AGRONOMY

Course No. : AGRO-111

Course Title : PRINCIPLES OF AGRONOMY

Course Credit : 1+1=2

Theory :

Meaning and scope of Agronomy, Relationship with other sciences, Role of Agronomist National and international agricultural research institutes and SAU's in India, agricultural research stations/centres in Maharashtra. Agroclimatic zones of India and Maharashtra. Soil – Definition, classification, properties, factors affecting soil properties, soil fertility and productivity. Tillage and tilth – Definition, objectives, types of tillage, implements used, modern concepts of tillage, tilth and characteristics of ideal tilth. Classification of crops. Seeds and sowing – quality of seed, seed testing, seed multiplication, seed treatment, sowing methods, crop stand establishment, planting geometry and its effect on growth and yield – sole, paired and skipped row planting. Manures and fertilizers – Plant nutrients and their role in crop production, classification of manures and fertilizers and green manuring. Weed – Definition, characteristics, merits and demerits. Cropping systems – Definition, types, advantages and disadvantages, precision, farming. Harvesting – Signs of maturity, methods of harvesting.

Practical:

Study of tillage implements; Practice of ploughing; Practice of puddling; Study of seeding equipments and introduction of remote sensing. Different methods of sowing; Study of manures, fertilizers and green manure crops / seeds (including calculations); Study of intercultivation implements and practice; Practice of methods of fertilizer applications; Participation in ongoing field operations.

Theory : Teaching Schedule

Lecture No.	Topic to be covered	Weightage
1	Agronomy, its definition, scope and relationship with other sciences, Role of Agronomist.	6
2	National and International Agricultural Research	4

	Institutes, State Agricultural universities in India, Research stations and centres in Maharashtra.	
3	Agro-climatic Zones of India and Maharashtra,	6
4 and 5	Soil, its definition, classification, soil properties, factors affecting soil fertility and productivity.	10
6	Tillage, its definition, objectives and types of tillage.	4
7	Factors affecting tillage, Tillage implements and tools, Effect of tillage on soil and crop growth	10
8	Tilth : its definition and characteristics, ideal tilth, Modern concepts of tillage.	6
9	Classification of crops	6
-	Mid term examination	
10	Crops stand establishment (sowing methods), seed quality, seed testing, Multiplication stages of seed	10
11	Seed treatment and its objectives.	4
12	Planting geometry: solid, paired and skipped row planting and its effect on growth and yield of crop	6
13	Importance of manures and fertilizers in crop production, Plant nutrients, their role in crop production, Classification of manures, fertilizers, and green manuring.	6
14	Methods and time of application of manures and fertilizers.	6
15	Weed – Definition, characteristics, merits and demerits.	4
16	Cropping systems, its definition, types, advantages and disadvantages.	6
17	Harvesting, signs of maturity of different crops and methods of harvesting.	6

Reference books :

1. Crop production and field experimentation by V.G. Vaidya, K.R. Sahastrabudhe and V.S. Khuspe. Continental Prakashan, Vijaynagar, Pune.
2. Hand book of Agriculture, ICAR Publication.

3. Modern techniques of raising field corps by Chidda Singh. Oxford and IBH Publishing Co. Ltd., Bangalore.
4. Principles of Agronomy by Sankaran S. and V.T. Subbiah Mudliyar, 1991. The Bangalore Printing and Publishing Co. Ltd., Bangalore.
5. Agronomy by S.C. Panda, 2006. Agribios Publication, New Delhi.
6. Crop Production and Management by Y.B. Moranchan. Oxford and IBH Publishing Co. Ltd., Bangalore.
7. Principles of Agronomy by S.R. Reddy, Kalyani Publishers, Ludhiana, India.
8. Principles of Crop Production by Martin J.H. and Leonard W.H. the Mac Million Company, New York – 1962.
9. Scientific Crop Production (Vol. I and II). Thakur C. Metropolitan Books Co. Pvt. Ltd., New Delhi.
10. Fundamentals of Agronomy. Gopal Chandra De. 1980. Oxford and IBH Publishing Co. Ltd., Bangalore.
11. Cropping Systems in the tropics – Principles and Practices by S.P. Palaniappan, Willey Eastern Ltd., New Delhi.

Practical :

Ex. No.	Name of the exercise
1	Introduction to Agronomy and acquaintance with College Agronomy Farm
2	Identification of seeds and crop plants at different growth stages.
3	Study of Primary Tillage implements and practice of ploughing
4	Importance of puddling in low land paddy cultivation, study of puddling implements and practice of puddling
5 and 6	Study of secondary tillage implements and working with them
7	Determination of purity and germination percentage of seed
8	Study of viability, dormancy and practice of seed treatments in different field crops
9	Study of different methods of sowing, seeding implements and working with them.
10	Calculation of Plant Population, Seed rate and fertilizer doses for different field crops

11	Identification and classification of different types of manures and fertilizers
12	Study of different methods of manures and fertilizer application and their application practice in important field crops
13	Study of different Intercultural Implements and working with them
14	Preparation of FYM and compost
15	Preparation of vermicompost, green manuring
16	Identification of different weeds
17	Participation in ongoing field operations and actual working in the field for raising field crops

Course No. : AGRO-112

Course Title : AGRICULTURAL METEOROLOGY

Course Credit : 1+1=2

Theory :

Agricultural meteorology, its importance in Agriculture Weather and climate, weather elements and factors affecting them. Earth's atmosphere, composition and structure of atmosphere. Solar radiation – nature, properties, depletion, factors affecting solar radiation, solar constant and energy balance. Atmospheric temperature – factors affecting temperature, importance of air temperature, horizontal and vertical distribution and variations in temperature and global warming. Soil temperature – importance of soil temperature, variation of soil temperature. Air pressure – Variations, isobars and pressure gradients. Wind – Types, classification, importance of wind in Agriculture, forces acting to produce wind, cyclones, anticyclones and general circulation system of earth. Atmospheric humidity – saturated and actual vapour pressure, specific and relative humidity, diurnal variation of humidity. Process of condensation, formation of dew, fog, frost, mist, snow, rain and hail. Cloud – types, formation and classification. Precipitation – hydrologic cycle, types of rain – thunder and hail storms, types of monsoon, agricultural seasons. Drought – its classification, strategy to mitigate drought. Microclimate Weather forecasting – Basics, types and importance of weather forecasting. Remote sensing and introduction to crop modeling.

Practical :

Site selection for Agromet observatory; Measurement of temperature; Measurement of rainfall; Measurement of evaporation (atmospheric/soil); Measurement of atmospheric pressure; Measurement of sunshine duration and solar radiation; Measurement of wind direction and speed and relative humidity; Study of weather forecasting and synoptic charts, measurement of dew.

Theory : Teaching Schedule

Lecture No.	Topic to be covered	Weightage (%)
1	Definition of Meteorology, Agricultural Meteorology, its importance, scope in general and agriculture in particular.	4
2 and 3	Concept of weather and climate, difference between weather and climate, weather elements and factors affecting them.	10
4	Earth's atmosphere, composition and structure of atmosphere.	6
5 and 6	Solar radiation, nature (direct, diffuse) its significance, factors affecting solar radiation, solar constant and energy balance	10
7 and 8	Atmospheric temperature, factors affecting temperature, importance of air temperature, horizontal and vertical temperature distribution, temperature variation, DALR, SALR, temperature inversion, stability and instability of air, heating of atmosphere, global warming	10
9	Soil temperature, importance of soil temperature, variation of soil temperature	6
	Mid Term Examination	
10	Air pressure, variation with height, isobars and pressure gradients	4
11	Wind-scale, importance of wind in agriculture, its classification, forces acting to produce wind, cyclone and anticyclones, general circulation system of earth	10
12	Atmospheric humidity, saturated and actual vapour	10

	pressure, specific and relative humidity, diurnal variation of humidity	
13	Process of condensation, formation of fog, dew, frost, mist, snow, rain and hail.	6
14	Cloud, its types, classification. Precipitation, its process and forms. Hydrological cycle.	6
15	Types of rains, thunder and hail storms, introduction to monsoon, its types. Agricultural seasons.	4
16	Drought its classification, strategy to mitigate drought. Microclimate	4
17	Basics of weather forecasting, types, importance of weather forecasting, remote sensing and introduction to crop modeling.	10

Reference Books :

1. Atmosphere, weather and climate – Barry R.G. and Charley R.J. The English Language Book Society and Mathuen and Co. Ltd., Sultolk.
2. Contemporary climatology – Handarson Sellers A. and Robinson P.J. Longman Scientific and Technical, England.
3. Introduction to Agrometeorology – H.S. Mavi, Oxford and IBH Publishing Co., New Delhi.
4. Meteorology – S.R. Ghadekar
5. Agricultural Climatology – J.R. Kakade
6. Our atmosphere by – Smita Bhutani
7. Climate, weather and crops in India – D. Lenka

Practical

Ex. No.	Name of the exercise
1	Study of Agro-meteorological observatory, its types, selection of site and plan of layout and visit to Agro-meteorological observatory.
2 and 3	Study of meteorological instruments and methods of recording observations.
4	Measurement of Air temperature.
5	Measurement of soil temperature.

6 and 7	Measurement of rainfall with the help of different rainguages.
8	Measurement of wind velocity with the help of cup anemometer and study of wind vane.
9	Measurement of evaporation by USWB Class A open pan evaporimeter.
10	Measurement of evapotranspiration by Lysimeter.
11	Measurement of Bright Sunshine hours by Campbell stokes sunshine recorder
12	Measurement of solar radiation
13	Measurement of atmospheric pressure..
14	Measurement of relative humidity with the help of Assmans Psychrometer
15	Measurement of dew.
16	Preparation of synoptic charts.
17	Study of automatic weather station.

Course No. : AGRO – 113

Course Title : INTRODUCTORY AGRICULTURE (ANCIENT HERITAGE, AGRICULTURE SCENARIO AND GENDER EQUITY IN AGRICULTURE)

Course Credit : 1+0=1

Theory :

Art, Science and business of crop production, Basic elements of crop production; Factors affecting crop production; History of Agricultural Development; Ancient India Agriculture in Civilization Era, Chronological Agricultural Technology development in India. Indian Agriculture, balance sheet, liabilities; Assets and Contrasting trends (DATA), Agril. growth, contrasting food chains, Diversity in physiography, Soil groups, marine, livestock and water; Liabilities: Soil factors, weather factors, Economic ecology, dry and irrigated agriculture, Farming Systems approach, value addition, requirements in new technology; Women in Agriculture: multifaceted roles and tasks, work stress factors, Nutritional and rural life standards, role in house hold design making, drudgery reduction for farm women, women friendly agricultural technology; Empowerment of women; Group dynamics for farm women, rural women; The nucleus of Agricultural Extension and Training.

Theory : Teaching Schedule

Lecture No	Topic to be covered	Weightage (%)
1 and 2	Agriculture Definition, Art, science and business of crop production. Scope of agriculture in India and Maharashtra.	8
3 and 4	Basic elements of crop production and factors affecting it.	6
5 and 6	History of Agricultural Development, Ancient India, Agriculture in civilization Era, Chronological Agricultural Technology development in India.	8
7	Indian Agriculture, balance sheet, liabilities, Assets and contrasting trends (DATA) Agricultural growth, Contrasting food chains.	8
8 and 9	Diversity in physiography : Soil groups, marine, livestock and water, liabilities soil factors, weather factors	12

	and Economic Ecology.	
	Mid term examination	
10	Dry and irrigated Agriculture, Farming System Approach	6
11	Value addition in field crops, requirements in new technology	10
12	Women in Agriculture: multifaceted roles and tasks, work stress factors, nutritional and rural life standards.	10
13 and 14	Role of women in household design making, drudgery reduction for farm women, women friendly agricultural technology.	12
15	Empowerment of women, group dynamics for farm women, rural women.	12
16 and 17	The nucleus of Agricultural Extension and Training.	8

Reference Books :

1) Principles of Agronomy : S. R. Reddy, Kalyani Publishers, Ludhiana, New Delhi, India.
2) Crop production and management : Y.B. Morachan
3) Agricultural development today and tomorrow Vol. I : Arun Kumar.
4) Agriculture Finance : Subba Reddy and Raghu Ram.
5) Women in Agriculture : Ranjit Kumar Samanta
6) Principles of Agronomy : Sankaran S. and V. T. Subbiah Mudliyar.
7) Hand Book of Agriculture ICAR, Publication, 2006.

Course No. : AGRO-124

Course Title : WATER MANAGEMENT INCLUDING MICRO IRRIGATION

Course Credit : 2+1=3

Theory :

Irrigation: Definition and objectives Water resources and irrigation development in India and Maharashtra Soil water relationships – physical properties of soil, volume mass relationship, classification of soil water, soil

moisture constants, water availability, forces acting on water movement and retention. Plant water relationship – Role of water in plant, plant structure, water absorption, factors affecting absorption and transpiration, rooting characteristics, moisture extraction pattern of crop, soil water plant atmospheric continuum (SPAC) relationship. Methods of soil moisture estimation Evapotranspiration– Evaporation, transpiration, evapotranspiration, factors influencing ET. Crop water requirement – water requirement, irrigation requirement, methods of estimation of water requirement and factors affecting water requirement. Effective rainfall – Definition, methods for estimation, factors affecting effective rainfall. Scheduling of irrigation – Approaches of irrigation scheduling, frequency and depth of irrigation, measurement of irrigation water. Methods of irrigation – Surface, surge, subsurface, sprinkler, raingun, micro-irrigation (Drip and micro-sprinkler) – components, merits and demerits. Fertigation – definition and advantages. Irrigation efficiency – concepts and estimation. Water use efficiency and measures to improve it. Conjunctive use of water Irrigation water quality and its management – water quality parameters, management strategies for utilization of poor quality water. Water management of different crops – cereals, oilseeds, pulses, commercial, vegetable and fruit crops. Agricultural drainage – definition, causes of water logging, effects of bad drainage on soil and crop, types, measures to improve bad drainage.

Practical:

Determination of bulk density by field method; Determination of soil moisture content by gravimetric method, tensiometer, electrical resistance block and neutron moisture meter; Determination of field capacity by field method; Determination of permanent wilting point; Measurement of irrigation water through flumes and weirs; Calculation of irrigation water requirement (Problems); Determination of infiltration rate; Demonstration of furrow method of irrigation; Demonstration of check basin and basin method of irrigation; Visit to farmers field and cost estimation of drip irrigation system; Demonstration of filter cleaning, fertigation, injection and flushing of laterals; Erection and operation of sprinkler irrigation system; Measurement of emitter discharge rate, wetted diameter and calculation of emitter discharge variability; Determination of EC, pH, carbonates, biocarbonates, Ca++ and Mg++ in irrigation water (quality parameters)

Theory : Teaching Schedule

Lecture No	Topic to be covered	Weightage (%)
1	Definition, objectives of Irrigation and water management.	4
2	Water resources of India & M.S., Irrigation development in India and Maharashtra.	5
3-6	Soil - Water Relationship Physical Properties of Soil, Volume Mass relationship, Classification of Soil water, Soil moisture constants, Water availability, Forces acting on water movement and retention.	10
	Plant - Water relationship Role of water in plant, Plant structure, Water absorption, Factor affecting absorption and transpiration, Rooting characteristics, Moisture extraction pattern of crop, SPAC relationship	10
7 and 8	Methods of Soil Moisture Estimation- Laboratory and field methods.	5
9 and 10	Evaporation, transpiration, Evapo-transpiration, factor influencing ET.	5
11 and 12	Water requirement, Irrigation requirement, methods for estimation of WR and factors affecting WR	6
13 and 14	Definition of effective rainfall methods of estimation, factor affecting ER.	3
15 and 16	Approaches of irrigation scheduling, frequency and depth of irrigation, measurement of irrigation water	5
17-18	Methods of irrigation – Surface, Surge, subsurface, Sprinkler, Raingun sprinkler	6
-	Mid term examination	
19 to 22	Micro irrigation and its type, Drip irrigation- components and its merits and demerits, Fertigation-Definition and Advantages	6
23 and 24	Irrigation efficiencies concepts and estimation, water use efficiency and measures to improve WUE, conjunctive use of water	10
25 and 26	Water quality parameters, management strategies for utilization of poor quality water	6

27 to 30	Water Management of Cereals, Oilseeds, Pulses, Commercial crops, Vegetable and fruit crops.	8
30 to 32	Definition of Drainage, Causes of water logging, effects of bad drainage	6
33 to 34	Types of drainage, bio-drainage, effect of Drainage on soil improvement and crop growth	5

Reference books :

1. Efficient use of irrigation water by - G. H. Sankara Reddi and T. Reddy, Kalyani Publishers, Ludhiana, India
2. Irrigation Water Management Principles and practices by - Dilip Kumar Majumdar.
3 Irrigation Theory and Practice by - A. M. Michael, Vikas Publishing House, New Delhi.
4 Irrigation and Drainage by D. Lenka, Kalyani Publishers, Ludhiana, India.
5 Manual on irrigation agronomy – Misra R.D. and M. Ahmed, Oxford and IBH Publishing Co., New Delhi.
6 Drip irrigation by Prof. R.K. Shivanappan, C. Padma and V. Kumar.

Practical

Ex. No.	Name of the exercise
1	Determination of Bulk Density by Core sampler method
2	Determination of Soil moisture content by different methods
3	Determination of field capacity by field method
4	Determination of permanent wilting point by sunflower pot method
5	Measurement of irrigation water flow using different devices
6	Determination of irrigation water requirement
7	Determination of infiltration rate of soil by Double ring infiltro meter method
8	Study of different methods of irrigation
9	Study of drip irrigation system and their components
10	Study of drip system, fertigation, cleaning and flushing
11	Study of Sprinkler irrigation systems and their components
12	Study of erection and operation of sprinkler irrigation system
13	Measurement of discharge rate, wetted diameter and emission uniformity of

	drip and uniformity coefficient of sprinkler system
14	Determination of Electrical Conductivity and pH of irrigation water
15	Determination of carbonates, bicarbonates, irrigation water
16	Determination of Ca^{++} and Mg^{++} in irrigation water
17	Visit to farmer's field and evaluation of cost estimation of Drip irrigation System

Course No. : AGRO-235

Course Title : FIELD CROPS-I (*KHARIF* CROPS)

Course Credit : 2+1=3

Theory :

Origin, geographic distribution, economic importance, soil and climatic requirement**,** varieties, cultural practices and yield of *kharif* crops.

Cereals : Rice, maize, *kharif* sorghum, pearl millet and minor millets

Pulses : Pigeonpea, mungbean, uridbean, horsegram, mothbean, cowpea

Oilseeds : Groundnut, sesame, soybean, castor and niger;

Fibre crops : Cotton, jute, sunhemp and dhaincha

Forage crops : Sorghum, pearlmillet, maize, cowpea, cluster bean, rainfed and irrigated grasses

Practical :

Rice nursery preparation and transplanting/seed bed preparation and sowing of *Kharif* crops; Calculations of seed rate; Sowing of soybean, pigeonpea, mungbean, maize, groundnut, and cotton; Effect of seed size on germination and seedling vigour of soybean/groundnut; Effect of sowing depth on germination of soybean; Identification of weeds in rice, maize and soybean fields and study of weed control experiments in these crops; Top dressing of nitrogen in maize and rice and study of fertilizer experiments on rice, maize, sorghum and millets; Study of yield contributing characters, yield calculations, harvesting and yield estimation of above crops; Study of crop varieties and important agronomic experiments; Study of forage experiments.

Theory : Teaching Schedule

Lecture No.	Topic to be covered	Weightage (%)

1 to 7	Cereals – Rice, maize, *kharif*, sorghum, pearlmillet and minor millets	25
8 to 13	Pulses – Pigeonpea, mungbean, urdbean, horsegram, mothbean, cowpea	20
14 to 20	Oilseeds – Groundnut, sesame, soybean, castor, niger	20
21 to 25	Fibre crops – cotton, jute, sunhemp, dhaincha	15
26 to 34	Forage crops – Sorghum, pearlmillet, maize, cowpea, cluser bean, rainfed and irrigated grasses	20

Above crops should be covered with botanical name, common name, geographical distribution, origin, family, economic importance, botanical description, soil and climate, seeds and sowing, varieties, manures and fertilizers, water management, weed management, Interculturing operations, crop rotation, pests and diseases, signs of maturity, harvesting, threshing and yield.

Reference Books :

1. Hand Book of Agriculture, ICAR Publication, 2006.
2. Field Crops : Rajendra Prasad.
3. Modern technique of raising field crops- Chhidda Singh.
4. Theory and Digest Agronomy – S.S. Cheema, B.K. Dhaliwal and T.S. Sahota
5. Farm Productivity New Century New Challenges : M.M. Hosmani, B.M. Chittarpur and H.B. Babalad.
6. Crop production and field experimentation : V.G. Vaidya, K.R. Sahasrabuddhe and V.S. Khupse, Continental Prakashan, Pune.

Practical :

Ex. No.	Name of the practical
1.	Identification of seeds and plants of important *kharif* crops
2.	Preparation of seedbed and irrigation layouts for important *kharif* crops
3.	Study of different seed treatments for *kharif* crops
4.	Rice nursery preparation and transplanting.

5.	Sowing of important *kharif* crops and calculations of seed rate.
6.	Study of effect of sowing depth on germination of soybean.
7.	Study of effect of sowing depth on germination of groundnut.
8.	Study of important growth stages and recording growth observations of *kharif* crops.
9.	Thinning and gap filling of *kharif* crops.
10.	Methods of fertilizer application for *kharif* crops.
11.	Interculturing and weed management of *kharif* crops.
12.	Scheduling of irrigation at critical growth stages of *kharif* crops.
13.	Study of yield contributing characters and yield calculations and cost of cultivation.
14.	Study of calculating fertilizer requirement, herbicidal dose for *kharif* crops
15.	Signs of maturity, harvesting and threshing methods of different *kharif* crops.
16.	Preparation of calendar of operations of different *kharif* crops.
17.	Visit to important agronomic experiments and Research station related to *kharif* crops

Course No. : AGRO-236

Course Title : PRACTICAL CROP PRODUCTION I (*KHARIF* CROPS)

Course Credit : 0+1=1

Crop planning, raising field crops in multiple cropping systems: Field preparation, seed treatment, nursery raising, sowing, nutrient management, water management, weed management and management of insect pests and diseases of crops harvesting, threshing, drying, winnowing, storage and marketing of produce. Preparation of balance sheet including cost of cultivation, net returns per student as well as per team of a group of students.

Practical :

Ex. No.	Title of the exercise
1.	Introduction, aims and objectives of practical crop production – I allotment of plot and its history.
2.	Study of physical and chemical properties of the allotted plot to the students.
3.	Study of package of practices for growing soybean crop (timely, late and rainfed).
4.	Preparation of calendar of operation for soybean.
5.	Study of preparatory, secondary tillage and seed bed preparation for soybean.
6.	Sowing and seed treatment of soybean.
7.	Study of nutrient management of soybean.
8.	Study of water management to soybean.
9.	Determination of germination/emergence count of soybean.
10.	Study of growth and yield contributing characters of soybean.
11.	Study of interculturing and weed management in soybean.
12.	Study of insect pest and diseases management in soybean
13.	Study of crop maturity signs, harvesting
14	Threshing, drying, winnowing, storage and preparation of produce for marketing of soybean.
15	Study of cost of cultivation and working out net returns per student
16	Summary report of Practical Crop Production
17	Study of weekly weather record for *kharif* season.

Note :

To get practical oriented knowledge to the student, 2 R area per student will be allotted for raising *kharif* crop of the region. The student has to raise the crop from sowing to harvesting threshing, drying, winnowing, storage and preparation of produce for marketing. Also he has to study the cost of cultivation, net return per student as well as per team of a group of students.

Course No. : AGRO-247

Course Title : FIELD CROPS- II (*RABI* CROPS)

Course Credit : 2+1=3

Theory :

Origin, geographical distribution, economic importance, soil and climatic requirements, varieties, cultural practices and yield of *rabi* crops

Cereals : wheat, barley, *Rabi* sorghum

Pulses : chickpea, lentil, peas, French bean

Oilseeds : safflower, sunflower, linseed, rapeseed and mustard

Sugar crops : sugarcane and sugarbeet

Medicinal and aromatic crops : mentha, lemon grass, citronella, palma rosa, isabgol and posta

Commercial crops : potato and tobacco

Forage crops : maize, berseem, lucerne and oat.

Practical :

Seed bed preparation and sowing of wheat, sugarcane and sunflower; Calculations on seed rate; Top dressing of nitrogen in wheat and study of fertilizer experiments on wheat and mustard; Identification of weeds in wheat and grain legumes, application of herbicide and study of weed control experiments; Morphological characteristics of wheat, sugarcane, chickpea and mustard; Yield contributing characters of wheat; Yield and quality analysis of sugarcane; Crop distribution in the state and the region; Important agronomic experiments of rabi crops and visit to research stations related to rabi crops.

Theory :

(Teaching Schedule)

Lecture No.	Topic to be covered	Weightage (%)
1 to 5	Cereals – Wheat, *rabi* sorghum, barley	20
6 to 10	Pulses – Chickpea, lentil, pea, French bean	15
11 to 16	Oilseeds – Sunflower, safflower, rapeseed and mustard, linseed	20
17 to 20	Sugarcrops – Sugarcane, sugarbeet	10
21 to 27	Medicinal and aromatic crops – Mentha, Lemon grass, citronella, palma rosa, Isabgol, posta	10
28 to 30	Commercial crops – Potato, tobacco	10
31 to 34	Forage crops – Lucerne, berseem, maize, oat	15

Above crops should be covered with botanical name, common name, geographical distribution, origin, family, economic importance, botanical description, soil and climate, seeds and sowing, varieties, manures and fertilizers, water management, weed management, interculturing operations, crop rotation, pests and diseases, signs of maturity, harvesting, threshing and yield.

Reference Books :

1. Hand Book of Agriculture, ICAR Publication, 2006.
2. Field Crops: Rajendra Prasad.
3. Modern technique of raising field crops- Chhidda Singh.
4. Medicinal plants: S.K. Jain
5. Theory and Digest Agronomy: S.S. Cheema, B.K. Dhaliwal and T.S. Sahota
6. Farm Productivity New Century, New Challenges: M.M. Hosmani, B.M. Chittapur and H.B. Babalad.
7. Crop Production and Field Experimentation: V.G. Vaidya, K.R. Sahasrabuddhe and V.S. Khuspe, Continental Prakashan, Pune.
8. Text book of field crop Production 2004, ICAR, New Delhi.

Practical :

Ex. No.	Title of the Exercise
1.	Identification of seeds and plants of important *rabi* crop
2.	Preparation of seedbed and irrigation layouts for important *rabi* crops
3.	Study of the different seed treatments for *rabi* crops.
4.	Sowing of important *rabi* crops and calculation of seed rate of *rabi* crops.
5.	Sowing of forage crops
6.	Study of important growth stages and recording of growth observations of *rabi* crops.
7.	Thinning and gap filling in *rabi* crops.
8.	Fertilizer application to *rabi* crops and calculation of fertilizer requirement of *rabi* crops
9.	Interculturing and weed management in *rabi* crops.
10.	Study of morphological characters of wheat, sugarcane, chickpea and mustard.
11.	Scheduling of irrigation at critical growth stages for *rabi* crops.
12.	Study of yield and quality aspect of important *rabi* crops and yield contributing characters of wheat.
13.	Study of signs of maturity, harvesting
14	Threshing and winnowing of *rabi* crops.
15	Harvesting and preparation of *jaggery* from sugarcane.
16	Study of cost of cultivation of *rabi* crops
17	Preparation of calendar of operations for important *rabi* crops.
18	Visit to important agronomic experiments and research station related to *rabi* crops

Course No. : AGRO-248

Course Title : CROP PRODUCTION II (*RABI* CROPS)

Course Credit : 0+1=1

Theory :

Crop planning, raising field crops in multiple cropping systems: Field preparation, seed treatment, nursery raising, sowing, nutrient management,

water management, weed management and management of insect-pests and diseases of crops harvesting, threshing, drying, winnowing, storage and marketing of produce. Preparation of balance sheet including cost of cultivation, net returns per student as well as per team of a group of students.

Practical :

Ex. No.	Title of the Exercise
1.	Introduction, aims and objectives of practical crop production – II, allotment of plot and its history.
2.	Study of physical and chemical properties of the allotted plot to the students.
3.	Study of package of practices for growing Wheat crop (timely, late and rainfed).
4.	Preparation of calendar of operation for Wheat.
5.	Study of preparatory, secondary tillage and seed bed preparation for Wheat.
6.	Sowing and seed treatment of Wheat.
7.	Study of nutrient management of Wheat.
8.	Study of water management to Wheat.
9.	Determination of germination/emergence count of Wheat.
10.	Study of growth and yield contributing attributes in Wheat .
11.	Study of interculturing and weed management in Wheat.
12.	Study of insect pest and diseases management in Wheat
13.	Study of crop maturity signs, harvesting
14	Threshing, drying, winnowing, storage and preparation of produce for marketing of Wheat.
15	Study of cost of cultivation and working out net returns per students
16	Summery report of Practical Crop Production – II
17	Study of weekly weather record for *Rabi* season.

