and makes pictorial presentation in journal	
11.	Search information from different places and write about social health conditions and changes take place and makes pictorial presentation in journal	
12.	Search information from different places about problems faced by old people in India and makes its mental mapping presentation in the Journal	19
13.	Working with old age people in old age homes, Day care centers	

Management of Old Age [Section – II]

Sr. No.	List of Practicals	Periods
1.	Working with old age people in old age homes, Day care centers and learns to take care of old age people by applying theoretical knowledge	110
2.	Prepare questionnaire and conducts interview of old age people the students always meet	
3.	Performs Practicalss, collects pictures related to the emergency actions, its steps and present in the journal	
4.	Prepare a first aid box under able guidance	
5.	Performs Practicals with old age people by monitoring blood pressure	
6.	Prepares health report cards of old age people under the guidance of Doctors and Nurses	
7.	Working with old age people in old age homes	
8.	Serves food to old people as per their requirement	
9.	Working with old age people in old age homes/day care centers	40
10.	Working with administrative staff	
11.	Planning and implementing recreational activities while	
12.	Working with old age homes/day care centers/ recreation centers for old age people	
13.	Working with old age homes/daycare centers/ recreation centers for old age people	15
14.	Collection of addresses and phone no. in the journal by doing survey	5
15.	Working with old age people in different centers	20
	Total	**240**

Paper II: Care of Children with special needs (T8)

Objectives

To enable the students to –

1. Become aware of children with special needs.
2. Learn to identify causes of problems of children with special needs.
3. Become aware of current terminology in the field of children with special needs.
4. Learn classification of children with special needs.
5. Become aware of identifying children with special needs and available services for them.
6. Learn to identify common needs and challenges facing families of children with special needs.
7. Learn to create and/or modify environment, equipment, material supplies and experiences to meet individual needs of children with special needs.
8. Establish and maintain positive collaborative relationships with other professionals and work effectively as member of a professional team.
9. Get the knowledge of the importance of early identification and early intervention of children with hearing impairment.
10. Develop skills and competencies in working with children with theory impairment.
11. Equip with various techniques of teaching and evaluation in special and inclusive set up.
12. Discuss integration of goals from Individualize Education programme (IEP) in to daily activities and routines.

Theory

Sr. No.	Unit	Sub-Unit	Periods
1.	Introduction to special needs of children	1.1 Meaning of special needs and classification of special needs 1.2 Early intervention	11
2.	Gifted Children	1.1 Definition 1.2 Concept of Intelligence 1.3 Characteristics of Gifted Children 1.4 Needs of Gifted Children 1.5 Nurturance of Gifts/ Enhancement of Abilities	12
3.	Children with Mental / Intellectual Challenges	3.1Definition 3.2 Classification of Mentally challenged 3.3 Characteristics of each sub group 3.4 Needs of mentally challenged children 3.5 Training for Activities of Daily Living	9
4.	Children with	4.1 Definition	22

	Physical Challenges	4.2 Introduction to Visual impairment 4.3 Needs of children with Visual impairment 4.4 Introduction to hearing impairment 4.5 Needs of children with hearing impairment/ deaf children 4.6 Stimulation for speech and language development in children with H.I. 4.7 Introduction to Cerebral Palsy 4.8 Needs of children with C.P. 4.9 Introduction to Other muscular difficulties 4.10 Special arrangements, devices used to make children independent with cerebral palsy.	
5.	Children with Pervasive Developmental Disorder	5.1 Definition 5.2 Types of P.D.D. like A.D.H.D., Autism 5.3 Main characteristics of children with ADHD 5.4 Needs of children with ADHD 5.5 Main characteristics of children with Autism 5.6 Needs of children with Autism 5.7 Difference between children with retardation and children with Autism 5.8 Issues regarding Sensory Integration in Autism. 5.9 Base of S.I. to behavioural problems in children with Autism.	11
6.	Children with Learning Difficulties	6.1Definition 6.2 Types of Learning Difficulties like Dyslexia, Dysgraphia, Dyscalculia, Dyspraxia 6.3 Characteristics of children with LD as ADHD, poor vocabulary, etc. 6.4 Needs of children with LD. 6.5 Concept of Remedial Teaching.	20
7.	Children with Emotional problems and Behavioural problems	7.1 Introduction to emotional problems like separation anxiety, over attachment, fears and phobias etc. 7.2 Problems related with food and feeding habits, related with excretion and toilet training. 7.3 Behavioural problems like stubbornness, throwing temper tantrums, self injurious behaviour, and behaviour injurious to	35

		others. 7.4 Repetitive and stereotypic behaviour.	
		TOTAL	**120**

Practicals

Sr. No.	List of Practicals	Periods
1.	Prepare a tree diagram of classification and makes pictorial presentation in the journal	10
2.	Write about early intervention in the journal and the services come under early intervention	
3.	Find out how IQ is calculated.	35
4.	Visit psychology centers where IQ tests are administered	
5.	Plan activities for gifted children in the journal	
6.	Planning activities in the journal	15
7.	Visit the special schools	
8.	Visit to the special school and inclusive school	40
9.	Plan activities in the journal	
10.	Collect pictures of different devices to make pictorial presentation in the journal	
11.	Collect pictures of type of PDD to make pictorial presentation in the journal	50
12.	Visit to the special school and inclusive school and observes children with ADHD	
13.	Visit to the special school and inclusive school and observe children with Autism and write the differences between mentally challenged children and children with Autism with understanding	
14.	Visit to the special school and inclusive school and observes children with Autism and write about the behavioural problems shown by Autistic children	
15.	Visit to the inclusive school and observes children with Learning Difficulties	40
16.	Prepares a plan for remedial teaching	
17.	Visit to the nursery schools, inclusive schools and special schools.	50
18.	Visit to the nursery schools, inclusive schools and special schools writes observations in the journal	
	Total	**240**

Paper III: Organization and Management of Institutional House Keeping (T9)

Objectives

To enable the students to –

1. Become aware of necessary knowledge, skills, values and attitudes regarding International Housekeeping.
2. Become aware regarding essential features of Institutional International Housekeeping related to human development and care.
3. Provide opportunities to the students for developing necessary operating skills relating to the Human Development and care and Health care services.
4. Develop the right kind of values and attitudes to function effectively in the field of Institutional Housekeeping.
5. Develop the skills of supervision and management in the field of cleaning, waste management, laundry procedures, room management and outdoor management.
6. Acquire the related schemes to organize and manage a housekeeping department.

Theory

Sr. No.	Unit	Sub-Unit	Periods
1.	Introduction to institutional house keeping	1.1 Concept of institutional house keeping 1.2 Need and importance of institutional house keeping 1.3 Types of institution which require institutional housekeeping related to human development and care 1.4 Introduction to work culture and housekeeping work to be done in particular institute- ➢ Nursery schools ➢ Day care centres ➢ Play grounds ➢ Play centers ➢ New born room ➢ Hospitals ➢ Old age homes ➢ Offices	6
2.	Cleaning	2.1 Need and importance of cleaning 2.2 Type of cleaning- daily, weekly, yearly 2.3 Introduction to various cleaning	26

		equipment 2.4 General safety rules while using cleaning agents and equipment 2.5 Public area cleaning 2.6 Pest control	
3.	Waste management	3.1 Supervision of waste disposal 3.2 Classification of waste 3.3 Introduction to eco-friendly methods of waste management	16
4.	Laundry procedures	4.1 Need and importance of laundering 4.2 Material used for laundering 4.3 Specialized stain removal techniques 4.4 Storage and distribution of laundry packs of bead spreads and pillow covers etc. 4.5 General safety rules for handling laundry material and equipment	22
5.	Room management and outdoor management	5.1 Room inspection 5.2 Room arrangements and decoration 5.3 Care of different fixtures, furniture, floors 5.4 Maintenance and management of garden, outdoor space of the institute.	27
6.	Organization and management of housekeeping department	6.1 Need and importance of independent department of house keeping 6.2 Administration and management of housekeeping department Human resource management ➢ Housekeeping Staff and their characteristics ➢ Staff duties and Responsibilities ➢ Job specifications ➢ Time management ➢ Material management ➢ Financial management ➢ Maintenance of reports, registers and records	23
		TOTAL	**120**

Practicals

Sr. No.	List of Practicals	Periods
1.	Make a list of Types of institution which require institutional housekeeping related to human development and care	5
2.	Collect information about cleaning in details with the help of checklist by visiting various institutions related to human development and care	30
3.	Collect information about eco-friendly methods of waste disposal.	25
4.	Stain removal techniquess.	40
5.	Prepare inventory control list of laundry material and laundry packs to be distributed for the related human development and care institutions	
6.	Prepares a room inspection checklist and visit different institutes to observe	65
7.	Working in the garden	
8.	Visit the different institutes and studies outdoor space of each institute	
9.	Prepares organizational chart and staff duties	75
10.	Working in the house keeping department of different institutes	
11.	Prepares specimen time table, time schedule for different institutes	
12.	Makes specimen budget plans for different institutes	
	Total	**240**

LIST OF TOOLS AND EQUIPMENT

Sr. No.	ITEM	NEEDED Quantity
1	OHP	1
2	All type of Cooking utensils with pressure cooker, food processor	As per requirement
3	Fridge	1
4	Computer	1
5	LCD projector	1
6	Containers to preserve food ingredients	As per requirement
7	Storage cupboard	2
8	Sewing machine for toy making	1
9	First aid box	1

10	Health maintenance equipment • Thermometer • Blood Pressure Equipment • Sugar Checking Instrument	 1 1 1

Note: Any other required equipment, tools, machines, appliances which is not in the list but required for the course may be purchased

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CATERING AND FOOD TECHNOLOGY GROUP

1: Food Products Technology (X7, X8, X9)

Scheme of Examination

Std. XI

Paper	Title of the Paper	Theory		Practicals		Term work	Project work	I.V.	Total Marks
		Marks	Time (Hrs)	Marks	Time (Hrs)				
1	Bakery Technology	80	3	80	3	20	10	10	200
2	Cookery Technology	80	3	80	3	20	10	10	200
3	Indian Cuisines & Hygiene	80	3	80	3	20	10	10	200

* IV = Industrial Visit

Scheme of Examination

Std. XII

Paper	Title of the Paper	Theory		Practicals		Term work	Project work	OJT	I.V.	Total Marks
		Marks	Time	Marks	Time					
1	Advanced Bakery Technology	80	3	80	3	10	10	10	10	200
2	Advanced Cookery Technology	80	3	80	3	10	10	10	10	200
3	Food Costing & International Cuisine	80	3	80	3	10	10	10	10	200

** OJT = On Job Training

* IV = Industrial Visit

Introduction

The food processing industry in India is known as sunrise industry due to huge demand by people. Industrialization, urbanization and globalization increase the demand for ready-to-eat and ready-to-cook food day-by-day. These foods have gained importance due to their delicious taste, attractive appearance and palatability. Especially bakery products are preferred by all age groups which has better shelf life. Most of the ready-to-eat food products are produced by unorganized sector which are mostly manually operated. Therefore the qualities of these products are not up to the mark of consumer's expectations. Hence the application of modern sophisticated technology with trained personnel is required to cater the needs of growing food processing industry.

This syllabus deals with various aspects of food products technology. It also equips the students with industrial knowledge and skills of producing Indian and international cuisines with aims at producing entrepreneurs and professionals in food products.

General Objectives

1. To create technical manpower required for bakery industry.
2. To prepare value added nutritionally rich food products.
3. To promote employment opportunity in food industry.
4. To develop entrepreneurial skills.

Specific Objectives

1. To impart scientific and technical knowledge in food products in particular and food science in specific.
2. To study the factors affecting food acceptability.
3. To provide the adequate technical manpower to food industries.
4. To impart knowledge for production of quality food products.
5. To create awareness among the people for use of ready-to-eat and ready-to-cook foods.
6. To create awareness about food hygiene, sanitation and quality.
7. To aware the students for relationship between human health, nutrition and ready-to-use food.
8. To know how to run the entrepreneur successfully, by maintaining different accounts.
9. To create awareness regarding different food laws, rules and regulations and quality control in food industry in India.
10. To impart knowledge of Indian and International cuisines.

Job Opportunities

The students of Bakery Technology and Catering Technology have tremendous job opportunities:

As a cook : Commis I, II, III

- As a bakery assistant

- Industrial catering
- Catering business
- Kitchen Stewarding assistant
- Employment in food restaurants, canteen and bakeries
- Instructor/Teacher in schools and colleges
- Can work in Food Craft Institute

Self Employment Opportunities

- Run own fast food centre, Dhaba.
- Run food service centre, bakery unit, canteen, mess, food preparation centre, snacks centre, food parlour.
- (Supplier of food) Cater for various functions and gatherings.
- Food producer, entrepreneurs
- Run Industrial canteen
- Run food point nearby market, school, offices etc.
- Run classes for cookery and bakery technology.
- Establish cottage scale industry.

Std. XI
Paper I: Bakery Technology (X7)
Theory

Sr. No.	Unit	Sub-Unit	Periods
1.	Bakery Industry	1.1 Importance of bakery Industry	05
		1.2 Terms used in bakery technology	05
2.	Ingredients in bakery	2.1 Classification of ingredients	01
		2.2 Role of ingredients in bakery products	10
		2.3 Characteristics of ingredients in bakery products	10
		2.4 Composition and structure of major ingredients	04
3.	Bread making technology	3.1 Bread making process	10
		3.2 Baking	02
		3.3 Methods	08
4.	Cake making technology	4.1 Cake making process	10
		4.2 Baking	02
		4.3 Methods	08
5.	Biscuit making technology	5.1 Biscuit making process	03
		5.2 Baking	02
		5.3 Methods	05
6.	Quality Assessment	6.1 Ideal characteristics of bread and cake.	20

		6.2 Defects in bakery products	15
		Total	**120**

Practicals

Sr. No.	List of Practicals	Periods
1.	Identification and use of bakery equipments and machineries.	8
2.	Identification of different bakery ingredients – 2.1 Different cereals and processed flours. 2.2 Dry and Compressed yeast. 2.3 Different types of sugar. 2.4 Different types of fat. 2.5 Fresh and Stale egg.	 4 4 4 4 4
3.	Estimation of wet gluten from different cereals.	4
4.	Indenting and plan of work while preparing more than one product at a time.	4
5.	Preparation of bread by different methods. 5.1 Straight dough method – Bread loaf, bread sticks, surti butter. 5.2 No time dough method – Bread loaf, Dinner rolls, Doughnuts, ladi pav, pitta bread. 5.3 Sponge and dough method – Bread loaf = 100% sponge, 70%-30% sponge.	 24 32 24
6.	Preparation of different cakes – Pound cake, vanilla buns, Madeline's, lemon cake, orange muffins, chocolate cake, marble cake, eggless cake, fatless cake with gel.	72
7.	Preparation of biscuits – Nankatai, coconut cookies, ginger biscuits, tricolour biscuits, butter buttons, melting moments, short bread biscuits, vanilla biscuits, orange biscuits, masala biscuits.	52
	Total	**240**

Paper II: Cookery Technology (X8)
Theory

Sr. No.	Unit	Sub-Unit	Periods
1.	Introduction to Cookery Technology	1.1 Importance of cooking	2
		1.2 Culinary Terms	4
2.	Commodities in Cookery	2.1 Ingredients used in cookery	2
		2.2 Role of ingredients and additives in cookery	10
3.	Cooking of food	3.1 Preparation and processing methods of	10

		food	
		3.2 Methods of cooking	10
4.	Components of food	4.1 Introduction	1
		4.2 Carbohydrates	2
		4.3 Proteins	2
		4.4 Fats	2
		4.5 Minerals	2
		4.6 Vitamins	2
		4.7 Water	1
5.	Effect of heat on food and functions in cookery	5.1 Sugars	8
		5.2 Cereals	8
		5.3 Dals and pulses	4
		5.4 Milk and Milk products	8
		5.5 Animal food	4
		5.6 Fats and oil	8
		5.7 Fruits and Vegetables	8
6.	Menu Planning	6.1 Types of menu	10
		6.2 French Classical menu	8
		6.3 Menu Card	4
		Total	**120**

Practicals

Sr. No.	List of Practicals	Periods
1.	Identification of food commodities.	2
2.	Weighing and measuring of all commodities and conversion of household measures like, spoon, katori, cup, glass etc.	6
3.	Preparation and processing methods before cooking food.	2
4.	Role of additives used in cookery.	2
5.	Effect of heat on food and functions in cookery.	2
6.	Actual preparation of recipes from different food commodities: 1. Cereals 2. Dals and pulses 3. Milk and Milk products 4. Eggs 5. Meat 6. Fish 7. Chicken 8. Vegetables 9. Snacks 10. Chutneys 11. Salads	 15 15 15 15 15 15 16 16 32 8 16

	12. Sweets/Desserts 13. Beverages (Note: Refer Annexure I for list of Menus for preparation of above recipes)	16 16
7.	Planning menu for breakfast, lunch, dinner, wedding, birthday, conference and any other events.	16
	Total	**240**

Paper III: Indian Cuisines and Hygiene (X9)
Theory

Sr. No.	Unit	Sub-Unit	Periods
1.	Hygiene and Sanitation	1.1 Importance of hygiene, health and sanitation	07
		1.2 Sanitation in cooking	08
		1.3 Food Standards	08
		1.4 Pest Control	10
		1.5 Garbage Disposal	15
2.	Food Storage and food spoilage	2.1 Importance of food storage	06
		2.2 General guidelines of food storage	06
		2.3 Food spoilage	05
		2.4 Causes, signs and preventive measures of food spoilage	15
3.	Cuisines of Northern India	3.1 Food culture of North India	10
4.	Cuisines of Eastern India	4.1 Food culture of Eastern India	10
5.	Cuisines of Western India	5.1 Food culture of Western India	10
6.	Cuisines of Southern India	6.1 Food culture of Southern India	10
		Total	**120**

Practicals

Sr. No.	List of Practicals	Periods
1.	Equipments – List of small, large and mechanical equipments and tools used in catering industry.	06
2.	Handling and operation of each of the equipments.	06
3.	Cleaning procedure – Cleaning of equipments personal hygiene.	06

4.	Visit to various food service centers and catering institutes. Evaluation of layout and storage area on the basis of hygiene and cleanliness.	14
5.	Preparation of receipes of cuisine of Northern India. (Any twenty from the list enclosed in Annexure II)	42
6.	Preparation of receipes of cuisine of Eastern India. (Any twenty from the list enclosed in Annexure II)	42
7.	Preparation of receipes of cuisine of Western India. (Any twenty from the list enclosed in Annexure II)	42
8.	Preparation of receipes of cuisine of Southern India. (Any twenty from the list enclosed in Annexure II)	42
9.	Running the canteen in Institute/School/College or Implant training for 10 days in established commercial food units like Hotels/Canteen/Restaurant.	40
	Total	**240**

Std. XII
Paper I: Advanced Bakery Technology (X7)
Theory

Sr. No.	Unit	Sub-Unit	Periods
1.	Improvers in bakery products	1.1 Introduction to bread improvers	05
		1.2 Classification of improvers used in bread products 1.3 Role in bakery.	20 05
2.	Cake making technology	2.1 Cake recipe balancing	05
		2.2 Rules of recipe balancing	10
		2.3 Classification and types of cake	15
3.	Cake Decoration	3.1 Introduction	02
		3.2 Ingredients in icing	02
		3.3 Classification and types of icing	16
4.	Pastry Making	4.1 Introduction	05
		4.2 Ingredients used for pastry making	07
		4.3 Types of pastry	15
5.	Special bakery products	5.1 Introduction	05
		5.2 Types	08
		Total	**120**

Practicals

Sr. No.	List of Practicals	Periods
1.	Preparation of bread and cake using improvers Bread – sweet dough (Rich dough) Bread with milk powder/milk/egg Cake – Dundee cake, Christmas cake	40
2.	Cake formula derivation: High ratio cake – Pineapple upside down cake Low ratio cake – Genoese sponge cake/plain cake Rich cake – Date-walnut cake Lean cake – Fatless sponge, swiss roll	40
3.	Preparation of icing and application on bakery products. Glaze icing – on orange muffins/doughnuts Butter icing – on plain/chocolate cake Fresh cream – on genoese sponge/fatless sponge cake Truffle icing – on genoese sponge/fatless sponge cake Demonstration of marzipan, gum paste, royal icing and fondant	48
4.	Pastry – Short crust pastry – Variety of tarts and pies with different fillings Flaky pastry, khari, vegetable puff, cream roll Danish pastry – Chelsea buns, crescent rolls, Cinnamon rolls	40
5.	Special bakery products:- a. Eggless bakery products – Eggless cake, ladi pav, biscuits, buns b. High fibre bakery products – Bran muffins, whole wheat flour cake, bajra buns, bran bread rolls, bran biscuits. c. Low calorie bakery products – Fatless sponge muffins, sugar free cake, sugar free biscuits, whole wheat bread d. Multigrain bakery products – Ragi flour biscuits, multigrain biscuits, peanut wheat and soya biscuits, soya, wheat, rice cake, multigrain bread, ragi and wheat cake.	72
	Total	**240**

Paper II: Advanced Cookery Technology (X8)
Theory

Sr. No.	Unit	Sub-Unit	Periods
1.	Stocks and Soups	1.1 Stocks	5
		1.2 Kinds / Classification and storage of stock	6

		1.3 Soups	10
2.	Sauces	2.1 Importance of sauces	5
		2.2 Types of sauces	15
3.	Appetizers, accompaniments and salads	3.1 Appetizers	8
		3.2 Salads	5
		3.3 Salad Dressings. English, American and Lemon Dressing	6
4.	Sandwiches	4.1 Infroduction 4.2 Preperation of sandwich 4.3 Types of sandwich	1 4 3
5.	Meat, Sea foods and Poultry	5.1 Meat : Cuts and their uses	5
		5.2 Tenderness of meat	10
		5.3 Fish : Classification, storage & cuts	5
		5.4 Cooking methods	5
		5.5 Chicken : Cuts	5
6.	Ice Cream and Chocolates	6.1 Definition	2
		6.2 Classification	8
		6.3 Preparation of chocolates	12
		Total	**120**

Practicals

Sr. No.	List of Practicals	Periods
1.	Stocks – Preparation of white stock, brown stock, vegetable stock, glazes.	16
2.	Soups – Preparation of consommé, Cream of tomato soup, Spinach soup, Cabbage chowder, Minestrone and Mulligatawny.	16
3.	Sauces – Preparation of white sauce (Penne with cream cheese sauce and baked vegetables) Preparation of brown sauce (Poulet sauté chicken) Preparation of veloute sauce (Veloute Danoise) Preparation of tomato sauce (Spaghetti Bolognaise, Baked beans with Toast) Preparation of Hollandaise sauce & Asparagus with Hollandaise sauce Preparation of Mayonnaise (Russian salad & Waldrof Salad)	24
4.	Cocktails – Preparation of melon, grape fruit, mixed fruit, orange and florida cocktails.	16
5.	Indian snacks – Refer Annexure I	16
6.	Salads – Preparation of salads – Cole slaw, mixed vegetable salad, pasta salad, green salad, tossed salad.	8
7.	Sandwiches – Preparation of vegetable sandwich, vegetable burger, club sandwich, chicken sandwich, canapés.	12
8.	Meat, Seafood, Poultry:	

	Preparation of Meat products – Seekh kabab, shammi kabab, mutton curry Preparation of Chicken products – Tandoori chicken, chicken tikka, brown stew Preparation of Egg products – Omelet, egg curry, French toast Preparation of Seafood products – Fish colert (salad), fish Florentine, fish curry, prawns rice.	16 16 12 12
9.	Ice creams – Preparation of vanilla, butterscotch, pista, chocolate, mango, strawberry ice cream. Preparation of kulfi Preparation of falooda	36
10.	Inplant training for 10 days in established Hotels, Canteen and Restaurants. OR Running the canteen in the institute/school/college	40
	Total	**240**

Paper III: Food Costing & International Cuisine (X9)
Theory

Sr. No.	Unit	Sub-Unit	Periods
1.	Costing in food establishment	1.1 Nature of food cost control 1.2 Objectives of food cost control 1.3 Obstacles in food cost control 1.4 Elements of food cost 1.5 Break even analysis	24
2.	Cost control system	2.1 Study of costing system 2.2 Phases of food cost control 2.3 Cycle of food cost control through basic operating activities	30
3.	A) Budget B) Unit Cost	3.1 Importance and Classification of budget Unit costing and cost sheet	12
4.	Book keeping	4.1 Importance of book keeping 4.2 Rules of double entry book keeping 4.3 Preparation of Journal 4.4 Preparation of subsidiary books	30
5.	International Cuisine	1.1 Introduction 1.2 Chinese & Thai Cuisine 1.3 Mexican & Italian Cuisine 1.4 Japanese & Korean Cuisine	24
		Total	**120**

Practicals

Sr. No.	List of Practicals	Periods
1.	Market survey – To know various bakery and cookery raw materials and their rates (wholesale and retail).	16
2.	Calculation of elements of costs and profit levels.	16
3.	Preparation of indent and store requisition slip for one batch and 4 servings of cookery and bakery products.	32
4.	Preparation of formats for inviting and receiving quotations – (item wise).	8
5.	Preparation of comparative statement on the basis of quotations received – (item wise).	8
6.	Preparation of purchase order.	8
7.	Steps followed in receiving the above items.	4
8.	Preparation of standard purchase specification (S.P.S) and delivery challan and credit note.	16
9.	List the steps followed in storing procedure. Preparation of Bin card.	4
10.	Calculation of actual price and selling price of bakery and cookery products (cost sheet).	24
11.	International cuisines (Practicalss) (Refer annexure III for Practicalss)	104
	Total	**240**

Annexure I

1a)	Rice Preparations	1. Lemon Rice 2. Moong dal khichdi 3. Egg rice 4. Peas Pulao, veg pulao 5. Chicken Biryani 6. Prawns pulao
1b)	Wheat Preparations	1. Chapatti/phulka 2. Paratha 3. Stuffed parathas [aloo, gobi, mooli] 4. Puris 5. Moghlai parathas 6. Missie roti 7. Nan

		8. Bhatura
2	Dal and pulses preparations	1. Dal tadka 2. Masala dal 3. Amti 4. Sambhar 5. Rajma 6. Chole 7. Usal
3	Milk preparations	1. Dahi 2. Paneer 3. Cheese 4. Basundi 5. Rabdi 6. Khoa
4	Egg preparations	1. Boiled egg [hard & soft] 2. Poached egg 3. Fried egg 4. Scrambled egg 5. Masala omlette 6. Egg curry 7. Egg Bhurji 8. Egg Pudding
5	Meat dishes	1. Mutton curry 2. Masala do pyaaza 3. Mutton khorma 4. Mutton palak
6	Fish preparations	1. Fish cutlets 2. Masala fried fish 3. Prawns curry 4. Fish curry
7	Chicken dishes	1. Chicken curry 2. Chicken Tikka 3. Fried chicken 4. Chicken Tandoori
8	Vegetable preparations	1. Fried bhindi 2. Beans foogath 3. Sukhe aloo 4. Mutter paneer 5. Vegetable jhalfarezi 6. Aloo mutter 7. Aloo gobi [cauliflower]
9	Snacks	1. Vegetable cutlet 2. Batata wada 3. Medu wada 4. Samosa

		5. French toast 6. Poha 7. Upma 8. Ragda pattice 9. Pani Puri 10. Bhel 11. Chivda 12. Chakli 13. Shankarpale
10	Chutneys	1. Garlic chutney 2. Mint chutney 3. Green coconut chutney 4. Coconut chutney 5. Khajur chutney 6. Ground nut chutney 7. Linsead / Niger seed chutney
11	Raitas and Indian salads	1. Boondi raita 2. Palak raita 3. Aloo ka raita 4. Tomato onion cuchumber 5. Carrot salad 6. Cabbage salad 7. Cucumber cuchumber 8. Fruit Chat
12	Sweets	1. Doodhi halwa/carrot halwa 2. Sheera 3. Semolina Laddu 4. Besan Laddu & Boodi Laddu 5. Gulab Jamun 6. Shrikhand 7. Porriadg (Kheer) 8. Burfi 9. Chikki
13	Non alcoholic beverages	1. Tea 2. Coffee [hot & cold] 3. Milk shake [seasonal] 4. Fruit punch 5. Lassi [sweet & salty] 6. Jaljeera 7. Fruit juices & mocktails

Annexure II

Cuisine of Northern India

1. Chicken makhanwalla
2. Amritsari machhi
3. Daal Makhani
4. Pakoda kadhi
5. Brinjal bhartha
6. Sarson da saag & Makki ki roti
7. Dahi bhalla
8. Shahi paneer
9. Chaana Bhaturas
10. Stuffed kulcha
11. Parathas
12. Missie roti
13. Dum aloo
14. Kashmiri pulao
15. Assorted pakodas
16. Phirni
17. Daal Baati
18. Gatey ki sabji
19. Churma
20. Moghlai Biryani
21. Shahi tukda
22. Murg mussallam
23. Rogan josh
24. Navratan khorma
25. Vegetable pulao
26. Palak paneer

Cuisine of Eastern India

1. Macher jhol
2. Bengali khichdi
3. Rossogolla
4. Ras malai
5. Puri
6. Sandesh
7. Rajbhog
8. Malai chap
9. Doi maacha
10. Alloo Paneer Posto
11. Chingari macher malai kary
12. Ras Angori

Cuisine of Western India

1. Masala bhat
2. Gola bhat
3. Mung dal khichadi
4. Nagpuri vada bhat
5. Thalipeeth
6. Ukad shengule
7. Jowar/Bajra bhakri
8. Sadhi poli
9. Puran poli
10. Tomato sar
11. Varan/Amti
12. Bharali Vangi
13. Gujarathi kadhi
14. Dudhi Chana Dal Nu Shak
15. Bharawan Bhindi
16. Oondhioyo
17. Dhokla
18. Kolhapuri chicken curry
19. Maharashtrian fish curry
20. Goan fish curry
21. Usal
22. Modak
23. Khandvi, Dhokla
24. Sol kadhi
25. Chirote
26. Jilebi

Cuisine of Southern India

1. Hyderabadi Biryani
2. Hyderabadi Kheema
3. Rasam
4. Doodhi pachadi
5. Malabar fish curry
6. Tamarind rice
7. Cabbage thoran
8. Moong dal payasam
9. Avial
10. Sambhar
11. Idli
12. Masala dosa
13. Daal wada
14. Uttapam
15. Ven Pongal
16. Mysore pak
17. Bisi Bele Huliyana
18. Chitranna, Tomato Rice
19. Chutney (dry & wet)

Annexure III

Chinese Cuisine

1. Sweet and sour chicken soup
2. Hot and sour soup
3. Hakka Noodles
4. American Chopsuey
5. Vegetable fried rice
6. Chicken fried rice
7. Chilly chicken
8. Manchurian chicken
9. Prawn in garlic sauce
10. Sweet and sour prawns
11. Fish with Schezwan sauce
12. Baked pancakes
13. Honeyed noodles

Thai Cuisine

1. Pad Thai Noodle
2. Chicken in red curry
3. Fish in green curry
4. Thai rice
5. Chicken satay
6. Momo

Italian Cuisine

1. Risotto a la Italian
2. Ravioli Milanese
3. Spaghetti carbonara
4. Pasta Salad
5. Saboyan
6. Spaghetti Frutii Di Mari
7. Lasanga Verda

Mexican Cuisine

1. Mexican Rice
2. Nachos and salsa
3. Tacos
4. Fajitas
5. Quesidilla
6. Creamy Burrito Casserole
7. Chicken Tartilla Soup

French Cuisine

1. French onion soup
2. Coq au vin
3. Courge provencale
4. Crepes suzette
5. Chicken A la chardon
6. Garlic Artichoke Dip
7. Lemon soufflé

Japanese Cuisine

1. Bara sushi (vinegared rice with fish & bean)
2. Tempura (vegetable & shrimp fritters)
3. Sushi rice (vinegared rice)
4. Tamago Suimoud (Egg Soup)
5. Suki Yaki

Work Integrated Training Center

- Government Tourism Organization.
  - Resorts of Maharashtra Tourism Development Corporation
  - Indian Railway Catering and Tourism Corporation
  - Catering Establishments of Air India
- Three Star and above categorized Hotels and Resorts
- Industrial Canteens

- Catering and Bakery establishment

Space for class room 400 sq. ft.
Space for laboratory 800 sq. ft.