Note :

To get practical oriented knowledge to the student, 2 R area per student will be allotted for raising *rabi* crop of the region. The students has to raise the crop from sowing to harvesting threshing, drying, winnowing, storage and preparation of produce for marketing. Also he has to study the cost of cultivation, net return per student as well as per team of a group of students.

Course No. : AGRO-359

Course Title : WEED MANAGEMENT

Course Credit : 1+1=2

Theory :

Weeds : Introduction, harmful and beneficial effects, classification, propagation and dissemination, Weed biology and ecology, crop weed association, crop weed competition and allelopathy. Concept of weed prevention, control and eradication, Methods of weed control : Physical, cultural, chemical and biological methods. Integrated weed management

Herbicides : Definition, advantages and limitation of herbicide usage in India

Herbicide : Classification, formulations, methods of application

Introduction Adjuvants : their use in herbicides.

Mode of action of herbicide : Translocation and absorption, persistence and fate of herbicides.

Introduction to selectivity of herbicides, Compatibility of herbicides with other agro chemicals.

Weed management in major field and horticultural crops

Shift of weed flora in cropping systems : Aquatic, parasitic and problematic weeds and their control.

Practical:

Identification of weeds; Survey of weeds in crop fields and other habitats; Preparation of herbarium of weeds; Calculations on weed control efficiency and weed index; Herbicide label information; Computation of herbicide doses; Study of herbicide application equipments and calibration; Demonstration of methods of herbicide application; Preparation of list of commonly available herbicides; Study of phytotoxicity symptoms of herbicides in different crops; Biology of nut sedge, bermuda grass, parthenium and celosia; Economics of weed control practices; Tours and visits of problematic weed areas.

Reference books :

1. Weed Science Principles : R. Jayakumar and R. Jagannathan (2002).
2. Weed management – Principles and Practices : Gupta O.P. (2000), Agribios, India Publication..
3. Principles of Weed Science : Rao V.S. (2000), Oxford and IBH Publishing Co., New Delhi, India.

4. Principles in Weed management : Aldrich, R.J. and Kramer R.J. (1997), Panama Publishing Corporation, New Delhi, India.
5. Weed, weedicides and weed control: Principles and Practices – Mandal R.C. (1999).
6. Modern weed control – Crafts A.S. 1975. University of California Press, California, USA.
7. Scientific Weed management – Gupta, O.P. 1984. Today and Tomorrow Publishers, New Delhi.
8. All about weed control. Subramanian S., Mohammed Ali and Jayakumar R. 1991. Kalyani Publishers, Ludhiana, India.
9. Modern weed Management. Gupta O.P. (2008) Agribios, India.

Theory: Teaching Schedule

Week No.	Lecture No.	Topic to be covered	Weightage
1	1	Weeds - introduction, harmful and beneficial effects of weeds.	4
2 and 3	2 and 3	Propogation and dissemination	8
4 and 5	4 and 5	Weed biology and ecology, crop weed association	6
6	6	Crop weed competition and allelopathy, Factors affecting crop weed competition.	10
7	7	Concept of weed prevention, control and eradication	8
8 and 9	8 and 9	Weed control methods- Physical(mechanical)-Cultural-Chemical and Biological methods.	8
10	-	Mid term examination	
11	10	Chemical method of weed control in field and horticultural crops	6
12	11	Integrated weed management in important field crops.	6
13	12	Herbicides, advantages and disadvantages and limitations in herbicide usage in India	6

14	13	Classification of herbicides, their properties and formulation	8
15	14	Methods of herbicide application	6
16	15	Absorption and translocation of herbicides and factors affecting it.	6
17	16	Introduction to selectivity, mode of action and persistence of herbicides, Introduction to adjuvants.	8
18	17	Compatibility of herbicides with other agrochemicals and shift of weed flora in cropping systems, Control of aquatic, parasitic and problematic weeds	10

Practical :

Ex. No.	Name of the exercise
1 and 2	Identification of weeds
3 and 4	Survey of weeds in crop fields and other habitats
5 and 6	Collection of weeds and preparation of weed herbarium
7	Calculations of weed control efficiency and weed index
8	Herbicide label information and computation of herbicide doses
9 and 10	Study of herbicide application equipments and calibration
11	Demonstration on methods of herbicide application
12	Preparation of list of commonly available herbicides
13	Study of phytotoxicity symptoms of herbicides in different crops
14	Biology of Nut sedge and Bermuda grass
15	Biology of Parthenium and Celosia
16	Economics of weed control practices
17	Tours and visits to problematic weed areas

Course No. : AGRO-3610

Course Title : FARMING SYSTEMS AND SUSTAINABLE AGRICULTURE

Course Credit : 1+1=2

Theory

Farming systems – Definition, scope, classification and components. Integrated farming system (IFS), models for irrigated and rainfed situation. Cropping systems – indices for evaluation of cropping systems. Organic farming – Definition, principles and components. Sustainable agriculture - Introduction, definition, goal and current concepts. Factors affecting ecological balance and ameliorative measures Land degradation and conservation of natural resources – low external input agriculture (LEIA) and high external input agriculture (HEIA). Irrigation problems Waste lands and their development.

Practical:

Preparation of cropping scheme for irrigated situations; Preparation of cropping scheme for dryads situations; Study of existing farming systems in nearby villages; Preparation of integrated farming system model for wetlands; Preparation of integrated farming system model for drylands; Preparation of enriched Farm Yard Manure; Preparation of Vermicompost; Visit to urban waste recycling unit; Study of profitable utilization of agricultural wastes; Visit to poultry and dairy units to study resource allocation, utilization and economics; Visit to an organic farm to study various components and utilization; Study of degraded lands.

Theory : Teaching Schedule

Lecture No.	Topic to be covered	Weightage (%)
1-2	Farming systems – Definition, scope, classification and components.	8
3-4	Integrated farming system (IFS) models for irrigated and rainfed situation.	12
5-6	Cropping systems – types, advantages and disadvantages, indices for evaluation of cropping systems	12
7	Organic farming – Definition, principles and components	16

8	Sustainable agriculture – Introduction, goal and current concepts, scenario	6
9	Factors affecting ecological balance and ameliorative measures for maintaining sustainability	6
	Mid-term examination	
10-11	Land degradation and conservation of natural resources, management practices to prevent environmental deteriorations (soil, water, plant, diseases, weeds, nutrients, etc.)	6
12	Impact of LEIA (Low External Input Agriculture) and HEIA (High External Input Agriculture) on crop productivity	6
13	Low cost technology and non-monetary inputs.	8
14	Irrigation problems : Excess and insufficiency of water supply, poor quality water, sewage water	10
15	Reclamation of wasteland	4
16-17	Problematic soils (nutrient deficiency, problematic weeds) and their development	6

Reference books :

1. Cropping systems - Theory and practice. Chatterjee B.N. and Maiti S. 1984. Oxford and IBH Publishing Co., Calcutta, India.
2. Cropping systems in tropics – Principles and practices – Palanniappan S.P. 1985. Willey Eastern Ltd., New Delhi.
3. Soil management and organic farming. Panda S.G. 2006. AGROBIOS, New Delhi.
4. Organic Farming – Dahama O.P.
5. Organic Farming in India, Problems and Prospects, Thapa U. and Tripathi P. 2006.
6. Organic Farming – theory and practice, Palanippan S.P. and Anandurai K. 1999. Scientific Publishers, Jodhpur.
7. Organic Farming. Lampin, N. 1990. Farming Press Books, Ipswitch, U.K.

Practical :

Ex. No.	Name of the exercise
1	Study of cropping scheme
2	Preparation of cropping scheme for irrigated situations
3	Preparation of cropping scheme for dry land situations
4 and 5	Study of existing farming systems in nearby villages
6	Preparation of integrated farming system model for wetlands
7	Preparation of integrated farming system model for irrigated lands/garden lands (Commercial crops + Dairy + Biogas + Sericulture)
8	Preparation of integrated farming system model for dry lands (Rainfed crops + Sheep/Goat + Dryland Horticulture)
9 and 10	Study of enriched Organic Manures: Preparation of enriched FYM and vermicompost
11 and 12	Study of profitable utilization of agricultural wastes for sustainable agriculture (plant residues, biogas slurry, coir waste etc.)
13	Visit to urban waste recycling unit
14	Visit to poultry unit to study resource allocation, utilization and economics
15	Visit to dairy unit to study resource allocation, utilization and economics of
16	Visit to an organic farm to study the various components and its utilization
17	Study of degraded lands

Course No. : AGRO-3611

Course Title : ORGANIC AND RAINFED FARMING

Course Credit : 1+1=2

Theory :

Organic farming - Introduction, concept, relevance in present context, organic production requirements Biological intensive nutrient management - organic manures, vermicomposting, green manuring, recycling of organic residues, biofertilizers Soil improvement and ammendments Integrated diseases and pest management – use of biocontrol agents, biopesticides pheromones, trap crops, bird perches.

Weed management Quality considerations - certification, labeling and accreditation process, marketing, and export. Rainfed farming - meaning importance and problems, soil and climatic characteristics of rainfed areas; rainfall and its distribution and effectiveness Concept of watershed Technique of soil and water conservation, *in situ* moisture conservation, harvesting and recycling of runoff water. Management practices for rainfed crops. Drought management Crop diversification - cropping systems Crop substitution – sequence/intercropping and their importance in rainfed farming Contingency planning for aberrant weather situations, alternate land use systems. Improved agronomic practices for raising rainfed crops.

Practical:

Raising of vegetable crops organically through nutrient, diseases and pest management; vermicomposting; vegetable and ornamental nursery raising; macro quality analysis, grading, packaging, post harvest management, marketing of organically raised produce, visit to biocontrol lab, biofertilizer unit and vermicompost unit, Study of cropping systems, preparation of cropping scheme and estimation of cropping intensity under rainfed farming, use of mulches, crop residues and antitranspirant in rainfed farming, study of important package of practices for rainfed crop, study of fertilizer use in rainfed farming, conditions, levels and methods of fertilizer application, study of erosion permitting, erosion resisting crops and their effect on runoff and moisture conservation, Identification of critical growth stages of important field crops, crop planning according to land use capability classification, preparation of contingent crop plan for abrent weather situation, study of watershed project, visit to Dry farming research station.

Theory : Teaching schedule

Lecture No.	Topic details	Weightage (%)
1	Organic farming - Introduction, concept, advantages and disadvantages, relevance in present context, organic production requirements.	10
2	Biological intensive nutrient management	4
3	Organic manures: FYM, Compost, vermi composting, green	6

	manuring.	
4	Recycling of organic residue and biofertilizers	6
5	Soil improvement and amendments	6
6	Integrated weed, disease and pest management.	4
7	Use of bio-control agents, bio-pesticides, pheromones, trap crops, bird perches, weed management.	6
8	Quality consideration, certification, labeling and accreditation process, marketing and exports.	8
9	Meaning and importance of rainfed farming, problems, soil and climatic studies of rainfed farming, characteristics of rainfed areas Mid term examination	6
10	Rainfall, its distribution and its effectiveness in rainfed farming.	4
11	Concept of watershed management in rainfed farming.	6
12	Techniques of soil and water conservation in rainfed farming.	4
13	*In situ* moisture conservation, harvesting and recycling of runoff water.	6
14	Drought management. Use of antitranspirant in rainfed farming	4
15	Aberrant weather situation	4
16	Contingent crop planning for rainfed farming.	4
17	Crop substitution, sequential cropping, intercropping and its importance in rainfed farming.	6
18	Improved agronomic practices for raising rainfed crops.	6

Reference Books :

1. Trends in organic farming in India, 2006, Agrobios Publication
2. Organic farming for sustainable agriculture, 2005. A.K. Dahama Agrobios Publication, Jodhpur.
3. Handbook of Organic Farming, A.K. Sharma.
4. Organic Farming in India, Problems and Prospects, Thapa U. and Tripathi P. 2006.
5. Organic Farming – theory and practice, Palanippan S.P. and Anandurai K. 1999. Scientific Publishers, Jodhpur.

6. Sustainable Development of Dryland Agriculture in India. : R.P.Singh
7. Dry farming technology in India. : P.Rangaswamy
8. Dryland Resources and Technology, Vol. 8 L.L.Somani, K.W.Kausal
9. Physiological aspects of dryland farming. U.S. Gupta
10. Dry farming in India. N.V. Kanitkar, S.R. Sirur and Gokhale
11. Agronomy by S.C. Panda 2006. Agrobios Publication, New Delhi.

Practical :

Ex. No.	Name of the exercise
1	Raising of agronomic/vegetable crops organically
2	Preparation of FYM, compost and green manuring
3	Preparation of vermicompost
4	Pest and disease management in organically raised crops
5	Calculation of nutrient requirement for organically raised crops using different sources.
6	Grading, packaging, post harvest management and marketing of organically raised produce.
7	Visit to bio-control lab, biofertilizer unit and vermi compost unit.
8	Study of cropping systems, preparation of cropping scheme and estimation of cropping intensity under rainfed farming.
9	Use of mulches, crop residues and antitranspirant in rainfed farming.
10	Study of important package of practices for rainfed crops.
11	Study of fertilizer use in rainfed farming, conditions, levels and methods of fertilizer application.
12	Study of erosion permitting, erosion resisting crops and their effect on runoff and moisture conservation.
13	Identification of critical growth stages of important field crops.
14	Crop planning according to land use capability classification.
15	Preparation of contingent crop plan for aberrant weather situation.
16	Study of watershed project.
17	Visit to Dry Farming Research Station.

DEPARTMENT OF AGRICULTURAL BOTANY

Course No. : BOT – 111

Course Title : ENVIRONMENTAL SCIENCE

Course Credit : 1+1=2

Theory :

Scope and importance of environmental studies, Natural, resources: Renewable and nonrenewable resources, forest, water, food, energy and land resources, Ecosystems: Definition, concept, structure and functions, producers, consumers and decomposers of ecosystem, Energy flow in the ecosystem, Types of ecosystems, Bio-diversity: Definition, classification, Threats to biodiversity and its conservation, Environmental pollution: causes, effects and control of Air pollution, Water and soil pollution, Noise, thermal and marine pollution, Causes, effects and management of soil nuclear hazards and industrial wastes, Disaster management, flood, earthquakes, cyclones and land slides,
Social issues and the environmental, unsustainable to sustainable development, The Environment protection Act, the Air Act, the water Act, the wildlife protection Act and forest conservation Act., Woman and child welfare, HIV/AIDS and Role of information technology on environment and human health.

Practical :

Collection, processing and storage of effluent samples. Determination of Bio-chemical oxygen demand (BOD) in effluent sample. a) Determination of chemical oxygen demand (COD) in effluent sample. b) Estimation of dissolved oxygen in effluent samples. a) Determination of sound level by using sound level meter. b) Estimation of repairable and non-respirable dust in the air by using portable dust sampler. Determination of total dissolved solids (TDS) in effluent samples. Estimation of species abundance of plants. Estimation of nitrate contamination in ground water. Analysis of temporary and total hardness of water sample by titration. Estimation of pesticide contamination in agro ecosystem. Visit to Social service organization / Environmental education center. Crop adaptations to environmental variables, soil conditions. Visit to local polluted site, observations and remedial measures.

Book recommended :

1. Dhaliwal G. S. and Kler, D. S. (1995). Principles of Agricultural Ecology, Himalaya publishing Housing, Bombay.
2. Sharma P. D. (1993), Ecology and Environment, Rastogi publication, Meerut.
3. Mishra K. C. (1993). Manual on plant Ecology, Oxford and IBH Publishing Co. New Delhi.
4. Shuklal, R. S. and Chandel, P. S. (1983) Plant Ecology, S. Chand and Co. New Delhi.
5. Vasistha, P. C. (1978). A text book of Plant Ecology, Vishal Publications, Jullunder.
6. Weaver, J. E. and Clements, F. E. (1938). Plant Ecology, McGraw Hill Book Co. New Yourk, USA.
7. Odum, E. P. (1971). Fundamentals of Ecology, Toppan Co. Ltd. Tokyo.

Course No. : BOT – 122

Course Title : PRINCIPLES OF GENETICS

Course Credit : 2+1=3

Theory :

Introduction : Definition of genetics, history and role of genetics in Agriculture, Mendel's laws of inheritance : law of segregation, exceptions to the laws, Types of gene action, Multiple alleles, pleiotropism, penetrance and expressivity, Quantitative traits – multiple factor hypothesis, Differences between qualitative and quantitative traits, Cytoplasmic inheritance, Difference between cytoplasmic and chromosomal inheritance, Mutation and its characteristics, Methods of inducing mutations and CIB techniques, Gene expression and differential gene activation, Lac operon and fine structure of gene, Ultra structure of cell and cell organelles and their functions, Study of chromosome structure, morphology, types and number in following crops Cereals- Rice, Wheat, Triticale, Sorghum, Bajra, Maize, Nagali, Prosomillets, Foxtail millet, Kodomillet. Pulses : Pigeonpea, Green gram, Black gram, Cowpea, Chickpea, Horsegram, Lentil, Lantharus, Rajama bean, Dolichous, Lablabean, Oilseed : Groundnut, Sunflower, Safflower, Linseed, Castor, Sesame, Soybean. Fibre : Cotton, Jute. Fruit & Plantation crop: Mango, Coconut, Cashew, Guava, Pomogranet, Sapota, Nutmeg, Grape, Citrus. Vegetable : Tomato, Brinjal, Chilli, Okra. Cash crop : Sugarcane and Tobacco, karyotype and idiogram, Mitosis, Meiosis their

significance and difference, DNA and its structure, function, types, modes of replication and repairs, RNA and its structure, function and types, Transcription, Translation, Genetic code and outline of protein synthesis, Crossing over and factors affecting it, Mechanism of crossing over, Cytological proof of crossing over, Linkage, types of linkage and estimation of linkage, sex determination and sex linked inheritance, Numerical chromosomal aberrations (polyploids), Structural chromosomal aberrations, Evolution of different crops Cotton, Wheat, Tobacco, Triticale, Brassica.

Practical :

Microscopy. Preparations and use of fixatives and stains for light microscopy. Preparation of microslides – Identification of various stages of mitosis. Identification of various stages of meiosis. Preparation of various stages of meiosis. Monohybrid ratio and its modifications. Dihybrid ratio and its modifications. Tribybrid ratio. Chi-square analysis. Interaction of factors. Epistatic factors – supplementary, duplicate. complementary, additive, inhibitory. Linkage – two point test cross. Linkage – three point test cross. Induction of polyploidy using colchicines. Induction of chromosomal aberrations using chemicals.

Books Recommended :

1. Sunderaj D.D., Thulsidas G and Dorairaj M.S. (1997). Introduction to cytogenetics and plant breeding, Popular Book Depot, Chennai.
2. Singh B.D. (1990). Fundamentals of Genetics, Kalyani Publisher, Ludhiana.
3. Gupta P.K. (1997). Genetics, Rastogi Publications, Meerut.
4. Gardner, E.J. (1981). Principles of Genetics, Johan Wiley and Sons, U.S.A.
5. Griffiths, A.J.F., Miller, J.H. Suzuki, D.T., Lewantin, R.C. and W.M. Gelbart (1996). An Introduction to Genetic Analysis (6th edition). W.H. Freeman, New York.
6. Stickberger M.W. (1996). Genetics (3rd edition) Mac Millan Publishing Co. New Delhi.

Course No. : BOT – 233

Course Title : PRINCIPLES OF PLANT BREEDING

Course Credit : 2+1=3

Theory :

Definition, history of plant breeding, Aims and objectives of Plant Breeding, Classification of plants and Botanical description, Floral biology, Emasculation and pollination techniques in cereals, millets, Pulses and oilseeds & fibres and plantation crops etc., Reproduction sexual and asexual, Apomixis and their classification, Significance in plant Breeding, Pollination – modes of pollination, genetic consequences, difference between self and cross pollinated crops. Methods of breeding – Introduction and acclimatization, Selection – Mass selection, Johannsons's pureline theory, genetic basis, Pure line selection, Hybridization – aims, objectives and types of hybridization, Methods of handling of segregating generations – Pedigree method, Bulk method, Back cross method and various modified methods, Incompatability & Male sterility – types and their utilization in crop improvement, Heterosis, in breeding depression, theories of heterosis, Exploitation of hybrid vigour, development of inbred lines, single cross & double cross hybrid, Population improvement programme recurrent selection, Synthetics and composites, Methods of breeding for vegetatively propagated crops – clonal selection and hybridization, Mutation breeding, Ploidy breeding, Wide hybridization & significance in crop improvement.

Practical :

Botanical description and floral biology, floral morphology, selfing, emasculation and crossing techniques in Rice and Sorghum; Maize and Wheat, Bajara and Ragi; Sugarcane and Coconut; Groundnut, Castor, Sunflower, Niger, and Sesamum; Redgram, Bengalgram and Greengram; Soybean, Cowpea, Blackgram; Chillies, Brinjal and Tomato; Bhendi, Onion, Bottle gourd and Ridge gourd; Cotton and Mesta; Jute and Sunhemp. Study of megasporogenesis and microsporogenesis; Fertilization and life cycle of an angiospermic plant; Plant breeder's kit Hybridization techniques and precautions to be taken . Study of male sterility and incomaptability in field crops.

Books Recommended :

1. Singh B.D. (2000) Plant Breeding Principles and Methods. Kalyani Publishers, New Delhi.
2. Chaudhary, R.C. (1994). Introduction to Plant Breeding. Oxford and IBH publishing Co. Pvt. Ltd. New Delhi.
3. Poehlman, J.M. (1986). Breeding Field Crops, AVL, Publishing Company, New Delhi.
4. Chaudhary, H.K. (1980) Elementary Principles of plant Breeding, oxford and IBH Publishing.
5. Fehr, W.R. (1987) Principles of Cultivars Development (Vol.I) Mac Millan publishing company Inc., New York.
6. Roy, Darbeshwar (2000) Plant Breeding analysis and exploitation of variation. Narosa publishing
7. Hai Har Ram (2005) Vegetable Breeding- Principles and Practices. Kalyani publishers, New Delhi.

Teaching Schedule (Theory) :

Lecture No.	Topic	Weightages
1.	Definition, history of plant breeding. Aims and General objectives of Plant Breeding.	7
2.	Classification of plants and Botanical description. (Bot. name, family, chromosome no of major crops)	5
3.	Floral biology, Emasculation and pollination techniques Definition and types.	3
4.	Reproduction sexual and asexual. Apomixis and their classification, Significance in plant Breeding.	
5.	Pollination – modes of pollination, genetic consequences, Difference between self and cross pollinated crops- list of crops with their mode of pollination	
6.	Genetic Principles of breeding in self pollinated crops – Introduction and acclimatization.	
7.	Selection – Mass selection.	
8.	Johannsons's pureline theory - genetic basis & Pure line selection.	

9.	Hybridization – aims, objectives and types of hybridization.	
10.	Genetic Principles of handling of segregating generations – pedigree method.	
11.	Bulk method.	
12.	Back cross method.	
13.	Various modified methods.	
14.	Genetic Principles of breeding of cross pollinated crop- Mass selection.	
15.	Progeny selection and line breeding	
16.	Incompatibility mate sterility - Definition, types and their utilization in crop improvement	
17&18.	Male sterility – Definition, types and their utilization in crop improvement.	
19&20.	Heterosis and inbreeding depression - Definition, types - theories of heterosis utilization in crop improvement	
21	Exploitation of hybrid vigour, Definition of hybrid Vigour, development of inbred lines, single cross & double cross hybrid.	
22 -25	Population improvement programme- Definition Recurrent selection, types, genetic Principles of Simple, reciprocal, recurrent selection of GCA and recurrent selection of SCA.	
26.	Synthetics and composites. Definition of Synthetics, composites and examples.	
27&28.	Genetic Principles for breeding of vegetatively propagated crops – clonal selection and hybridization - Definition of clone, elonal selection, and examples.	
29.	Mutation breeding - definition of Mutation & Mutagens, classification of Mutagen with example, Mode of action- EMS & Gamma days, merits & demerits at mutation breeding, significance in crop improvement & achievements in general.	
30 & 31.	Ploidy breeding definition, types, significance in crop improvement with examples of natural & synthetic poly ploids.	
32.	Wide hybridization definition, types with examples, role of by bridization in crop improvement.	

Practical :

Practical No.	Topics
1.	Botanical description, floral biology, morphology selfing, emasulation and crossing technique in rice and sorghum.
2.	Botanical description, floral biology, morphology selfing emasulation and crossing technique in Maize/wheat.
3.	Botanical description, floral biology, morphology selfing emasulation and crossing technique in Bajara and ragi.
4.	Botanical description, floral biology, morphology selfing emasulation and crossing technique in sugarcane & coconut.
5.	Botanical description, floral biology, morphology selfing, emasulation and crossing technique in groundnut, castor & sesamum.
6.	Botanical description, floral biology, morphology selfing emasulation and crossing technique in sunflower and Niger.
7.	Botanical description, floral biology, morphology selfing, emasulation and crossing technique in redgram, greengram cowpea and bengalgram.
8	Botanical description, floral biology, morphology selfing, emasulation and crossing technique in soybean and black gram.
9.	Botanical description, floral biology, morphology selling, emasculation and crossing technique in chilli, brinjal, tomato and bhendi.
10.	Botanical description, floral biology, morphology selfing, emasulation and crossing technique in onion, bottle gourd, ridge gourd.
11.	Botanical description, floral biology, morphology selfing, emasulation and crossing technique in cotton, mesta, jute and sunhemp.
12.	Study of megasporogenesis and microsporogenesis.
13.	Fertilization and life cycle of an angiospermic plant.
14.	Plant breeders kit.
15.	Study of male sterility.
16.	Study of incomapribility.

Course No. : BOT – 234

Course Title : CROP PHYSIOLOGY

Course Credit : 2+1=3

Theory :

Introduction, Definition, Importance in agriculture. Growth and Development, Definition, Determinate and indeterminate growth, measurement of growth, Growth analysis, Growth characteristics, Definitions and mathematical formulae. Crop water Relations, physiological importance of water to plants, water potential and its components, measurement of water status in plants. Transpiration, significance, Transpiration in relation to crop productivity, water use efficiency, WUE in C_3, C_4 and CAM plants, factors affecting WUE. Photosynthesis, Energy synthesis, Significance and C_3, C_a and CAM pathway, Relationship of photosynthesis and crop productivity Translocation of assimilates, phloem loading apoplastic and symplastic transport of assimilates, source-sink concept. Photorespiration, factors affecting photosynthesis and productivity, photosynthetic efficiency, Dry matter partitioning, Harvest index of crops. Respiration and its significance, Brief account of growth respiration and maintenance respiration, Nutriophsiology – Definition- mengel's classification of plant nutrients- physiology of nutrient uptake functions of plant nutrients – deficiency and toxicity symptoms of plant nutrients foliar nutrition – hydroponics.Introduction of photoperiodism and vernalisation in relation to crop productivity – photoperiodism.Plant growth regulators – occurrence – biosynthesis – mode of action of auxins, gibberellins, cytokinins, commercial application of plant growth regulators in agriculture. Senescence and abscission – definition – classification- Theories of mechanism and control of senescence – physiological and biochemical changes and their significance. Post harvest physiology. Seed dormancy definition–types of seed dormancy advantages and disadvantages of seed dormancy causes and remedial measures for breaking seed dormancy, optimum conditions of seed storage factors influencing seed storage (ISTA standards) Fruit ripening, Metamorphic changes, Climacteric and non-climacteric fruits – Hormonal regulation of fruit ripening (with ethrel, CCC, paclobuterozole).

Practical:

Preparation of solutions, Growth analysis : Calculation of growth parameters. Measurement of absorption spectrum of chloroplastic pigments and fluorescence Measurement of water potential by Chardakov's method. Measurement of leaf area by various methods. Estimation of chlorophyll content of fresh water / Sea water Eco. system. Methods of measuring rate of photosynthesis. Measurement of rate of respiration in plant. Stomatal frequency and index. Respirometer –Measurement of respiration. Leafanatomy of C_3 and C_4 plants.Measurement of transpiration. Imbibitions of seed Optimum conditions for seed germination Effect ABA on regulation of stomata. Study of transpiration and water balance in plants.