QUALIFICATIONS OF TEACHERS/INSTRUCTOR

1. Full Time Teacher
   4 years degree in Hotel Management and Catering Technology with 2 years experience

   Or

   3 years Diploma in Hotel Management and Catering technology after HSC with 3 years experience

   Or

   Any Graduation with P.G. Diploma in Hotel Management with 3 years experience

   Or

   M.Sc. Home Science (Foods and Nutrition)

2. Full Time Instructor
   4 years degree in Hotel Management and Catering Technology

   Or

   3 years Diploma in Hotel Management and Catering technology after HSC with 1 year experience

   Or

   Any Graduation with P.G. Diploma in Hotel Management with 1 year experience

   Or

   B. Tech in Food Technology

   Or

   B.Sc. Home Science with specialization in Foods and Nutrition

Reference Books

1. Theory of Cookery – Krishna Arora; Frank Bros & Co. Ltd., New Delhi
2. Indian Cookery – Pritam Oberoi
3. Taste of India – Madhur Jaffery
4. Oriental Cookery – Lo Kenneth
5. Food Heritage of India – Vimal Patel
6. Larousse Gastronomy
7. Hygiene and Sanitation in Food Industry – S. Roday
8. Nutrition for Food Service & Culinary Professionals – Drummond Karen Eich
9. Professional Baking – Gic
10. Professional Cooking – John Wiley & Sons
11. Introductory Foods – Hughes O & Bennion M (1970), The Macmillan Co. Ltd., New York
12. Food Commodities – Bernard Davis (1978) William Heinemann Ltd., New York
13. The larder Chef, Leto MJ and Bode, H (1975) Heinemann Ltd, London
14. Understanding Cooking, Lundberg, D.E. Kotschaver, L.H & Casserani, V (1970) Arnoid-Heinemann, India.
15. Accounting & Cost Control in Hotel and Catering Industry Ed. II – Kotas, R (1972)
16. Hotel & Catering Costing and Budgets – Boardman. R.D.
17. Accounting & Cost Control in Hotel and Catering Industry – Ozi D'Chuna
18. Catering Management – An Integrated Approach – Sethi & Malhan
19. Theory of Catering by Ronald Kinton and Victor Ceserani.
20. All about Catering By Julia Reay
21. An Introduction to Food & Beverage Studies By Marzia Magris & Cathy McCrery
22. Food Microbiology by William Frazier
23. Food & Nutrition By Arya Publishing House, Educational Publishers, Karol Bagh, New Delhi.
24. Food Science By Sumati Mudambi
25. Modern Cookery for teaching and the trade volume I (fifth edition) – Thangham E. Philip, Orient Longman Ltd; Mumbai.
26. Modern Cookery for teaching and the trade volume II (fifth edition) – Thangham E. Philip, Orient Longman Ltd; Mumbai.

27. Practicals Cookery – Ronald Kinton, Victor Cesarani & David Foskett
28. Bakers handbook on Practicals baking (1966) Wheat Associates, New Delhi
29. Bakery Materials and Methods – Daniel A.R., Applied Science Publishers Ltd., England
30. Up to date confectionery. A complete guide to the craft – Daniel A. R. (1965) Maclaren & Sons, England.
31. Modern Ceral Chemistry, D.W. Kent, Jones & A.J. Amos, Food Trade Press, Washington D.C., USA.
32. Practicals baking – W.T. Sultan, The AVi Publishing Co., Westport Connecticut, USA
33. Basic Baking: Science & Craft, S.C. Dubey: Published by S.C. Dubey, School of Baking, Gujrat Agri. University, Anand.
34. Ceral Technology, S.A. Matz; The AVI Publishing Co., Westport Connecticut, USA.

List of Tools and Equipments Required

Sr. No.	Name of Item	Quantity
1	Pressure Cooker 5 ltrs and & 3 ltrs	08 No.
2	Steamer	02 No.
3	Idli Stand	02 No.
4	Kadai Large	02 No.
5	Kadai Medium	08 No.
6	Wok (Chinese Kadai)	02 No.
7	Aluminum Dekchi Medium	08 No.
8	Aluminum Dekchi Small	08 No.
9	Tawa	08 No.
10	Frying Pan	08 No.
11	Aluminum Sauce Pan	08 No.
12	Vessels with lid (Hindolium & S.S.)	24 No.
13	Round Bottom Vessels	08 No.
14	Stainless Steel Containers different size	12 No.
15	Masala Dabbas	08 No.

16	Sizzler Plates	06 No.
17	Sieve	06 No.
18	Colander	08 No.
19	Spaghetti Strainer	02 No.
20	Tea, Coffee urns (Thermal Jars)	01 No.
21	Steel Plates	24 No.
22	Stainless Steel Mug	04 No.
23	Stainless Steel Glasses	12 No.
24	Rolling Pins & Boards	08 No.
25	Chopper different types	04 No.
26	Kitchen Knife (big)	02 No.
27	Vegetable Knife	08 No.
28	Paring Knife	02 No.
29	Coconut Grater	02 No.
30	Steel Bowls	12 No.
31	Perforated Spoon	12 No.
32	Serving Spoon (big, medium, small)	18 No.
33	Spatula (S.S.)	12 No.
34	Egg cutter	12 No.
35	Grater (S.S.)	06 No.
36	Handi Tong	12 No.
37	Tong	08 No.
38	Measuring Cup Metal	08 No.
39	Measuring Spoon Metal	08 No.
40	Tea Strainer	04 No.
41	Table Spoon	12 No.
42	Tea Spoon	12 No.
43	Fork (S.S.)	12 No.
44	Spatula	12 No.
45	Baking tray	08 No.

46	Baking cake tin (round)	06 No.
47	Baking cake tin (square)	06 No.
48	Bread Knife	02 No.
49	Palate Knife	06 No.
50	Bread Tin	06 No.
51	Ring Mould	06 No.
52	Small cup mould	24 No.
53	Pizza Cutter	04 No.
54	Dough Cutter	04 No.
55	Whisk	06 No.
56	Turn Table	04 No.
57	Wooden Spoon	08 No.

2. TOURISM AND HOSPITALITY MANAGEMENT (Y4, Y5, Y6)

Scheme of Examination

Std. XI

Paper	Title of the Paper	Theory		Practicals		Term work	Project work	I.V.	OJT	Total Marks
		Marks	Time (Hrs)	Marks	Time (Hrs)					
1	Concepts of Tourism	80	3	80	3	10	10	10	10	200
2	Transport	80	3	80	3	10	10	10	10	200
3	Basic Hospitality Management	80	3	80	3	10	10	10	10	200

* IV = Industrial Visit

** OJT = On Job Training

Scheme of Examination

Std. XII

Paper	Title of the Paper	Theory		Practicals		Term work	Project work	I.V.	OJT	Total Marks
		Marks	Time (Hrs)	Marks	Time (Hrs)					
1	Event Management	80	3	80	3	10	10	10	10	200
2	Travel Agency Operations	80	3	80	3	10	10	10	10	200
3	Advanced Hospitality Management	80	3	80	3	10	10	10	10	200

* IV = Industrial Visit

** OJT = On Job Training

INTRODUCTION

Tourism being the second largest industry in the world today plays a very important role in revenue & employment generation. Tourism & Hospitality Industry comes under service sector, thus, it can be used to enhance international understanding, communal harmony, global peace & cultural exchange.

Tourism & Hospitality Industry requires advanced communication devices such as internet, satellite etc. It promotes various local income generation activities, generation of foreign currency as well as helps for export activities.

This course will introduce the basic principles of tourism and focus on the intricate aspects of the three major tourism industry components i.e. accommodation, travel and visitor services. This course will indicate how direct and indirect links between these components are mandatory for the very success of a country's tourism industry and in turn the global tourism industry.

This course aims at developing & promoting the basic vocational expertise in order to keep pace with this ever changing & dynamic tourism & hospitality industry. This proves to be the Job Oriented Course which is made keeping in mind the present need of the industry.

GENERAL OBJECTIVES

To enable the students –

1. To get a general idea about tourism & hospitality industry and various activities performed by these industries
2. To create awareness about need & importance of tourism & hospitality industry related techniques
3. To create the reliable & creative trained manpower for fast growing tourism & hospitality industry.
4. To encourage young entrepreneurs to start their own business related to tourism & hospitality industry.
5. To enhance the income generating activities in tourism & hospitality sector as service oriented industries.
6. To understand the concept and types of events, their management, advertising and marketing.

SPECIFIC OBJECTIVES

To enable the students –

1. To understand complete travel & hospitality related terminologies & formalities

2. To impart the knowledge about various modes of transport and respective reservation systems (CRS) for Rail, Air, Road and Water transport
3. To understand accommodation reservation systems in hospitality industry
4. To impart the skill to plan out and execute various tour programmes
5. To assist the learners to organize various events such as MICE (Meetings, Incentives Conferences & Conventions & Exhibitions)
6. To impart knowledge about effective communication skills
7. To impart various skills to the learners through On the Job Training Programmes & Industrial Visits
8. To handle various Front Offices, Food & Beverage & Housekeeping related activities
9. To inform about computer & related technologies like internet etc.
10. To impart knowledge about actual working of Travel Agency & Hotel as an industry, the probable difficulties faced by them & the action taken during the adverse situation.

Job Opportunities

Wage Employment

1. Reservation Assistant
2. Holiday Consultant
3. Booking Assistant
4. Manager, Assistant manager, tour manager, tour escort.
5. Marketing Executive
6. Passport, visa consultant
7. Jobs in various departments in hotel such as -
    - House keeping
    - Front office
    - Travel desk
    - Restaurants, Bar
    - Accounts
    - Sales and Marketing
8. Event escorts
9. Anchor
10. Technicians - sound & Light
11. Hostess
12. Decorators such as -
    - Floor
    - Stage
13. Designer
    - Web designing
    - Stage designing
    - Layout designing
14. Security and bouncers

Self Employment

1. Travel agent
2. Tour Operator
    - Inbound
    - Outbound
    - Domestic
3. Tourist guide
4. Free lancing booking agent of
    - Bus
    - Car
    - Railway
    - Air
    - Hotel
5. Service providers such as -
    - House keeping
    - Catering
    - Floral decoration
    - Rangoli, Mehandi, DJ
    - Pick-up and drop service
6. Event Manager
7. Ice carving and salad decorator

Std. XI
Paper I: Concepts of Tourism (Y4)
Theory

Sr. No.	Unit	Sub-Unit	Periods
1.	Terminology	1.1 Definition 1.2 Meaning, Scope & Limitation of Tourism 1.3 Elements of Tourism 1.4 Forms of Tourism 1.5 Types of Tourism	10
2.	Culture of India	2.1 Regions of India 2.2 Fairs & Festivals 2.3 Handicrafts 2.4 Dances & Music 2.5 Cuisine	30
3.	Maharashtra at a Glance	4.1 Political map & physical features of Maharashtra 4.2 Various Tourist places in Maharashtra	10

		4.3 Tourist potential Maharashtra 4.4 Role of MTDC in Tourism Promotion	
4.	Geography of India	9.1 Geographical regions of India (East, West, North, South) 9.2 Natural Tourist Destinations in India	50
5.	Tourism Organization	12.1 Introduction to Government Tourism Organizations 12.2 Functions and objectives of WTO, Ministry of Tourism, ITDC, State Tourism Development Corporations 12.3 IATA, AAI, TAAI,ASTA,PATA, IATO, ICAO etc, ASI State Archaeology	10
6.	Significance & Impact of tourism	6.1 Social benefits of Tourism 6.2 Economic benefits of Tourism 6.3 Negative impacts of Tourism	10
		Total	**120**

Practicals

Sr. No.	List of Practicals	Periods
1.	Study of Tourism Destinations (Adventure, Natural, Pilgrimage places with respect to geographical surrounding) in and around course center.	25
2.	Visit and prepare Visit reports about places of Religious Importance	25
3.	Preparation of project report on places of tourist interest like temples, historical sites, monuments, places of natural beauty etc along with photographs.	25
4.	Map Reading -Locating, marking, plotting of location, places, areas, routes etc on Map of Maharashtra (Tourist map, Political Map & Physical Map)	25
5.	Visit to State Tourism Organization (like MTDC) and collection of information on tourist destination	25
6.	Map Reading with respect to longitude, latitude, Time Difference, International Date line & GMT	25
7.	Map Reading & marking Tourist Destinations in India & around the World along with important Airlines & Airline Codes	25
8.	Visit to various Tourism Organizations to know their facilities, functions and importance (Local Travel Agents Associations, Government Tourism Offices & State wise Tourism Offices)	25
9.	Visit to ASI or State Archaeology Office	20
10.	Case Studies to study positive and negative impacts of Tourism.	20
	Total	**240**

Paper II: Transport (Y5)
Theory

Sr. No.	Unit	Sub-Unit	Periods
1.	TRANSPORT NETWORK	1.1 Introduction -Transport 1.2 Features of good transport 1.3 Criteria for selecting a good transport 1.4 Classification of types of transport 1.5 Infrastructure -Importance of infrastructure in tourism evolution need for development of infrastructure. 1.6 Contribution & role played by transport in the tourism industry.	15
2.	Roadways	2.1 Roadways - Introduction & Objectives 2.2 Features of Road Transport. 2.3 Role of Small Transport Services. 2.4 Major Transport Operators in India 2.5 Rules & Regulations for Roadways 2.6 Places of tourist interest in vicinity of Tourist Destination.	20
3.	Railways	3.1 Introduction, Objectives & Importance of Railways with respect to tourism. 3.2 Services & facilities offered by Railway to traveler. 3.3 Tourist Special Trains in India. 3.4 Comparison with travel passes abroad	30
4.	Airways	4.1 Objectives & Introduction 4.2 Contribution of airways 4.3 Role & Functions of national & domestic carrier/ feeder / airlines 4.4 Information about private airlines & their contribution to tourism industry.	30
5.	Airport Essentials	7.1 Objectives & Introduction 7.2 Formalities at Airport 7.3 Documentation in respect to Airways	15
6.	Water ways	8.1 Objectives & Introduction 8.2 Functions & Principles of Waterways 8.3 Types & Forms of Waterways 8.4 Cruise tourism	10
		Total	**120**

Practicals

Sr. No.	List of Practicals	Periods
1.	Preparation of Project Report on the development of travel from ancient, medieval & modern times	20
2.	Locate various tourist destinations & their routes with the help of Navigation Software available in Mobile.	20
3.	Study of reservation & cancellation systems of roadways	20
4.	Visit to Regional Transport Office to learn about Tourist Permit Insurance, IDP, registration procedure of different types of vehicles	20
5.	Field visit to booking office for bus /car reservation & related information.	20
6.	Preparation of database of timetable, types of class & fares etc of Bus / Small Car Services, booking ticket across the reservation counter/ website	30
7.	Visit to Railway Station to understand various formalities about-train ticket reservation /cancellation	20
8.	Collect information about destinations connected to India by air.	20
9.	Visit to Airline Office /Airport to understand about facilities, amenities, available reservation / Cancellation. Concessional air fares & in-flight service	20
10.	Preparations & understanding of Air Travel terminologies & documentation at airport.	20
11.	Collection of information related to water transport -Reservation, time tables, types of classes, fares, services etc. at the reservation counter/website	30
	Total	**240**

Paper III: Basic Hospitality Management (Y6)
Theory

Sr. No.	Unit	Sub-Unit	Periods
1.	Introduction & History of Hotels	1.1 Introduction & History of Hotels 1.2 Types of Hotels & Types of rooms 1.3 Significance of hotel in tourism 1.4 Terminologies 1.5 Information on Hotel facilities 1.6 Local knowledge 1.7 Importance of front office 1.8 Departments of a Hotel	15

		1.9 Front office functions 1.10 Front office's interactions with other departments 1.11 Organizational charts	
2.	Reservation	2.1 Introduction 2.2 Types of reservations 2.3 Room Assignment	15
3.	Room Availability & Assignment	3.1 Introduction 3.2 Terminology	25
4.	Registration procedure	4.1 Importance of registration card /form 4.2 Payment methods 4.3 Rooming 4.4 Reports 4.5 Special Situations	25
5.	Personal Hygiene for Tourism & Hospitality	5.1 Introduction 5.2 Need for Personal Hygiene 5.3 Sanitary procedures for personal hygiene.	20
6.	Health Tourism	6.1 Meaning, introduction & definition 6.2 Current Trends & avenues 6.3 Spas & Ayurvedic Massage centres 6.4 Role of sales person &buying procedure.	20
		Total	**120**

Practicals

Sr. No.	List of Practicals	Periods
1.	Visit to various types of accommodation units like Hotels, Motels Resorts & Supplementary Accommodation units to understand standard procedures for - Arrival of guests - Departure of guests - Room Reservation method - Room allocation - Front Office Functions such as Wake-up calls, Guest Messages etc.	40
2.	Study Standard procedures of welcoming the guests in Hotel – - Individual or group arrival - Standard Greeting or Welcoming procedures - Welcome Phrases - Politeness and etiquettes in front office - Welcome Cards - Providing information about facilities available for guests - Handling Guest feedback etc.	50