Books recommended :

1. Plant Physiology : R. M. Devlin. Affiliated East-West press Pvt. Ltd. New Delhi.
2. Plant Physiology : Mayer D. S. and B. D. Anderson (1988).
3. Plant Physiology : Pande S. N. and B. K. Sinha (1982). Vikas Publishing House Pvt. Ltd. New Delhi.
4. The book of Plant Physiology : Verma V. (1987).
5. Plant propagation practices : Husson T. H. and Dele E. Wester (1987).
6. Plant Physiology : Lincoln Taiz and Eduardo Zeiger Sinauer Associates, Inc. Sunderland. M.A. 01375 USA.
7. Plant Physiology R.G.S. Bidwell . Macmillan Publishing Co Inc. Newyork.

Theory :

Lecture No.	Topics	No. of lecture required
1	Introduction, Definition, Importance of crop physiology	1
2-4	**Growth and Development:** Definition, Determinate and indeterminate growth, monocarpic and polycarpic species with examples, measurement of growth, Growth analysis, Growth characteristics, Definitions and mathematical formulae	3

5-7	**Crop water Relations:** Physiological importance of water to plants, water potential and its components, measurement of water status in plants.	3
8-10	**Transpiration:** Significance, Transpiration in relation to crop productivity, water use efficiency, WUE in C_3, C_4 and CAM plants, factors affecting WUE.	3
11-13	**Photosynthesis**: Energy synthesis, Significance and C^3, C^a and CAM pathway, Relationship of photosynthesis and crop productivity	3
14-15	**Photorespiration**: Factors affecting photosynthesis and productivity, photosynthetic efficiency, Dry matter partitioning, Harvest index of crops.	2
16-17	**Respiration**: Respiration and its significance, Brief account of growth respiration and maintenance respiration	2
18-19	**Translocation**: Translocation of assimilates, phloem loading, apoplastic and symplastic transport of assimilates, source-sink concept.	2
20-22	**Nutriophsiology**:– Definition- mengel's classification of plant nutrients- functions of plant nutrients – deficiency and toxicity symptoms of plant nutrients foliar nutrition – hydroponics.	3
23-24	**Photoperiodism and Vernalisation**: Introduction of photoperiodism and vernalisation in relation to crop productivity – photoperiodism. Plant classification on basis of photoreponses – Florigine concept in flowering- Role of Phytochrome in flowering process-vernalization methods.	2
25-27	**Plant growth regulators**: – occurrence – biosynthesis – mode of action of auxins, gibberellins, cytokinins, commercial application of plant growth regulators in agriculture.	3

28-29	**Senescence and abscission**:– definition – classification- physiological and biochemical changes and their significance. Senescence and abscission	2
30-32	**Post harvest physiology**: Fruit ripening, Metamorphic changes, Climacteric and non-climacteric fruits – Hormonal regulation of fruit ripening (with ethrel, CCC, paclobuterozole)	3
	Total	**32**

Practical :

Sr. No	Title
1.	Preparation of solutions
2.	Growth analysis : Calculation of growth parameters
3.	Methods of measuring water status in roots, stems and leaves.
4.	Measurement of water potential by Chardakov's method
5.	Measurement of absorption spectrum of chloroplastic pigments and fluorescence
6.	Measurement of leaf area by various methods
7.	Estimation of chlorophyll content in the leaf
8.	Methods of measuring rate of photosynthesis
9.	Measurement of rate of respiration in plant
10.	Stomatal frequency and index
11.	Respirometer – Measurement of respiration
12.	Leaf anatomy of C_3 and C_4 plants
13.	Measurement of transpiration
14.	Imbibition of seed
15.	Optimum conditions for seed germination
16.	Effect ABA on regulation of stomata
17.	Effect of ethylene on ripening of fruit

Course No. : BOT – 245

Course Title : BREEDING OF FIELD AND HORTICULTURE CROPS

Course Credit : 2+1=3

Theory :

Lecture No.	**TITLE**	**Weightage %**
1	Definition, Cropwise Breeding objectives and important concepts of breeding, self pollinated , cross pollinated and vegetatively propagated crops	5
2	i) International Institutes for crop improvement ii) Role of Crop improvement Institutes and organizations in India a. ICAR: NRCs, Directorates of crop improvement, AICRP, NAIP, Adhoc Projects etc. b. SAUs c. Other Instituites: e.g. BARC, Mumbai, VSI, Pune d. Private Seed and Plant Biotechnology Co.	5
3-4	Study in respect of origin, Botanical names, family, Genus, Chromosome numbers, Distribution of species, Wild species and forms, a. Cereals (Sorghum, Bajra, Maize, Rice, Wheat, Ragi) b. Pulses (Tur, Gram, Mung, Udid, Soybean) c. Oilseeds (Ground nut, Soybean, Sunflower, Safflower, Sesame, Linseed) d. Fiber (Cotton, Kenaf, Roselle, jute) e. Fruit (Mango, Aonla, Guava, Custard apple, Banana, Papaya) f. Vegetables (Tomato, Brinjal, Bhindi, Chilli, Cucumber) g. Flowers (Chrysanthemum, Rose, Galardia, Gerbera, Marigold)	10
	Major breeding procedures for development of hybrids/ varieties of various crops: Introduction, Merits and demerits, Procedure flowchart with	

	modifications in short, Achievements	
5-8	**a. Self pollinated crops:** Mass selection, Pureline selection, Pedigree selection, Bulk method, Backcross method, Progeny and Single Seed Descent selection	8
9-11	**b. Cross pollinated crops:** Population improvement, (Mass, Progeny selection and Recurrent selection)	8
12-13	**c. Other methods:** Clonal selection, Mutation, Polyploidy, Distant hybridization	8
14-15	Plant genetic resources, their conservation and utilization in crop improvement: Germplasm definition, landrace, Variety, cultivar, wild type, Gene pool concept, Genetic erosion, germplasm collection and conservation types and methods in short	5
16-17	Ideotype concept in crop improvement: Concept, Types of ideotype, Characteristics of a ideotype, Major steps in ideotype breeding, Ideotype of rice, wheat, sorghum, cotton Merits and limitation of ideotype breeding	8
18 19 20	Breeding for stress resistance: Introduction, Types of stresses a. Biotic stresses: History, Types of resistance, Variability in pathogens and pests, , mechanism of pathogen resistance, achievements b. Abiotic stresses: Types, Drought and mineral toxicity resistance, achievements	10
21	Genetic basis of adaptability for unfavorable environments, salinity, drought, high and low temperature	3
22	**Biometrics:** a. Definition of biometrics, assessment of variability, Range, Arithmetic mean, Variance, S.D., S.E., C.V.	3
23	b. Hardy- Weinberg law: Introduction, Definition and explanation, Factor distributing the equilibrium in population	
24	c. Multiple factor hypothesis: Explanation of Yule	2

	hypothesis given by Nilsson-Ehle(1908)	
25-26	d. Components of genetic variance i.e. Additive, dominance, epistasis, GCV, PCV and ECV, GA, EGA, Heritability	5
27	e. Heterosis and Inbreeding depression: Definition, types, theories, estimation, commercial utilization	5
28	f. Combining ability analysis: Definition, Use of CA, CA analysis approaches in short.	5
29	g. Genotype x Environment interaction and influence on yield performance	5
30	h. Stability analysis: Objectives, different models of stability analysis in short.	
31-32	IPR and its related issues: History, Need of IPR, Full forms and head quarters of WTO, GATT, UPOV, TRIPs, FAO, WIPO etc Acts: Need & Objectives i. Registration and protection Act 1999 (Geographical Indications of goods) ii. PPV & FRs Act. 2001 iii. Biological diversity Act 2002 Registration of plant varieties under “PPV and FR’s Authority and Registry” in India, Farmers & Researchers Rights Duration and effect of registration and benefit sharing. Breeders Variety, Farmers variety, extant variety, EDV, Private company variety, DUS testing, CBD	5
Total Contact Hours -32		100

Reference books :

1. Allard R.W. (1960) Principles of Plant Breeding, John Wiley & Sons, New York
2. Singh B. D. (2005) Plant Breeding: Principles and Methods, 7th ed., Kalyani Publishers, New Delhi- Ludhiana

3. Singh R.K. and Choudhary B. D. (2004) Bimetrical methods in quantitative genetics,
Kalyani Publishers, New Delhi- Ludhiana
4. Poelman and D. Borthakur (1969) Breeding asian field crops with special reference to
crops of India, 2nd ed. Oxford & IBH Publishing Co.
5. Peter K. V. (1998) Genetics and breeding of vegetables, ICAR, New Delhi
6. Kalloo G., Vegetable breeding, International books and periodicals supply services,
Pitampute, Dehli-4
7. Chahal G. S. and S.S. Gosal (2002) Principles and procedures of Plant Breeding (
Biotechnology and Conventional Approaches) Narosa Publishing House, New Delhi & Mumbai
8. Dhillon, B.S.; R.K. Tyagi; Arjun Lal and Saxena (2004) Plant Genetic Resources,
9. Website PPV & FR Authority, New Delhi. WWW. Plantauthority -gov. in.

Practical :

Ex. No.	Title of exercise
1	Floral biology and hybridization technique in cereals (Any one crops)
	a. Sorghum
	b. Bajra
	c. Maize
	d. Rice
	e. Wheat
2	Floral biology and hybridization technique in pulses(Any one crops)
	a. Tur
	b. Gram
3	Floral biology and hybridization technique in oilseeds (Any one crops)
	a. Ground nut
	b. Soybean
	c. Sunflower

	d. Safflower
	e. Sesame
	f. Linseed
4	Floral biology and hybridization technique in cotton
5	Floral biology and hybridization technique in fruit crops (Any one crops)
	a. Mango
	b. Banana
	c. Citrus
	d. Grape
	e. Coconut
	f. Sapota
6	Floral biology and hybridization technique in vegetables (Any one crops)
	a. Brinjal
	b. Chilli
	c. Tomato
	d. Okra
7	Floral biology and hybridization technique in flower crops (Any one crops)
	a. Rose
	b. Jasmine
	c. Marigold
8	Quality breeding in some important crops
9	Sources of donor plants
10	Handling of breeding material and maintenance of experimental record
	a. Self pollinated crops
	b. Cross pollinated crops
	c. Layout of field experiments and trials
11	Problems on Hardy- Weinberg law
12	Estimation of Variability parameters(GCV, PCV, ECV,GA, EGA)
13	Estimation of Heritability
14	Estimation of Heterosis and Inbreeding depression
15	Estimation of Combining Ability
16	Visits (Arrange on holidays)
	a. Seed production and certification plots: Crop name, Variety, Isolation

	distance, Stage of seed, maintenance of record & registers etc.
	b. AICRP trials and programmes: Crop name, Varieties, Layout, Design, Replication, Objectives, maintenance of record & registers etc.
	c. Grow out test plots: Name crop & variety and Record morphological characters, stage of crop
	d. Various research stations: Mandate crops, Breeding objectives, Breeding trials, Generation of crop i.e. F_1, F_2, BC_1, BC_2…. etc.
	e. Other institutions.

Course No. : BOT – 356

Course Title : PRINCIPLES OF BIOTECHNOLOGY

Course Credit : 2+1=3

Theory:

Concept of plant biotechnology, History of plant tissue culture and plant genetic engineering. Scope and importance of plant biotechnology in crop improvement, Totipotency and morphogenesis, Nutritional requirements of plant tissue culture, Techniques of in vitro culture, Test tube fertilization, endosperm culture, Factors affecting on test tube fertilization and endosperm culture, Application and achievements and types of somaclonal variation, somatic embryogenesis and synthetic seed production, protoplast isolation and culture, protoplast manipulation and fusion, somatic hybrids and cybrids and their applications in crop improvement.

Concept of genetic engineering Restriction enzymes and their uses, concept of vectors and their types for gene transfer, Gene cloning, Direct method of gene transfer, Indirect method of gene transfer, Transgenic plant and their applications, Different type of blotting techniques, DNA fingerprinting , DNA based marks : RFLP, RAPD, SSR and DNA probes, Mapping of QTL and future prospect, MAS and its application in crop improvements.

Practical :

Lecture	Topics	Marks
1	History of plant tissue culture and plant genetic engineering	2
2	Scope and importance of plant biotechnology in crop improvement	3
3	Totipotency and morphogenesis	5

4	Nutritional requirements of plant tissue culture Calculations for molar solution, normal solution, percent solution different types of medium Role of hormones and growth regulators.	5
6	Techniques of in vitro culture. Types of cultures Principals of different culture Different application of cultures.	5
7	Test tube fertilization Limitations of test tube fertilization Applications of test tube fertilization Procedure of test tube fertilization	2
8	Factors affecting on test tube fertilization and endosperm culture.	5
9	Endosperm culture. Mature and immature endosperm culture Procedure of endosperm culture Applications of endosperm culture.	10
10,11	Somaclonal variation Applications of somaclonal variation Achievements of somaclonal variation Types of somaclonal variation Procedure of somaclonal variation	10
12	Somatic embryogenesis Somatic hybrids Synthetic seed production Application of synthetic seed	10
13,14,15	Protoplast culture Isolation (Enzymatic and mechanical method) Production of cybrids Applications of protoplast culture	10
16,17,18, 19,20,21 22	Concept of genetic engineering Restriction enzymes and their uses Concept of vectors and their types for gene transfer Gene cloning	10

	Direct method of gene transfer Transgenic plant and their applications	
23	Different types of blotting techniques Southern Northern Western	3
24	DNA fingerprinting	5
25	DNA based markes PCR principal and concept RFLP, RAPD, SSR, DNA probes and their application	5
26,27	Mapping of QTL and future prospects Concept of quantitative and qualitative trait loci Concept of G X E interaction Different types of mapping population Advantages and disadvantages of different mapping populations MAS and its application in crop improvements.	10

References Books :

1. Gupta PK. 2004. Biotechnology and Genomics. Rastogi Publications.
2. Sambrook J, Fritsch T & Maniatis T. 2001. Molecular Cloning – a Laboratory
   Manual. 2nd Ed. Cold Spring Harbour Laboratory Press.
3. Primrose SB. 2001. Molecular Biotechnology, Panima.
4. Bhojwani SS.1983. Plant Tissue Culture; Theory and Practice. Elsevier.
5. Christou P & Klee H.2004. Handbook of Plant Biotechnology. John Wiley & Sons.
6. Chittaranjan K, 2006-07. Genome Mapping and Molecular Breeding in Plants. Vols. T-VII. Springer.
7. Weising K, Nybom H, Wolff K & Kahl G.2005. DNA Fingerprinting in
8. Plants: Principles, Methods and Applications. Taylor & Francis.

Practical :

Plant tissue culture laboratory specifications and organization of equipments and their use, Different sterilization techniques and aseptic manipulations, Preparation of tissue culture media and their composition, Preparation of explants (Banana / Sugarcane) establishment and maintenance of callus cultures from different explants, sub culture of callus, Regulation of marphogenesis from different explants, roots, stem, leaf, bud, Micropropagation with shoot apex culture in different plants (Banana / Sugarcane), Meristem culture, Anther and pollen culture, Embryo and endosperm culture, Somatic embryogenesis and artificial seed production, isolation and culturing of protoplast, Isolation of genomic DNA, Gene transfer method: direct method, Gene transfer method : indirect method, Gel electrophoresis technique, Confirmation of genetic transformation.

Sr. No	Practical
1	Plant tissue culture laboratory specifications, and organization of equipments and their use
2	Different Sterilization techniques and aseptic manipulations.
3	Preparation of tissue culture media and their composition
4	Preparation of explants (Banana/ Sugarcane) establishment and maintenance of callus cultures fro different explants, sub culture of callus
5	Regulation of morphogenesis from different explants, roots, stem, leaf, bud
6	Micro propagation with shoot apex culture in different plants (Banana/ Sugarcane)
7	Meristem culture
8	Anther and pollen culture
9	Embryo and endosperm culture
10	Somatic embryogenesis and artificial seed production
11	Isolation and culturing of protoplast
12	Isolation of genomic DNA
13	Gene transfer method : direct method
14	Gene transfer method: indirect method.
15	Gel electrophoresis technique
16	Confirmation of genetic transformation.

Course No. : BOT 367

Course Title : PRINCIPLES OF SEED TECHNOLOGY

Course Credits : 2+1=3

Theory :

Seed – definition development of seed, functions and parts of seed, Definition of seed technology, Role and Goals of Seed Technology in Crop Production, Seed Dormancy- causes & methods of breaking the seed dormancy, Principles of Quality Seed Production. Seed purity- Genetic purity, Stages of Seed Multiplication. Methods of seed production- isolation. Field Inspection and Roguing. Seed law and Seed certification. Seed certification agency- structure, role and duties, methods of seed production in self pollinated, often cross pollinated and cross pollinated crops, types of cultivars, Varietal characters , Role of producer, Seed production agencies and seed certification agency in certified seed production. Seed viability and vigour test. Harvesting, drying, processing, seed sampling, seed testing -Purity analysis. Working of STL,. Grow-out test and Electrophoresis. Seed deterioration - types, causes and remedial measures. Seed storage, Pest and diseases seed, seed aging. Marketing, marketing agencies, planning and economics of production.

Practicals :

Study of seed structure. Study of seed dormancy , Causes of seed dormancy and methods of breaking dormancy. Study of seed germination and Factors affecting it. Principles of quality seed production. Stages of seed multiplication. A) Seed production in self pollinated crops- Wheat/ Rice and Groundnut. b) Seed production in often cross pollinated crops – Cotton and Sorghum. C) Seed production in cross pollinated crops – Bajra and Maize. Seed production in vegetable Tomato, Onion and okra. Seed certification procedure. Study of seed processing. Seed Sampling, Working of Seed Testing Laboratory. Physical purity Test, Germination Test. Seed viability and vigour test Seed Health-I (seed pathology. Seed Health-II (Seed Entomology).

Book recommended :

1. Agrawal R.L. (1980). Seed Technology, Oxford and IBH Publecation Co., New Delhi.
2. Agrawal P.K. and Dadlani, M. (1987) . Techniques in Seed Science and Technology, South Asian Publisher, New Delhi.
3. Nema, N. P. (1986) Principles of Seed Certification and Testing. Allied Publishers, New Delhi.

Teaching schedule Theory :

No. of Lecture	Topics	Weight age of marks
1	Introduction to Seed Production Importance of Seed production	02
2	Seed Policy, Seed demand forecasting and planning certified, foundation and breeder and production	05
3	Deterioration of crop varieties, factors affecting deterioration and their control, maintenance of genetic purity during seed production	05
4	Seed quality, definition, characters of good quality seed	04
5	Different classes of seed, production of nucleus and breeder's seed	05
6	Maintenance and multiplication of pre-release and newly released varieties in self and cross pollinated crops	03
7	Seed production, foundation and certified seed production in maize (varieties, hybrids, synthetics and composites)	03
8	Foundation and certified seed production of rice (varieties and hybrids)	03
9	Foundation and certified seed production of sorghum and bajra (varieties, hybrids, synthetics and composites)	03
10	Foundation and certified seed production of cotton and sunflower (varieties and hybrids)	04
11	Foundation and certified seed production of castor (varieties and hybrids)	03
12	Foundation and certified seed production of tomato and brinjal (varieties and hybrids)	03
13	Foundation and certified seed production of chillies and bhendi (varieties and hybrids)	03
14	Foundation and certified seed production of onion, bottle gourd and ridge gourd (varieties and hybrids)	03

15	Seed certification, phases of certification, procedure for seed certification.	05
16	Field inspection and filed counts etc.	03
17,18	Seed Act and Seed Act enforcement, Central Seed Committee, Central Seed Certification Board, State Seed Certification Agency.	05
19	Central and State Seed Testing Laboratories, Duties and Powers of seed inspectors, offences and penalties.	
20	Seed control order, seed control order 1983, seed Act 2000 and other issues related to seed quality regulation.	02
21	Intellectual property right, patenting, WTO, plant breeders rights	**03**
22	Varietal identification through grow-out test and electrophoresis,	04
23,24, 25	Seed drying, forced air seed drying, principle, properties of air and their effect on seed drying, moisture equilibrium between seed and air, heated air drying, building requirements, types of air distribution systems for seed drying, selection, of crop dryers and systems of heated air drying, recommended temperature and depth of the seeds, management of seed drying.	05
26,27	Planning and layout of seed processing plant, establishment of seed processing plant, seed processing air screen machine and its working principle, different upgrading equipments and their use.	05
28	Establishing a seed testing laboratory. Seed testing procedures for quality assessment.	02
29	Seed treatment, Importance of seed treatment, types of seed treatment, equipment used for seed treatment (slurry and Mist-O matic treater)	05
30,31,32	Seed packing and seed storage, stages of seed storage, factors affecting seed good storage and	03

	conditions required for good storage, General principles of seed storage, constructional features for good seed warehouse, measures for pest and disease control, temperature control	
33,34	Seed marketing, marketing structure, marketing organization, sales generation activities, promotional media, pricing policy, factors affecting seed marketing	03

Practical :

Reference Books : -

1. Agroawal R. L. Seed Technology .
2. Khare Dhirebndra and Bhale M. S., Seed Technology.
3. Agrawal PLK. And Dadlani M. Techniques in Seed Science and Technology.
4. Mcdonald M.B. and Copeland L.O. Seed Science and Technology, Laoratory manual.
5. CICR website

SOIL SCIENCE AND AGRIL. CHEMISTRY

Course No. : SSAC-111

Course Title : INTRODUCTION TO SOIL SCIENCE (B. SC. (AGRI.)

Course Credit : 2+1=3

Teaching Schedule :

Lecture No.	Topic	Weightage
1 & 2	Soil pedological and edapholgical concept. Origin of the earth Earth's crust composition	3
3& 4	Study of soil forming rocks and minerals	3
5 & 6	Weathering of rocks and minerals	6
7 & 8	Soil forming factors and processes, Components of soils	6
9	Study of soil profile.	4
10 & 11	Soil physical properties: Soil texture, textural classes, particle size analysis	5
12 to 14	Soil structure Classification, soil aggregates, significance of soil consistency, Soil crusting. Bulk density and Particle density. Soil porosity, their significance and manipulation. Soil compaction and soil colour.	6
15, 16 & 17	Soil water: Retention and potentials, soil moisture constants, movement of soil water, infiltration, percolation permeability, Drainage: Methods of determination of soil moisture	6
18	Thermal properties of soils, Soil temperature	3
19	MID TERM	
20 & 21	Soil air: Gaseous exchange. Influence of soil temperature, air on plant growth	5
22 & 23	Soil colloids: Properties, nature, types and significance	5
24 & 25	Layer silicates clays: Genesis and sources of charges	5
26 & 27	Adsorption of ions. Ion exchange. CEC and AEC. Factors influencing ion exchange and its significance	6
28, 29 & 30	Soil organic matter: composition, Determination of organic. Humus. fractionation of organic matter, carbon	6

	cycle C:N ratio	
31 to 33	Soil biology: Definition soil Biomass, soil organisms and their beneficial and harmful roles	4
34 & 35	Soil survey and USDA Soil classification. Land Capability classification Soils of India. Soils of Maharashtra.	4
36	Soil erosion. Types, universal soil loss equation & control measures.	3

Text Books :

1. Text book of Soil Science by J. A. Daji.
2. Physical properties of soil by C. C. Shah and NK. Narayana (1966)
3. Fundamentals of Soil Science (8^{th} edition) 1990 by Henry. D. Fothk.
4. Text book of Soil Science (Second edition) 1994 by Biswas and Mukharjiee
5. Nature and properties of soils (Tenth edition) by N. C. Brady, prentice Hall of India Pvt. Ltd. New Delhi.
6. Fundamentals of Soil Science – A Text Book by V.D. Patil & C.V. Mali
7. Fundamentals of Soil Science by ISSS, New Delhi.

Practical :

Pract. No.	Name of practical
1	Study of soil forming minerals and their identification
2	Study of soil farming rocks and their identification
3	Collection of soil sample and processing of soil for physico-chemical analysis.
4	Study of soil profile in field
5	Determination of Bulk density and particle density of soil
6	Determination of hydraulic conducting of soil
7	Determination soil strength and Determination of moisture content of soil
8	Determination moisture constants.
9	Determination of infiltration rate of soil
10	Determination of soil texture and particle size analysis by hydrometer method

11	Determination of aggregate size analysis
12	Determination of soil temperature
13	Study of basic analytical concepts techniques and calculations
14	Determination of organic carbon content of soil
15	Determination pH and EC of soil
16-17	Determination of CEC of soil.

Course No. : SSAC-122

Course Title : SOIL CHEMISTRY, SOIL FERTILITY AND NUTRIENT MANAGEMENT

Course Credit : 2+1=3

Teaching Schedule :

Lect. No.	Topic	Weightage
1-2	Soil as a source of plant nutrient, essential and beneficial nutrients.	3
3	Criteria of essentiality, forms of nutrients in soil	3
4-5	Mechanisms of Nutrient transport to plants.	5
6-7	Factors affecting nutrient availability to plants, measures to overcome deficiencies and toxicities.	5
8-9	Problem soils: acid soils, salt affected and calcareous soils, characteristics and nutrient availabilities	5
10-11	Reclamation of problematic soils : Mechanical, chemical & Biological Methods.	5
12-13	Fertilizer and Insecticides : Effects on soil water and air	5
14-15	Irrigation water-Quality and its appraisal Indian standards for water quality	5
16-17	Use of saline water for agriculture	5
18-19-20	Soil fertility: different approaches for soil fertility evaluation	5
21-22	Soil testing Methods- Chemical Methods and critical levels of different nutrients in soil	5
23-24	Plant analysis Methods- critical level of nutrients, DRIS approach, Rapid tissue test, Indicator plants	5

25-26	Chemistry of submerged soil	3
27-28	Soil Test based fertilizer recommendations to crops	3
29-30-31	Factors influencing Nutrient use efficiency (NUE), in respect to N, P, K, S, Fe & Zn fertilizers	6
32-33	Sources Methods and scheduling of nutrient for different soils and crops grown under rain fed and Irrigated conditions	6
34-36	IPNS & Fertilizer Management	6

Practical :

Pract. No.	Title of Experiment
1	Principle and application of Spectrophotometry / Colorimetry
2	Principle and application of Flame Photometry
3	Principle and application of Atomic Absorption Spectrophotometer (AAS)
4	Determination of pH and EC from soil saturation extract
5	Determination of $CaCO_3$ in soil (Rapid Titration Method)
6	Estimation of available N in soil (Subbiah and Asija., 1956)
7	Estimation of available P_2O_5 in soil (Olsen et. al., 1954/ Bray's)
8	Determination of available K_2O in soil using flame photometer
9	Estimation of available sulphur in soil (Turbidity method)
10	Estimation of DTPA extractable Micronutrients from soil using AAS
11	Determination of exchangeable Ca & Mg in soil
12	Determination of carbonates and bicarbonates in soil water saturation extract
13	Lime / Gypsum requirement of problem soils
14	Estimation of Total N from plant sample by Microkjeldhals Method
15	Estimation of Total P from plant sample by Vandomolybdate Method
16	Estimation of Total K from plant sample using Flame Photometer
17	Determination of Fe, Zn, Mn and Cu. From plant sample by AAS
18	Establishment of soil testing Laboratory and visit to District soil Testing Laboratory

Course No. : SSAC – 243

Course Title : MANURES, FERTILIZERS AND AGRO-CHEMICALS

Course Credit : 2+1=3

Theory :

Lesson No.	Title	Weightage
1, 2, & 3	Raw materials for organic recycling, sources of organic matter and their composition, C:N ratio	5
4 & 5	Definition and classification of bulky and concentrated organic manures, their composition and nutrient availability.	5
6 & 7	Preparation of FYM, composts, different methods of composting, sources, decomposition and losses during handling and storage of FYM.	4
8 & 9	Mechanical compost plants and vermicompost.	5
10 & 11	Green manuring , types advantage, disadvantage; Oil-cakes, composition and nutrient availability.	3
12	Sewage and sludge, Biogas plant slurry. Their composition and effect on soil and plant growth.	4
13 & 14	Fertilizers and their classification; N fertilizers : classification, manufacturing process and properties their fate and reaction in soils.	5
15	Phosphatic fertilizers, Manufacturing process and properties	5
16	Potassic and complex fertilizers their fate and reaction in the soil.	5
17 & 18	Secondary & Micronutrient fertilizers their types, composition, reaction in soil and effect on crop growth.	5
19 & 20	Handling and storage of fertilizers.	3
21 & 22	Biofertilizers and their role in crop production.	5
23 & 24	Organic chemistry as prelude to agro chemicals; classification of agro chemicals.	4

25, 26 & 27	Botanical insecticides (neem) pyrethrum, synthetic pyrethroids, major classes & use.	4
28, 29 & 30	Synthetic organic insecticides, major classes and properties and usage.	4
31 & 32	Herbicides – Major classes – properties and uses of 2-4 D, Atrozine, glyphosphate, butachlor, benthiocarb.	4
33 & 34	Fungicides – Major classes, properties and use of carbendazim, carboxin, captain, tridemorphic and copper oxychloride. Trichoderma	4
35	Plant growth regulators	4
36	Fertilizer control order and Insecticides Act	2

Practical :

Expt.No	Title
1	Determination of moisture from organic manure
2	Fertilizer Adulteration test / Identification of Adulteration in fertilizer / Detection of adulteration in fertilizers (Rapid test)
3	Determination of organic matter from compost / FYM / oil cake (Ignition method)
4 & 5	**a)** Determination of total nitrogen from FYM / Compost / oilseed cake and C : N ratio (By Kjeldahl method)
6 & 7	Determination of total phosphorus and potassium from compost / FYM.Mineral constituents of the ash and preparation of solution.
8	Determination of (Amide nitrogen) from urea.
9	Determination of ammoniacal nitrogen content of ammonium sulphate.
10	Determination of nitrate nitrogen content of potassium nitrate
11	Determination of water soluble phosphorus in superphosphate (Pumberton method)
12	Determination of acid soluble phosphorus from rock phosphate
13	Determination of total potassium content of muriate of potash (by flame photometer).
14	Determination of sulphur Content from fertilizer (Gravimetric Method)
15	Determination of Zinc content from micronutrient fertilizer (EDTA Method)
16	Estimation of COD value of organic waste / effluent.
17	Argentimetric and idometric titrations for analysis of lindane / dimethoate, metasystox / endosulfan / malathion / copper and sulphur fungicide**.**
18	Compatability of fertilizer mixtures

Reference books:

1. Brady: 1990 : Nature and properties of soil 10th Edition
2. Brady N.C. : Nature and properties of soil. 1985 : 10th edition.
3. FAT (1980) Hand book on Fertilizer Technology.