3.	Study of Standard procedures of guest Check- in & Check -out including the following – - Individual, Group and VIP Check-in & Check Out - Documentation related to guests - Opening a Guest Folio /Master Bill - Handling Walk -ins & Skippers - Receiving Payment by cash /card /company account - Handling Guests luggage including the left luggage	50
4.	Studying Various formats & understanding how to use them effectively for Front Office Work - Reservation card - Registration card - Message Slip - Housekeeping reports etc.	30
5.	Study of Standard procedures to enter a guest room.	30
6.	Studying of Standard Procedures to be followed for personal hygiene by the hotel study such as - Hand wash procedures - Freedom from body odour - Clean teeth & breaths - Clean & Neat uniform - Personal care practices during illness to avoid spreading contagious diseases - Tips for hair, make-up, jewellery, perfumes etc for hotel staff.	25
7.	Visit to Spa & nearest Hospitals to understand opportunities & growth in Medical Tourism	15
	Total	**240**

Std. XII
Paper I: Event Management (Y4)
Theory

Sr. No.	Unit	Sub-Unit	Periods
1.	Event Management and Planning	1.1 Introduction 1.2 Event Crew & Team 1.3 Event Resource Management	20
2.	Event Marketing	2.1 Introduction 2.2 Event Leadership & Communication 2.3 Event Safety & Security 2.4 Event Communication & Presentation Skills	20
3.	Special Events	3.1 Introduction 3.2 Event Marketing	30

		3.3 Advertising & Public Relations 3.4 Event Sponsoring, Production & Logistics	
4.	Event Preparation	4.1 Introduction 4.2 Event Preparation & Designing 4.3 Mega Events Co-ordination	30
5.	Handling of media	5.1 Introduction to Handling of media 5.2 Events Risk Management 5.3 Event Ethics & Code of Conduct	10
6.	Event Evaluation	7.1 Event Monitoring 7.2 Event Evaluation 7.3 Handling of Emergencies	10
		Total	**120**

Practicals

Sr. No.	List of Practicals	Periods
1.	Meet various event organizers and collect the information about various types of events conducted and duties & responsibilities of event crew.	25
2.	See the videos of various types of events conducted and prepare a PPT based information collected.	25
3.	Role plays and simulations of various activities involved in event management such as marketing, selling, booking.	25
4.	Preparation of an event checklist.	15
5.	Study the procedures followed for ushering & escorting for events.	15
6.	Study the procedures followed for manning counter & stall volunteering.	15
7.	Celebration of World Tourism Day and India Tourism Day as an event in your institute with the help of following points – - Guest lectures - Seminars - Exhibitions - Food Festivals - Cultural programmes - Quiz Contests - Preparation of an event report for the same.	25
8.	Study the procedures followed for events preparation for different types of events.	20
9.	Attend various mega events, sports events, theme events in your city and prepare a visit report for the same.	20
10.	List out safety and security measures required for different types of events.	15

11.	Arrange visit to tourism/ hospitality / trade fair or exhibition and prepare a visit report for the same.	20
12.	Prepare a project report on celebration of local festivals.	20
	Total	**240**

Paper II: Travel Agency Operations (Y5)
Theory

Sr. No.	Unit	Sub-Unit	Periods
1.	Travel Agency Business	1.1 Introduction 1.2 Functions 1.3 Approval 1.4 Finance Assistance for tour promotion	25
2.	Documentation	2.1 Introduction 2.2 Passport & Visa 2.3 Insurance & Health Formalities 2.4 Forex 2.5 Liaisoning with Intermediaries	25
3.	Ticketing	3.1 Introduction 3.2 Special Fare	10
4.	CRS	4.1 Introduction 4.2 Roadways 4.3 Railways 4.4 Airways 4.5 Waterways	20
5.	Office Procedures	5.1 Introduction 5.2 Advantages of BSP 5.3 BSP Operations 5.4 Standard Traffic Documents (STD)	10
6.	Itinerary Planning	6.1 Introduction 6.2 Basics of Itinerary Planning 6.3 Steps 6.4 Types of Itineraries 6.5 Costing	30
		Total	**120**

Practicals

Sr. No.	List of Practicals	Periods
1.	Visit to different types of travel agencies in your city and tabulate your	25

	findings.	
2.	Find out various finance schemes in travel agencies for tour promotion.	15
3.	Visit the site - www.passport.gov.in and know the procedure of filling online passport application form.	25
4.	Know the formalities and documents required for various visas like Schengen, Dubai, Far East etc.	25
5.	Collect information about exchange rates of various currencies.	15
6.	Visit the site - www.irctc.co.in & create a profile on web portal and understand the process of railway ticket booking and cancellation.	25
7.	Visit the site - www.makemytrip.com or www.yatra.com or www.goibibo.com and understand the procedure of air ticket booking and cancellation.	25
8.	Introduction to any CRS and understand the basic commands applicable to CRS.	20
9.	Generate PNR in CRS.	15
10.	Understand the procedure of filling of various documents such as – i. Reservation Card ii. Payment vouchers iii. Refunds	25
11.	Prepare six itineraries (Domestic and International) with their costing i. Weekend (Domestic) ii. One Week (Domestic and International) iii. Two Weeks (Domestic and International) iv. Prepare and plan 8 days itinerary within Maharashtra preferably Ajanta and Ellora.	25
	Total	**240**

Paper III: Advanced Hospitality Management (Y6)
Theory

Sr. No.	Unit	Sub-Unit	Periods
1.	The Food and Beverage Service Industry	1.1 Introduction 1.2 Classification of Catering establishments 1.3 Food and Beverage operations	20
2.	Types of Food and Beverage Service	2.1 Introduction 2.2 Various types of food and beverage service 2.3 Terms related to food & beverage service	20
3.	Food and Beverage Service Personnel	3.1 Introduction 3.2 Job Description and Job Specification 3.3 Attributes of Food and Beverage service personnel 3.4 Inter-departmental relationship	20

4.	Housekeeping Department	4.1 Introduction to Housekeeping department 4.2 Organizing the Housekeeping department 4.3 Job Description	30
5.	Functions of Housekeeping	5.1 Housekeeping Terms 5.2 Departments that Housekeeping co-ordinates with	20
6.	Marketing	6.1 Introduction, Definition and concept of Marketing 6.2 Difference between marketing and selling 6.3 Modern marketing concepts 6.4 Elements of Marketing mix and 4 P's	10
		Total	**120**

Practicals

Sr. No.	List of Practicals	Periods
1.	Study various Basic Technical Service Skills including the following – - Holding of service spoon and fork - Carrying glasses - Carrying clean cutlery, crockery and flatware's - Using of service salver and tray - Clearing the side plates and knife - Clearing accompaniments - Crumbing down	35
2.	Study the procedures for laying a table including the following – - Laying and relaying of table cloth - Laying and relaying of cover - Removal of spare cover - Waiting at the table	35
3.	Prepare a project report on Local Cuisine and supply of local cuisine at Tourist Destination	20
4.	Study various procedures followed in restaurant during serving a guest, including the following – - Napkin folds (lunch & dinner) - Forms & methods of service - Tray carrying - Order of table service	35
5.	Study Various procedures followed for servicing a guest room including the following – - Room cleaning and servicing a vacant room, Bed making in occupied as well as check out room - Guest bathroom cleaning procedure - Handling various situations during servicing the room such as	35

	DND rooms, valuables found in room, guest's entry during servicing etc. - Replenishing amenities in guest room i.e. ordinary guest room and VIP room - Setting up a chamber maid trolley for servicing rooms	
6.	Study various procedures followed for servicing public areas of the hotel - Various job procedures along with cleaning agents / equipments used for servicing public area of the hotel. - Areas under public area & their respective cleaning schedules like lobby, corridors, elevators, swimming pool, restaurants, etc. - Various types of cleaning followed in public area like daily cleaning, weekly cleaning, special cleaning, spring cleaning etc.	20
7.	Study various procedures followed for safety standards and procedures for potential hazards including the following – - Safety standards and precautions to be taken while cleaning public area - Preparation of cleaning schedules for public area.	20
8.	Preparation of a questionnaire for market research related to hospitality industry.	20
9.	Conduct a survey of tourist and get information from them about their visit. Then tabulate, evaluate and analyze the data collected.	20
	Total	**240**

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List of space, Tools and equipments required

Classroom area required	-	400 sq. ft.
Area required for laboratory	-	800 Sq. ft.
Power Load required	-	2 Kw

Sr. No.	Particular	Quantity	Unit
1.	Service Tables	At least 1	Nos.
2.	Chairs	At least 4	Nos.
3.	Crockery Set	At least 1	Nos.
4.	Glass and jugs (including different types of wine glasses)	At least 1 Each	
5.	Table linen	As required	
6.	Side board	At least 1	Nos.
7.	Storage cupboards	At least 1	Nos.
8.	Coffee pots, Tea pots, Sugar Pots and Milk Jugs (Silver Types)	At least 1 Set Each	
9.	Tea Urn (5 lit. capacity)	1	Nos.
10.	Cutlery set as per eleven course menu (silver Type)	At least 1 Set Each	
11.	Silver Service trays/salver etc.	At least 2	Nos.
12.	Sundry equipment	As required	
13.	Furniture and furnishings	As required	
14.	Towels	01	Nos.
15.	Bed sheets	03	Nos.
16.	Blankets	01	Nos.
17.	Night spread	01	Nos.
18.	Bed covers	01	Nos.

19.	Pillow covers	02	Nos.
20.	Hand towels	01	Nos.
21.	Hand Napkins	01	Nos.
22.	Mattress protector	01	Nos.
23.	Bath Mats	01	Nos.
24.	Door Mats	02	Nos.
25.	Curtains	As required	
26.	Flower vase	01	Nos.
27.	Flower Pots	01	Nos.
28.	Carpet	01	Nos.
29.	Vaccum Cleaner wet and dry	01	Nos.
30.	Writing cum dressing table	01	Nos.
31.	Beds	01	Nos.
32.	Mattress	01	Nos.
33.	Pillows	02	Nos.
34.	Bed side tables	02	Nos.
35.	Sofa chairs	03	Nos.
36.	Coffee table	01	Nos.
37.	Computer with internet connection	01	Nos.
38.	LCD Projector	01	Nos.
39.	Reception Counter	01	Nos.
40.	Dummy EPABX board with telephone	01	Nos.
41.	CSR	01	Nos.
42.	Various charts	As per need	
43.	Maps - world, India and states	As per need	

Note: - IT Laboratory with internet connection of 25 computers can be utilized on sharing basis with other courses.

AGRICULTURE GROUP

1: HORTICULTURE (L1, L2, L3)

Scheme of Examination

Std. XI

Paper	Title of the Paper	Theory		Practicals		Term work	Project work	Educational Visit	Total Marks
		Marks	Time (Hrs)	Marks	Time (Hrs)				
1	Fundamentals of Horticulture	80	3	80	3	20	10	10	200
2	Nursery Management	80	3	80	3	20	10	10	200
3	Fruit Production	80	3	80	3	20	10	10	200

* EV = Educational Visits

Scheme of Examination

Std. XII

Paper	Title of the Paper	Theory		Practicals		Term work	Project work	OJT	Educational Visit	Total Marks
		Marks	Time (Hrs)	Marks	Time (Hrs)					
1	Vegetable Production	80	3	80	3	10	10	10	10	200
2	Floriculture and Landscaping	80	3	80	3	10	10	10	10	200
3	Post Harvest Technology	80	3	80	3	10	10	10	10	200

* EV = Educational Visits

** OJT = On Job Training

Introduction

India made amazing progress in the fields of horticulture in recent decades. It has improved lot in production and quality of different fruits, vegetables and flower crops. Efforts of Indian farmers are responsible for first rank of India in the production of fruits. Further, India became second largest producer of vegetables in the World. Concrete efforts are essential to improve the awareness about production, handling and preservation of fruits, vegetables and flowers which is only possible through training. So courses containing advanced technology in the areas of horticulture have been included in the education system at Secondary and Higher Secondary levels which will be helpful in training the younger students.

The nutritive value of fruits and vegetables is very high. Horticulture crops are also important for improving the economic status of the farmers as they get more returns per unit area as compared to the agronomical crops. They are beneficial to small and marginal farmers.

Commercial cultivation of fruits, vegetables and flowers has tremendous scope as these Internationalcrops have great demand in domestic and International markets. Besides, there is a great demand for processed products of fruits, vegetables and flowers.

The production, grading, packaging, marketing and processing of horticultural crops generate large employment. Training the students in the areas of horticulture provide opportunities for wage employment and self employment in Urban and Rural sectors. This will help in socio-economic upliftment in rural areas.

Maharashtra is now recognized as a horticulture state of India and diversified and sustainable agriculture, in Maharashtra horticultural crops are more important. Certain fruit crops are very useful for bringing dry and waste land under cultivation.

The increasing productions of flowers and vegetables in green houses have shown positive indication for improving export potential of horticultural produce.

Hence, it is worthwhile to study horticulture science as it shows great prospects in changing the socio-economic conditions of Indian farmers and creation of self and wage employment for the young generation.

Objectives

To enable the student to –

1. Familiarize students with the horticultural plants and their utilization.
2. Acquire knowledge of production technology of horticultural crops.
3. Acquire knowledge of harvesting and Post Harvest Technology of horticultural crops.
4. Develop skills in green house technology for production of flowers and vegetables.
5. Study and use of production technology of fruit and vegetable crops and flowers.

6. Adopt techniques of production of planting material and nursery management for plantation purpose.
7. Study techniques of using fertilizers, growth regulators and irrigation for increasing productivity.
8. Train man power for acquiring skills of horticultural plant propagation.
9. Train man power for acquiring skills of plant protection.
10. Survey and compare production and cost of production with ideal projects to achieve success in profitable production of crops.
11. Understand marketing procedure for horticultural produce.
12. Learn and search best suitable crops and cropping pattern for different regions.
13. Train students from Rural and Urban area for having skills of kitchen gardening and polyhouses.

Job Opportunities

Wage Employment

1. Technical Assistant in fruit and vegetable processing companies
2. Agricultural Assistant and sales representative in fertilizer companies
3. Supervisor in Nurseries
4. Agricultural Assistant, sales representative in agro-chemical companies
5. Packaging, Forwarding and Export companies of Agro produce
6. Assistants & Supervisors in Corporate Producers of Fruits, Vegetables and Flowers
7. Assistants & Supervisors in Green houses
8. Lab Assistants in Tissue Culture Laboratories
9. Experts in Agro Service Centers
10. Mail
11. Orchard Manager
12. Vocational Instruchar

Self Employment

1. Erection of green house (Polyhouse, Shedding net, etc.)
2. Gardening and landscaping
3. Organic vegetable production
4. Commercial fruit, vegetable, flower producer
5. Dealer of plant protection appliances
6. Weed control services
7. Harvester
8. Grader
9. Packager
10. Mali
11. New nursery
12. Tissue culture laboratory
13. New orchard/Orchard Management

Std. XI
Paper I: Fundamentals of Horticulture (L1)
Theory

Sr. No.	Unit	Sub-Unit	Periods
1.	Introduction to Horticulture	1.1 Definition and branches of horticulture 1.2 Scope and importance 1.3 Nutritional values of horticultural crops 1.4 Classification of horticultural crops 1.5 Constraints in cultivation of horticultural crops	12
2.	Physiographical and External Requirements of Horticultural Crops	2.1 Soil 2.2 Climate	12
3.	Morphology and Plant Physiology	3.1 Plant cell 3.2 Plant Parts and their functions 3.3 Pollination and fruit development 3.4 Mode of bearing of horticultural crops 3.5 Plant physiological processes	16
4.	Plant breeding	4.1 Introduction 4.2 Objectives of plant breeding	4
5.	Tillage and tillage implements	5.1 Meaning of tillage 5.2 Objectives of tillage 5.3 Types of tillage 5.4 Tillage implements 5.5 Improved implements	8
6.	Plant Nutrients Manures and fertilizers	6.1 Essential plant nutrients and their classification 6.2 Functions and deficiency symptoms 6.3 Manures and fertilizers	16
7.	Irrigation	7.1 Meaning of irrigation 7.2 Methods of irrigation 7.3 Irrigation scheduling	12
8.	Plant Protection	8.1 Introduction 8.2 Pests control 8.3 Diseases control	12
9.	Weed Management	9.1 Meaning and classification 9.2 Characteristics of weeds 9.3 Losses caused by weeds 9.4 Weed control	8
10.	Harvesting and	10.1 Methods of harvesting	10

	Marketing	10.2 Grading, packaging and storage of horticultural produce 10.3 Marketing of horticultural produce	
11.	Use of Information Technology in Horticulture	11.1 Introduction 11.2 Terminologies 11.3 Application in Horticulture 11.4 Use of Internet 11.5 E-Trading and Agro informatics	10
		Total	**120**

Practicals

Sr. No.	List of Practicals	Periods
1.	Study of Agro climatic zones and fruit zones of Maharashtra	4
2.	Use of garden tools for different operations	8
3.	Study of different plant parts	16
4.	Measuring leaf area and growth of different plants	4
5.	Practice of emasculation and pollination	8
6.	Use of different meteorological instruments	12
7.	Collection of soil samples	4
8.	Identification of ideal soil for cultivation	4
9.	Analysis of soil using soil testing kit, visit to soil testing laboratory	16
10.	Practicing fertilizer application	8
11.	Calculating fertilizer dose according to soil testing report	4
12.	Preparation of compost	16
13.	Preparation of vermi compost	8
14.	Practice of green manuring	8
15.	Preparation and use of fertilizes solutions	8
16.	Practice of training	12
17.	Practice of pruning	8
18.	Use and maintenance of machinery and equipments (Sprayers, Pruners, Cutters)	16
19.	Identification of insect pests and diseases	8
20.	Practicing methods of irrigation	8
21.	Identification of weeds and practicing weed control operation	8
22.	Spraying plant growth regulators	4
23.	Using horticulture related websites for information	4
24.	Practicing harvesting methods by using traditional and advanced instruments	8

25.	Practicing grading & packaging of horticultural crops.	4
26.	Visit to Agro business centers	8
27.	Visit to Agro tourism center	8
28.	Visit to Farm implements maintenance centers	8
29.	Visit to horticulture training centers	8
	Total	**240**

Project work (any one)

1. Preparation of weed album
2. Collection of insects- pest
3. Collection of diseases samples
4. Collection of specimen of different types of soils
5. Project proposal for vermicompost unit.
6. Project proposal for mushroom cultivation unit.
7. Project proposal for bio-dynamic compost unit.
8. Project proposal for spirulina production.
9. Project proposal for azolla production.
10. Project proposal for establishment of agro tourism centre.

Paper II: Nursery Management (L2)
Theory

Sr. No.	Unit	Sub-Unit	Periods
1.	Plant Propagation	1.1 Introduction 1.2 Scope and importance of Plant Propagation 1.3 Propagation media 1.4 Containers used for Propagation 1.5 Propagation Structures	12
2.	Sexual Propagation	2.1 Definition of sexual propagation 2.2 Advantages and disadvantages of sexual propagation 2.3 Definition and parts of Seed 2.4 Classification of seed 2.5 Seed germination 2.6 Seed dormancy 2.7 Seed treatments	20
3.	Asexual Propagation	3.1 Definition 3.2 Classification 3.3 Advantages and disadvantages	8
4.	Use of Modified	4.1 Different modified plant parts	8

	Parts for Propagation	4.2 Care, Storage and application	
5.	Propagation by Cutting	5.1 Definition and types of cutting 5.2 Factors affecting rooting of cuttings 5.3 Propagation by cutting	8
6.	Propagation by Layering	6.1 Definition and scope 6.2 Types of layering 6.3 Factors affecting success of layering 6.4 Advantages and Limitations of layering	8
7.	Propagation by Grafting	7.1 Definition and meanings 7.2 Important types of grafting 7.3 Formation of graft union and graft incompatibility 7.4 Advantages and limitations	16
8.	Propagation by Budding	8.1 Definition and meaning 8.2 Important types of budding 8.3 Advantages and limitations of budding	06
9.	Micro propagation	9.1 Introduction and importance of micro propagation 9.2 Methods and requirements of Micro propagation 9.3 Scope and limitations for micro propagation	8
10.	Nursery and Nursery Management	10.1 Introduction 10.2 Types of nurseries 10.3 Management of mother plants 10.4 Parts of nursery and inventory control 10.5 Labour and cost management	16
11.	Marketing of Nursery Plants	11.1 Nursery record 11.2 Advertising and sale 11.3 Packaging and transport of nursery plants	6
12.	Nursery laws	12.1 Maharashtra Nursery Act 12.2 Maintaining quality standards of nursery	4
		Total	**120**

Practicals

Sr. No.	List of Practicals	Periods
1.	Selection of site for nursery	4
2.	Preparation of nursery beds	16

3.	Use of different growth media for growing plants	16
4.	Sterilization of propagation media	8
5.	Establishing shed nets for nurseries	4
6.	Preparation of potting mixture	4
7.	Filling of garden containers	8
8.	Propagation by cutting methods	8
9.	Practice of different types of layering	8
10.	Propagation by different types of grafting	16
11.	Practice of different types of budding	8
12.	Raising forest plants	4
13.	Practicing Renovation Methods	8
14.	Using modified plant parts for propagation	12
15.	Raising seedlings in nursery	12
16.	Practicing various nursery operations	12
17.	Hardening tissue cultured plants in nursery	16
18.	Sterilization methods of culture media	4
19.	Plant protection of nursery plants	8
20.	Practice of shifting nursery plants form beds to containers	8
21.	Cares of nursery plants	4
22.	Maintenance of nursery equipments	4
23.	Raising ornamental plants	8
24.	Setting ornamental nursery	8
25.	Packaging of nursery plants	4
26.	Quality control of nursery plants	4
27.	Visit to nursery	8
28.	Visit to green house	8
29.	Visit to tissue culture laboratory	8
	Total	**240**

Project work (any one)

1. Project proposal for establishing vegetable nursery
2. Project proposal for establishing fruit nursery
3. Project proposal for establishing ornamental nursery
4. Project proposal for establishing flower nursery
5. Project proposal for establishing forest nursery

Paper III: Fruit Production (L3)
Theory

Sr. No.	Unit	Sub-Unit	Periods
1.	Introduction to fruit production	1.1 Importance of Fruits and fruit crops 1.2 Scope for fruit production 1.3 Present scenario (status) of fruit industry in Maharashtra	4
2.	Preparation of plan and layout of orchard	2.1 Selection of site for orchard 2.2 Layout of orchard 2.3 Methods of planting 2.4 Fencing and wind breaks 2.5 Preparatory operations for plantation of fruit crops 2.6 Selection and planting of fruit plants	12
3.	Orchard management	3.1 Care of young plant 3.2 Orchard management practices 3.3 Intercropping in orchard	12
4.	Water and Nutrient Management of fruit plants	4.1 Application of organic manures and fertilizers 4.2 Micro nutrient management 4.3 Micro irrigation 4.4 Fertigation 4.5 Integrated nutrient management	12
5.	Constraints in fruit production	5.1 Reasons for low productivity 5.2 Specific problems of different fruit crops 5.3 Remedies	4
6.	Crop Maximization Practices	6.1 Special horticultural practices 6.2 Canopy management 6.3 High density planting 6.4 Renovation Rejuvenation practices	12
7.	Use of agrochemicals in fruit production	7.1 Pesticides 7.2 Fungicides 7.3 Plant growth regulators 7.4 Bio extracts and bio stimulants 7.5 Agrochemical residues in fruits	8
8.	Dry land fruit crops	8.1 Introduction 8.2 Features of dry land 8.3 Fruit crops suitable for dry lands	10
9.	Study of fruit crops	9.1 Production technology of Major fruit crops 9.2 Production technology of minor fruit crops	30
10.	Plantation crops	10.1 Importance, scope and limitations	8

		10.2 Commercially important crops 10.3 Cultivation of plantation crops	
11.	Economics of fruit Production	11.1 Cost analysis 11.2 Types of farm records and profit making	8
		Total	**120**

Practicals

Sr. No.	List of Practicals	Periods
1.	Identification of area for commercial fruit production in Maharashtra	8
2.	Visit to fruit orchard	8
3.	Laying out of orchards according to planting methods	12
4.	Preparation of pits for planting fruit plants	12
5.	Filling of pit and planting of fruit plant	12
6.	Providing support and shade to fruit plants	8
7.	Preparing beds for irrigating fruit crops	12
8.	Providing micro irrigation to fruit plants	12
9.	Mulching for fruit plants	4
10.	Training of fruit plants	12
11.	Identification of difficulties in fruit production	8
12.	Pruning of grapes	8
13.	Practicing pruning of other fruit plants	8
14.	Estimation of fertilizer dose for fruit crops	4
15.	Application of fertilizer doses for fruit crops	8
16.	Foliar application of nutrients	4
17.	Application of growth regulators for fruit crops	8
18.	Control of pests of fruit crops	8
19.	Control of diseases of fruit crops	8
20.	Calculating quantity of insecticide and fungicide for spraying	4
21.	Practice of girdling	4
22.	Practice of notching	4
23.	Practice of bending	8
24.	Practice of thinning	8
25.	Practicing dry farming activities	8
26.	Estimation of water requirement of different fruit crops	8
27.	Study of product utilization of plantation crop	8
28.	Visit to dry land farm	8

29.	Estimation and analysis of profit	8
30.	Information of chemical residues in exportable fruits	8
	Total	**240**

Project work (any one)

1. Project proposal for specific fruit crop production
2. Collection of insects-pest of fruit crops
3. Collection of specimens of diseases of fruit crops

Std. XII
Paper I: Vegetable Production (L1)
Theory

Sr. No.	Unit	Sub-Unit	Periods
1.	Introduction to vegetable production	1.1 Definition, scope and limitations importance 1.2 Nutritional importance 1.3 Present status of vegetable crops in India 1.4 Classification of vegetable crops 1.5 Types of vegetable gardens 1.6 Factors affecting vegetable production 1.7 Skill of vegetable farm management 1.8 Handling and marketing of vegetables	16
2.	Cropping systems	2.1 Crop rotations and Intercropping 2.2 Other cropping Systems 2.3 High density planting 2.4 Multistory cropping	8
3.	Special practices for vegetable gardens	3.1 Training and pruning 3.2 Beneficial practices in vegetables 3.3 Hardening of seedlings 3.4 After care of transplanted seedlings 3.5 Vegetable forcing	8
4.	Seed production techniques	4.1 Characteristics of good seeds 4.2 Seed multiplication stages 4.3 Principles of seed production 4.4 Hybrid vegetable seed production	12
5.	Commercial cultivation of vegetable crops	5.1 Vegetable crops –Cabbage, cauliflower, pea, cluster bean, ridge gourd, okra, tomato, brinjal, potato, onion	36

6.	High-tech vegetable Production	6.1 Production structures 6.2 Precision Farming	16
7.	Growing Exotic vegetables	7.1 Important exotic vegetables 7.2 Production and marketing of exotic vegetables	4
8.	Organic vegetable production	8.1 Meaning 8.2 Importance of organic vegetables 8.3 Production and marketing of organic vegetables	4
9.	Quality parameters of vegetables	9.1 Quality parameters 9.2 Varieties suitable for quality production	6
10.	Vegetable farm management	10.1 Types of farming 10.2 Economics	10
		Total	**120**

Practicals

Sr. No.	List of Practicals	Periods
1.	Preparation and laying out of land for growing vegetables	8
2.	Identification and classification of vegetable seeds	4
3.	Preparation of raised bed for sowing seeds	4
4.	Raising seedlings of vegetable crops and their transplanting	8
5.	Raising seedlings in pro-trays	4
6.	Visit to vegetable farm	8
7.	After cares of transplanted seedlings	8
8.	Methods of planting vegetables	8
9.	Layout and preparation of model kitchen garden	8
10.	Methods of irrigation for vegetables	8
11.	Layout of micro irrigation systems for vegetables	16
12.	Preparing plan for continuous supply of vegetables for a year	4
13	Practical growing of vegetables from planting to harvesting	36
14	Sowing or planting methods of vegetables	8
15	Estimation of Plant population and seed rate	8
16	Estimation of fertilizers requirements as per recommendations	8
17	Practicing certain operations in green house for cultivation of vegetables	8
18	Extraction of seed from vegetables	4
19	Identification of insects-pests and diseases of vegetables	8
20	Visit to green house producing vegetables	8
21	Fertilizer Application In Vegetable crops	8

22	Practicing training and pruning of vegetable crops	8
23	Practicing earthing up	4
24	Practicing blanching	4
25	Practicing Starter application	4
26	Visit to Seed farm growing vegetables	8
27	Use of organic fertilizers and bio extracts	8
28	Knowing quality standards of vegetable crops	4
29	Visit to vegetable nursery	8
30	Export marketing knowledge of export markets for vegetables	8
	Total	**240**

Project work (any one)

1. Project proposal for specific vegetable production
2. Project proposal for establishing vegetable nursery
3. Project proposal for production of crops in green house

Paper II: Floriculture and Landscaping (L2)
Theory

Sr. No.	Unit	Sub-Unit	Periods
1.	Floriculture	1.1 Introduction 1.2 Types and uses 1.3 Scope and limitation importance	4
2.	Commercial cultivation of flower crops	2.1 Flower crops-Rose, aster, chrysanthemum, gladiolus, marigold, tuberose, jasmine.	30
3.	Hi-tech Floriculture	3.1 Crop growing structure 3.2 Production technology	12
4.	Export of flowers	4.1 Export standards and procedures 4.2 Export of cut flowers and ornamentals	8
5.	Layout of Gardens	5.1 Principles of garden design 5.2 Types of gardens 5.3 Styles of garden	16
6.	Features of garden	6.1 Garden features 6.2 Garden adornments	6
7.	Development and maintenance of lawn	7.1 Selection of site 7.2 Preparation of land 7.3 Planting material and methods 7.4 Maintenance and use	8
8.	Ornamental plants	8.1 Classification of ornamental plants	24

		8.2 Annual flowering plants 8.3 Herbaceous perennials 8.4 Shrubs 8.5 Trees 8.6 Climbers and creepers 8.7 Cacti and succulents 8.8 Grasses and bamboos 8.9 Palms 8.10 Bulbous plants 8.11 Aquatic plants	
9.	Landscaping and garden maintenance	9.1 Meaning and Concept 9.2 Principles of landscaping 9.3 Designing technique 9.4 Garden maintenance techniques	6
10.	Bonsai and Flower arrangements	10.1 Bonsai making 10.2 Flower arrangements 10.3 Flower exhibitions	6
		Total	**120**

Practicals

Sr. No.	List of Practicals	Periods
1.	Identification and use of some ornamental, shady, flowering avenue trees	8
2.	Study of pots and containers	8
3.	Methods of potting and repotting	8
4.	Identification of annuals, biennials, perennials (Flowering plant and their seeds)	8
5.	Identification and planting of some Ornamental, flowering and foliage shrubs	8
6.	Identification and planting of ornamental climbers and creepers	8
7.	Identification and use of Edges and Hedges	8
8.	Practicals growing of flower crops	32
9.	Identification and use of some bulbous plants and herbaceous plants, cacti and succulents	8
10.	Visit to green house growing flowers	8
11.	Preparation of garden design and layout	8
12.	Planting and Development of lawn and maintenance	8
13	Visit to flower production unit	8
14	Propagation of ornamental plants	4
15	Propagation of roses	8

16	Designing and implementation of landscape plan, visit to landscaping work	8
17	Preparation of Value Added Forms of Flowers	8
18	Visit to florist shop	8
19	Care and storage of modified plant parts	4
20	Selection and planting of trees for bonsai	4
21	Training and maintenance of bonsai	4
22	Practicing pinching, de suckering and disbudding	8
23	Pruning of hedges	8
24	Designing and development of Carpet bed	8
25	Designing and development of arches	8
26	Designing and development of flower beds	8
27	Designing and development of ponds	8
28	Designing and development of rockery and fountains	8
29	Packing flowers for transport	4
30	Treatment to flowers	4
	Total	**240**

Project work (any one)

1. Project proposal for specific flower crop production
2. Project proposal for establishing ornamental nursery
3. Project proposal for establishing flower nursery
4. Collection of seed of flower crops
5. Project proposal for garden development

Paper III: Post Harvest Technology (L3)
Theory

Sr. No.	Unit	Sub-Unit	Periods
1.	Scope and Importance of post harvest technology	1.1 Importance of processing 1.2 Scope for processed products 1.3 Value addition concept 1.4 Nutritive value of processed products 1.5 Future prospects for Processing Industries	12
2.	Pre and post harvest management of Horticultural Crops	2.1 Maturity and maturity indices 2.2 Ripening of fruits 2.3 Harvesting 2.4 Grading and packaging 2.5 Storage and preservation	10