4. Dohama A. K. : Organic farming for sustainable agriculture: 1977 : 2nd edition. Agrobotamic.Bikaner.
5. Gaur et al . 1984 . Organic manures, ICAR
6. Mariakulandi and Manickam: 1975 : Chemistry of fertilizers and manures.
7. ICAR Handbook of manures and fertilizers (1971) publication.
8. ICAR (1959)': Role of earthworms in agriculture
9. Subba Rao N. S.: Biofertilizers in Agriculture (1986). Oxford & IBH PUB.CO. New Delhi.
10. Tandon H. L. S. (1994) : recycling of crop, animal, human and industrial Wastes in Agriculture. FDCO, Delhi
11. Krishna and Murthy (1978) : Manual on compost and other organic manures Biswas T.D. and S.K. Mukharjee (1994) : Text book of soil science 2nd edition.
12. Yawalkar et al (1981) : Manures & fertilizers:

Course No. : SSAC – 354

Course Title : BIOCHEMISTRY

Course Credit : 2+1=3

Theory :

Lect. No.	Topic	Weightage
1	History, scope and importance of biochemistry	4-5
2-3	Structure and organelles of plant cell and their role	3-4
4	Biomolecules - Definition, types, structure, properties and its applications	2-3
5-6	Carbohydrates - Definition, classification, structure, properties and functions.	5-6
7-8	Nucleotides and Nucleic acid - Definition, components and their structure	5-6
9-10	Amino acids, peptides and proteins - Definition, classification, structure and properties	6-7
11	Plant proteins and their quality, Essential amino acids and limiting amino acids	5-6
12-13	Lipids - Definition, classification, properties and their significance	4-5
14	Fatty acids- Definition, classification, structure and essential fatty	4-5

	acids	
15-16	Biochemical energetics : Definition, free energy concept of chemical reaction, Components of electron transport chain, energy rich compounds	3-4
18-19	Enzymes- Definition, Classification, factor affecting enzyme activity.	5-6
20	Enzyme immobilization (inactivation) and its Industrial application in agro- industries	4-5
21	Vitamins and their coenzymes derivatives	3-4
22-23-24	Metabolic energy and it's generation metabolism - glycolysis, Citric acid cycle, Pentose phosphate pathways	4-5
25-26	Phosphorylation - Definition, cyclic and non-cyclic and substrate level phosporylatin, oxidative phosphorylations.	4-5
27	Fatty acid oxidation-β-oxidation	3-4
28-29	Biosynthesis- carbohydrates, lipids, proteins and nucleic acid	4-5
30	Metabolic regulation- integration of carbohydrate, lipid and protein metabolism	4-5
31-32-33	Secondary metabolites - glycosides, tannins, lignins, gums and mucilager-Definition, classification, properties and their physiolo - gical roles and application in food and pharmaceutical industries	4-5
34-35-36	Secondary metabolites –alkaloids, terpenoids - Definition, classification, properties and their physiological roles and application in food and pharmaceutical industries	4-5

Practicals :

Pract. No.	**Name of practical**
1-2-3	Qualitative tests for carbohydrates, proteins and lipids
4	Extraction of oil by Soxhlet’s method
5	Estimation of protein by Lowry's method
6-7	Estimation of oil quality parameters (acid value, saponification value and iodine value)
8-9	Quantitative determination of reducing and total sugars by Benedict's method

10-11	Study of protein denaturation by heat, pH, precipitation of proteins with heavy metals
12	Determination of Ascorbic acid from fruit juice
13	Estimation of chlorophyll from plant sample
14	Separation of plant pigments by paper chromatography
15	Characterization of lipids by thin layer chromatography (TLC)
16	Determination of poly-phenols by Folin-Denis method
17	Study of amino acid models
18	Study of structural models of sugar- sucrose and starch

Reference Books:

1. Fundamentals of Biochemistry by J.L. Jain
2. Biotechnology by B.D., Singh
3. Principles of Biochemistry by Lehninger, Nelson & Cox
4. Outlines of Biochemistry by Conn & Stumpf
5. Textbook of biochemistry by A VSS, Ramarao
6. An Introduction to Practical Biochemistry by D.T. Plummer
7. Laboratory Manual in Biochemistry by Jairaman

Horticulture

Course No. : HORT-111

Course Title : PRODUCTION TECHNOLOGY OF FRUIT CROPS

Course Credit : 2+1=3

Theory:

"A" (Fundamentals)

Definition of Horticulture, fruit science: scope, importance, area and production of fruit crops in Maharashtra and India, Export import scenario of fruit crops in India, Classification of fruit crops on Horticultural basis, Climate and soil, Selection of site, fencing, wind break and shelter belts, Planning, layout and planting systems, High density, planting and meadow orcharding, Methods of propagation in fruit crops, Use of rootstocks in fruit crops, Training and pruning of fruit crops, Use of bio - regulators in propagation and fruit production, Nutritional management of fruit crops, Irrigation management of fruit crops, Special horticultural practices: Bahar treatments, notching, ringing, bending, girdling etc.

"B" Fruit production technology

Origin, B. N. family, area and production, soil and climate, commercial varieties, Propagation and planting, after cares (irrigation, weed management, nutritional requirement, use of PBR, physiological disorders, plant protection measures and special horticultural practices), Harvesting and yield of following crops, Mango, Banana, Citrus (Sweet orange, Mandarin, Acid Lime), Guava and sapota, Grape, Pineapple, Papaya, Pomegranate, Anonacious fruits, Ber and fig, Aonla and Jackfruit, Apple, Brief cultivation in tabular form on following crops, Strawberry, Cherry, Pear, Plum, Peach, Almond, Karonda, Phalsa and Bael, Recommendations of Joint Agresco (last five years)

Practical :

Study of garden tools and implements, Study of propagation media, containers, potting mixtures, potting, depotting, repotting and transplanting, Study of fruit crops and their varieties, Study of fruit crops and their varieties, Plant propagation by seed (scarification, stratification), Plant propagation by cutting and layering, Plant propagation by budding and grafting, Propagation through

specialized vegetative structures and micro propagation, Layout and planting of fruit crops, Training and pruning of fruit crops, Preparation and application of bio regulators in horticultural crops, Methods of irrigation, Methods of manuring and fertilizer application and fertigation, Methods of harvesting: Mannual, Mechanical and Chemical, Visit to commercial nursery, Visit to commercial orchard.

Books Recommended:

1. Bose T. K. 1990 Fruits of India Tropical and Subtropical, Naya Prakash, Culcutta.
2. Hard Block of Horticulture – ICAR
3. Arid fruit culture – B. A. Chundawat
4. Fruit culture in India – Sham Singh and others
5. Principles of Horticulture and fruit growing – Kunte and Yawalkar
6. Pomology – Kumar
7. Production Technology of fruit crops – Shammugvelk k. G.
8. Fruits – Ranjit Singh.

Lesson plan :

Lesson No.	Topic	*Marks*
	"A" (Fundamentals)	
1.	Definition of Horticulture, fruit science: scope, importance, area and production of fruit crops in Maharashtra and India.	**10**
2.	Export import scenario of fruit crops in India.	**5**
3.	Classification of fruit crops on Horticultural basis	**10**
4.	Climate and soil	**10**
5.	Selection of site, fencing, wind break and shelter belts	**10**
6.	Planning, layout and planting systems	**10**
7.	High density, planting and meadow orcharding	**5**
8.	Methods of propagation in fruit crops	**10**
9.	Use of rootstocks in fruit crops	**5**
10.	Training and pruning of fruit crops	**10**
11.	Use of bio - regulators in propagation and fruit production	**10**
12.	Nutritional management of fruit crops	**5**
13.	Irrigation management of fruit crops	**5**

14.	Special horticultural practices: Bahar treatments, notching, ringing, bending, girdling etc.	**10**
	"B" Fruit production technology	
	Origin, B. N. family, area and production, soil and climate, commercial varieties, Propagation and planting, after cares (irrigation, weed management, nutritional requirement, use of PBR, physiological disorders, plant protection measures and special horticultural practices), Harvesting and yield of following crops.	
15, 16	Mango	**10**
17, 18	Banana	**10**
19, 20	Citrus (Sweet orange, Mandarin, Acid Lime)	**10**
21	Guava and sapota	**5**
22, 23	Grape	**10**
24	Pineapple	**5**
25	Papaya	**5**
26	Pomegranate	**5**
27	Anonacious fruits	**5**
28	Ber and fig	**5**
29	Aonla and Jackfruit	**5**
30	Apple	**5**
31	Brief cultivation in tabular form on following crops Strawberry, Cherry, Pear, Plum, Peach, Almond, Karonda, Phalsa and Bael.	**5**
32	Recommendations of Joint Agresco (last five years)	

Practicals:

1. Study of garden tools and implements
2. Study of propagation media, containers, potting mixtures, potting, depotting, repotting and transplanting
3. Study of fruit crops and their varieties.
4. Study of fruit crops and their varieties.
5. Plant propagation by seed (scarification, stratification)
6. Plant propagation by cutting and layering
7. Plant propagation by budding and grafting.

8. Propagation through specialized vegetative structures and micro propagation.
9. Layout and planting of fruit crops.
10. Training and pruning of fruit crops.
11. Preparation and application of bio regulators in horticultural crops.
12. Methods of irrigation.
13. Methods of manuring and fertilizer application and fertigation.
14. Methods of harvesting: Mannual, Mechanical and Chemical.
15. Visit to commercial nursery.
16. Visit to commercial orchard.

Books Recommended

1. Bose T. K. 1990 Fruits of India Tropical and Subtropical, Naya Prakash, Culcutta.
2. Hard Block of Horticulture – ICAR
3. Arid fruit culture – B. A. Chundawat
4. Fruit culture in India – Sham Singh and others
5. Principles of Horticulture and fruit growing – Kunte and Yawalkar
6. Pomology – Kumar
7. Production Technology of fruit crops – Shammugvelk k. G.
8. Fruits – Ranjit Singh.

Course No. : HORT-232

Course Title : PRODUCTION TECHNOLOGY OF VEGETABLES AND FLOWERS

Course Credit : 1+1=2

Theory :

Importance and scope of olericulture, Vegetable garden and vegetable classification, Origin, area, production, varieties, package of practices for vegetables : Fruit vegetables : Tomato, Bringjal, Chillies, Okra, Cucurbitaceous vegetables – Cucumber, ridge gourd, bottle gourd, bitter gourd and melons, Cole crops – cabbage, cauliflower and Knolkhol, Bulb crops – onion and garlic. Beans and peas – French beans, cluster beans, dolichus beans, peas and cowpea. Tuber crops – potato, sweet potato, Root crops – carrot, radish. Leafy vegetables- amaranthus, palak, methi. Importance of ornamental horticulture,

Types and styles of ornamental gardens, Study of trees, shrubs, climbers, palms, indoor plants and seasonal flowers (Common name, botanical name, family, propagation method and uses), Package of practices for roses, jasmine, chrysanthemum gladiolus, marigold and tuberose

Practical :

Identification of important vegetable seeds and plants, Identification of important ornamental plants, Planning and layout of kitchen garden, Raising and transplanting of vegetable seedlings and seasonal flowers, Study of garden features, Planting of lawns and it's maintenance, Seed extraction in tomato and brinjal, Potting, Depotting and Repotting and maintenance of indoor plants, Visit to commercial vegetable and ornamental garden, Training and pruning of roses and pinching and disbudding in chrysanthemum, Planning and layout of gardens and garden designs for public and private areas, Intercultural operations in vegetable crops, Harvesting indices of different vegetables, Grading and packaging of vegetables and flowers, Prolonging the vase life of cut-flowers, Flower arrangement.

Books recommended :

1. Shanmugavellu, K.G. . Production Technology of Vegetable Crops
2. Thamburaj S. (2005) Vegetable, tubers and spices. ICAR publication, New Delhi
3. Niraj, N.P. (2006) Basic concept of vegetable science. IBDC, Luknow
4. Singh, S.P. (2005) Production technology of vegetable crops. ARCC, Hissar
5. Bose, T.K. and M.G. Som (2005) Vegetable crops in India, Naya Prakosh, Kolkatta
6. Gopalswami Iyenger K.S. (1970) Complete gardening in India
7. Bose, T. K. and L.P. Yadav (1986) Commercial flowers, Naya Prkosh, Culcutta
8. Mukhopadhay, A. (1987) Floriculture in India. Lyal Book Depot. Ludhiyana
9. Vishnuswarup (1972) Garden flowers. National Book Trust, New Delhi
10. Bose, T. K. and Mukharjee (1976) Garden plants. Naya Prakosh, Culcutta
11. Pal , B. P. (1972) Rose in India. ICAR, New Delhi
12. G. S. Randhawa and A.K. Mukhopadhay (2001). Floriculture in India
13. Hand Book of Horticulture, ICAR publication

Lesson Plan (Theory) :

Periods	Topic	Weightage of Marks
1	Importance and scope of olericulture	10
2	Vegetable garden and vegetable classification	10
	Origin, area, production, varieties, package of practices for following vegetables :	
3-5	Fruit vegetables : Tomato, Bringjal, Chillies, Okra	10 for each crop
6-7	Cucumber, Water melon, bitter gourd and Potato	5 for each crop
8	Cabbage, cauliflower, Onion	10 marks each
	Brief cultivation in tabular form on following crops	
9	Ridge gourd, Ash gourd, Snake gourd, Bottle gourd, Musk melon, Knol khol, Beans and peas : French bean, Cluster bean, Dolichus bean, peas and Cowpea	2 marks each
10	Garlic, Sweet potato, Carrot, Radish, Amaranthus. Palak, Methi, coccinia, Drumstick	2 marks each
11	Importance of ornamental horticulture, Types and styles of ornamental gardens	10 for each
12	Study of trees, shrubs, climbers, palms, indoor plants and seasonal flowers (Common name, botanical name, family, propagation method and uses)	2 marks each
13 -15	Package of practices for	10 marks each
	Rose	
	Jasmine	
	Chrysanthemum	
	Gladiolus	
	Marigold	
	Tuberose	
16	Recommendations of JOINT AGRESCO of last five years	5 marks

Lesson Plan (Practical)

Periods	Topic
1	Identification of important vegetable seeds and plants
2	Identification of important ornamental plants
3	Planning and layout of kitchen garden
4	Raising and transplanting of vegetable seedlings and seasonal flowers
5	Study of garden features
6	Planting of lawns and it's maintenance
7	Seed extraction in tomato and brinjal
8	Potting, Depotting and Repotting and maintenance of indoor plants
9	Visit to commercial vegetable and ornamental garden
10	Training and pruning of roses and pinching and disbudding in chrysanthemum
11	Planning and layout of gardens and garden designs for public and private areas
12	Intercultural operations in vegetable crops
13	Harvesting indices of different vegetables
14	Grading and packaging of vegetables and flowers
15	Prolonging the vase life of cut-flowers
16.	Flower arrangement

Course No. : HORT-243

Course Title : PRODUCTION TECHNOLOGY OF SPICES, AROMATIC, MEDICINAL AND PLANTATION CROPS

Course Credit : 1+1=2

Theory :

Importance and cultivation technology of Spices – ginger, turmeric, pepper, cardamom, nutmeg, pimenta, cinnamon coriander, cumin, fenugreek, aromatic crops – lemon grass, citronella, palmarose, vetiver, geranium, dawana; Plantation crops – coconut, arecanut, betelvine, cashew, cocoa, coffee, tea, , oilpalm; Medicinal plants – diascoria, rauvolfia, opium, ocimum, perwinkle, aloe, guggul, belladonna, nux vomica, *Solanum khasiamum*, aonla, senna, plantago, stevia, coleus and acorus, hida, behada, arjun, mahua, adulsa, safed musali, fulwel, and satap.

Practical :

Botanical description and identification of aromatic plants; Identification of varieties in spices and plantation crops; Identification of medicinal plants; Propagation techniques in aromatic and spice crops; selection of mother palm and seed nuts in coconut and oil palm; Study of identification of aromatic plants; Distillation procedures for aromatic crops; Propagation methods in plantation crops; Propagation and planting methods in turmeric; Propagation and planting techniques in ginger; Harvesting procedures in aromatic plants; Processing and curing of spices (ginger, turmeric and black pepper); Training methods in betelvine; Rejuvenation practices in cashewnut; Products-byproducts of spices and plantation crops; Procedures for oleoresin extraction; Visit to local commercial plantations, Aromatic and medicinal plant nurseries and seed spices field.

Books Recommended :

1. Cultivation and industries of medicinal and aromatic plants. Atal E.K. and Kaput B.M., (1989) Vol. 1 & 2.
2. Adavances in horticulture (1995), Medicinal and aromatic plant by K.L.Chaddha and Rajendra Gupta.
3. Medicinal plants, S.K.Jain.
4. Indian medicinal plants, (1975) Vol. 1 to 4 by K.R.Kirtikar and others.
5. Introduction to spices, plantation, medicinal and aromatic crops by Kumar N.
6. A Handbook of Horticulture, Dr.K.L.Chadha, ICAR Publication 2003.
7. Spices, plantation crops, medicinal and aromatic plants, N.Kumar etal. Oxford and IBH Publishers, New Delhi 1997.
8. Spices, V.B. Singh and Kirti Singh, New Age International Publishers, 1997
9. Major spices of India (Crop managemnt), J.S.Pruthi, ICAR Publication 1993
10. Minor spice and Condiment, J.S.Pruthi, ICAR Publication, 2001.

Lesson Plan (Theory)

Lecture No.	Topic	Weightage Marks
1	Importance, area and production of spices, plantation crops, medicinal and aromatic crops	5
2-4	Package of practices of important spices crops viz. Ginger, Turmeric, Black pepper, Cardamom, Coriander,	20

	Nutmeg, Cinnamon, Cumin and Pimenta	
5-8	Production technology of important plantation crops viz. Coconut, Arecanut, Coffee, Tea, Betel vine, Cashew, Cocoa, Oil palm	25
9	Classification of medicinal plants on the basis of parts utilized viz. Root, bard, stem, leaf, flower, fruit, seed, latex and gum. Study of commercial parts of medicinal crops and its utilization as a drug.	5
10-13	Package practices of important medicinal crops viz. Diascoria, Rauwolfia, Opium, Occimum, Periwinkle, Aloe, Guggul, Belladonna, Nux vomica, Solanum, Aonla, Senna, Plantago, Stevia, Coleus, Acorus, **Hirda, Behada, Arjun, Mahua, Adulsa, Safaid Musali, Gulwel and Satap**	25
14-15	Package practices of important aromatic crops viz. Lemon grass, Citronella, Palma Rosa, Vetiver, Geranium, Mentha, Khus and Dawana.	15
16	Recommendations of JOINT AGRESCO for last Five years	5

***Note :** –

The spices shown in **"Bold"** type has been included as a additional important species of respective category which were not considered for new syllabus.

Practical :

Practical No.	**Topic**
1	Botanical description and identification of spices crops and varieties
2-3	Botanical description and identification of plantation crops and varieties
4-5	Botanical description and identification of Medicinal crops and varieties
6-7	Botanical description and identification of Aromatic crops and varieties

8	Propagation methods and planting techniques of spices, plantation , medicinal and aromatic crops
9	Selection mother palms and seed nuts in coconut and oil palm
10	Propagation methods and planting techniques in ginger and turmeric
11	Processing and curing of spices (ginger, turmeric and black pepper)
12	Training method in betel vine and rejuvenation practices in cashew nut.
13	Distillation procedures for aromatic crops
14	Products, Byproducts of spices and plantation corps
15	Procedures for oleoresins extractions
16	Visit to local commercial plantations and nurseries of spices, plantation, medicinal and aromatic plants

Course No. : HORT- 364

Course Title : POST – HARVEST MANAGEMENT AND VALUE ADDITION OF FRUITS AND VEGETABLES.

Course Credits : 1+1=2

Theory :

Importance of post harvest technology in horticultural crops. Maturity, Maturity indices, harvesting and post harvest handling of fruits and vegetables. Ripening, changes during ripening and factors affecting ripening of fruits and vegetables. Pre-harvest factors responsible for deterioration of harvested fruits and vegetables. Chemicals used for hastening and delaying ripening of fruits and vegetables. Methods of storage, pre-cooling, pre-storage treatment, low temperature storage, controlled atmospheric storage, hypo-baric storage, irradiation and low temperature storage, irradiation and low cost storage structures. Various methods of packing, packaging and cushioning materials and transport. Importance and scope of fruits and vegetables preservation in India. Unit layout- Selection of sit and precaution for hygienic conditions of the unit. Principles and methods of preservation by heat, low temperature, chemicals, fermentation, canning, bottling, ultra-violet and ionizing radiation. Spoilage of canned products, biochemical, enzymatic and microbial spoilage.

Practical :

Practice in judging the maturity of various fruits. Practice in judging the maturity of various vegetable. Determination of physiological loss in weight (PLW), total soluble solids (TSS) and acidity of fruits and vegetables. Packaging methods, types of packaging and importance of ventilation. Packing methods for export or international trade. Specific pacing for export of mango, banana, grapes, pomegranate, sweet orange mandarin, okra, onion and cucurbits. Methods of prolonging storage life, effect of ethylene on ripening of banana/mango. Identification of equipments and machinery used in preservation of fruits and vegetables. Preservation by drying. Preparation of jam, jellies and marmalade. Preparation of squashes, cordials, syrups and Juices. Preparation of Chutneys, pickles ketchup and Sauce. Preservatives, colour permitted and prohibited in India. Visit to local processing unit/ cold storage/ processing industry.

Books recommended :

1. Preservation for fruits and vegetables. Principle and practices Shrivastava & Sanjeev Kumar.
2. Post harvest physiology, handling, utilization of tropical and subtropical fruits and vegetables. By Pantastico, E.R
3. Post harvest biotechnology of vegetables. By Salunke, D.K.
4. Fruits and vegetables preservation. By Girdharilal, Sidhappa and Tandon.

Lesson Plan (Theory) :

Periods	Topic	Weightage
1	Importance of post harvest technology in horticultural crops.	5
2,3	Maturity, Maturity indices, harvesting and post harvest handling of fruits and vegetables.	10
4,5	Ripening, changes during ripening and factors affecting ripening of fruits and vegetables.	10
6	Pre-harvest factors affecting quality on post-harvest shelf life of fruits and vegetables	5
7	Factors responsible for deterioration of harvested fruits	5

	and vegetables	
8	Chemicals used for hastening and delaying ripening of fruits and vegetables.	5
9,10	Methods of storage, pre-cooling, pre-storage treatments, low temperature storage, controlled atmospheric storage, hypo-baric storage, irradiation and low cost storage structures.	10
11	Various methods of packing, packaging and cushioning materials and transport.	5
12	Importance and scope of fruits and vegetables preservation in India.	5
13	Unit layout- Selection of site and precaution for hygienic conditions of the unit.	5
14,15	Principles and methods of preservation by heat, low temperature, chemicals, fermentation, canning, bottling, ultra-violet and ionizing radiation.	10
16	Spoilage of canned products, biochemical, enzymatic and microbial spoilage. JOINT AGRESCO recommendations of last five years.	5

Lesson Plan (Practical) :

Practical No	Topic
1	Judging the maturity of various fruits
2	Judging the maturity of various vegetables.
3 &4	Determination of physiological loss in weight 9POLW), total soluble solids (TSS) and acidity of fruits and vegetables.
5	Packaging material, types of packaging and importance of ventilation
6	Packing methods for export. Specific packing for export of mango, banana, grapes, pomegranate, sweet orange, mandarin, okra, onion and cucurbits
7	Methods of prolonging storage life, effect of ethylene on ripening of banana/ mango.
8	Identification of equipment and machinery used in preservation of

	fruits and vegetables.
9	Preservation by drying.
10 & 11	Preparation of Jam, Jellies and marmalade
12	Preparation of Squashes, Cordials, Syrups and Juices.
13	Preparation of Chutneys, Pickles Ketchup and Sauce
14	Preparation for Candies, crystallized, Glazed fruits and Preserve
15	Preservatives, colour permitted and prohibited in India
16	Visit to local processing unit/ cold storage\/ cold storage/ processing industry and FPO licensing and food laws.

ENTOMOLOGY

Course No. : ENT-231

Course Title : INSECT MORPHOLOGY AND SYSTEMATICS

Course Credit : 2+1=3

Theory :

History of Entomology in India. Factors for insects abundance. Classification of phylum Arthropods upto classes. Relationship of class Insecta with other classes of Arthropoda. Morphology : Structure and functions of insect cuticle and moulting. Body segmentation, Structure of Head, thorax and abdomen, Structure and modifications of insect antennae, mouth parts and legs. Wing venation, modifications and wing coupling apparatus, Structure male and female genetalia, Sensory organs. Metamorphosis and diapause in insects. Types of larvae and pupae. Structure and functions of digestive, circulatory, excretory, respiratory, nervous, secretary (Endocrine) and reproductive system in insects. Types of reproduction in insects. Systematics : Taxonomy – importance, history and development and binomial nomenclature. Definitions of Biotype, Sub-species. Species, Genus, Family and Order. Classification of class Insecta upto Orders. Orthoptera, Acrididae. Dictyoptera, Mantidae, Odonata, Isoptera, Termitidae, Thysanoptera, Thripidae. Hemiptera. Pentatomidae, Coreidae, Pyrrhocoridae, Lygacidae, Cicadellidae, Deiphacidae, Aphididae. Coccidae, Aleurodidae, Pseudococcidae, Neuroptera, Chrysopidae Lepidoptera, Noctuidae, Sphingidae, Pyralidae, Gelechiidae, Arctiidae, Coleoptera, Coccinellidae, Chrysomelidae, Cerambycidae, Curculionidae, Bruchidae, Scarabaeidae, Hymenoptera, Tenthridinidae, Apidae, Trichogrammatidae, Ichneumonidae, Braconidae, Diptera, Cecidomyiidae, Trypetidae, Tachinidae, Agromyziidae.

Practical :

Methods of collection and preservation of insects including immature stages; External features of Grasshopper / Blister beetle; Types of insect antennae, mouthparts and legs; Wing venation, types of wings and wing coupling apparatus Types of insect larvae and pupae; Dissection of digestive system in insects (Grasshopper); Dissection of male and female reproductive systems in insects (Grasshopper); Study of characters of orders Orthoptera, Dictyoptera, Odonata, Isoptera, Thysanoptera, Hemiptera, Lepidoptera, Neuroptera, Coleoptera, Hymenoptera, Diptera and their families of agricultural importances.