		2.6 Marketing	
3.	Principles and Methods of preservation	3.1 Principles of preservation 3.2 Classification of preservation methods 3.3 Rules and regulations	8
4.	Spoilage of Fruits, Vegetable and their products	4.1 Factors responsible for spoilage of fruit and vegetable products their 4.2 Practices for Minimizing spoilage of fruit and vegetable products their.	8
5.	Chemical preservation	5.1 Use of class I preservatives 5.2 Use of class II preservatives	8
6.	Canning and Bottling	6.1 Food containers 6.2 Tin containers 6.3 Steps in canning of fruits and vegetables	20
7.	Preservation of Juices of fruits vegetable beverages	7.1 Different types of fruit, vegetable and beverages 7.2 Steps and reciepes for fruit vegetable and beverages	10
8.	Pickling and Sauces	8.1 Meaning and requirements 8.2 Reciepes and Steps	8
9.	Drying and Dehydration Methods	9.1 Difference between drying and dehydration 9.2 Drying and Dehydration Techniques	8
10.	Jam, Jellies and marmalades	10.1 Definition and meaning 10.2 Procedure for jam 10.3 Procedure for jelly 10.4 Procedure for marmalade	12
11.	Candies and Preserves	11.1 Meaning 11.2 Procedure for candies 11.3 Procedure for Preserves	4
12.	Storage of processed products	12.1 Need for storage 12.2 Storage methods 13.4 Storage of processed products	4
13.	Packaging of processed products	13.1 Packaging material and their significance 13.2 Modern packaging	4
14.	Waste utilization in Processing Industries	14.1 Need for waste utilization 14.2 By products of processing	4
		Total	**120**

Practicals

Sr. No.	List of Practicals	Periods
1.	Study of Methods of Fruit and Vegetable Preservation.	4

2.	Identification and uses of different equipments required for fruit Preservation	4
3.	Preparation of Fruit Juices	8
4.	Preparation of Lemon Squash	8
5.	Preparation of Lemon Cordial	8
6.	Preparation of Mango Jam	8
7.	Preparation of Guava Jelly	8
8.	Preparation of Santra Marmalade	8
9.	Preparation of Mango Pickles	12
10.	Preparation of lemon pickles	8
11.	Preparation of sauces	8
12.	Preparation of Tomato Ketchup	8
13	Papain Extraction from Papaya	8
14	Preparation of Candy (Ber and Anola)	8
15	Canning of Peas	12
16	Dehydration of Banana, Grape And Vegetables	16
17	Preparation of Potato Chips	4
18	Preparation of Tooty Fruity	8
19	Preparation of Gulkand and Rose Water	8
20	Preparation of Preserve	8
21	Preservation of mango pulp	8
22	Drying of leafy and pod vegetables	12
23	Maturity indices of fruits and vegetables	8
24	Grading and packing of fruits and vegetables for marketing	8
25	Identification of micro organism responsible for food spoilage	4
26	Preparation of syrup and brine	4
27	Visit to processing unit	8
28	Waste utilization in fruits and vegetables	8
29	Visit to packaging unit and storage house	8
30	Analysis of food for quality parameters	8
	Total	**240**

Project work (any one)

1. Project proposal for establishing Processing unit
2. Project proposal for establishing storage unit
3. Project proposal for packaging and forwarding unit.

Reference Books

1. Complete Gardening in India - K.S. Gopal Swami, Pub.G. KasturyRangan
2. Garden Flowers - Vishnu Swarup, Pub.National Book Trust
3. General flower in colour - Daniel D. Folay, Pub. Macmilin
4. Rose in India - I.C.A.R. New Delhi, By R.K. Deshpande Pub. KesariPrakashan
5. Seasonal Flowers - Bhanu L. Desai, By I.C.A.R. New Delhi
6. Fruit Culture in India - Sham Singh, Dr. Krishnamurti and S.L. Katyal
7. Fruit Growing in India - W.B. Hayes
8. Plant Propagation, Principle and Practices- Hudson Hartman Dale E. Kester
9. Plant Propagation - John P. Mahlstedo Eanest S. Haber
10. Fundamentals of Horticulture - J.B. Edmond
11. Preservation of Fruits and Vegetable- Lal G. Sidappa G.S. Tandon G.L. I.C.A.R.F. New Delhi
12. Commercial Fruits and Vegetables Products- Gruess, W.V. McGraw Hill, New York
13. Food Science - Potter Norman
14. Food Chemistry - Mayer Lillian H.
15. Practicals Cannin - Lock Arthur
16. Canned Foods - A.G. Herson
17. Food Dehydration - ArsdelWallance B.V.
18. Deep Freezing- Cox Pat N.
19. Mannual of Analysis if fruits, vegetable products - Ranganna S.
20. Sensory Evaluation of Food Amerine Maynard A.
21. Methods of food Analysis - Joslya Maynard A.
22. Chemical Analysis of Food - Peerson David
23. Technology of Food Product- R.K. Goel
24. Commercial Fruit crops - T.K. Bose and A. Mukhopadhaya
25. Commercial Vegetables - T.K. Bose and A. Mukhopadhaya
26. Garden Designing and Land Scaping - T.K. Bose and A. Mukhopadhaya
27. Nutritive Value of Indian Foods - Gopalan, C.B.V. Ram Sastri and S.C. Balsubramaniam National Institute of Nutrition, Hyderabad
28. Our Leafy Vegetables -H. B. Singh and S.A. Joshi--I.C.A.R.
29. Vegetable crops- C.H. Thomson and Kelly C. William McGraw Hill Book Co. INC, USA
30. Vegetable Crops of India -K.S. Yawalkar Hort-Pub. House, Nagpur
31. Vegetable Crops of India- T.K. Bose and M.G. Som Naya Prakash, Culcutta
32. The Rose in India- B.P. Pal I.C.A.R. New Delhi
33. Rose for Pleasure and profit- V.S. Padhye
34. General and Applied Entomology -G.K. Nayer
35. Text Book of Soil Science- J.A. Dagi,Media promoters and publishers, Mumbai
36. Commercial Fruits in India- G.S. Chima, S.S. Bhat and K.K. Nayak
37. Fruit Nursery Practice in India -L. Venkatraman Directorate of Extension Ministry of- Oxford and IBH Pub. Co. Pvt. Ltd
38. Introductory Ornamental Horticulture- J.S. Arora Kalyani Pub, Ludhiana

List of Tools and Equipments

Sr. No.	Name of Equipments
1	Crown corking machine
2	Microscope
3	Caps Sealing machine
4	Screw Type Juice extrator
5	Sieves set
6	Gel Meters
7	Distilled water apparatus
8	Physical Balance
9	Chemical Balance
10	Counter Balance
11	Balance Dispencing
12	Spring Balance
13	Jelly Thermometer
14	Deepfoot Thermometer
15	Gas Connection
16	Specific gravity hydro meter
17	Hand refractometer
18	Basket Press
19	Can lifting tunges
20	Dust bin
21	First aid box
22	Wooden laddle
23	Measuring spoon set
24	Aluminum Trays 12inch X 20inch X 6inch
25	Lime squeezers
26	Coring knife
27	Cutting knife

28	Pineapple eye remover
29	Pineapple punch
30	Peeling knife
31	Pitting knife
32	Burette, pipettes, beakers and conical flasks of different capacities
33	Measuring cylinder (100ml,250ml,500ml)
34	Graduated glass set
35	Petri dishes, cover slips etc.
36	Reagent Bottles (Different capacity)
37	Rubber stopper, tubing, funnel
38	Spirit lamp
39	Pots, Kettles, Bhagunas of various sizes (Stainless steel, Aluminum, Copper Bottom)
40	Bullock pair, plough, Harrows, Hoes, Tractor, Power tiller (May Maintain these things OR Hire)
41	Pump set
42	Sprayers and dusters
43	Drip and Sprinkler sets
44	Spanners set
45	Harvesting equipments
46	Lawn mower
47	Secateurs
48	Budding and grafting knife
49	Khurpi, Vila, Pike axe, Kudali etc.
50	Transplanting trowel
51	Pruning saw
52	Hedge shear
53	Refrigerator
54	Oven

Maharashtra state Board of Secondary and Higher Secondary Education , Pune

Syllabus

Higher Secondary Vocational Course

Course Name :- **Crop Science**

Subject Code :- Q4, Q5, Q6

Std :-- XI

Paper-I (Q 4) : Fundamentals of Agriculture.

Paper-II (Q 5) : Elements of Agriculture.

Paper-III (Q 6) : Crop and Seed Production Part - I

Std :-- XII

Paper-I (Q 4) : Crop and Seed Production Part - II

Paper-II (Q 5) : Applied Agriculture

Paper-III (Q 6): Farm Management, Marketing and Agroforestry

Crop Science (Q4,Q5,Q6)
Scheme of examination
Std. XI

Paper	Title of the paper	Theory		Practical		Term work	Project work	Educational Visit	Total Marks
		Marks	Time (Hrs)	Marks	Time (Hrs)				
1	Fundamentals of Agriculture	80	3	80	3	20	10	10	200
2	Elements of Agriculture	80	3	80	3	20	10	10	200
3	Crop and Seed Production Part - I	80	3	80	3	20	10	10	200

Scheme of examination
Std. XII

Paper	Title of the paper	Theory		Practical		Term work	On the job training	Project work	Educational Visit	Total Marks
		Marks	Time (Hrs)	Marks	Time (Hrs)					
1	Crop and Seed Production Part - II	80	3	80	3	10	10	10	10	200
2	Applied Agriculture	80	3	80	3	10	10	10	10	200
3	Farm Management, Marketing and Agroforestry	80	3	80	3	10	10	10	10	200

Std. XI

Paper-1 : Fundamentals of Agriculture (Q 4)
Theory

S.No	Unit	Subunits	no. of periods
1.	Introduction to agriculture	1.1 History and scope of agriculture 1.2 National income, per capita income. 1.3 Agriculture as an industry 1.4 Classification of crop plants	10
2.	Weather and climate	2.1 Definition 2.2 Different weather elements and their effect on crop growth. 2.3 Instruments of measurement of weather parameters 2.4 Weather forecasting	14
3.	Soil	3.1 Definition and functions 3.2 Rocks and Minerals 3.3 soil formation 3.4 Properties of soil 3.5 Soil fertility and productivity 3.6 Soil of Maharashtra	16
4.	Tillage and tillage implements	4.1 Definition of tillage 4.2 Objectives of tillage 4.3 Types of tillage 4.4 Implements for different tillage operations 4.5 Modern concepts of tillage.	14
5.	Modes of reproduction	5.1 Sexual reproduction 5.2 Asexual reproduction 5.3 Tissue culture	12
6.	Morphology of flower, inflorescence and pollination	6.1 Definition of flower 6.2 Parts of flower 6.3 Types of flower 6.4 Meaning and types of inflorescence 6.5 Pollination	12
7.	Seed	7.1 Definition and parts of seed. 7.2 Difference between seed and grain. 7.3 Principles of seed production. 7.4 Seed multiplication 7.5 Seed classification 7.6 Characteristics of seed. 7.7 Seed legislation.	14
8.	Seed testing	8.1 Definition and objectives 8.2 Seed germination 8.3 Seed dormancy 8.4 Other seed tests 8.5 Seed certification	14
9.	Watershed management	9.1 Definition and concept. 9.2 Components of watershed 9.3 Objectives of watershed management. 9.4 Planning for watershed. 9.5 Integrated watershed management 9.6 Water harvesting. 9.7 Farm pond	14
			120

Practicals

Sr no	List of Practical	Periods
1	Study of agro climatic zones of Maharashtra.	4
2	Study of meteorological equipments	12
3	Study of actual measurement of different parameters-Visit to a meteorological observatory.	12
4	Study of soil profile.	4
5	Identification of rocks and minerals	8
6	Collection and preparation of soil samples for analysis.	8
7	Soil analysis – visit to a soil testing laboratory.	16
8	Identification of seed and plant parts of different crops.	4
9	Study of preparatory tillage implements, handling and use of different preparatory tillage implements.	12
10	Study of intertillage implements , handling and use of different intertillage implements.	12
11	Seed bed preparation for kharif crops.	12
12	Disection of flower to study the morphology.	8
13	Study of pollination and their types.	12
14	Study of inflorescence	4
15	Study of techniques of isolation and rouging in seed production plot.	8
16	Visit to a tissue culture laboratory to study the techniques of tissue culture.	12
17	Study of parts of seed.	12
18	Study of modes of reproduction	4
19	Practice of various methods of vegetative reproduction i.e. budding, grafting, layering, etc.	20
20	Physical purity analysis of seed, calculation of percent physical purity	4
21	Calculation of pure live seed percentage	4
22	Seed germination tests	8
23	Evaluation of seedlings after germination test	4
24	Study of methods of breaking seed dormancy	8
25	Seed moisture testing by using moisture meter	4
26	Study of seed inspection and seed certification	8
27	Study of design and construction of farm pond	8
28	Visit to model watershed area	8
		240

Project work (any one of the following)

1) Project proposal for soil testing laboratory.
2) Project proposal for tissue culture unit.
3) Project proposal for meteorological observatory.
4) Collection of specimens of different types of soil along with brief infomation.
5) Preparation of model of any one implement.
6) Project proposal for farm pond.

Std. XI

Paper II -Elements of Agriculture (Q 5)
(Theory)

S.No.	Unit	Subunits	No of perids
1.	Plant nutrition	1.1 Essential plant nutrients. 1.2 Classification of essential nutrients. 1.3 Functions and deficiency symptoms 1.4 Integrated nutrient management 1.5 Fertigation.	14
2.	Manures and fertilizers	2.1 Definition. 2.2 Classification of manures and fertilizers. 2.3 Farm Yard Manure. 2.4 Compost. 2.5 Green manuring. 2.6 Biofertilizers. 2.7 Chemical fertilizers. 2.8 Time and methods of fertilizer application 2.9 Organic farming	18
3.	Sowing	3.1 Sowing methods 3.2 Sowing time. 3.3 Sowing depth. 3.4 Spacing 3.5 Implements for sowing	12
4.	Seed rate, plant population and seed processing	4.1 Seed rate 4.2 plant population 4.3 Seed cleaning 4.4 Seed treatment 4.5 Seed drying	12
5.	Irrigation and drainage	5.1 Meaning of irrigation. 5.2 Advantages & adverse effects of irrigation. 5.3 systems of irrigation 5.4 Scheduling of irrigation 5.5 Meaning of drainage 5.6 Advantages of drainage 5.7 Improper drainage.	14
6.	Plant protection	6.1 Pest and Disease 6.2 Principles and methods of pest and diseases control 6.3 Integrated pest management 6.4 Integrated disease management 6.5 Study of important pest 6.6 Study of important diseases	14
7.	Weed management	7.1 Definition of weed 7.2 Characteristics of weed 7.3 Classification of weed 7.4 Weed dispersal 7.5 Effects of weed 7.6 Weed control	14
8.	Hybridization	8.1 Meaning and objectives 8.2 Types of hybridization 8.3 Technique(steps) of hybridization	14
9	Plant growth regulators	9.1 Meaning 9.2 Types 9.3 Uses	08
			120

Practicals

Sr no	List of Practical	Periods
1	Identification of different manures and fertilizers	12
2	Methods of application of solid fertilizers.	8
3	Methods of application of liquid fertilizers.	8
4	Methods of preparation of F Y M.	12
5	Practice of green manuring.	12
6	Calculations of fertilizer requirement for different crops.	8
7	Calculations of unit value and cost/kg of fertilizer.	8
8	Use of biofertilizers for seed treatment.	8
9	Visit to a fertilizer factory / FYM or compost preparation unit	12
10	Practice of different methods of sowing.	8
11	Study of different components of drip irrigation system.	8
12	Study of different components of Sprinkler irrigation system.	8
13	Visit to a farm for studying drip and sprinker irrigation system.	12
14	Procedure and practice of irrigation by surface and subsurface irrigation system.	8
15	Calculations of duty and delta(total requirement) of water.	8
16	Study of drainage and remedies of improper drainage.	4
17	Practice of seed treatment in major field crops.	8
18	Calculations of seed rate for crops multiplied by seed.	4
19	Calculations of seed rate for Vegitatively propagated crops like sugarcane,potato.	4
20	Calculations of plant population for different crops.	4
21	Collection of technical information regarding agro chemicals	8
22	Collection of technical information regarding different fertilizers	8
23	Formulation of Bordeaux mixture	8
24	Practice of application of insecticides, pesticides and fungicides.	8
25	Identification of different weeds	8
26	Study of weed control.	8
27	Study of plant protection equipments.	8
28	Techniques (steps) of hybridization.	12
29	Use of plant growth regulators	8
		240

Project work (any one of the following)

1) Preparation of weed album along with brief information.
2) Project proposal for drip irrigation for 1 ha land.
3) Project proposal for sprinkler irrigation for 1 ha land.
4) Collection of samples of manure and fertilizers with brief information.