Reference Books:

1. Elements of Economic Entomology – David and Anathkrishanan
2. General and Applied Entomology -- David and Kumarswami
3. Insect Physiology and Anatomy_ N. C. Pant and Swaraj Ghai
4. Imms General Text Book of Entomology –Vol. I & II - Richard and David
5. An Introduction to Study of Insects – Borror
6. Insect Structure and Function - Chapman
7. Physiological Systems in Insects – Mark J. Klowden

Teaching Schedule (THEORY) :

No.	Topic
1 & 2	**Introduction** * Introduction and history of Entomology including contribution of scientist in brief (Aristotal, Carlous Linnaeus, Fabricious, Charles Darwin, Lefroy, Wigglesworth, Snodgrass, Pradhan, Runwal., Pruthi and Ananthkrishnan. Definition : Insect & Entomology Characteristics of Class-Insecta * Economic importance of insects : harmful, beneficial and productive insects * Pests of national importance e.g. Locust, termite and whitegrub alongwith their extent of losses. * Premier Institutes concerned with Entomology : International – CAB (UK), IOBC(Trinidad), International Institute of Insect Physiology – Kenya. National – National Institute of Biological Control (Bangalore) NCIPM - (New Delhi), CIB (Faridabad), National Plant Protection Institute, Hyderabad, Indian Grain Storage Institute (Hapur),
3	**Dominance of Class Insecta**
4	**Insect Integument** Structure, chemical composition and functions of Cuticle

	Process of moulting, cuticular appendages and processes
5	**Body segmentation and structure of Head** Body regions, structure of head capsule, and positions of head and structure of cervix
6	**Structure of thorax and abdomen** Segmentation, appendages and processes, pregenital & post genital appendages and structure of genitalia
7	**Structure and modifications of Antennae** Components of typical antenna, basal articulation, functions and modifications (with examples)
8 & 9	**Structure and modifications of mouth parts** Structure and feeding mechanism of **Mandibulate** type of mouthparts and **Haustellate** type of mouth parts (piercing & sucking ; chewing & lapping; sponging; rasping & sucking and siphoning)
10	**Structure and modifications of leg** Components of typical leg, basal articulation, tripod locomotion and modifications (with examples)
11	**Structure and modifications of wings** Basal articulation, regions, hypothetical wing venation, wing coupling apparatus and modifications (with examples)
12	**Sensory and Sound producing organs** Sensory organs : Location and function (mechanoreceptors, audioreceptors chemoreceptors, thermo & humidity receptors, photoreceptors and vision & visual organs, with examples Sound producing organs : Tympanum & Stridulatory organs
13	**Metamorphosis and Seasonal adoptions** Definition and types of metamorphosis with examples. Seasonal adoptions (aestivation, quiescence, hybernation and diapause) with examples
14 & 15	**Immature stages of Insects** Structure of egg, eclosion and its type (with examples) Types of larvae and pupae (with examples); nymphal stage
16	**Structure and functions of Digestive system** Alimentary canal : salivary glands, proventriculus, filter chamber,

	digestion and absorption of food.
17	**Structure and functions of Circulatory system** Organs of circulations, composition of blood and functioning of dorsal vessel
18	**Structure and functions of Excretory system** Organs of excretion and their functioning; products of excretion
19	**Structure and functions of Respiratory system** Organs of respiration and types of respiration (with examples)
20 & 21	**Structure and functions of Nervous system** Organs of nervous system, types of neurons and conduction of nerve impulse
22 & 23	**Structure of Reproductive systems in Insects** Male and female reproductive systems and types of reproduction
24 & 25	**Systematics** Importance and history of Taxonomy; development of binomial nomenclature along with its rules and regulations Definitions : Order, Family, Genus, Species, Sub-species and Biotypes Metamorphosis and its significance
26 & 27	**Classification** Phylum Arthropoda along with its characters Class Insecta along with its characters
28 & 29	**Characters of orders along with families of agricultural importance** Orthoptera (Fam: Acrididae), Dictyoptera (Fam: Mantidae)
30 & 31	**Characters of orders along with families of agricultural importance** Odonata, Isoptera (Fam: Termitidae) and Thysanoptera (Fam:Thripidae)
32	**Characters of orders along with families of agricultural importance** Hemiptera (Fam: Pentatomidae, Coreidae, Pyrrhocoridae, Lygaeidae, Cicadellidae, Delphacidae, Aphididae, Aleurodidae, Coccidae, Psedococcidae
33	**Characters of orders along with families of agricultural**

	importance Neuroptera (Fam: Chrysopidae), Lepidoptera (Fam: Noctuidae, Sphingidae, Pyralidae, Gelechiidae, Arctiidae.
34 & 35	**Characters of orders along with families of agricultural importance** Diptera (Fam:Cecidomyiidae, Trypetidae, Tachinidae, Agromyziidae) Hymenoptera (Fam: Tenthridinidae, Apidae, Trichogrammatidae, Ichneumonidae, Braconidae)
36	**Characters of orders along with families of agricultural importance** Coleoptera (Fam: Coccinellidae, Chrysomelidae, Cerambycidae, Bruchidae, Scarabaeidae, Curculionidae)

Weightage for the Semester-end Theory Exam.

Introduction (Lec.No. 1 to 3) : 10 Marks

Morphology (Lec. No.4 to 23) : 40 Marks

Systematics (Lec. No. 24 to 36) : 30 Marks

Total : 80 Marks

PRACTICAL :

No	Topic
1	Methods of collection and preservation of insects including immature stages
2	External features of typical insect (eg. Grasshopper) Structure of head, thorax and abdomen
3	Structure of antenna and its modifications
4	Dissection of Chewing and biting type of mouthparts
5	Dissection of Chewing and lapping type of mouthparts
6	Dissection of Piercing and sucking type of mouthparts
7	Dissection of Chewing and biting type of mouthparts
8	Structure of typical leg and modifications of legs
9	Wing venation, types of wings and wing coupling apparatus
10	Metamorphosis in insects along with its significance and

	types of insect eggs, larvae and pupae
11	Dissection of digestive system of Cockroach / Grasshopper
12	Dissection of male reproductive system of Cockroach / Grasshopper
13	Dissection of female reproductive system of Cockroach / Grasshopper
14	Dissection of central nervous system of Cockroach / Grasshopper
15	Study of characters of orders along with their families of agricultural importance: Odonata,Orthoptera and Dictyoptera
16	Study of characters of orders along with their families of agricultural importance: Isoptera, Thysanoptera and Hemiptera
17	Study of characters of orders along with their families of agricultural importance: Neuroptera, Lepidoptera and Hymenoptera
18	Study of characters of orders along with their families of agricultural importance: Diptera and Coleoptera

Assignment : Each student should collect at least 100 insect specimens belonging to the aforesaid orders.

Weightage for the Semester-end Practical Exam.

Dissection of the mouthparts : 08 Marks

Dissection of the system : 10 Marks

Identification : 16 Marks

Collection and Viva : 06 Marks

Total : 40 Marks

Course No. : ENT-242

Course Title : INSECT ECOLOGY AND INTEGRATED PEST MANAGEMENT INCLUDING BENEFICIAL INSECTS

Course Credit : 2+1=3

Theory :

Insect Ecology :-

Introduction, Environment and its components . Effect of abiotic factors-temperature, moisture, humidity, rainfall, light, atmospheric pressure and air currents, Effect of biotic factors – food competition, natural and environmental resistance. Concepts of Balance of life in nature, biotic potential and

environmental resistance and causes for outbreak of pests in agro-ecosystem. Pest surveillance and pest forecasting. Categories of pests. IPM, Introduction, importance, concepts principles and tools of IPM. Host plant resistance, Cultural, Mechanical, physical, Legislative, Biological,(parasites, predators & transgenic plant pathogens such as bacteria, fungi and viruses) methods of control. Chemical control- importance hazards and limitations Classification of insecticides, toxicity of insecticides and formulations of insecticides. Study of important insecticides. Botanical insecticides - neem based products. Cyclodines Organophosphates, Carbamates, Synthetic pyrethroids, Novel insecticides, Pheromones, Nicotinyl insecticides, Chitin synthesis inhibitors, Phenyl pyrazoles, Avermectins, Macrocyclic lactones, Oxadiazimes. Thiourea derivaties, pyridine azomethines, pyrroles, etc. Nematicides, Rodenticides, Acaricides and fumigants, Recent methods of pest control, repellents, antifeedants, hormones, attractants, gamma radiation and genetic control. Practices, scope and limitations of IPM. Insecticides. Act 1968 - Important provisions. Application techniques of spray fluids, Phytotoxicity of insecticides Symptoms of poisoning, first aid and antidotes, Beneficial insects. Parasites and predators used in pest control and their mass multiplication techniques, Important groups of microorganisms, bacteria, viruses and fungi used in pest control and their mass multiplication techniques, Important species of pollinators weed killers and scavenger, their importance. Non insect pests - mites, nematodes, rodents and birds. Vermiculture.

Practical :

Visit to meteorological observatory automatic weather reporting station; Study of terrestrial and pond ecosystems of insects, studies on behaviour of insects and orientation (repellency, stimulation, deterancy). Study of distribution patterns of insects, sampling techniques for the estimation of insect population and damage; Pest surveillance through light traps, pheromone traps and field incidence; Practicable IPM practices, Mechanical and physical methods; Cultural and biological methods; Chemical control, Insecticides and their formulations; Calculation of doses/ concentrations of insecticides; Compatibility of pesticides and Phytotoxicity of insecticides; IPM case studies; Identification of common phytophagous mites and their morphological characters; Identification of common plant parasitic nematodes and their morphplogical characters; Identification of

common plant parasitic nematodes and their morphological characters Identification of rodents and bird pests and their damage; Identification of eartahworms in vermiculture-visit to vermiculture unit; Other beneficial insects-Pollinators, weed killers and scavengers.

Theory :

Lecture No.	Topic	Maximum Marks Alloteed
1	Insect Ecology : Definition – Importance of ecology and its scope.	3
	Environment : Its components	3
3	Effect of abiotie factors – temperature, moisture, humidity, rainfall, light. Atmospheric pressure and air currents.	5
4	Effect of biotic factors-food competition natural and environmental resistance.	5
5	Concepts of balance of life in nature, biotic potential and environmental resistance. Causes of pests outbreaks in agro-ecosystem.	3
6	Pest surveillance and pest forecasting.	4
7	Categories of pests.	2
8	IPM-Definition, importance, concepts, principles and tools of IMP.	10
9	Practices, scope and limitation of IPM.	10
10	Host Plant Resistance.	5
11	Cultural, mechanical. Methods of Pest control.	10
12	Physical, Legislative. Methods of pest control.	10

13	Biological methods of pest control.(Parasites, predators)	5
14	Microbial methods of pest control (Bacteria, Fungi, Viruses Nematodes, weed Killers.)	5
15	Chemical control- importance, hazards and limitations.	3
16	Classification of insecticides-Inorganic & organic	10
17	Mode of action.	10
18	Novel insecticides IGR, chitin synthesis inhibitor, Juvenile Hormones mimic, ecdysone agonistic	10
19	Toxicity of insectides.	10
20,21 &22	Formulations ofinsecticides, pesticide application equipment Recent methods of pest control- repellents, antifeedants attractants, gamma radiation, genetic control (Transgenic crops)	10
23	Semichemicals	5
24	Insecticide Act 1968, important provisions.	5
25	Phytotoxicity and compatibility of insecticides.	2
26	Symptoms of poisoning, first aids and antidotes.	3
27	Mass multiplication rechniques 1. Trichogramma 2. Cryptoiaemus (coccinellids) 3. Epiricania melanoleuca 4. Kopidosoma Koehleri 5. Chrysopids.	10
28	Important group of microorganisms. Bacterial- mass multiplications (Bt), Pseudomonas. Fungi – mass multiplication Verticillum lecanii, Beaveria,	15

	Metarrhizum. Viruses – HaNPV , SNPV, Mass multiplication.	
29 & 30	Sericulture /Lac culture / apiculture.	15
31	Non-insect pests : mites, rodents, birds, and nematodes, snails.	10
32	Vermicalture :- importance, species of vermicaompost, morphology, techniques of vermicompost production, use of Vermicompost in agriculture.	

Practical :

Practical No.	Topic
1	Visit to meteorological Observatory.
2	Study of terrestrial and pond ecosystem of insects.
3	Study of behaviour of insects and orientation.
4	Study of distribution pattems and sampling techniques for the estimation of insect population and damage.
5	Surveillance of pests by using light traps, pheromone traps and field incidence.
6	Practicable IPM practices- mechanical and physical Methods.
7	Practicabl IPM practices – Cultural, biological and chemical methods.
8	Insecticides and their formulations.
9	Calculation of doses/ concentrations of insecticides / Pesticide equipments.
10	Study of compatibility and phytotoxicity of insecticides.
11	IPM case studies.
12	Study of mites.
13	Study of plant parasitic nematodes.
14	Study of rodents and birds.
15	Study of earthworms and visit to vermeries.
16	Study of pollinators, weed killers and scavengers.

Reference Books :

1	Ecological Entomology	Hufakar C.V.
2	The ecology and Insect population	Clark L.R,Gier P.W.Rushas R.D. Marris R.F.
3	Fundamentals of Insect Ecology	Agarwal M.L.
4	Fundamentals of Insect Ecology	Odum E.P.
5	Elements of Insect Ecology	Yazdani S.S.and Agarwal M.L.
6	Principles of Insect Pest Management	Dhaliwal G.S. and Arora Ramesh
7	Integrated Pest Management	Dhaliwal G.S. and Araora Ramesh
8	Introductaion to Insect Pest Management	Metcalf R. L. Luckman W. H.
9	Insect Pest Management	Venugopal Rao
10	Entomology and Pest Management	Pedigo L. P.
11	Insecticides with novel modes of action mechanism and application	Ishaaya I. And Degheleel
12	Insecticides : Toxicology and uses	Gupta H.C.L.
13	A Text books of applied Entomology	Shrivastava K. P.
14	Pesticide application equipment	Bindra O.S.
15	Pest population and assessment of crop losses.	Atwal A.S. Bal Raj Singh
16	Agricultural entomology and pest control	Pradhan S.
17	Microbial control of crop pests	Rabindra R.J. Kennedy J.S. Rajshekharan B. Shrinivasan M.R.
18	Technology for mass production	PDBC, Banglore
19	Rodents in Indian Agriculture	Aswar Prakash
20	Bees and Beekeeping in India	Abrol D.P.
21	Bee Keeping	Phillops E.F.
22	Honeybees and their management	Mishara R.C.
23	Introduction to sericulture	Gangaji G. Sullochannachetty J.
24	Elements of Economic entomology	David B.V. and Kumaraswami T.

Course No. : ENT-353

Course Title : CROP PESTS AND STORED GRAIN PESTS AND THEIR MANAGEMENT

Course Credit : 2+1=3

Theory:

Stored grain pests: Coleopteran and Lepidopteran pests, their biology and damage, preventive and curative methods. Distribution, biology, nature and symptoms of damage, and management strategies of insect and non insect pests of rice, sorghum, maize, ragi (Eleucine coracana), wheat, sugarcane, cotton, mesta, sunhemp, pulses, groundnut, castor, ginger, safflower, sunflower, mustard, brinjal, bhendi, tomato, cruciferous and cucurbitaceous vegetables, potato, sweet potato, colacasia, moringa, amaranthus, chillies, mango, citrus, grapevine, cashew, banana, pomegranate, guava, sapota, ber, apple, coconut, tobacco, coffee, tea, turmeric, betelvine, onion, coriander, garlic, curry leaf, pepper, ginger and ornamental plants.

Practical:

Identification of pests, their damage symptoms and management of rice, sorghum, maize, wheat, sugarcane, cotton, pulses, solanaceous and Malvaceous vegetables, cruciferous and cucurbitaceous vegetables, chilli, mango, cotton, citrus, and sapota.

Theory : Teaching schedule

Lecture No.	Topic	Maximum marks allotted
1 & 2	Polyphagous pests : 1. Armyworm, 2. White grub, 3. Termite, 4. Locust.	5
3 & 4	Distribution, biology, nature, and symptoms of damage, and management strategies of insect and non insect pests of Rice: Stem borer, BPH, GH, Leaf hopper, rice grass hopper.	10
5 & 6	Sorghum stem borers, shoot fly, midge fly, aphids, Delphacid, Earhead caterpillar (H. armigera), grass hopper.	10
7	Maize and Ragi:stem borers, leaf eating caterpillars Wheat : Stem borer, aphids, rodents	5

8 & 9	Sugarcane : borers (early, internode, top shoot Pyrilla, wooly aphid, white fly, mealy bug.)	10
10&11	Cotton:Bollworms (Pink, American, spiny), jassids, red cotton bug, dusky cotton bug,thrips, mealy bugs, mites.	10
12	Mesta, suhhemp and pulses (Gram pod borer, tur plume moth, pod fly, mites), maruca, sunhemp caterpillar.	10
13	Groundnut: Leaf miner, thrips, pod bug, white grub Castor : castor semilooper, leaf eating Caterpillar, capsule borer, jassids	5
14	Safflower : Safflower aphid Sunflower: Hairy caterpillar, Spilosoma, Capitulum borer (Helicoverpa armigera) Mustard : Mustard saw fly, mustard aphids.	
15&16	Stored grain pests: bilogy and damage of following pests Coleoptera-Rice weevil, Pulse beetle, Lesser grain borer, Rust red flour beetle, Saw toothed grain beetle, Long headed flour beetle, Cigarette beetle, Khapra, Bruchids. (Pulses and groundnut)	10
17	Lepidoptera – Rice moth, Indian meal moth, Grain moth.	
18	Preventive and curative methods of management of stored grains pests	
19	Brinjal-Shoot and fruit borer, leaf hoppers, aphids, whitefly, mites and Epilachna beetle. Bhendi- Shoot and fruit borer, leaf hoppers, aphids, whitefly Tomato-Fruit borer, leaf miner, aphids, thrips, whitefly, mites.	10
20	Cruciferous crops- (Cabbage, cauliflower, broccoli, knolkhol) Diamond back moth, aphids, painted bug, Head borer Spodoptera.	

21	Cucurbitaceous vegetables (Bitter gourd, bottle gourd, ridge gourd, smooth gourd, cucumber, water melon, muskmelon) Fruit fly, aphids, leaf miner, whitefly, thrips, red pumpking beetle.	
22	Potato-Cut worm, potato tuber moth Sweet potato-Sweet potato weevil, Sweet potato leaf eating caterpillar.	
23	Colocassia and Moringa- Leaf eating caterpillar, web worm, stem borer, Spodoptera, aphics. Chilli- Thrips, Helicoverpa Amaranthus – Leaf eating caterpillar	
24	Mango-Stem borer, stone weevil, fruit fly, mealy bug, mango hopper, shoot borer, thrips	10
25&26	Citrus – Lemon butterfly, white fly, black fly, leaf miner, fruit sucking moth, Psylids.	10
27	Grapevine- Thrips, stem girdler, flea beetle, mealy bugs	10
28	Cashew – Tea mosquito, cashew stem borer Banana- Aphids, root stock weevil, nematode.	5 5
29	Pomegranate- Fruit borer, fruit sucking moths, thrips, shot hole borer. Guava-fruit fly, spiraling whitefly, bark eating caterpillar.	5 5
30	Sapota-Chikoo moth, seed borer, bud borer. Ber-Fruit fly, fruit borer.	5
31	Apple-San Jose scale, wooly aphids. Cocunut and Arecanut- Rhinoceros beetle, Black headed caterpillar, coconut mites, red Palm weevil, rodents.	3 5 5
32	Tobacco-Tobacco leaf eating caterpillar Coffee and tea-coffee and tea mosquito bug, Coffee seed borer.	5

33	Turmeric and Ginger-Rhizome fly Beetle vine-mites Onion and Garlic-Thrips Coriander-Mites.	10
34	Curry leaf and pepper-Scale, Pollu beetle, mealy bug. Rose, Gerbera, Carnation-Thrips, mites, whitefly, flower borer Ornamental plants- Snails, mealy bug, scale	
35	Fig- Jassid, mites, fruit borer Anola-fruit borer	
36	Forage crops- Aphids, Spodoptera	

Sr.No.	Topics	Weightage%	Marks
1.	Polyphagous and cereals	20	16
2.	Pulses and oilseeds	15	12
3.	Sugarcane and fibre	15	12
4.	Stored grains	10	08
5.	Vegetables	15	12
6.	Fruit crops	20	16
7.	Spices, condiment and forage	05	04
	Total	**100**	**80**

Practical :

Topics	Marks
Collection	06
Spotting	30
Viva	04
General performance	10
Total	**50**

Reference books :

Sr.No.	Name of books
1	Trends in Agril Pest Management by Arora & Dhaliwal
2	Agril. Pest of Sough Asia And their Management by Atwal & Dhaliwal
3	General & Applied Entomology by David and Ananthakrishnan
4	Insect and Fruits Insects and Vegetables by Butani D.K.
5	Integrated Pest Management by Venugopal Rao
6	Plant Protection Schedule by Department of Agriculture
7	Joint Agresco Recommendation
8	Insects and Mites by Nair
9	Handbook of Agriculture for South India – TVR, Ayyar
10	Elements of Economic Entomology by David and Kumarswamy (Recent Edition)
11	Pests of floriculture crops and their control by T. Ramesh

Practical: Teaching schedule

Practical No.	Topic
1.	Identification, damage symptoms and management of pest of rice.
2.	Pests of sorghum
3.	Pests of maize and wheat
4.	Pests of sugarcane
5.	Pests of cotton
6.	Pests of pulses
7.	Pests of solanaceous vegetables
8.	Pests of malvaceous vegetables
9.	Pests of Cruiciferous vegetables
10.	Pests of cururbitaceous vegetables
11.	Pests of chilli
12.	Pests of Mango
13.	Pests of Citrus
14.	Pest of Sapota
15.	Pest of dryland fruit crops.
16.	Pests of stored grain.

Course No. : ENTO-364

Course Title : INTRODUCTORY NEMATOLOGY

Course Credits : 1+1`=2

Theory:

Introduction: History of Phytonematology, Economic importance, General Characteristics of Plant Pathogenic Nematodes. Nematode - general morphology and biology. Classification of nematodes up to family level with emphasis on groups containing economically important genera, Classification of nematodes by habitat. Identification of economically important plant nematode up to generic level with the help of keys and description. Symptoms caused by nematodes with examples, Interaction between plant parasitic nematodes and disease causing fungi, bacteria and viruses. Different methods of nematode management . Cultural methods (crop rotation, fallowing, soil amendments, other land management techniques) Physical methods (soil solarization, hot water treatment) Biological methods. Chemical methods (Fumigants and non fumigants) Resistant varieties. IDM.

Practical:-

Methods of survey – sampling methods, collection of soil and plant samples; Extraction of nematodes from soil and plant tissues following combined Cobb's decanting sieving and Baermann funnel technique, counting and estimation of plant parasitic nematodes; Preparation of temporary and permanent mounts; Method of preparation of perincal patterns for identification of species of Meloidogyne; Study and identification of most important plant parasitic nematodes with special reference to their characteristics and symptomtology – Meloidogyne, Pratylenchus, Heterodera, Ditylenchulus, Globodera, Tylenchulus, Xiphinema, Radopholus, Totylenchulus, and Helicotylenchus. Experimental techniques used in pathogenicity studies with root knot nematode.

Reference books:

Sr. No.	Name of Book	Name of the Author and publication
1.	Plant Nematode Control	Whitehead A. G. CAB International Wallingford U.K.
2.	Nembatode Pest Management	Swarup G. Deogupta D. R. and Gill J. S.
3.	An appraisal of Eco-Friendly Appraches.	Nematalogical Society of India IARI New Delhi

4.	A Treatisc on phytonematology	P. Parvatha Reddy Agri cole Publishing Academy New Dhilli.
5.	Plant Nematology	P. Parvatha Reddy

Teaching Schedule (Theory)

Lecture No.	Topic	Marks
1.	Introduction: History of Phytonematology, Economic importance.	8
2.	General Characteristics of Plant Parasitic Nematodes.	5
3.	Nematode general morphology and biology.	5
		20%
4.	Classification of nematodes up to family level with emphasis on group containing economically important genera.	8
5.	Classification of nematodes by habitat.	5
		20%
6.	Identification of economically important plant nematode up to generic level with the help of keys and description.	5
7.	Symptoms caused by nematodes with examples.	5
8.	Interaction between plant parasitic nematodes and disease causing fungi, bacteria and viruses.	5
		20%
9.	Different methods of nematode management.	8
10.	Cultural methods (crop rotation, fallowing, soil amendments, other land management techniques), resistant varieties.	5
11.	Physical methods (soil solarization, hot water treatment)	5
12.	Biological methods.	5
13.	Chemical methods (Fumigants and non fumigants)	5
		20%
14.	Entomophilic nematodes-species, biology	5
15.	Mode of action.	5
16.	Mass production techniques.	8
		20%

Teaching Schedule (Practical)

Lecture No.	Topic
1.	Methods of survey- sampling methods, collection of soil and plant samples.
2.	Extraction of nematodes from soil and plant tissues following combined Cobb's decanting- sieving and Baermann funnel technique.
3.	Counting and estimation of plant parasitic nematode.
4.	Preparation of temporary and permanent mounts.
5.	Method of preparation of perennial patterns for identification of species of Meloidogyne.
6.	Study and identification of mot important plant parasitic nematodes with special reference to their characteristics and symptomotology- Meloidogyne and Rotylenchulus.
7.	Pratylenchus and Helicotylenchus
8.	Heterodera and Xiphinema
9.	Ditylenchus and Globodera
10.	Tylenchulus and Radophotus
11-12.	Mass Production of EPN
13.	Pathogenicity studies of EPN
14.	Experimental techniques used in pathogenicity studies with root-knot nematode.
15.	Soil solarization and sterilization methods.

PLANT PATHOLOGY AND AGRIL. MICROBIOLOGY

Course No. : PATH- 111

Course Title : INTRODUCTORY PLANT PATHOLOGY

Course Credit : 1+1=2

Theory :

Introduction, History of Plant Pathology: History and development of Plant Pathology in ancient, dark, premodern, modem and present eras, Contribution made by different scientists, **Definitions and objectives of Plant Pathology:** Concepts of disease, Disease triangle, **Important plant pathogenic organisms:** Different groups like fungi, bacteria, fastidious vesicular bacteria and phytoplasma with examples of diseases caused by them, **Morphology and reproduction**: of spiroplasmas, viruses, viroids, algae, protozoa and phanerogamic parasites with examples of diseases caused by them, **Prokayotes** - classification of prokaryotes according to Bergey's manual of Systematic bacteriology, **General characters of fungi:** mycelium (septate and non-septate), nutrition of fungi - saprophytes, parasites and symbiosis), definition of fungus, somatic structures, types of fungal thalli, fungus tissues, modification of thallus, reproduction in fungi (asexual and sexual) - spores (asexual and sexual), spore fruits (asexual and sexual), Asexual reproduction: fission, budding, and fragmentation; **Sexual reproduction:** plasmogamy, karyogamy and meiosis, **Method of reproduction:** planogametic copulation, gametangial contact, gametangial copulation, spermatization, dikaryotization; **Nomenclature:** binomial system of nomenclature, rules of nomenclature; **Classification of fungi**-upto genus

Practical:

Morphology of fungi (Vegetative), Reproductive structures and spore fruits in fungi, Symptoms produced by plant pathogens like fungi, bacteria, viruses and phytoplasmas, Acquaintance to Plant Pathology laboratory and equipments, Preparation of culture media for fungi and bacteria, Isolation techniques, Demonstration of Koch’s postulates, Collection of disease specimen and

preparation of mounts, Preservation of disease samples, Study of important genera of plant pathogenic fungi like *Pythium, Phytophthora, Albugo Sclerospora, Perenosclerospora, Pseudoperenospora, Perenospora, Plasmopara,* and *Bremia* (Oomycota); *Mucor* and *Rhizopus* (Zygomycota); *Oidium, Oidiopsis, Ovulariopsis, Erysiphe, Phyllactinia, Uncinula* and *Podosphaera* (Ascomycota); *Puccinia* (Different stages), *Uromyces, Hemiliea, Sphacelotheca* (*Soroporium*), *Ustilago, Tolyposporium Agaricus, Pleurotus and Ganoderma* (Basidiomycota); *Septoria, Colletotrichum, Pestalotiopsis, Pyricularia, Drechslera, Alternaria, Stemphyllium, Cercospora, Phaeoisariopsis, Rhizoctonia* and *Sclerotium* (Asexual Ascomycetes - Deuteromycota)

Text books Recommended :

1. Introduction to principles of plant pathology by R. S. Singh, Oxford and IBH Publ. Co., New Delhi (1996)
2. Essentials of plant pathology by V. N. Pathak, Prakash Publ., Jaipur (l972)
3. Plant pathology by G. N. Agrios 4th edition, Academ. Press, New york (1997)
4. Introductory Plant Pathology by M. N. Kamat, Prakash Publ, Jaipur (l967)
5. Plant diseases by R. S. Singh
6. Introductory Mycology by Alexopoulos, Mims and Blackwel (2004)
7. Introductory Plant Pathology by H.C. Dube

B) Teaching schedule

Lecture No.	Topics to be covered
1	Introduction
2	History, Definition and objectives of Plant Pathology
3	Concepts of disease, disease triangle
4	Definition of Plant Pathology
5	Important plant pathogenic organisms, different groups, Fungi, Bacteria, Fastidious and Vesicular bacteria and Phytoplasma with examples of diseases caused by them.
6	Spiroplasmas, Viruses, Viroids, Algae, Protozoa, and phanerogamic parasites with examples of diseases caused by them.
7,8	Prokaryotes, classification of prokaryotes according to Bergey's manual of Systematic bacteriology.