Std. XI

Paper-III : Crop and Seed Production Part – I (Q6)
(Theory)

S.No.	Unit	Subunits	No. of periods
1.	Commercial production of cereal crops	1.1 Paddy 1.2 Bajra 1.3 Maize 1.4 Jowar 1.5 Wheat 1.6 Finger millet	40
2.	Commercial production of pulse crops	2.1 Red gram 2.2 Green gram 2.3 Black gram 2.4 Gram 2.5 Pea	40
3.	Seed production of cereals	3.1 Jowar 3.2. Bajra 3.3 Maize	40
			120

Practicals

Sr no	List of Practical	Periods
1	Study of floral biology of paddy, wheat and maize.	12
2	Practice of seed treatments for paddy, wheat and maize.	8
3	Practice of seedbed preparation for paddy, wheat and maize.	8
4	Practice of sowing paddy, wheat and maize	8
5	Practice of intercultivation in paddy, wheat and maize.	8
6	Harvesting, threshing, winnowing and storage of paddy, wheat and maize	12
7	Practice of seed treatments for jowar and bajra	8
8	Practice of seedbed preparation for jowar and bajra.	8
9	Practice of sowing for for jowar and bajra.	12
10	Practice of intercultivation in for jowar and bajra.	8
11	Harvesting, threshing, winnowing and storage for jowar and bajra.	8
12	Rhizobium inoculation treatment in pulse crops.	4
13	Azotobactor inoculation treatment in cereal crops.	4
14	Study of floral biology of gram, green gram and red gram.	8
15	Study of floral biology of black gram and pea	8
16	Practical cultivation of any one pulse crop.	16
17	Visit to a *dal* mill / rice mill	12
18	Study of pest and diseases of paddy, maize and their control measures.	8
19	Study of pest and diseases of jowar and bajra and their control measures	8
20	Study of pest and diseases of gram, red gram, green gram, pea and their control measures	8
21	Practical cultivation for seed production of any one cereal crop.	16
22	Visit to a seed farm.	12
23	Practice of rouging in seed crop	12
24	Study of pest and diseases of black gram and pea	12
25	Sowing pattern of jowar and bajra for hybrid seed production	8
26	Detasselling in maize	4
		240

Project work (any one of the following)

1)Preparation of crop cafeteria of cereals
2) Preparation of crop cafeteria of pulses
3) Preparation of seed herbarium with brief information of each crop.
4) Collection of insect pest samples along with nature of damage and control measures (as per crops in syllabus).
5)Collection of disease specimens and their display along with symptoms and control measures. (as per crops in syllabus).

Std. XII

Paper-I : Crop and Seed Production Part- II (Q4)
(Theory)

S.No.	Unit	Subunits	No. of periods
1.	Commercial production of sugar and fibre crops	1.1 Sugarcane. 1.2 Cotton	24
2.	Commercial production of oilseed crops	2.1 Groundnut 2.2 Safflower 2.3 Sunflower 2.4 Soybean 2.5 Sesamum,	36
3.	Commercial production of spice crops	3.1 Onion 3.2 Turmeric 3.3 Ginger	20
4.	Seed production of important crops.	4.1 Cotton 4.2 Sunflower 4.3 Potato 4.4 Onion 4.5 Chilli	40
			120

Practicals

Total periods-240

Sr. no.	List of Practical	Period
1	Identification of seed and plant parts of crop included in theory syllabus.	4
2	Study of floral biology of cotton.	4
3	Study of floral biology of groundnut .	8
4	Study of floral biology of Soybean.	4
5	Study of floral biology of sunflower and safflower.	8
6	Calculations of theoretical seed rate for crops included in theory syllabus.	4
7	Calculations of optimum plant populations for crops included in theory syllabus.	4
8	Seed treatment in sunflower, sesamum and safflower.	8
9	Seed treatment in groundnut and soybean.	8
10	Seed treatment in cotton and sugarcane.	8
11	Handling and tying of tillage implements.	8
12	Practice of seedbed preparation for sunflower, sesamum and safflower.	8
13	Practice of seedbed preparation for groundnut and soybean.	8
14	Preparation of raised beds and raising of seedlings of chilli and onion.	8
15	Study of layouts for sugarcane planting.	8
16	Practice of planting of turmeric and ginger on broad ridges.	8
17	Calculations of fertilizer requirements for different crop.	8
18	Practice of emasculation and pollination in cotton.	8
19	Methods of artificial pollination in sunflower.	8
20	Visit to a jaggery preparation plant to acknowledge the procedure of jaggery preparation.	12
21	Practice of curing turmeric and ginger. -visit to such curing plant.	12
22	Visit to a sugar factory.	12
23	Practice of de-shelling of groundnut.	4
24	Study of important insect- pest, diseases of groundnut, soybean and their control measures.	8
25	Study of important insect- pest, diseases of Cotton and their control measures.	8
26	Study of important insect- pest, diseases of sugarcane and their control measures.	8
27	Study of important insect- pest, diseases of chilli, onion, potato and their control measures.	8
28	Study of important insect- pest, diseases of turmeric, ginger and their control measures.	8
29	Study of important insect- pest, diseases of sunflower ,safflower, sesamum and their control measures.	8
		240

Project work (any one of the following)

1) Preparation of seed herbarium with brief information of each crop as per syllabus.
2) Preparation of crop cafeteria of spices and oilseed crops.
3) Project proposal for jaggery preparation plant.
4) Collection insect pest specimens of the crops in theory syllabus and their display along with nature of damage and control measures.
5) Collection of disease specimens of the crops in theory syllabus and their display along with symptoms and control measures.

Std. XII

Paper-II : Applied Agriculture (Q 5)
(Theory)

S.No.	Unit	Subunits	No. of periods
1.	Nursery	1.1 Introduction to nursery 1.2 Types of nursery 1.3 Planning and layout of nursery 1.4 After cares of nursery	14
2.	Green house and poly house	2.1 Importance and scope 2.2 Types of green house 2.3 Installation of green house and poly house 2.4 Crops grown in green house and poly house	16
3.	Apiculture	3.1 Meaning and objectives 3.2 Features 3.3 Crops useful for apiculture 3.4 Bee rearing 3.5 Products of apiculture	10
4.	Mushroom Production	4.1 Importance and scope 4.2 Production technique 4.3 Harvesting and processing	12
5.	Vermicompost	5.1 Importance 5.2 Methodology 5.3 Species used 5.4 Composition 5.5 Vermiwash	12
6.	Seed processing plant	6.1 Meaning and importance of seed processing 6.2 Processing sequence 6.3 Layout planning of seed processing plant 6.4 Records and forms to be maintained in seed processing plant	16
7.	Seed testing laboratories	7.1 Conditions essential for good testing work 7.2 Layout and design of seed testing laboratory 7.3 Guidelines for managing seed testing work 7.4 forms and records to be maintained in seed testing laboratory	14
8.	Landscaping	8.1 Concept and importance 8.2 Layout and design 8.3 Landscaping of home, institutional and industrial garden	12
9.	Modern concepts in farming	9.1 Organizational farming 9.2 Agro-tourism 9.3 Agro-based industries 9.4 Agro-service centre	14
			120

Practicals

Total periods-240

Sr. No.	List of Practical	Periods
1.	Study of planning and layout of nursery	8
2.	Preparation of nursery bed	8
3.	Study of garden tools and equipments	8
4.	Study of planning and layout of poly house	8
5.	Study of different types of poly houses	8
6.	Visit to nursery and poly house	12
7.	Preparation of potting mixture for cultivation of rose and gerbera in poly house	8
8.	Filling of pots and trenches for planting of rose and gerbera in poly house	4
9.	Production technique of mushroom	8
10.	Harvesting and processing of mushroom	8
11.	Study of different products of apiculture	4
12.	Honey production	8
13.	Study of layout and design for landscaping	8
14.	Study of preparation of vermicompost.	4
15.	Visit to a compost and vermicompost preparation unit.	12
16.	Study of seed processing plant-layout, design, general processing sequence.	4
17.	Processing sequence for complete cleaning of seed of jowar, bajra, cotton, groundnut, soybean.	12
18.	Study of forms and records used in processing plant	4
19.	Guide lines for management of seed testing work	4
20.	Visit to a seed processing plant.	12
21.	Layout and design of seed testing laboratory.	8
22.	Study of Forms and records used in seed testing laboratory.	8
23.	Visit to a seed testing laboratory.	12
24.	Study of organizational farming	4
25.	Study of making *dal*- visit to *dal* mill / visit to oil mill to study procedure of oil extraction	12
26.	Visit to rice mill for acquiring the knowledge of various byproducts of rice	12
27.	Procedure of establishing agro service center	8
28.	Visit to agro service center	12
29.	Visit to agro tourism center	12
		240

Project work (any one of the following)

1) Project proposal for agro -service center
2) Project proposal for poly house
2) Project proposal for seed processing plant.
3) Project proposal for seed testing laboratory.
4) Preparation of records and forms to be maintained in seed processing plant.
5) Preparation of records and forms to be maintained in seed testing laboratory.
6) Reports of visit to a seed processing plant, seed testing laboratory or vermicomposting unit.
7) Project proposal for *dal* mill/ rice mill/ oil mill

Crop Science

Std. XII

Paper-III Name: Farm Management, Marketing and Agroforestry (Q6)
Theory

S.No.	Unit	Subunits	No. of periods
1.	Farm management	1.1 Definition 1.2 Objectives 1.3 Functions of farm manager 1.4 Choice of enterprise 1.5 Selection of farm 1.6 Farm layout 1.7 Farm planning 1.8 Farm Budgeting 1.9 Organizing farm inputs 1.10 Cropping schemes and calendar of operations 1.11 Labour management	26
2	Farm economics	2.1 Farm credit and capital 2.2 Farm accounts and records 2.3 Crop insurance	08
3.	Cropping systems	3.1 Study of different types of cropping systems	14
4.	Agricultural marketing	4.1 Definition 4.2 Prerequisites for efficient Agricultural Marketing 4.3 Process of agricultural marketing 4.4 Types of agricultural marketing 4.5 Functions of agriculture marketing 4.6 Agricultural communication	18
5.	Seed marketing	5.1 Seed demand forecasts 5.2 Seed marketing structure and organization 5.3 Arrangement for storages of seed 5.4 Sales promotional activities 5.5 Post sales service 5.6 Factors affecting seed marketing 5.7 Economics of seed production 5.8 Seed pricing	24
6	Ware housing	6.1 Meaning and importance 6.2 Working 6.3 Types 6.4 Ware housing in India	12
7	Agroforestry	7.1 Definition of forest and agroforestry 7.2 Branches of forestry 7.3 Need for agroforestry 7.4 Classification of agroforestry system 7.5 Tree species suitable for agroforestry	18
			120

Practicals

Total periods-240

Sr. No.	List of practical	Periods
1	Study and preparation of cropping scheme.	8
2	Study of crop rotation and deciding crop rotations in your locality.	8
3	Visit to a model farm.	12
4	Study of labour management.	4
5	Maintenance of farm records.	4
6	Calculation of cost of cultivation and production.	8
7	Visit to a co-operative society	12
8	Study and visit to a different types of market.	8
9	Study of awareness in purchasing agricultural inputs.	4
10	Visit to a seed company.	12
11	Preparation of leaflets, pamphlets and posters.	12
12	Handling and use of Radio, Tape recorder, Television.	8
13	Handling and use of Computer ,CD, DVD	8
14	Practice of using Cellphones, Internet for advertising in marketing	4
15	Study of communication through Videoconferencing.	8
16	Exercise on arranging local cultural programme as a medium of communication.	8
17	Exercise on arranging Farmer Day.	8
18	Preparation of hoardings, boards for advertising in marketing.	8
19	Preparation of electrical letter boards, air balloons and letters for advertising in marketing..	8
20	Preparation of circular letter, invitation letter.	8
21	Visit to seed sale center, seed dealers shop/ seed storage structure.	8
22	Study of forest species	8
23	Agricultural clinic- Students should practiced for arranging such clinic in a village	8
24	Seed production costs.	4
25	Study of ware housing in India, visit to ware house	8
26	Visit to district industry center	12
27	Study of result demonstration, method demonstration and frontline demonstration.	4
28	Study and practice of group discussion.	8
29	Visit to *Krishi Vigyan Kendra* to impart vocational skill training to the students.	12
30	Study of cropping systems –visit to ideal farm.	8

Project work (any one of the following)

1) Project proposal for establishing co-operative society.
2) Project proposal for establishing agricultural clinic/agricultural consultancy
3) Project proposal for cultivation of forest species.
4) Cost of cultivation and production of different crops.
5) Collection of leaflets, pamphlets and posters related to different agricultural products.

3: Animal Husbandry and Dairy Technology (Q7, Q8, Q9)

Scheme of Examination
Std. XI

Paper	Title of the Paper	Theory		Practical		Term work	Project Work	Educational Visit	Total Marks
		Marks	Time (Hrs)	Marks	Time (Hrs)				
1	Dairy Cattle and Buffalo Breeding and Feeding	80	3	80	3	20	10	10	200
2	Sheep, Goat and Pig Management	80	3	80	3	20	10	10	200
3	Poultry Production	80	3	80	3	20	10	10	200

EV: Educational Visit

Scheme of Examination
Std. XII

Paper	Title of the Paper	Theory		Practical		Term work	OJT	Project work	Educational Visit	Total Marks
		Marks	Time (Hrs)	Marks	Time (Hrs)					
1	Dairy Production and Management	80	3	80	3	10	10	10	10	200
2	Milk Processing	80	3	80	3	10	10	10	10	200
3	Milk Products	80	3	80	3	10	10	10	10	200

OJT: On the job training

EV: Educational Visit

Std. XI

Paper I: Dairy Cattle and Buffalo Breeding and Feeding (Q7)

Theory

Sr. No.	Unit	Sub-Unit	Periods
1	Introduction to dairy industry	1.1 Present position of Cattle and Buffalo in India and World	10
		1.2 Scope and limitations for dairy farming in India	
		1.3 Nutritive value of animal products	
		1.4 Integrated livestock farming	
		1.5 Common terms used in Animal Husbandry	
2	Cattle and Buffalo breeds	2.1 Classification of cattle breeds	25
		2.2 Milch purpose - Sahiwal, Red- Sindhi, Gir and Tharparkar	
		2.3 Dual purpose - Deoni, Ongole, Kankrej and Hariana	
		2.4 Draft purpose - Khillar, Dangi, Red Kandhari and Gaolao	
		2.5 Exotic breeds: Holstein Friesian, Jersey and Brown Swiss	
		2.6 Classification of buffalo breeds	
		2.7 Murrah, Surti, Mehsana, Jaffarabadi, Nagpuri, Pandharpuri, Marathwadi	
3	Animal breeding and selection	3.1 Systems of breeding: Inbreeding and Out breeding	15
		3.2 Basis of selection: Individual, pedigree and progeny testing.	
		3.3 Methods of selection: Tandem, Independent Culling and Selection Index method	
		3.4 Artificial Insemination	
		3.5 Embryo transfer technology	
		3.6 Cloning technique	
4	Anatomy and physiology of bovines	4.1 Digestive System	25
		4.2 Ruminant digestion	
		4.3 Male reproductive system	
		4.4 Female reproductive system	
		4.5 Oestrous cycle	
		4.6 Pregnancy	
		4.7 Parturition	
		4.8 Udder	
5	Feed nutrients	5.1 Water	15
		5.2 Proteins	
		5.3 Carbohydrates	
		5.4 Lipids	
		5.5 Vitamins	

		5.6 Minerals	
6	Feeds and Feeding	6.1 Classification of feedstuffs	30
		6.2 Preservation of forages	
		6.3 Processing of feedstuffs	
		6.4 Feeding standards	
		6.5 Ration	
		6.6 Thumb rule for cattle feeding	
		6.7 Watering of animals	
		6.8 Cultivation practices of common fodder crops viz. Maize, jowar, cowpea, lucerne, berseem, gajraj, subabul	
		Total	**120**

Practicals

Sr. No.	List of Practicals	Periods
1.	Nomenclature of external body parts of cattle and buffalo.	8
2.	Demonstration of morphological features of milch breeds of cattle.	12
3.	Demonstration of morphological features of dual purpose breeds of cattle.	12
4.	Demonstration of morphological features of draft breeds of cattle.	12
5.	Demonstration of morphological features of exotic breeds of cattle.	12
6.	Demonstration of morphological features of various breeds of buffalo.	12
7.	Study of digestive systems of bovine.	12
8.	Study of reproductive systems of bovine.	12
9.	Study of structure of udder.	12
10.	Signs and detection of heat in animals.	12
11.	Study of methods of pregnancy diagnosis.	12
12.	Signs and stages of parturition.	12
13.	Study of equipments required for collection of semen.	12
14.	Identification of commonly used conventional and non-conventional feedstuffs.	08
15.	Methods for silage and hay making.	12
16.	Feeding schedules for different classes of livestock.	16
17.	Computation of ration for various classes of livestock as per ISI standards and feed formulation by using computer.	16
18.	Demonstration of chaffing and urea-molasses treatment.	12
19.	Study of cultivation practices for commonly used fodder crops.	12
20.	Visit to local veterinary dispensary to demonstrate A.I. technique.	12
	Total	**240**

Project work (Any one of the following)

1. Prepare a project report on various milch cattle breeds reared in your area.
2. Prepare a project report on various buffalo breeds reared in your locality.
3. Prepare a project report on manufacturing cattle feed for various categories of dairy animals.
4. Prepare a project report on various fodder crops cultivated for dairy farming in your locality.
5. Prepare a project report on various reproductive technologies adopted for breeding at A.I. Centre in your area.