9	General characters of Fungi
10	Definition of Fungus, somatic structures, types of fungal thalli, fungus tissues, modification of thallus
11	Reproduction in Fungi (Asexual)
12	Reproduction in Fungi (Sexual)
13	Nomenclature, Binomial system of nomenclature
14	Rules of nomenclature
15	Classification of Fungi-up to genus

C) Lesson Plan

Lesson No.	Topics to be covered
1	Introduction
2	History, Definitions and objectives of Plant Pathology History of Plant Pathology- History and development of Plant Pathology in ancient, dark, premodern, modem and present eras. Contribution made by - Surpal, Theophrastus, Pliny, Iwanowski, Robert Hook, Anton van Leeuwenhoek, Needham, Linnaeus, Tillet, Prevost Robert Koch, Marshal Ward, Millardet, Jenson, Meyar, Burril, E.F. Smith, Erikson, Biffen, Iwanwasky, Stakman, Cragie, Luthra, Stanley, Bowden & Pierie, Doi & Asuyama, Butler, Mehta, Mundkur, Dastur, Kulkarni, Bhide, Uppal, Tirumalachar, Patel and Rangaswamy.
3	Concepts of disease, disease triangle
4	Definition of Plant Pathology
5	Important plant pathogenic organisms, different groups: Fungi, Bacteria, Fastidious Vesicular bacteria and Phytoplasma with examples of diseases caused by them.
6	Important plant pathogenic organisms, different groups: Morphology and reproduction -Spiroplasmas, Viruses, Viroids, algae, Protozoa, and phanerogamic parasites with examples of diseases caused by them.
7,8	Prokaryotes, classification of prokaryotes according to Bergey's manual of Systematic Bacteriology.

9	General characters of Fungi - mycelium (septate and non-septate), Nutrition of fungi, saprophytes, parasites and symbiosis)
10	Definition of Fungus, somatic structures, types of fungal thalli, fungus tissues, modification of thallus
11	Reproduction in Fungi (asexual and sexual): Spores (asexual and sexual), spore fruits (asexual and sexual)
12	Reproduction in Fungi (Asexual and sexual): Asexual reproduction - Fission, budding, and fragmentation Sexual reproduction - Plasmogamy, karyogamy and meiosis Method of reproduction – Planogametic copulation, Gametangial contact, Gametangial copulation, spermatization, dikaryotization
13	Nomenclature, Binomial system of nomenclature
14	Rules of nomenclature
15	Classification of Fungi-upto genus

D) Weightages

Sr. No.	Name of Topic	Weigh-tages
1	Introduction	6-7
2	Important plant pathogenic organisms, different groups, Fungi, Bacteria, Fastidious vesicular bacteria and Phytoplasma, Spiroplasma, Viruses, Viroids, algae, Protozoa, and phanerogamic parasites with examples of diseases cased by them	6-8
3	Prokaryotes, classification of prokaryotes according to Bergy's manual of systematic bacteriology.	6-7
4	General characters of Fungi	4-5
5	Definition of Fungus, somatic structures, types of fungal thalli, fungus tissues, modification of thallus	6-8
6	Reproduction in Fungi (Asexual and sexual)	4-5
7	Nomenclature, Binomial system of nomenclature	4-5
8	Classification of Fungi – up to genus.	4-5
	Total	**40-50**

E) Exercise schedule (practical)

Exercise No.	Topics to be covered
1	Morphology of fungi (Vegetative)
2	Reproductive structures and spore fruits in fungi
3	Symptoms produced by fungal plant pathogens
4	Symptoms produced by bacterial plant pathogens
5	Symptoms produced by viruses and phytoplasma
6	Acquaintance to Plant Pathology laboratory and equipments
7	Preparation of culture media for fungi and bacteria
8	Isolation techniques, demonstration of Koch's postulates, collection of disease specimen and preparation of mounts
9	Preservation of disease samples
10	Study of Pythium, Phytophthora and Albugo
11	Study of Sclerospora, Perenosclerospora, Pseudoperenospora, Perenospora, Plasmopara, and Bremia
12	Study of genera Mucor and Rhizopus
13	Study of Oidium, Oidiopsis, Ovulariopsis, Erysiphe, Phyllactinia, Uncinula and Podosphaera
14	Study of Puccinia (Different stages), Uromyces, Hemiliea
15	Study of Sphacelotheca, Ustilago and Tolyposporium
16	Study of Agaricus, Pleurotus and Ganoderma
17	Study of Septoria, Colletotrichum, and Pestalotiopsis
18	Study of Pyricularia, Helminthosporium, Drechslera, Alternaria, Stemphyllium, Cercospora, Phaeoisariopsis, Rhizoctonia and Sclerotium

Course No. : MIBO-121

Course Title : AGRICULTURAL MICROBIOLOGY

Course Credit : 2+1=3

Theory:

History of Microbiology: Spontaneous generation theory, Role of microbes in fermentation, Germ theory of disease, Procaryotic and eucaryotic microorganisms. Morphology, cytology and other characters of bacteria, fungi,

algae, actinomycetes and mycoplasma. Bacteriophages: structure and properties of Bacterial viruses – Lytic and Lysogenic cycles: viroids, prions. Metabolism in bacteria: ATP generation, chemoautotrophy, photo autotrophy, respiration, and fermentation. Bacterial genetics; Gene expression; Genetic recombination: transformation, conjugation and transduction, genetic engineering, Plasmids, episomes, genetically modified Organisms. Protection against infections. Plant – Microbe interactions.

Applied areas of Microbiology. Soil Microbiology: Microbial groups in soil, microbial transformations of carbon, nitrogen, phosphorus and sulphur, Biological nitrogen fixation. Microflora of Rhizosphere and Phyllosphere microflora, microbes in composting. Microbiology of Water: potable, irrigation, sewage water and water purification systems. Microbiology of food: microbial spoilage of food and principles of food preservation. Beneficial microorganisms in Agriculture: Biofertilizer (Bacterial Cyanobacterial and Fungal). Methods of application and quality norms of biofertilizer. Microbial insecticides. Microbial agents for control of Plant diseases. Biodegradation, Biogas production,

Practical:

General instructions, Familiarization with instruments, materials, glassware etc. in a microbiology laboratory: Practice of Aseptic methods: I - Evaluation of aseptic technique with Nutrient broth tubes. II- Evaluation of aseptic technique with a Nutrient agar plate. Methods of Sterilization and Preparation of media I- Preparation of nutrient broth, nutrient agar plates, nutrient agar slant and nutrient agar stabling; II- Sterilization of glassware by Dry heating; III - Sterilization of nutrient broth by Filtration. Plating methods for Isolation and Purification of bacteria I - Isolation of bacteria by Streak plate method. II - Isolation of aerobic spore forming bacteria by Enrichment using Streak plate method. III - Checking of purity of a bacterial culture by Streak plating method. Identification of bacteria by staining methods and Biochemical tests: I– Morphological examination of bacteria by Simple and Differential staining. II – Different biochemical tests for identification of bacterial culture; Enumeration of bacteria: I - Enumeration of bacteria by Stain slide method. II- Enumeration of bacteria by most probable number method. III - Enumeration of bacteria by Pour plate method and Spread plate method.

Books recommended:

1. Agricultural Microbiology. 1998. G. Rangaswani and D.J. Bagyraj. Prentice Hall of India., New Delhi.
2. An Introduction to Microbiology. 1996. P. Tauro, K.K. Kapoor and K.S. Yadav. Wiley Eastern Ltd., New Delhi.
3. Microbiology, 1986. M.J.Pelczar, E.C.S. Chan and N.L. Krieg. Mc Graw Hill 5th Edition, New York, USA.
4. Soil microorganisms and plant growth. 1977. N.S.. Subbarao Oxford & IBH Publ. Co. , New Delhi.

B) Teaching Schedule

Lecture No.	Topics to be covered
1.	Microbiology: Introduction, Scope in Agriculture and allied fields
2.	History of Microbiology.
3.	Spontaneous generation.
4.	Role of microbes in fermentation and germ theory of disease
5.	Microbial world: Prokaryotic and eukaryotic microorganisms
6 & 7.	Morphology, cytology and other characters of bacteria.
8.	Morphology, cytology and other characters of fungi
9.	Morphology, cytology and other characters of algae
10.	Morphology, cytology and other characters of actinomycetes
11.	Metabolism in bacteria: ATP generation, chemoautotrophy. photo autotrophy
12.	Metabolism in bacteria; respiration and fermentation.
13.	Bacterial genetics. Gene expression, genetic recombination.
14.	Bacterial transformations
15.	Transduction, genetic engineering, plasmids, episomes, genetically modified organisms
16.	Bacterial viruses- Lytic and lysogenic cycles, viroids, prions.
17.	Protections against infections and plant microbe interactions
18	Applied areas of microbiology.
19.	Soil Microbiology. Microbial groups in soil.
20.	Microbial transformations of carbon.

21.	Microbial transformations of nitrogen.
22.	Biological Nitrogen Fixation. .
23.	Microbial transformations of phosphorus..
24.	Microbial transformations of sulphur and iron.
25.	Microflora of rhizosphere, phyllosphere and microbes in composting.
26 & 27	Microbiology of water: potable/irrigation / sewage water and water purification system
28 & 29	Microbial spoilage and principles of food preservation
30 & 31	Beneficial microorganisms in Agriculture: Biofertilizers. Bacterial, Cyanobacterial and fungal biofertilizers.
31 & 32	Methods of application of biofertilizers and Quality control of biofertilizers.
33	Microbial insecticides. Microbial agents for plant disease control.
34	Biodegradation and Biogas production.

C) Lesson Plan

Lecture No.	Topics to be covered
1.	Microbiology: Introduction, Scope in Agriculture and allied fields
2.	History of Microbiology, Origin of life. Discovery of microorganisms, Invention of microscope.
3.	Spontaneous generation, Settlement of spontaneous generation conflict, Era of germ theory of disease. Immunization research. Development of Agricultural Microbiology.
4.	Role of microbes in fermentation and germ theory of diseases. Contributions of Robert Koch and Louis Pasteur. Koch's Postulates.
5.	Microbial world: Prokaryotic and eukaryotic microorganisms. Microorganisms. Groups of Microorganisms.. Microflora and microfauna. Characters and importance of bacteria, fungi, actinomycetes, algae, viruses, mycoplasma, nematodes and earthworms.
6.	Bacteria: Morphology, cytology and other characters. Bacterial cell structure and functions of external and internal parts. Morphology of bacteria: size, shape, cell grouping, endosperm formation, and capsule

	formation.
7.	Bacteria: Nutrients required for growth of bacteria. Nutritional types of bacteria. Bacterial growth. Growth curve. Growth phases. Reproduction of bacteria. Methods of reproduction
8.	Morphology, cytology and other characters of fungi: Fungal hyphae, mycelium, types of mycelia, reproduction methods of fungi, nutritional mode of fungi. Agriculturally important fungi.
9.	Morphology, cytology and other characters of algae. Algae, distribution and growth requirements. Morphology and cytology of algae. Major groups of algae and their importance.
10.	Morphology, cytology and other characters of actinomycetes. Actinomycetes, similarities with bacteria and fungi, habitat, general characters, reproduction, important actinomycetes and their importance in agriculture and allied fields.
11.	Bacterial metabolism: Catabolism and anabolism. ATP generation Chemoautotrophy. Photo autotrophy
12.	Metabolism in bacteria: Respiration and Fermentation.
13.	Bacterial genetics. Bacterial genome. Arrangement of genes. Mutation in bacteria. Genetic variability. Bacterial conjugation. Properties of plasmids. Properties of clones Genetic exchange by conjugation.
14.	Bacterial Transformations.
15	Transduction. Generalized and Specialized transduction. Genetic Engineering. Cutting and joining of DNA. Genetic recombination. Genetically modified organisms
16.	Bacterial viruses- Bacteriophages. Structure of bacteriophages. Properties of bacteriophages. Lytic and lysogenic cycles.
17.	Protection against infections and plant microbe interactions. Immunity, types of immunity. Parasitism, Predation, Symbiosis, Commensalisms.
18.	Applied areas of Microbiology. Scope of Agricultural Microbiology in other fields. Beneficial and harmful activities of microbes in agriculture and allied branches of Microbiology.
19.	Soil Microbiology. Introduction and importance. Microorganisms present in soil. Bacteria, fungi, actinomycetes, algae in soil. Protozoa

	and earthworms, nematodes in soil.
20.	Microbial transformations of carbon. Carbon cycle. Decomposition of organic matter.
21.	Microbial transformations of nitrogen. Nitrogen cycle. Steps of N cycles and microbes involved.
22.	Biological Nitrogen Fixation. Symbiotic and asymbiotic N fixation *Rhizobium* légume symbiosis. Associative dinitrogen fixation.
23.	Transformation of phosphorus in soil. P cycle, steps and microbes involved. Phosphate solubilization, mechanism and organisms involved.
24.	Microbial transformation of sulphur. Sulphur cycle, steps and microbes involved. Sulphur compound in soil. Oxidation of Sulphur Iron transformations in soil. Iron cycle, steps and Microbes involved
25	Microflora of Rhizosphere, Phyllosphere and microbes in composting. Rhizosphere. Rhizosphere concept. Microflora of rhizosphere . Effect of rhizospheric microflora on crop plants. Factors affecting rhizospheric microfloral population. Phyllosphere: Phyllosphere microflora and their effect on crop plants.. Microbes in composting. Cellulolytic microbes. Microbes in prevailing in different phases of composting.
26.	Microbiology of water: Sanitary quality of water. Polluted water. BOD and water purification methods
27.	Microbiology of water: Waste water. Sewage and microbial flora in sewage, Effects of waste water on plants and microorganisms. Purification methods
28.	Microbiology of Food: Food microflora. Food intoxication, Food infections, Food poisoning. Microbial spoilage of important foods. Methods of food preservation.
29.	Microbiology of Food: Spoilage and preservation of f agricultural produce. Preservation of fruits, vegetables, milk, and other food products.
30	Beneficial microorganisms in agriculture: Biofertilizers. Definition, Types of biofertilizers. Types based on the basis of microbial group involved, activity performed by microbial agent used to prepare biofertilizer, physical consistency and relation with the host crop. Role

	of biofertilizers.
31& 32.	Methods and rate of application of biofertilizer. Seed treatment method with precautions while treating seeds with biofertilizer, Application through soil, irrigation water and other methods. Quality control of biofertilizers. Specified quality control norms for biofertilizers
33	Microbial insecticides. Microbial agents for plant disease control. Bioinsecticides and biopesticides. *Trichoderma*, *Pseudomonas*.
34	Biodegradation and Biogas production.

D) Weightages

Group	Topics	Weightages
I	Microbiology. History of Microbiology. Spontaneous Generation. Role of microbes in fermentation and germ theory of diseases. Microbial world. Prokaryotes and eucalypts. General characters of microbes	8 to 9
II	Bacteria, Cytology, Morphology, nutrition, growth curve, reproduction	10 to 11
III	Morphology, cytology and other characteristics of fungi, algae, actinomycetes, mycoplasma.	10 to 11
IV	Metabolism in bacteria and Bacterial Genetics	10 to 11
V	Bacterial Viruses. Lytic and lysogenic cycle, viroids and prions.	4 to 5
VI	Applied areas of Microbiology, Soil Microbiology and microbial transformation of carbon	4 to 5
VII	N cycle, Biological N fixation	10 to 11
VIII	Sulphur and Iron transformations and S and Fe cycles. Microflora of rhizosphere, phyllosphere and microbes in composting.	6 to 7
X	Microbiology of food. Microbiology of water	4 to 5
XI	Biofertilizer, Types, Methods of application and quality control	8 to 9
XII	Microbial insecticides, biodegradation and biogas production	6-7
	Total	**80 to 92**

E) Exercise schedule (Practical)

Exercise No.	Title of exercise
1.	Acquaintance with microscope and other lab equipments.
2.	Study of morphology of bacteria
3.	Simple staining of bacteria
4.	Gram staining of bacteria
5.	Methods of sterilization
6.	Preparation of culture media.
7.	Preparation of nutrient broth, pour plate, slants and stabs
8.	Isolation of bacteria by streak method.
9.	Isolation of *Rhizobium* bacteria by pour plate technique
10.	Purification methods of bacterial cultures
11	Estimation of soil microflora by dilution pour plate technique
12.	Estimation of soil microflora by buried slide techniques
13.	Enumeration of bacteria by direct microscopic count method.
14.	Isolation of bacteria (*Azotobacter)* by enrichment culture technique
15.	Isolation of phosphate solubilizing bacteria using specific medium.
16.	Tests for Acid and gas production and liquefaction of gelatin by bacteria
17.	Enumeration of bacteria (*Azospirillum)* by most probable method

Course No. : PATH-232

Course Title : PRINCIPLES OF PLANT PATHOLOGY

Course Credit : 1+1=2

Theory :

Terms **and concepts, Survival and dispersal of plant pathogens:** Survival - mode of perpetuation of pathogen, facultatism by dormant mycelium and sclerotia; perpetuation on alternate and collateral hosts; heteroecism, autocism, polymorphism, physiological specialization, **Dispersal:** continuous dissemination - autonomous dissemination, Role of air, wind, water, animals, birds, insects, nematodes and mites in dissemination of plant pathogens, Discontinuous dissemination – man, seed, soil and agricultural operations, **Phenomenon of infection:** pre-penetration, penetration and post penetration,

Mechanism of infection and avenues of penetration, direct and indirect penetration, Pathogenesis: role of enzymes, toxins, growth regulators and polysaccharides, **Defense mechanisms in plant:** structural and biochemical (pre and post infection), **Plant disease epidemiology and disease forecasting:** remote sensing, Epidemiology - definition, simple interest and compound interest diseases, essential conditions for epiphytotics, decline of epidemics, **Plant disease forecasting:** methods of disease forecasting, survey and surveillance, forecasting models, satellite imaginary forecasting; **General principles of plant disease management:** importance, principles – avoidance, exclusion, eradication, protection and resistance

Practical:

Study of different groups of fungicides and antibiotics, Preparation of fungicides: Bordeaux mixture, Bordeaux paste and chestnut compound, Methods of application of fungicides: seed, soil, and foliar, Bioassay of fungicides: poisoned food techniques; inhibition zone technique; slide germination technique, Biocontrol of plant pathogens: Dual culture technique, Detection of seed microflora, Seed treatment, Visit to quarantine station and remote sensing laboratory, Soil solarization, Handling of plant protection equipments.

Text books Recommended :

1. Introduction to principles of plant pathology by R. S. Singh, Oxford and IBH Publ. Co., New Delhi (1996)
2. Essentials of plant pathology by V. N. Pathak, Prakash Publ., Jaipur (l972)
3. Plant pathology by G. N. Agrios 4th edition, Academ. Press, New york (1997)
4. Introductory Plant Pathology by M. N. Kamat, Prakash Publ, Jaipur (l967)
5. Plant diseases by R. S. Singh
6. Introductory Plant Pathology by H.C. Dube

Theory : B) Teaching schedule

Lecture No.	Topics to be covered
1	Terms and concepts
2	Survival and dispersal of Plant Pathogens

3	Phenomenon of infection: Pre-penetration, penetration and post penetration
4	Pathogenesis: Role of enzymes, toxins, growth regulators and polysaccharides, Defense mechanism in plants: Structural and biochemical (pre and post infection)
5	Plant disease epidemiology and disease forecasting, Remote sensing
6	General principles of plant disease management - Importance General principles: Avoidance, exclusion, eradication, protection and resistance
7	Plant quarantine and inspection: Quarantine rules and regulations and pest risk analysis
8	Cultural methods: Rouging, eradication of alternate and collateral hosts, crop rotation, manure and fertilizer management, mixed cropping, sanitation, hot weather ploughing, soil amendments, time of sowing, seed rate and plant density, irrigation and drainage.
9	Mechanism of biological control and PGPR
10	Physical methods: Use of heat, steam
11	Chemical methods: Methods of application of fungicides
12	Host plant resistance
13	Application of biotechnology in plant disease management (Development of disease resistant transgenic plants through gene cloning).
14	Integrated plant disease management (IDM) concept, advantages and importance.

C) Lesson plan

Lesson No.	Topics to be covered
1	Terms and concepts in Plant Pathology: Immunity, Immunization, Perpetuation, Incubation period, Polygenic resistance, Setae, Antherezoid, Blastospores, Parasite, Facultative parasite, Facultative saprophyte, Obligate parasite, Homothalism, Heterothalism, Holocarpism, Eucarpism, Dikaryosis, Entomochory, Plasmogamy,

	Spore, Karyogamy, Haustoria, Alternate Host, Colateral host, Heteroecism, Autoecism, Anamorph, Teleomororph, Chronic symptom, conjugation, Horizontal resistance, Verticle resistance, Host, Parasite, Pathogen, Hyperparasite, Hypersensitivity, Inoculum, Masked symptoms, Nonhost resistance, Paraphysis, Pathogenicity, Phytoalexin, Propogule, Resistance, Susceptibility, Symptomless carrier and Tolerance.
2	Survival and dispersal of plant pathogens: Survival: Mode of perpetuation of pathogen, facultatism by dormant mycelium and sclerotia; perpetuation on alternate and collateral hosts; heteroecism, autocism, polymorphism, physiological specialization. Dispersal: Continuous dissemination - Autonomous dissemination. Role of air, wind, water, animals, birds, insects, nematodes and mites in dissemination of plant pathogens . Discontinuous dissemination – Man, seed, soil and agricultural operations
3	Phenomenon of infection: Pre-penetration, penetration and post penetration Mechanism of infection and avenues of penetration, direct and indirect penetration
4	Pathogenesis: Role of enzymes, toxins, growth regulators and polysaccharides Defense mechanisms in plant: structural and biochemical (pre and post infection)
5	Plant disease epidemiology and disease forecasting: Remote sensing Epidemiology: A) Definition, B) Simple interest and compound interest diseases, C) Essential conditions for epiphytotics - 1. Distance of susceptible plants from the source of primary inoculum, 2. Abundance of distribution of susceptible host, 3. Disease proneness in the host, 4. Presence of suitable alternate and collateral host for survival, 5. Presence of aggressive isolate of pathogen, 6. High multiplication rate of pathogen, 7. Low death rate, 8. Easy and rapid disposal of the pathogen, 9. Adaptability of pathogen D) Decline of epidemics: saturation of pathogen in host population,

	reduction the aggression of the pathogen E) Plant disease forecasting: a) Methods of disease forecasting, b) Survey and surveillance, c) Forecasting models, d) Satellite imaginary forecasting
6	General principles of plant disease management: Importance, General principles – Avoidance, exclusion, eradication, protection and resistance
7	Plant Quarantine and inspection: Quarantine rules and regulations and pest risk analysis,. A) Plant quarantine - domestic and international seed certification, B) PEQ, C) Eradication – 1. Removal of plant parts and sanitation, 2. Eradication of alternate hosts, 3. Destruction of collateral host, 4. Rouging, 5. Cultural practices
8	Cultural methods: Rouging, eradication of alternate and collateral hosts, crop rotation, manure and fertilizer management, mixed cropping, sanitation, hot weather ploughing, soil amendments, time of sowing, seed rate and plant density, irrigation and drainage.
9	Role of biological control and PGPR . Biological-cross protection, use of suppressive soil, introduction of newer antagonist, use of hypo-virulent strain, use of hyperparasites
10	Physical methods: heat, steam, hot water, solar heat
11	Chemical methods: methods of application of fungicides, seed treatment, soil application and spray/dust application
12	Host plant resistance
13	Application of biotechnology in plant disease management (Development of disease resistance transgenic plant through gene cloning)
14	Integrated plant disease management (IDM) concept, advantages and importance

D) Weightages

Lesson No.	Topics to be covered	Weight -ages
1	Terms and concepts	4-6
2	Survival and dispersal of plant pathogens, Phenomenon of infection-pre-penetration, penetration and post penetration	4-4
3	Pathogenesis-Role of enzymes, toxins, growth regulators and polysaccharides, defense mechanisms in plant structural and biochemical (pre and post infection) Plant disease epidemiology and disease forecasting - Remote sensing	7-8
4	General principles of plant disease management – Importance, General principles – Avoidance, exclusion, eradication, protection and resistance	5-6
5	Plant quarantine and inspection- Quarantine rules and regulations	4-6
6	Cultural methods - Rouging, eradication of alternate and collateral hosts, crop rotation, manure and fertilizer management, mixed cropping, sanitation, hot weather ploughing, soil amendments, time of sowing, seed rate and plant density, irrigation and drainage.	4-6
7	Role of Mechanism of biological control and PGPR	4-6
8	Physical methods: heat, steam, hot water, solar heat Chemical methods: methods of application of fungicides - seed treatment, soil application and spray/dust application	4-6
9	Host plant resistance: Application of biotechnology in plant disease management (Development of disease resistance transgenic plant through gene cloning)	4-6
10	Integrated plant disease management (IDM): concept, advantages and importance	4-6
Total		**40-50**

E) Exercise schedule (Practical)

Exercise No	Topics to be covered
1	Study of different groups of fungicides and antibiotics
2,3	Preparation of fungicides: Bordeaux mixture, Bordeaux paste and chestnut compound
4	Methods of application of fungicides: seed ,soil, and foliar
5	Bioassay of fungicides: poisoned food techniques
6	Inhibition zone technique
7	Slide germination technique
8	Biocontrol of plant pathogens
9	Dual culture technique
10	Detection of seed microflora
11	Seed treatment
12	Visit to quarantine station and remote sensing laboratory
13	Soil solarization
14	Handling of plant protection equipments

Course No. : PATH-243

Course Title : DISEASES OF FIELD CROPS AND THEIR MANAGEMENT

Course Credit : 2+1=3

Theory:

Economic importance, symptoms, cause, epidemiology and disease cycle and integrated management of diseases of rice, sorghum, bajra, maize, wheat, sugarcane, *ragi,* finger millet, turmeric, ginger, tobacco, groundnut, sesamum, sunflower, safflower, linseed, castor, cotton, red gram, Bengal gram, black gram, green gram, tea, soybean.

Practical:

Study of symptoms, etiology, host-parasite relationship and specific control measures of diseases of rice, sorghum, wheat, bajra, maize, *ragi,* finger millet, sugarcane, turmeric, ginger, tobacco, groundnut, castor, sunflower, safflower, sesamum, linseed, cotton, red gram, green gram, black gram, Bengal

gram, soybean. Field visits at appropriate time during the semester. Survey and collection of disease samples of above crops and their preservation.

Sr. No.	Lecture No.	Topic to be covered	Sr. No.	Lecture No.	Topic to be covered
Economic importance, symptoms, cause, epidemiology, disease cycle and integrated management of diseases of :					
1	1, 2	Rice	13	19	Linseed
2	3, 4	Sorghum	14	20	Cotton
3	5, 6	Bajra	15	21, 22	Red gram
4	7	Maize	16	23	Bengal gram
5	8	Ragi and Nagli (Finger millet)	17	24	Black gram
6	9, 10	Wheat	18	25	Green gram
7	11, 12	Sugarcane	19	26	Soybean
8	13	Tobacco	20	27, 28	Turmeric
9	14	Groundnut	21	29	Ginger
10	15	Sesamum	22	30	Onion
11	16	Sunflower	23	31	Garlic
12	17, 18	Safflower	24	32	Castor

Note: Students should submit 50 pressed, well mounted diseased specimens in three installments during the semester. Books recommended

Teaching schedule (Lesson plan)

Lesson No.	Lesson	Topic to be covered
1, 2	Rice diseases	Blast, bacterial blight, false smut, udbatta, sheath blight, leaf scald and rice tungro virus
3, 4	Sorghum diseases	Smuts, charcoal rot, grain mold, leaf spots, rust
5, 6	Bajra diseases	Rust, smut, downy mildew, ergot, rust
7	Maize diseases	Downy mildew, smut
8	Ragi & finger	Leaf spots, blast

	millet	
9, 10	Wheat diseases	Stem rust, brown rust, yellow rust, blights, loose smut, bunt of wheat
11, 12	Sugarcane diseases	Smut, mosaic, grassy shoot, rust, red rot
13	Turmeric diseases	Leaf spots, rhizome rot
14	Ginger diseases	Leaf spots, rhizome rot
15	Tobacco diseases	TMV, leaf curl, broom rape
16, 17	Groundnut diseases	Leaf spots (Tikka), rust, bud necrosis, stem rot
18	Sesamum diseases	Leaf spots, wilt, powdery mildew, phyllody
19, 20	Sunflower diseases	Downy mildew, leaf spot, rust, necrosis virus
21	Safflower diseases	Wilt, leaf spot, mosaic, root rot
22	Linseed diseases	Wilt, rust
23, 24	Cotton diseases	Angular leaf spot, grey mildew, anthracnose, leaf spots, boll rot, wilt, and reddening
25	Red gram diseases	Wilt, sterility mosaic, leaf spot
26	Bengal gram diseases	Wilt, stunt, stem rot, root rot and blight
27	Black gram diseases	Powdery mildew, leaf spot, virus
28	Green gram diseases	Powdery mildew, leaf spots, blight, yellow mosaic
29	Soybean diseases	Rust, anthracnose, bacterial blight, viruses
30	Onion diseases	Smudge, *Alternaria* blight, blast, downy mildew, storage rots
31	Garlic diseases	Leaf spots, blight
32	Caster diseases	Rust, leaf spots
	Total lessons	**32**

Reference Books :

1. Diseases of tropical and subtropical field, fibre and oil plants by Cook, A. A. 1981, Mac Millan Pub NewYork
2. Diseases of crop plants in India by Rangaswamy G. 1988, Pub New Delhi
3. Plant Diseases by Singh, R. S. 1996, Oxford & IBM Ltd New Delhi.
4. Plant Pathology by G. N. Agreose 5th Edition.

D) Weightages :

Sr. No.	**Topic**	**Weightages/ Marks**	**Sr. No.**	**Topic**	**Weightages/ Marks**
Economic importance, symptoms, cause, epidemiology, disease cycle and integratemanagement of diseases of :					
1	Rice	5-6	13	Linseed	2-3
2	Sorghum	5-6	14	Cotton	6-7
3	Bajra	4-5	15	Red gram	3-4
4	Maize	3-4	16	Bengal gram	4-5
5	Ragi and Nagli (Finger millet)	2-3	17	Black gram	2-3
6	Wheat	6-7	18	Green gram	2-3
7	Sugarcane	4-5	19	Soybean	4-4
8	Tobacco	2-3	20	Turmeric	3-3
9	Groundnut	5-6	21	Ginger	2-3
10	Sesamum	2-3	22	Onion	3-4
11	Sunflower	5-6	23	Garlic	1-1
12	Safflower	4-5	24	Castor	1-1
				Total	**80-100**

Practical :

1. Study of symptoms, etiology, host-parasite relationship and specific control measures of the following crop diseases.

2. Survey, collection and preservation of disease samples of rice, sorghum, *bajra,* wheat, maize, sugarcane, turmeric, tobacco, groundnut, castor,

sunflower; sesamum, cotton, redgram, green gram, black gram, Bengal gram and beans.

3. Field visits at appropriate time during the semester

Crops to be covered	**Diseases to be covered**	**Exercise No.**
Study of symptoms, etiology, host-parasite relationship and specific control measures of the following diseases of:		
Rice	Blast, bacterial blight, false smut, leaf scald and rice tungro virus	1
Sorghum	Smuts, charcoal rot, grain mold, leaf spots	2
Bajra	Rust, smut, downy mildew	3
Maize	Downy mildew, smut	3
a) *Ragi*	Leaf spots	4
b) Finger-millet	Leaf spots	4
Wheat	Stem rust, brown rust, yellow rust, loose smut, bunt of wheat	5
Sugarcane	Smut, mosaic, grassy shoot, downy mildew	6
Groundnut	Leaf spots, rust, bud necrosis, stem rot	7
Sunflower	Downy mildew, leaf spot, rust, necrosis virus	8
Safflower	Wilt, leaf spot, mosaic, root rot	8
Turmeric	Leaf spots	9
Garlic	Leaf spots, blight	9
Cotton	Angular leaf spot, grey mildew, anthracnose leaf spots, boll rot, wilt, and reddening	10
Red gram	Wilt, sterility mosaic	11
Bengal gram	Wilt, stunt, stem rot, root rot and blight	11
Green gram	Powdery mildew, leaf spots and blight, yellow	12

	mosaic	
Black gram	Powdery mildew leaf spot, virus diseases	12
Soybean	Rust, anthracnose, bacterial blight, viruses	12
Tobacco	TMV, leaf curl, broom rape	13
Linseed	Wilt, rust	13
Castor	Rust, leaf spots,	14
Sesamum	leaf spots, wilt, powdery mildew, phyllody	14
	Total	**14**
Note: Students should submit 50 pressed, well mounted diseased specimens in three installments during the semester		

Course No. : PATH-354

Course Title : DISEASES OF HORTICULTURAL CROPS AND THEIR MANAGEMENT

Course Credit : 2+1=3

Theory:

Economic importance symptoms cause disease cycle and integrated management of diseases of citrus, mango, banana, grapevine, pomegranate, papaya, guava, sapota, custard, apple, ber, fig, strawberry, cashew, aonla, jamun, cocum, arecant, coconut, apple, chili, brinjal, lady finger, potato crucifers, cucurbits, tomato, beans, onion, garlic, leafy vegetables, betelvine, mulberry, coffee, tea, oil, palm, rose, chrysanthemum and jasmine, aster, marigold, gladiolus, carnation, tuberose, gerbera .

Practical:

Study of symptoms, etiology, host-parasite relationship and specific control measures of diseases of citrus, mango,banana, grapevine, pomegranate, papaya, guava, sapota, custard apple, ber, fig, strawberry, cashew, aonla, jamun, cocum, arecanut, coconut, apple, chili, brinjal, ladies finger, potato, crucifers, cucurbits, tomato, beans, onion, garlic, leafy vegetables, betelvine, mulberry, coffee, tea, oil, plam, rose, chrysanthemum and jasmine, aster, marigold, gladiolus, carnation, tuberose, gerbera. Field visits at appropriate time during the

semester. Survery and collection of disease samples of above crops and their preservation.

Note: students should submit 50 pressed well mounted diseased specimens in three installments during the semester.

Books recommended :

1. Diseases of fruit crops by Pathak, V.N. 1980 Oxford & BH Pub
2. Diseases of tropical and subtropical field fibre and oil plants by Cook A.A. 1981, Mac Millan Pub NewYork
3. Diseases of crop plants in India by Rangaswamy G 1988, Pub New Delhi
4. Diseases of ornamental plants in India by Sohi H.S. 1992 ICAR, New Delhi.
5. Diseases of vegetable crops. Singh, R.S 1994 Oxford & IBM, New Delhi
6. Plant Diseases by Singh, R.S. 1996, Oxford & IBM Ltd New Delhi
7. Plant Pathology by G.N. Agreose 5th Edition.

Teaching schedule

Lecture No.	Topic to be covered
1 & 2	Diseases of citrus : Gummosis, anthracnose, bacterial canker tristeza greening mottle leaf sooty mould die-back exocortis
3 & 4	Diseases of mango : Anthracnose powdery mildew stone graft mortality pink disease dieback sooty mould red rust loran thus malformation bacterial leaf soot
5 & 6	Diseases of Banana : Wilt (Panama) sigatoka cigar end rot Moko wilt, bunchy top, infectious chlorosis
7 & 8	Diseases of grapevine : Downy mildew powdery mildew anthracnose, rust, bacterial leaf sopts and blight crown gall viral diseases
9	Diseases of pomegranate : Leaf and fruit spots anthracnose fruit rot wilt complex oily spot
10	Diseases of Papaya : Anthracnose root and stem rot leaf blight leaf curl ring spot and mosaic
11	Diseases of guava : Wilt anthracnose fruit canker leaf reddening
12	Diseases of sapota ; Leaf spots leaf blight fruit rot and flat limb

13	Diseases of strawberry : wilt leaf spots blights Diseases of apple : Scab fire blight crown gall blight mosaic
14	Diseases of Chili : Anthracnose and dieback wilt powdery mildew leaf spots leaf curl mosaic
15	Diseases of Brinjal ; Damping off Verticillium and other wits Phomopsis blight and fruit rot bacteria wilt life
16	Diseases of ladies finger : Powdery mildew wilt and yellow vein mosaic
17	Diseases of Crucifer : Downy mildew white rust, Alter aria leaf spots, and black root.
18	Diseases of cucurbits : Downy mildew powdery mildew wilt angular leaf spots and mosaics
19	Diseases of potato : Early and late blights scab black heart brown rot, potato virus X and Y
20 &21	Diseases of tomato : Damping off of seedling, early and late blights powdery mildew wilts, buck eye rot, leaf curl mosaic big bus blossom end rot
22	Diseases of beans and means : Anthracnose, rust, powdery mildew wilt/root rot, bacterial blight mosaic
23 &24	Diseases of Onion and garlic : Smut, purple blotch / blight, smudge, downy mildew neck and bulb rot, white rot, aspergillus blackening
25 & 26	Diseases of coconut and areca nut : wilt, stem bleeding cadang-cadang lethal yellow Ganoderma root rot Koleroga of areca nut
27	Diseases of betelving : Foot rot and wilt anthracnose powdery mildew bacterial leaf spot
28	Diseases of coffee, tea and fig : Rust Diseases of custard apple : fruit rot leaf spots and blight
29	Diseases of cashew : Anthracnose die-back blight wilt rust
30	Diseases of rose : Powdery mildew, black spots, die-back, wilt crown galls, mosaic
31	Diseases of carnation gladiolus gerbera : Root and foot rot / wilt, leaf spost / blight, powdery mildew of carnation and gerbera
32	Chrysanthemum Leaf blight wilt/root rot Aster, Marigold : leaf spots Jasmin : Rust

Lesson Plan and Weightage :

Lesson No	Crop	Topic to be covered	Weightage
1 & 2	Citrus	Gummosis anthracnose bacterial canker tristeza greenig mottle leaf sooty mould	5
3 & 4	Mango	Anthracnose powdery mildew stone graft mortality pink disease disease dieback sooty mould red rust loranthus malformation	5
5 & 6	Banana	Wilt (Panama) sigatoka cigar end rot Moko wilt bunchy top infectious chlorosis	5
7 & 8	Grapevine	Downy mildew powdery mildew anthracnose rust bacteria blight crown gall virus diseases	5
9	Pomegranate	Leaf and fruit spots anthracnose fruit rot wilt complex oily spot	3
10	Papaya	Anthracnose stem rot leaf blight leaf blight leaf curl ring spot mosaic	3
11	Guave	Wilt anthracnose fruit canker leaf reddening	3
12	Sapota	Leaf spots leaf blight fruit rot and flat limb	3
13	Strawberry, Apple	Wilt leaf spots blights scab fire blight crown gall blight mosaic	3
14	Chili	Anthracnose and dieback wilt powdery mildew leaf spots leaf curl mosaic	5
15	Brinjal	Damping off, Verticillium and other wilts Phomopsis blight and fruit rot bacterial wilt little leaf	5
16	Ladies Finger	Powdery mildew wilt and yellow vein mosaic	5

17	Crucifers	Downy mildew white rust Alterna leaf spots and black rot	4
18	Cucurbits	Downy mildew powdery mildew wilt angular leaf spots and mosaics	4
19	Potato	Late and early blight scab black heart brown	4
20 -21	Tomato	Damping off of seeding late and early blight powdery mildew wilts buck eye rot leaf curl mosaic big bud blossom end rot	5
22	Beans and peas	Anthracnose rust powdery mildew with/root rot bacterial blight mosaic	4
23 & 24	Onion and Garlic	Smut purple blotch/blight smudge downy mildew neck and bulb rot white rot Aspergillus blackening	5
25 & 26	Coconut and areca nut	Wilt, stem bleeding candang-cadang lethal yellow Ganoderma root rot koleroga o areca nut	4
27	Betelvine	Foot rot and wilt anthracnose powdery mildew bacterial leaf spot	3
28	Coffee, tea fig & custard apple	Rust Fruit rot leaf spots and blight	4
29	Ber Cashew	Powdery mildew leaf spots Anthracnose die-back blight wilt rust	4
30	Rose	Powdery mildew black spot, die back, wilt, crown galls, mosaic	3
31	Carnation gladiolus & gerera	Root and foot rot/wilt, leaf spots/blight, powdery mildew of carnation and gerbera	4
32	Chrysanthemum Aster Marigold Jasmin	Leaf blight, wilt/root rot Leaf spots Rust	3
		Total	**100**

D) Exercise Schedule (Practical)

1. Study of symptoms, etiology, host-parasite relationship and specific control measures of the following crop diseases.

2. Survey collection and preservation of diseases sample of citrus, mango, banana, grapevine, pomegranate, papaya, guava, sapota, custard apple, ber fig, strawberry, cashew, aonla, jamun, cocum, arecanut, coconut, apple, chili, brinjal, bhendi, potato, crucifers, cucurbits, tomato, beans, onions, garlic, leafy vegetables, betel vine, mulberry, coffee, tea, oil plam, rose, chrysanthemum and jasmine, aster, marigold, gladiolus, carnation, tuberose, gerbera.

3. Field visits at appropriate time during the semester.

Sr.No	Exercise No	Topic to be covered
	Study of symptoms, etiology, host-parasite relationship and specific control measures of the following diseases	
1	1	Diseases of citrus and mango
2	2	Diseases of banana and grapevine
3	3	Diseases of pomegranate and papaya
4	4	Diseases of guava, sapota, strawberry and apple
5	5	Diseases of chili, binjal & ladies finger
6	6	Diseases of crucifer & cucurbits
7	7	Diseases of potato & tomato
8	8	Diseases of beans peas, onion & garlic
9	9	Diseases of coconut & areca nut
10	10	Diseases of betelvine & cashew
11	11	Diseases of coffee, tea
12	12	Diseases of ber, fig & custard apple
13	13	Diseases of rose, chrysanthemum & jasmine
14	14	Diseases of carnation , Gladiolus
15	15	Diseases of gerbera, aster, marigold
16	16	Field visit at appropriate time during the semester

Animal Science and Dairy Science

Course No. : ASDS-111

Course Title : LIVESTOCK PRODUCTION AND MANAGEMENT

Course Credit : 1+1=2

Syllabus

Theory :

Place of livestock in the national economy, different livestock development programmes of Govt. of India. Important exotic and Indian breeds of cattle, buffalo, sheep, goat and swine. Measures and factors affecting fertility in livestock, reproductive behaviour like oestrus, parturition, etc. Milk secretion, milking of animals and factors affecting milk yield and composition. Selection and breeding of livestock for higher milk and meat production. Feeding and management of calves, growing heifers and milch animals and other classes and types of animals, housing principles, space requirements for different species of livestock. Disease control measures, sanitation and care, breeding, feeding and production records. Breed characteristics of poultry, their methods of rearing, breeding, feeding and management, incubation, hatching and brooding, vaccination and prevention of diseases, preservation and marketing of eggs, its economics and keeping quality. Cost of production of milk, economical units of cattle, buffalo, sheep, goat and swine.

Practical:

Identification, handling and restraining of animals; Judging and culling; Feeding and ration formulation; Hatching, housing and management of poultry; Visit to livestock farms and Economics of livestock production.

Teaching Schedule

Theory :

1. Importance of Livestock in the national economy and different livestock development programmes.
2. Livestock census and trends of Livestock Production.
3. Terminology used in livestock and poultry management.

4 & 5 Important Indian and exotic breeds of cattle, buffaoe, swine and poultry.

6. Principles of maximization of livestock production.
7. Feeding and management of calf, heifer and milking animal.
8. Feeding and management of dry, pregnant, draft animals and breeding bull.
9. Housing system for Cattle and Buffalo.

10) Diseases and it's preventive, curative measures in cattle, buffalo and poultry.

11) Bovine male and female reproductive system.

12 & 13) Fertility, sterility and reproductive behavior viz: oestrus and parturition.

14) Milk secretion and factors affecting milk yield and composition.

15) Care and management of chicks, pullets and layers.

16) Care and management of broilers.

Practicals :

1. External body parts of Cattle, Buffalo swine and poultry.
2. Routine management practices followed on livestock farm.
3. Methods of handling and restraining of animals.
4. Methods of identification marks and dehorning of animals.
5. Recording of pulse rate, respiration rate and body temperature of animals.
6. Preparation of feeding schedule and feeding different categories of cattle and buffaloes.
7. Estimation of Age and body weight of animals.
8. Clean and hygienic milk production and milking methods.
9. Judging of animals for dairy and draft purpose.
10. Study of computarized database on dairy farm.
11. Vaccination and control of ecto and endo parasites in cattle and buffalo.
12. Study of various dairy structures.
13. Artificial insemination and pregnancy diagnosis in farm animals.
14. Utilization of dairy farm wastes i.e. dung, urine ect.
15. Preparation of viable bank proposals for cattle, buffalo and poultry.

16. Incubation and hatching of eggs and grading, preservation and marketing of eggs.

Course No. : ASDS – 242

Course Title : LIVESTOCK BREEDING AND NUTRITION

Course Credits : 1+1=2

Theory :

History and concept of Animal Breeding. Cell and cell division. Gene; Functions and role in Animal Genetics, Gene action, Gene and Genotypic frequencies, Gene expression and mutation. Mendelian principles and Hardy Weinberg law. Chromosomes and its abnormatlities. Laws of probabilities and Animal breeding. Variations in economic traits of farm animals. Methods of selection. Genetic parameters; Heritability repeatability, genotypic, phenotypic and environmental correlatioin and regression. Sterility, fertility. Quantitantive and qualitative traits. Compostion of plant and animal body. Classfication of feeds and fodders. Important food ingredients and their functions in animal body. Digestive system, digestion and absorption of different nutrients in ruminants and non-ruminants. Feed supplements and feed additives, method of measuring food values. Feeding standard. Feed formulation and feeding pattern for different classes of livestock. Processing of low grade feeds and fodders *viz;* Use of by-pass nutrients technique; Preparation of complete feed block.

Practical :

Cell structure. Estimation of gene and genotypic frequency. Estimation of heritability. Estimation fo repeatability. Correlation studies. Estimation of breeding value of cow. Construction of selection index. Estimation of regressin coefficient. Sire indices. Estimation of genetic gain. Estimation of heterosis. Identification of feeds and fodders. Nutritive value of various feeds and fodders. Characteristics of good ration. Study of nutritive values; Nutritive ratio (NR), Starch equivalent (SE), DCP, TDN and GE. Nutrient requirement of different classes of animal. Feeding standards, their principles, thumb rule, computation of ration for different livestock. Silage and hay making. Chaffing of fodders. Improving low quality roughages for efficient utilization-urea, molasses and salt treatment.

Course No. : ASDS – 242

Course Title : LIVESTOCK BREEDING AND NUTRITION

Theory :

Lecture No.	Topic to be covered	Weightage per cent
1	History and concept of animal breeding.	5
2	Cell and Cell division.	2
3	Gene functions and role in animal genetics.	5
4	Gene actions, gene and genotype frequencies, gene expression and mutation.	7
5	Mendelian principles and hardy weinberg law, chromosomes and its abnormality.	8
6	Law of probabilities and animal breeding.	6
7	Variations in economic traits of farm animals, method of selection.	6
8 and 9	Genetic parameters-Heritability, repeatability, genotypic, phonotypic and environmental correlation and regrerssion.	7
10	Sterility, fertility. Quantitative and qualitative traits.	6
11	Compostition of plant and animal body.	5
12	Classification of feeds and fodders. Important food ingredients and their functions in animal body.	8
13	Digestive system. Digestion and absorption of different nutrients in ruminants and non-ruminants.	7
14	Important macro and micro nutrients in ruminants and non-ruminants.	5
15	Feed supplements and feed additives, methods of measuring food values.	7
16	Feeding standards feed foumulation and feeding pattren for different classes of livestock	7
17	Processing of low grade feeds and fodders viz. use of by-pass nutrients technique, preparation of complete feed block.	6

Practical :

No.	Topic to be covered
1	Cell structure, Estimation of gene and genotypic frequency.
2	Estimation of heritability, repeatability and correlation studies.
3	Estimation of breeding value fo cow.
4	Construciton of selection index estimation of regression coefficient.
5 and 6	Sire indices estimation of genetic gain estimation of heterosis.
7	Indentification of feeds and fooders.
8	Nutriture value of various feeds and fodders.
9	Characteristics of good ration.

10,11 and 12	Study of nutritive values- NR, SE, DCP, TD and GE. Procedure for metabolic trials.
13	Nutrient requirement of different classes of animals.
14	Feeding standands, their principles thumb rule.
15	Computation of ration for different livestock.
16	Silage and hay making, chaffing of fodders.
17	Imporving low qualtiy roughages for efficient utilization- urea molasses and salt treatment.

Books recommended :

1. Principles and Practices of Dairy Farm Management – Jagdish Prasad (1989), Kalyani Publishers, 1/1, Rajinder nagar, Ludhiana
2. Advances in Dairy Animal Production – Mudgal, V.D., Singhal, K.K. and Sharma, D.D. (1995), International Book Distributing Co., chaman Studio Building, 2nd floor, Charbagh, Lucknow.
3. Livestock Breeding in India – D. Sundaresan.
4. Text Book of Animal Husbandry – G.C. Banerjee(1999) 9th ed. Oxford and IBH publishers, New Delhi.
5. Dairy Borine production – Tomas, C.K and Sastri, N.S.R., Kalyani Publishers, 1/1 Rajinder Nagar, Ludhiane.
6. Dariying in India – Gupta, H.C. (1997) Kalyani Publishers, 1/1 Rajinder Nagar, Ludhiana.

Course No. : ASDS - 353

Course Title : TECHNOLOGY OF MILK AND MILK PRODUCTS.

Course Credit : 1+1=2

Theory :

Present status of Dairy Industry in Maharashtra and India. Definition and composition of milk. Physico chemical properties of milk. Microbial quality of raw milk. Factors affecting composition of milk. Physico-chemical and microbial standards for different types of milk. Nutritional importance of milk and its constituents. Reception and processing (platform test, chilling, standardization, homogenization, pasteurization, storage, marketing) of milk. Classification and composition fo milk products (Heat coagulated, heat and acid coagulated, Evaporated, fermented, frozen and fat riched products). ISI PFA and Agmark standards for rmilk products. International requirement for export of Dairy Products. Preservation of milk and milk products by Bio, Herbal, Chemical and Physical preservatives in use. Utilization of dairy by products whey and highacid milk. Packaging of milk and milk products with modern techniques.

Practical :

Platform tests, sampling of milk and milk products for various tests. Determination of fat, SNF, TS, Acidity, Sp gravity. Standardization of milk. Cream separation. Cleaning and sanitization of dairy equipments. Manufacture of Khoa, Basundi and Rabri, Paneer, Chhana, Dahi, Ice cream and Kulfi, Butter and Ghee. Manufacture of milk sweets -Pedha, Gulabjamun, Rosogolla, Shrikhand. Detection of common milk adulterants.

Books recommended :

1. Milk and its properties - Shrivastava, S.M. (1993) Kalyani publishers, 1/1 Rajinder nagar, Ludhiana
2. Milk and milk Products – Winton and Winton (1993), Agrobios (India), Agro. House, behind Nasrani cinema, chopsani Road, Jodhapur.
3. Milk Testing – Davis J.G. Agrobios (India), Agro. House, behind Nasrani cinema, Chopsani Road, Jodhapur.

4. Chemistry of Milk and Milk Products – Singh V.B (1965), Asian Publishers, New mandi, Muzaffarnagar.
5. Dairying in India – Gupta, H.A. (1997) Kalyani Publisher, 1/1 Rajinder nagar Ludhiana.
6. Outlines of Dairy Technology -Sukumar De (2000) Oxford University Press, New Delhi.

Theory (Teaching Schedule)

Lecture No	Topic to be covered	Weightage per cent
1	Present status of dairy industry in Maharashtra and India	6
2	Definition and composition of milk	7
3	Physico chemical properties of milk	9
4	Microbial quality of raw milk Factors affecting composition of milk	6
5	Physico chemical and microbial standards for different types of milk	7
6	Nutritional importance of milk and its constituents	9
7,8 and 9	Reception and processing (platform test, chilling standardization, homogenization, pasteurization, storage and marketing) of milk	10
10, 11 and 12	Classification and composition of milk products (heat coagulated, heat and acid coagulated, evaporated, fermented frozen and fat riched products)	10
13	ISI, PFA and AGMARK standards for milk products	7
14	International requirement for export of dairy products.	6
15	Preservation of milk and milk products by Bio, Herbal Chemical and Physical preservatives in use	7
16	Utilization of dairy by products whey and high acid milk	8
17	Packaging of milk and milk products with modern techniques	8

Practical (Teaching Schedule)

Lecture No.	Topic to be covered
1	Sampling of milk and milk products for various tests

2	Platform test
3	Determination of fat of milk
4	Determination of TS and SNF of milk
5	Determination of acidity and sp grvity of milk
6	Standardization of milk
7	Study of cream separation and cream separation
8	Cleaning and sanitization of dairy equipments
9 and 10	Manufacture of khoa, basundi and rabri
11	Manufacture of chhana and paneer.
12 and 13	Manufacture of dahi chakka and dShrikhand
14	Manufacture of ice cream and kulfi
15	Manufacture of butter and ghee.
16 and 17	Manufacture of milk sweets- pedha gulabjamun and rasogolla.
18	Detection of common milk adulterants.

Course No. : ASDS 364

Course Title : SHEEP AND GOAT PRODUCTION

Course Credits : 1+1=2

Theory –

Importance of sheep & goat production in national economy. Breeds of sheep & goat. Housing requirement of sheep & goat. Breeding seasons for sheep and goat. Methods fo breeding sheep and goat. Feeding practices for sheep and goat. Flushing of ewes and does. Care and management of Pregnant ewes / does. Carbe and management of lambs/ kids and rams/ bucks. Composition and utilization of sheep and goat milk. Grading and marketing of wool. Marketing of sheep and goat. Culling of sheep and goat. Preparation of animal for slaughter and different methods of slaughter. Dressing percentage and meat bone ratio. Different meat cuts. Study of common ailments and control of parasites in sheep and goat. Preventive measures (Vaccination) against different diseases of sheep and goat.

Practical –

Study of body parts of sheep and goat. Differences between sheep and goat. Selection of animals. Identification marks. Feeding of lambs/kids. Feeding practices for milking goat. Shearing and grading of wool. Important management practices such as clipping, spraying, dusting, docking, deworming, ringing.

Preparation of animals for animal show. Culling of animals. Judging of sheep and goat. Preparation of animal for slaughter and differeent methods of slaughter. Dressing percentage and meat bone ratio. Different meat cuts. Study of composition of sheep and goat milk and its product preparation. Study of farm records. Preparation of proposals for sheep and goat unit. Minimum requirements for sheep and goat meat export.

Books recommended

1. Goat, Sheep and Pig Production and Management – Jagdish Prasad (1996), Kalayani Publishers, 1/1 Rajinder nagar, Ludhiana.
2. Textbook of Animal Husbandry – G.C. Banargee (1999), 9th ed. Oxford and IBH publishers, New Delhi.
3. Goats and Their Profitable Management – Henry Stephan and Holmes Pegler (2005), Biotech books 1123/74 Trinagar, New Delhi.
4. Dairy Bovine Production – Thomas, C. K. and Sastri, NSR Kalyani Publishers 1/1 Rajinder nagar Ludhiana
5. Principles and practices of Dariy Farm Management – Jagdish Prasad (1989), Kalyani Publishers, 1/1 Rajinder nagar, Ludhiana.

Theory (Teaching Schedule)

Lecture No	Topic to be covered	Weightage per cent
1	Importance of sheep and goat production in national economy	5
2	Breeds of sheep and goat	7
3	Housing requirement of sheep and goat	8
4	Breeding seasons for sheep and goat	5
5	Methods of breeding in sheep and goat	5
6	Feeding practices for sheep and goat	8
7	Flushing of ewes and does	5
8	Care and management of pregnant ewes/ does	7
9	Care and management of lambs / kids and rams /bucks	7
10	Compositioin and utilization of sheep and goat milk	7
11	Grading and marketing of wool	5
12	Marketing of sheep and goat	5

13	Culling of sheep and goat	5
14	Preparation of animal for slaughter and different methods of slaughter	5
15	Dressing percentage and meat bone ratio. Different meat cuts	5
16	Study of common ailmeats and control of parasites in sheep and goat	5
17	Preventive measures (Vaccination) against different diseases of sheep and goat	6

Practical (Teaching Schedule)

1. Study of body parts of sheep and goat
2. Differences between sheep and goat
3. Selection of animals. Identification marks
4. Feeding of lambs / kids
5. Feeding practices for milking goat
6. Shearing and grading of wool

7&8. Important management practices such as clipping, spraying, dusting, docking, deworming, ringing

9. Preparation of animals for animal show
10. Culling of animals
11. Judging of sheep and goat
12. Preparation of animal for slaughter and different methods of slaughter
13. Dressing precentage and meat bone ratio. Different meat cuts.