Paper II: Sheep, Goat and Pig Management (Q8)
Theory

Sr. No.	Unit	Sub-Unit	Periods
1	Introduction to Sheep, Goat and Pig Husbandry	1.1 Present position of Sheep, Goat and Pig in India and World	05
		1.2 Scope and limitations for Sheep, Goat and Pig farming in India	
2	Sheep, Goat and Pig breeds	2.1 Classification of sheep breeds	25
		2.2 Sheep breeds: Indian: Deccani and Bannur Exotic; Merino, Rambouillet and Southdown	
		2.3 Classification of goat breeds	
		2.4 Goat breeds: Indian breeds Osmanabadi, Sangamneri, Jamunapari, Black Bengal, Barberi and Pashmina Exotic breeds Sannen, Alpine and Angora	
		2.5 Classification of Pig breeds	
		2.6 Pig breeds: Deshi pig Large white Yorkshire, Landrace.	
3	Sheep Management	3.1 Importance of sheep farming	25
		3.2 Housing for sheep	
		3.3 Management of lambs	
		3.4 Management of pregnant and lactating ewes	
		3.5 Management of breeding rams	

Std. XII
Paper I: Dairy Production and Management (Q7)
Theory

Sr. No.	Unit	Sub-Unit		Periods
1	Routine Management Practices	1.1	Identification of animals	25
		1.2	Dehorning	
		1.3	Castration	
		1.4	Grooming	
		1.5	Milking	
		1.6	Drying off	
		1.7	Culling	
		1.8	Hoof trimming	
		1.9	Ringing of bulls	
		1.10	Deworming	
		1.11	Spraying and dipping	
		1.12	Vaccination	
		1.13	Record keeping	
2	Dairy Cattle and Buffalo Management	2.1	Housing of dairy animals	20
		2.2	Raising of calves	
		2.3	Raising of heifers	
		2.4	Care and management of pregnant animals	
		2.5	Care and management of freshly calved animals	
		2.6	Care and management of lactating animals	
		2.7	Care and management of breeding bull	
		2.8	Judging of dairy animals	
3	Diseases of dairy animals	3.1	Introduction to diseases	15
		3.2	Bacterial diseases: H.S., B.Q., Brucellosis, Mastitis	
		3.3	Viral diseases: Foot and mouth disease, Ephemeral fever	
		3.4	Protozoan diseases: Theileriosis, Surra and Babesiosis	
		3.5	Parasitic diseases : Endoparasites and Ectoparasites	
		3.6	Systemic diseases : Simple indigestion, Tympany	
		3.7	Reproductive disorders : Dystokia, retention of placenta, metritis, prolapse of uterus, infertility	
		3.8	Metabolic diseases : Milk fever, ketosis	
4	Dairy Chemistry	4.1	Composition of milk	20

		4.2 Factors affecting on composition of milk	
		4.3 Physico-chemical properties of milk	
		4.4 Composition of cow and buffalo milk	
		4.5 Food & Nutritive value of milk	
		4.6 Judging and grading of milk	
		4.7 Flavour defects in milk	
		4.8 Adulteration of milk & milk products	
		4.9 Preservatives in milk and milk products	
5	Dairy microbiology	5.1 Types of microbes	10
		5.2 Classification of dairy bacteria	
		5.3 Factors affecting on growth of microbes	
		5.4 Effects of microbial growth on milk & milk products	
		5.5 Destruction of microbes	
		5.6 Clean milk production	
6	Dairy Co-operatives	6.1 History of co-operation	30
		6.2 Basic and General principles of co-operation	
		6.3 Anand Pattern	
		6.4 Primary milk co-operative society	
		6.5 District co-operative milk union	
		6.6 State milk federation	
		6.7 National Dairy Development Board (NDDB)	
		6.8 Milk procurement	
		6.9 Transportation of milk	
		Total	**120**

Practicals

Sr. No.	List of Practicals	Periods
1.	Study of housing systems for dairy animals.	12
2.	Identification marks for cattle and buffalo.	12
3.	Demonstration of dehorning and castration in cattle and buffalo.	12
4.	Routine management practices viz. grooming, washing, clipping and spraying.	12
5.	Milking of dairy animals.	12
6.	Maintenance of various farm records by using computers.	12
7.	Recording of body temperature, pulse and respiration.	8
8.	Determination of milk fat by Gerber method.	8
9.	Determination of titratable acidity percentage in milk.	8
10.	Study of different glass wares used in dairy laboratory.	8

11.	Preparation of standard solutions required for dairy laboratory.	12
12.	Determination of milk adulterants viz. water, sugar, urea and skim milk powder.	20
13.	Determination of milk preservatives viz. formaldehyde, boric acid and salicylic acid.	20
14.	Preparation of milk slides for bacteriological examination.	12
15.	Preparation of payment bill on the basis of data.	12
16.	Study of various equipments used for sampling of milk from Can, Tankers, storage tanks for physical, chemical and bacteriological analysis.	12
17.	Visit to Dairy Co-operative society (DCS) to study history of DCS, mode of collection, sampling of milk, weighing and recording, testing procedure, financial status and factors affecting its viability.	12
18.	Visit to dairy farm for demonstration of age, weight of animal, handling and casting of animals.	12
19.	Visit to Veterinary Clinic for identification and uses of commonly used medicines& instruments in animal treatment and demonstration of various methods of administration of drugs.	12
20.	Visit to nearby milk chilling plant.	12
	Total	**240**

Project work (Any one of the following)

1. Prepare a project report on economics of rearing 5 cross-bred cows on dairy farm.
2. Prepare a project report on economics of rearing 10 buffaloes on dairy farm.
3. Prepare a project report on economics of rearing 10 indigenous cows on dairy farm.
4. Study of different housing system for various categories of dairy animals in your area.
5. Prepare a project report on various routine managements practices followed on nearby dairy farm.
6. Prepare a project report on various calf rearing schemes adopted by co-operative unions.
7. Prepare a project report on vaccination programme for various diseases of dairy animals.
8. Prepare a project report on primary co-operative milk society regarding its role in village development.
9. Prepare a project report on various schemes for enhancing milk production by dairy Co-operative Union.
10. Prepare a project report on clean milk production on dairy farm.

Paper II: Milk Processing (Q8)

Theory

Sr. No.	Unit	Sub-Unit	Periods
1	Dairy plant accessories and metals	1.1 Pumps	15
		1.2 Valves	
		1.3 Pipes and pipe fitting accessories	
		1.4 Fabrication of dairy equipments	
		1.5 Characteristics of different metals and their alloys	
2	Raw milk reception dock	2.1 Reception of milk	25
		2.2 Filtration and clarification of Milk	
		2.3 Can washer	
		2.4 Crate washer	
		2.5 Measurement parameters	
3	Milk processing and special milk	3.1 Chilling of milk	30
		3.2 Storage of milk	
		3.3 Standardization of milk	
		3.4 Homogenization of milk	
		3.5 Pasteurization of milk	
		3.6 Sterilization of milk	
		3.7 Reconstituted milk	
		3.8 Recombined milk	
		3.9 Toned and double toned milk	
		3.10 Flavoured milk	
		3.11 Organic milk	
4	Steam generation and Refrigeration	4.1 Boiler	15
		4.2 Refrigeration system	
5	Cleaning, Sanitization and Effluent treatment	5.1 Cleaning process	20
		5.2 Sanitization	
		5.3 Effluents treatment	
6	Milko Tester and Packaging	6.1 Electronic milko-tester (EMT)	15
		6.2 Milk analyzer	
		6.3 Packaging of milk & milk products	
		Total	**120**

Practicals

Sr. No.	List of Practicals	Periods
1.	Identification of valves used in dairy plants.	8
2.	Identification of pumps used in dairy plants.	8
3.	Identification of various accessories of pipe fitting (Equal T, Reduced T, bends, U bend with flange, nipples, eccentric reducers, elbows, sockets and unions in dairy plants.	12
4.	Handling and using different weight and volume measurement devices.	12
5.	Handling and using of heat measuring devices.	12
6.	Handling and using of pressure measuring devices.	12
7.	Working with can scrubber and Preparation of detergent solutions for can and crate washer.	12
8.	Study of various platform test viz organoloptic test and COB test.	12
9.	Study of straight through can washer, common operational problems care and maintenance.	12
10.	Working with crate washers, common operational problems care and maintenance.	12
11.	Standardization of milk: solving problems, practicing standardization.	8
12.	Study of homogenizer, operation, precautions, and operational problems.	12
13.	Study of pasteurizers, operation, precautions, and operational problems.	12
14.	Preparation of standardized / pasteurized / sterilized / flavored milk.	32
15.	Preparation of recombined milk.	8
16.	Preparation of reconstituted milk.	8
17.	Preparation of toned / double toned milk.	16
18.	Study of boiler parts, constructional details, working, care & maintenance.	12
19.	Visit to dairy plant for demonstration of packaging machine, operation, temperature regulation & maintenance, cleaning and sanitization of dairy equipments.	12
20.	Determination of fat by milko-tester and major milk constituents by milk analyzer	8
	Total	**240**

Project work (Any one of the following)

1. Prepare a project report on different metals and alloys in fabricating dairy materials and equipments.

2. Prepare a project report on measurement parameters i.e. weight, volume, temperature, pressure instruments used and their units.
3. Prepare a project report on various packing material forms in packaging milk, and milk products in dairy industry.
4. Prepare a project report on various effluent treatments in dairy unions.
5. Prepare a project report on weight and measurement Act, FSSA-2011& ISO-HACCP for dairy industry.
6. Prepare a project report on different types of detergents and sanitizers used in dairy union for cleaning and sanitization of dairy equipments.
7. Prepare a project report on hot water and steam generation by boiler in small dairy unit.
8. Prepare a project report on systems of refrigeration followed for storage of milk and milk products in dairy plants.

Paper III: Milk Products (Q9)
Theory

Sr. No.	Unit	Sub-Unit	Periods
1	Concentrated Milk products	1.1 Basundi/Kheer	15
		1.2 Khurchan	
		1.3 Rabri/Rabadi	
		1.4 Khoa	
2	Fermented and Coagulated milk products	2.1 Starter culture	20
		2.2 Dahi/Curd	
		2.3 Shrikhand	
		2.4 Yoghurt	
		2.5 Lassi	
		2.6 Chhana	
		2.7 Surati paneer	
3	Fat rich milk products	3.1 Cream	30
		3.2 Butter	
		3.3 Ghee	
4	Frozen milk products and Dried milks	4.1 Kulfi	25
		4.2 Ice-cream	
		4.3 Softy ice-cream	
		4.4 Milk powder (WMP & SMP)	
		4.5 Casein (Industrial & edible)	
5	Cheese	5.1 Introduction to cheese	20
		5.2 Cheddar cheese	
6	Legal Standards	6.1 Legal standards for different classes of milk and various milk products	1[illegible]

76. Ravi
77. Spoon
78. Reagent bottle
79. Packaging material (cup, aluminum paper, vegetable butter paper, polythene bag/paper, bottle, laminated boxes, tin box etc.)
80. Pela (Glass/SS)
81. Aluminum cup
82. Chisel (Sandashi)
83. Glass slide with cover
84. Degchi
85. Crown corking machine with metal cork
86. Glass milk bottle (250ml)
87. Dipper
88. Milkotester
89. Milk analyzer

7. Models/Charts/Photographs of

1. Livestock breeds
2. Different milch breeds of cattle/ buffalo/sheep/goat
3. Body systems
4. Laminated photographs of livestock breeds
5. Charts of body systems
6. External body parts of cattle/buffalo/sheep/goat/poultry
7. Structure of egg.
8. Udder
9. Alveolar system
10. H.T.S.T. pasteurizer
11. Milko-tester
12. Milk analyzer
13. Milk tankers/storage tanks
14. Housing system for dairy animals
15. Straight through can washer
16. Homogenizer
17. Boiler

8. Computer.

9. Drug museum of commonly used drugs in animal treatment.

10. Museum of commonly used feedstuffs in livestock production.

NOTE: All other essential equipments / material /glass-wares

Chemicals & Consumables

Sr. No.	Name of item	Sr. No.	Name of item
1	Cow milk	34	Sugar
2	Buffalo milk	35	Furfural solution (2%)
3	Bromothymol blue 2.0 %	36	Cream
4	Sodium hydroxide	37	Table butter
5	Sodium lauryl sulphate	38	Deshi butter
6	Tatooing ink	39	Butter milk
7	Spirit	40	Starter culture
8	Cotton	41	Lactic acid
9	Aluminium tags	42	Citric acid
10	Disinfectants	43	Baking powder
11	Coal	44	Maida
12	Mustard oil	45	Ghee
13	Zinc oxide	46	Ice
14	Branding ink	47	Resorcinol
15	Alcohol	48	Sodium hypochloride
16	Iodine	49	Phenol solution
17	Custard apple	50	Trichloro-acetic acid (TCA 24% sol.)
18	Anjeer	51	Buffer (Sodium acetate) sol.
19	Basmati rice	52	Starch
20	Washing soda	53	Urea
21	Caustic soda	54	Formaldehyde
22	Liquid soap	55	Filter paper (Whatman No. 42 & 1)
23	Bleaching powder	56	Skim milk powder
24	Conc. Sulphuric acid	57	Whole milk powder
25	Conc. Hydrochloric acid	58	Cereal flour
26	Ethyl alcohol (68 % w/w & 75 % w/v)	59	Ferrous chloride
27	Ethenol (96 %)	60	Conc. Nitric acid
28	Ethyl alcohol (95 % sol.)	61	Liq. Ammonia
29	Gerber amyl alcohol	62	Turmeric paper
30	P.P. indicator (0.5 % sol.)	63	Litmus paper
31	Methylene blue thiocynate tablets	64	Chocolate powder
32	Salt	65	Antioxidants
33	Potassium hydroxide	66	Vanaspati oil

NOTE: All other essential equipments / material /glass-wares

Chemicals & Consumables

Sr. No.	Name of item	Sr. No.	Name of item
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9	Aluminium tags	42	Citric acid
10	Disinfectants	43	Baking powder
11	Coal	44	Maida
12	Mustard oil	45	Ghee
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29	Gerber amyl alcohol	62	Turmeric paper
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31	Methylene blue thiocynate tablets	64	Chocolate powder
32	Salt	65	Antioxidants
33	Potassium hydroxide	66	Vanaspati oil

Sr. No.	Name of item	Sr. No.	Name of item
67	Dalda	83	Resazurin
68	Rosalic acid	84	Kesar
69	Sodium carbonate	85	Mother starter culture ampule
70	Sodium bicarbonate	86	Coconut
71	Disodium p-Nitro-phenyl phosphate	87	Glucose
72	Boric acid	88	Calcium hydroxide
73	Bacteriological slides of different micro-organisms	89	Chlorine
74	Stabilizer	90	Acinol (Teepol)
75	Emulsifier	91	Sodium sulphate
76	Food colours	92	Sodium metasilicate
77	Different fruits	93	Tri-sodium phosphate
78	Essences	94	Silver nitrate
79	Anatto colour	95	Potassium chromate
80	Nuts (Cardamum,pista, cashew nut, almond etc.)	96	Paraphenylenediamine 2 %
81	Sodium alginate	97	Potassium oxalate
82	Methylene blue stain		

NOTE: All other essential chemicals & consumables