14&15. Study of composstion of sheep and goat milk and its products preparation

16. Study of farm records. Preparation of proposals for sheep and goat unit
17. Minimum requirements for sheep and goat meat export

Extension Education

B. Sc. (Agriculture)

Course No. : EXTN-111

Course Title : FUNDAMENTALS OF RURAL SOCIOLOGY AND EDUCATIONAL PSYCHOLOGY

Course Credit : 2+0=2

Revised Curricula for Undergraduate Degree Programme

THEORY:

- **Sociology -** Meaning, definition.
- **Rural sociology -** Meaning, definition, Scope, Importance of Rural Sociology in agricultural extension and Interrelationship between Rural sociology & Agricultural Extension.
- **Indian Rural Society -** Important characteristics, Differences and Relationship between Rural and Urban societies.
- **Social Groups -** Meaning, definition, Classification, Factors considered in formation and organization of groups, Motivation in group formation and Role of social groups in Agricultural Extension.
- **Social Stratification -** Meaning, Definition, Functions, basis for stratification, Forms of social Stratification Characteristics and – Differences between Class & Caste System.

- **Cultural concepts -** Culture, Customs, Folkways, Mores, taboos, Rituals and traditions – Meaning, Definition and their Role in Agricultural Extension.
- **Social Values and Attitudes** - Meaning, Definition, Types and role of Social Values and attitudes in agricultural Extension.
- **Social Institutions -** Meaning, definition, Major institutions in Rural society : marriage, family and religion, Functions and their Role in Agricultural Extension.
- **Social Organizations -** Meaning, Definition, types of organizations and role of social organizations in Agricultural Extension.
- **Social control –** Meaning, Definition, Need of social control and Means of social control.
- **Social change -** Meaning, Definition, Nature of Social change, Dimensions of social change and factors of social change.
- **Leader -** Meaning, Definition, types and their role in Agricultural Extension.
- **Psychology and educational Psychology -** Meaning, Definition, Scope, and Importance of Educational Psychology in Agricultural Extension.
- **Intelligence -** Meaning, Definition, Types, factors affecting intelligence
- **Personality -** Meaning, Definition, types, Factors influencing the Personality.
- **Teaching - Learning process –** Meaning and definition of Teaching, Learning, Learning experience and Learning situation, Elements of learning situation and its characteristics. Principles of learning and their implication for teaching
- **Perception and motivation.**

Course No. : EXTN-122

Course Title : DIMENSIONS OF AGRICULTURAL EXTENSION

Course Credit : 1+1=2

THEORY:

- **Education –** Meaning, definition, types-formal, informal and non-formal education their characteristics.
- **Extension Education- Meaning**, definition, concepts, objectives and principles

- **Agricultural Extension-** Meaning, definition,
- **Rural development –** Meaning, Definition, Concepts, Objectives, Importance and Problems in rural development
- **Developmental programmes of pre-independence era**- Sriniketan, Marthandam, Gurgaon experiment and Gandhian constructive programme Development programmes of post independence era, Firka Development, Etawah-pilot project and Nilokheri Experiment.
- **Community Development programme-** Meaning, definition, concepts, philosophy, principles, objectives, differences between community development and extension education

- **National Extension Service:**
- **Panchayat Raj System**: Meaning, Democratic decentralization and panchayat Raj, Three tier of Pachayat Raj systems, powers, functions and organizational setup
- **Agricultural Development Programmes**: with reference to objectives and salient features- Intensive Agricultural District Programme (IADP), High Yielding Varieties Programme (HYVP), Institution Village Linkage Programme(IVLP), Watershed Development Programme (WDP), National Agricultural Technology Projects (NATP), ATMA, ATIC, NHM, NAIP
- **Social Justice and Poverty alleviation programmes**- Integrated Tribal Development Programme (ITDP), Integrated Rural Development Programme (IRDP), Swarn Jayanti Gram Swarojgar Yojana (SGSY), Prime Minister Employment Yojana (PMEY)
- **New Trends in Extension, Privatization**.
- **Women Development Programmes**- Development of Women and Children in Rural areas (DWCRA), Integrated Child Development Schemes (ICDS), Mahila Samrudhi Yojana (MSY), Mahila Arthik Vikas Mahamandal (MAVIM)
- **Reorganized extension systems (T & V system)**- Salient features, Fortnightly Meetings, Monthly workshops, Linkages, Merits and Demerits, Single Window System of Extension in Maharashtra
- **Broad Based Extension (BBE)**- meaning and genesis

PRACTICAL:

- Visits to village and Krishi Vidnayan Mandal, to study the ongoing development programmes
- Visits to panchayat Raj Institutions, to study the functioning of Gram Panchayat (GP)
- Visits to Watershed Development Project area of the university
- Visit to a village to study the Self Help Groups (SHGs)
- Organizing PRA techniques in a village to identify the agricultural problems.

Suggested Readings:

Dahama O. P. & Bhatnagar O. P. (1980). Extension and Communication for Development, Oxford & IBH Publication CO. New Delhi.

Supe, S. V. (1997). An Introduction to Extension Education (Revised Ed), Oxford & IBH Publishing Co New Delhi

Van Den Ban AW & Hawkins H. S. (1996). Agricultural Extension (2nd edition), Black Well Science INC , Cambridge.

Kelsey, L.D. & Hearne, G.C. (1963).Cooperative Extension Work, Comstar Publishing Associate, New York

Ray, G. L. (1991). Extension Communication and Management, Nayaprakash, Kalkatta.

Sandhu, A. S. (1993). Text Book on Agricultural Communication Process and Methods. Oxford & IBH Publishing Co New Delhi

Mosher, A. T. (1978). An Introdction to Agricultural Extension, ADC, New York.

Hirevenkanagoudar, L. Manjunath, Chhaya Badiger, S. L. Patil (2004). Extension Approaches for agriculture and rural development, UAS, Dharwad.

Singh, A. K., Lakhan Singh, R. Roy Burman (2006). Dimensions of Agricultural Extension, Aman Publishing House, Meerut.

Lesson Plan :

Lecture	Course Content	Weightage

No.		
1,2,3	• **Education** – Meaning, Definition, Types – Formal, Informal and Non-formal education and their Characteristics. • **Extension Education** – Meaning, definition, concepts, objectives and principles. • **Agricultural Extension** – Meaning and Definition.	04
4	• **Rural development** – Meaning, Definition, Concepts, Objectives, Importance and Problems in rural development	04
5,6	• **Development programmes of pre-independence era** – Sriniketan, Marthandam, Gurgaon experiment and Gandhian constructive programme Development programmes of post independence era, Firka Development, Etawah – pilot project and Nilokheri Experiment.	05
7,8	• **Community Development programme** – Meaning, Definition, Concepts, philosophy, principles, Objectives, Differences between Community development and Extension Education. • **National Extension service.**	05
9,10	• **Panchayat Raj system** – Meaning of Democratic Decentralization and Panchayat Raj, Three tiers of Panchayat Raj system, powers, Functions and Organizational set up.	04
11,12	• **Agricultural Development Programmes** with reference to objectives & salient features – Intensive agricultural district Programame (IADP), High Yielding Varieties Programme (HYVP), Institution Village Linkage Programme (IVLP), Watershed Development Programme (WDP), National agricultural Technology Project (NATP), ATMA, ATIC, NHM, NAIP.	03

13,14	• **Social Justice and Poverty alleviation programmes** – Integrated Tribal Development Programme (ITDP) Integrated Rural Development Programme (IRDP), Swarna Jayanthi Gram Swarojgar Yojana (SGSY), Prime Minister Employment Yojana (PMEY). • **New trends in extension, privatization.**	05
15,16	• **Women development programmes** – Devdelopment of women and Children in Rural Areas (DWCRA), Integrated Child Development Scheme (ICDS) and Mahila Samriddi Yojana (MSY), Mahila Arthik Vikas Mahamandal (MAVIM).	05
17,18	• **Reorganized extension system (T & V Systm**) – Salient features, Fort nightly Meeting, Monthly workshops, Linkages, Merits and Demerits, Single Window System of Extension in Maharashtra • **Broad Based Extension (BBE**) – Meaning and genesis.	05

Course No. : EXTN-353

Course Title : EXTENSION METHODOLOGIES FOR TRANSFER OF AGRICULTURAL TECHNOLOGY

Course Credit : 1+1=2

Theory:

- **Communication –** Meaning, definition, models, elements and their characteristics. Barriers in communication.
- **Transfer of Technology (TOT) –** Meaning and definition.
- **Extension Programme Planning –** Meaning definition of planning, programmes and project, importance, principles and steps in programme planning process.
- **Monitoring –** Meaning and definition
- **Evaluation –** Meaning, definition, types, difference between monitoring and evaluation.

- **Extension Teaching Methods –** Meaning, definition, functions and classification.
- **Individual contact methods –** farm and home visit, result demonstration, field trials – Meaning, objectives steps, merits and demerits.
- **Group contact methods –** Group discussion, method demonstration, field trips – Meaning, objectives, steps, merits and demerits. Group discussion techniques – lecture, symposium, panel, debate, forum, buzz group, workshop, brain storming, seminar and conference.
- **Mass contact methods –** Campaign, exhibition, farmers rally, radio & television, community radio stations (CRS). Factors influencing the selection of Extension Teaching Methods and combination (Media Mix) of teaching methods. Advanced information sources – Internet, cyber cafe, video and tele conferences, kisan call centers, consultancy clinics.
- **Agricultural Journalism –** Meaning, scope and importance
- **News –** Definition, meaning, sources of new, types merits and limitations.
- **Diffusion and adoption of Innovations –** Meaning, definition Innovation – Decision Process adopters categories and their characteristics, factors influencing adoption process.
- **Capacity building of extension personnel and farmers –** Meaning, definition, training process (steps) types of training to extension personnel, farmers, farm women and rural youth FTC and KVK.

Practical:

- Identifying the problems, fixing the priorities and selecting a most important problem for preparation of project
- Developing a project based on identified problems in a selected village
- Organization of group discussion and method demonstrations
- Planning and writing of scripts for radio and television
- Planning and preparation of visual aids – charts, posters, Over Head Projector (OHP), transparencies, Power Point Slides.
- Planning and preparation of Extension Publication – leaflet, Folder, Pamphlet.
- Writing News Stores and Success Stories

- Handling of Public Address Equipments (PAE) Systems, Camera, Video Camera and Liquid Crystal Display (LCD) Projector.

Suggested Readings:

Kelsey L.D. and Hame G.C. (1963). Cooperative Extension Work. Comstar Publishing Associates, New York.

Ray G.L. (1993). Extension Communication and Management. Naya Prakash, Calcutta.

Sandhu A.S. (1993). Textbook on Agricultural Communication Process and Methods. Oxford and IBH Publication Co. New Delhi.

Samantha R.K. (1990). Development Communication for Agriculture. B R Publishing Corp, Delhi.

Mehta D.S. (1981). Mass Communication and Journalism in India. Vikas Publication, New Delhi.

Kamat M.G. (1985). Writing for Farm Families. Allied. New Delhi.

Singht A.K. Lakhan Singh, R. Roy Burman (2006). Dimensions of Agricultural Extension. Aman Publishing House, Meerut.

Dudhani C.M. Hirevenkanagoudar, L. Manjunath, S.N. Hanchinal, S.L. Patil (2004). Extension Teaching Methods and communication Technology. UAS Dharewad.

Lesson Plan and Weightage

Lecture No	Course Content	Weightage (%)
1,2	**Communication –** Meaning, definition, models, element and their characteristics, Barriers in communication. **Transfer of Technology (TOT) –** Meaning and definition	10
3,4,5	**Extension Programme Planning –** Meaning, definition of planning, programmes and project, importance, principles and steps in programme planning process. **Monitoring –** Meaning and definition. **Evaluation –** Meaning, definition, types, difference between monitoring and evaluation	18
6,7	**Extension Teaching Methods –** Meaning, definition, functions and classification.	10

	Individual contact methods – farm and home visit, result demonstration, field trials – Meaning, objectives, steps, merits and demerits	
8,9	**Group contact methods –** Group discussion, method demonstration, field trips – Meaning, objectives, steps, merits and demerits. Group discussion techniques – lecture, symposium, panel, debate, forum, buzz group, workshop, brain storming, seminar and conference.	10
10,11	**Mass contact methods –** Campaign, exhibition, farmers rally, radio & television, community radio stations(CRS). Factors influencing the selection of Extension Teaching Methods and combination (Media Mix) of teaching methods. Advanced Information Sources – Internet, cyber café, video and teleconferences, kisan call centers, consultancy clinics.	12
12,	**Agricultural Journalism –** Meaning, scope and importance	10
13	**News –** Definition, meaning, sources of news, types merits and limitation.	10
14,15	**Diffusion and Adoption of Innovations –** Meaning, definition, Innovation – Decision Process – adopters categories and their characteristics, factors influencing adoption process.	10
16,17,18	**Capacity building of Extension Personnel and farmers-** Meaning, definition, training process (steps) types of training training to Extension personnel, farmers, farm women ad rural youth FTC and KVK	10

Practical :

Lecture No.	Exercise
1	**Visit to village to identify the important Agricultural Problems-** Market problems, irrigation problems, fertilizers problems etc.
2,3	**Developing a project-** based on identified problems in a selected

	village.
4,5	**Organization of group discussion-** Meaning, types, advantages, limitations and assignment to the students **Organizations of Method demonstrations-** Meaning, objectives and steps in conducting method demonstration.
6,7	**Planning and writing of scripts** for Radio and Television
8,9,10	**Planning and preparation of Visual aids-** **Charts-** Definition, steps in preparation of chars, types **Poster-** Definition, steps in preparation of poster and components **Over Head Projector (OHP)-** Meaning, different parts of OHP, transparencies **Power Point Slides –** Requirements and steps in preparation of power point slides.
11,12	**Planning and preparation of Extension publications-** **Leaflets-** Definition, steps in writing leaflets, advantages and limitations. Folder- Definition, steps in writing folder, advantages and limitations. **Pamphlet-** Definition and importance.
13,14	**Writing news stories-** Definition of news, sources of news, kind steps in writing news stories and news structure **Writing success stories-** Definition and steps in writing success Stories.
15,16,17	**Handling of Public Address Equipment (PAE) System-**Definition, principles, steps in operation of Public Address System **Camera-** types steps in effective use of camera, and characteristics of good photographs. **Video Camera-** Steps in effective use of video camera **Liquid Crystal Display (LCD)-** Salient features, different parts, technical specifications and advantages.

Course No. : EXTN-364

Course Title : ENTREPRENEURSHIP DEVELOPMENT AND COMMUNICATION SKILLS

Course Credits : 1+1=2

Theory :

- **Entrepreneur-** Meaning, definition, characteristics and role demands of entrepreneur, identifying potential entrepreneurs.
- **Entrepreneurship Development-** concept of entrepreneurship, process of entrepreneurship development, importance of planning, monitoring and follow-up, managing competition, entrepreneurship development programmes.
- **Characteristics of Indian Agricultural Processing and Export Industry**
- **SWOT analysis- generation, incubation and commercialization of ideas and innovations.**
- **Entrepreneurial behavior-** concept, dimensions, factors affecting entrepreneurial behavior
- **Government schemes** and incentives for promotion of entrepreneurship. Government policy on small and Medium Enterprises (SMEs) SSIS.
- **Market survey, formulation of project, financial analysis of project.**
- **Communication skills**
- **Communication –** Meaning and process of communication.
- Advertisements- Meaning, types, forms, functions.
- **Writing skill –** Business letter, letters of inquiry, quotation orders and tenders, complaints letters.

Practical :

- Conducting market survey to know the demands for different products.
- Preparing advertisements for popularization of products and news
- writings
- Preparing project proposals.
- Individual and group presentation, feature of oral presentation.
- Evaluation of presentation : evaluation sheet, other strategies to be
- considered for evaluating presentation.

Dyadic communication : Face to face conservation, telephonic conversation, rate of speech, clarity of voice, speaking and listening

politeness, telephone antiquates.

- Meeting : Purpose, procedure, participation, chairmanship, physical arrangements, recording and writing of minutes of meetings.
- Seminar and conferences, regulating speech, physical appearance, body language, posture, eye contact
- Conducting o mock interviews : testing initiative, team spirit and leadership, group discussion and debates on current topics

Suggested Readings :

Akhouri, M.M., P. Mishra S.P. and Sengupta, Ritha (1989). Trainers manual on developing entrepreneurial motivation, NIESBUD, NEW Delhi.

Betty Gordan B (1979). Entrepreneurship, playing to win. Taraporewala, Bombay.

Entrepreneurship development Institute of India (1987). Developing New enterprenuers. EDLII, Ahmedabad,Nisiset Library;338.93/edi/87/25104.

Mancuso Joseph (1974). The entrepreneurs handbook (1st and 2nd). Arteck House.INC, USA

Patel V.J. (1987), entrepreneurship development Programme on India and its relevance to developing countries, Entrepreneurship development Institute of India, Ahmedabad, Nisiet Library; 338.93(540)/PAT/87/25103

Singh A.K., Lakhan singh, R.Roy Burman (2006). Dimensions of Agricultural Extension. Aman publishing House, Meerut.

Theory Lesson Plan :

Lecture No	Course Content	Weightage
1,2,3	• **Entrepreneur:** Meaning, definition, characteristics and role demands of entrepreneur, identifying potential entrepreneurs.	07
4,5,6	• **Entrepreneurship Development –** Concept of entrepreneurship, process of entrepreneurship development, importance of planning, monitoring and follow-up, managing competition, entrepreneurship development programmes.	07
7,8	• **Characteristics of Indian Agricultural**	05

	Processing and Export Industry.	
9,10	• **SWOT analysis,** generation, incubation and commercialization of ideas and innovations.	06
11,12	• **Entrepreneurial behavior –** Concept, dimensions, factors affecting entrepreneurial behavior.	05
13,14	• **Government schemes** and incentives for promotion of e entrepreneurship. Government policy on small and Medium Enterprises (SMEs) SSIS.	05
15	• **Market survey, formulation of project, financial analysis of project.**	05
16,17	**Communication Skills.** • **Communication –** Meaning and process of communication. • **Advertisement-** Meaning, types, forms, functions.	05
18	• **Writing Skill :** Business letter, Letters of inquiry, quotation orders, and tenders, complaints letters.	05

Practical :

Lecture No.	Exercise	Weightage
1	**Conducting market survey** to know the demands for different agricultural product – APMC & others.	06
2	**Preparing advertisement** for popularization of agricultural products.	04
3	**New writing –** Meaning, steps and writing news for local news papers/ hints for radio etc.	03
4	**Preparing a project proposal** for financial help	05
5,6	**Oral presentation** of projects by the students in the group	03
7	**Evaluation of presentation**	03
8,9,10	**Salient features of delivering speech** in various situations (Face to face, telephone, public etc.)	04
11,12	**Organization and participation** in group meetings	03

13	**Salient features of participating in Seminar and Conferences.**	03
14,15	**Conducting and practicing mock interviews –** Testing initiative, team spirit & leadership, and debates on current topics.	04
16,17	**Conducting meetings –** Purpose, procedure, participation, chairmanship, physical arraignments recording and writing minutes of the meeting.	02

Economics

Course No. : ECON-121

Course Title : PRINCIPLES OF AGRIL. ECONOMICS

Course Credit : 2+0=2

Theory :

Economics : Meaning, Definition ,Subject matter ,Division of Economics ,Importance of Economics ,Agricultural Economics : Meaning, Definition ,Basic Concepts: Goods, Service ,Utility ,Value ,Price, Wealth, Welfare .Wants: Meaning, Characteristics, Classification of Wants, Importance. Theory of consumption: Law of Diminishing Marginal utility, Meaning, Definition, Assumptions, Limitations, Importance .Consumer Surplus: Meaning, Definition, Importance. Demand: Meaning, Definition, Kinds of demand, Demand Schedule, demand Curve, Law of Demand, Extension and contractions Vs Increase and Decrease in Demand . Elasticity of Demand: Types of elasticity of demand, Degrees of price elasticity of Demand, Methods of Measuring Elasticity , Factors influencing elasticity of demand , Importance of elasticity of demand . Welfare economics : Meaning, Pareto's optimality .National income : Concepts , measurement .Public Finance: Meaning , Principles .Public Resource: Meaning, Services tax ,Meaning, Classification of Taxes : Cannons of Taxation, Public expenditure : Meaning, Principles. Inflation: Meaning, Definitions, Kinds of Inflation.

LESSION PLAN :

Lesson-1&2 :- Economics meaning, introduction of Economics, Defination Adamsmith , Marshall, Robbins, subject matter of economics –economic activities (wants ,efforts –satisfaction), modern view(Micro economics and macroeconomics).

Lesson 3&4 :- Traditional approach i.e.Consumption ,Production Exchange and distribution .Modern approach- Income theory or macroeconomics and price theory or microeconomics . Scope of economics ,importance of economics Agricultural economics – Meaning,introduction and defination.

Lesson 5&6 :- Basic terms and concepts of economics , i.e. Goods(Free Goods, Economic goods, Consumption Goods,Capitral Goods, Intermidiate Goods, Material and non-material Goods,Transferable and non transferable Goods,Personal and impersonal Goods, Private and Public Goods) , Utility- Meaning and forms of utility, Value, Wealth, Price Service, Welfare.

Lesson 7 :- Wants- Meaning and characteristics of wants , classification of wants and importance .

Lesson 8,9,&10 :- Consumption – Meaning , types of consumption and importance. Law of Diminishing marginal utility- meaning , defination , explaination of law with suitable diagram , assumption , limitation and importance of the law.

Lesson 11 :- Law of equimarginal utility – Meaning ,explaination of law with suitable example and diagram , Limitation and practical importance of the law.

Lesson 12 :- Consumer surplus – Meaning , explaination with example and diagram ,importance of cosumers surplus.

Lesson 13 &14 :- Demand – Meaning, defination ,kinds of demands , demand schedule, demand curve , law of demand ,extension and contraction , increase and decrease in demand .

Lesson 15&16 :- Elasticity of demand – Meaning, types of elasticity , degrees of price elasticity of demand , methods of measuring elasticity (3 methods), factor influencing elasticity of demand .

Lesson 17& 18:- Supply –Meaning, defination,kinds of supply , supply schedule , supply curve ,law of supply ,extension and contractions of supply ,increase and decrease of supply

Lesson 19&20 :- Elasticity of supply – Meaning , elastic ,inelastic supply (with suitable diagram) , mesurement of elasticity of supply and importance of elasticity of supply

Lesson 21&22:- Welfare economics – Meaning, criteria of welfare economics (growth of GNP) , Paretos optimality.

Lesson 23&24:- National income- Concepts and importance (GNP,NNP,PI) ,methods of measurements of national income .

Lesson 25,26 :- Public finance – Meaning ,distinction between public and private finance.

Lesson 27 :- Importance of public finance,function of public finance , principle of maximum social advantage

Lesson 28, 29 :- Public resource – Meaning,types and classification of taxes , advantages &30 and disadvantages of direct and indirect taxes , cannons of taxation .

Lesson 31 :- Public expenditure – Meaning and principles of public expenditure

Lesson 32 :- Inflation – Meaning , causes of inflation , control , nature of inflation kinds of inflation .

Reference Books:-

1. Elementary Economics and Theory :- K.K.Dawett and J.D.Verma
2. Modern Economics Theory :- K.K.Dawett
3. Principles of Economics :- M.L.Seth

Course No. : ECON-232

Course Title : PRODUCTION ECONOMICS AND FARM MANAGEMENT

Course Credit : 1+1=2

Theory:

Production Economics: Meaning, Definition, Nature and Scope of Agricultural Production Economics. Basic concepts and terms. Concepts of Production. **Production Functions:** Meaning, Definition, Types. **Laws of returns:** Increasing, Constant and decreasing. Factor Product Relationship. Determination of optimum input and output. Factor- factor relationship. Product-product relationship. Types of enterprise relationships. **Returns to scale:** Meaning, Definition, Importance**. Farm Management:** Economic principles applied to the Organizations of farm business. Types and systems of farming. Farm planning and budgeting. Risk and uncertainty. Farm budgeting**. Linear programming:** Assumptions, Advantages and Limitations of Linear programming.

Practical:

Computation of cost concepts; Methods of computation of depreciation; Analysis of Net worth statement; Farm inventory analysis; Preparation of farm plans and budgets; Types of farm records and accounts; Preparation of profit and loss account; Break, Even analysis; Economics analysis of different crop and livestock enterprises; Application of Farm Management Principles.

Suggested Readings :

1. Heady,E.O. and Dillon, J.L. (1961) : Agricultural Production Functions, Kalyani Publishers, New Delhi.

2. Heady,E.O : Economics of Agricultural Production and Resource Use, Prentice Hall, Inc., New York.
3. Gujarati, D.N. (1995) : Basic Econometrics, McGraw Hill, Singapore.
4. Sankhayan, P.L. Introduction to the Economics and Agricultural Production, Prentice Hall, New Delhi.

TEACHING SCHEDULE

A) THEORY :

Lect No.	Topic to be taught	Weightage
1.	Production Economics: Meaning, Definition	6
2.	Nature and Scope of Agricultural Production Economics..	8
3.	Concepts of Production Basic concepts and terms	6
4.	Production Functions: Meaning, Definition, Types	6
5.	Laws of returns: Increasing, Constant and decreasing	6
6.	Factor Product Relationship. Determination of optimum input and output.	8
7.	Factor relationship. Product relationship	9
8.	Types of enterprise relationships.	6
9.	Returns to scale: Meaning, Definition, Importance	7
10.	Economic principles applied to the Organizations of farm business	6
11.	Types and systems of farming	6
12.	Farm planning and budgeting	6
13.	Risk and uncertainty	6
14.	Farm budgeting.	6
15.	Linear programming: Assumptions, Advantages and Limitations of Linear programming.	8

B) PRACTICAL :

Practical No.	Topic to be taught	Weightage
1.	Computation of cost concepts;	6

2.	Methods of computation of depreciation	7
3.	Methods of computation of depreciation	7
4.	Analysis of Net worth statement	7
5.	Farm inventory analysis	7
6.	Farm inventory analysis	7
7.	Preparation of farm plans	7
8.	Preparation of budgets	7
9.	Types of farm records and accounts	7
10.	Preparation of profit and loss account	7
11.	Break Even analysis	6
12.	Economics analysis of different crop and livestock enterprises	6
13.	Economics analysis of different crop and livestock enterprises	6
14.	Economics analysis of different crop and livestock enterprises	6
15.	Application of Farm Management Principles.	7

Course No. :

ECON-243

Course Title : AGRICULTURAL FINANCE & CO – OPERATION MANAGEMENT

Course Credit : 1+1=2

Theory :

Sr. No.	Lecture No.	Details of Topic	Weightage
1	1st Lecture	**Agricultural finance** I) Meaning & Definition of Agril. Finance II) Concepts & Scope of Agril. Finance III) Importance of Agril. Finance	**05**
2	2ndLecture	**1)Time Value of Money :** (Investment Analysis) i)Future value of Present Money (Compounding) ii)Present value of future Money (Discounting) **2)Methods of Project Appraisal :** i) Undiscounted Measures ii) Discounted Measure **1)Undiscounted** a)Pay – Back period b) Proceed per Rupee of outlay **2) Discounted.** a) Net Present worth b) B-C. Ration. c) Internal Rate of Return	**05**

3	3rd Lecture	**1)Agricultural Credit :** i) Meaning & Defination of Credit & Agril. Credit. ii) Function of Agricultural Credit iii)Needs of Agricultural Credit **2) Classification of Agricultural Credit.** i) The purpose for which it is needed ii) The Length of period for which loans are required. Iii) The Security against which loans are advanced. IV) The form (nature), through which loans are advanced.	**10**
4	4th Lecture	**1) Sources of Agricultural Credit.** **1) Non Institutional Credit.** a)Professional Money Lender b) Non Professional Money Lender **2) Institutional credit** i) Government (Taccavi Loan) ii) Commercial Banks. iii)Co-operative Credit Agencies	**10**
5	5th Lecture	**Credit Analysis:** **1) 3.R'S :** 1)Return From the Investment 2)Repayment Capacity 3)Risk Bearing Ability	**05**
6	6th Lecture	**I)5C's :** 1) Characters 2) Capacity 3) Capital 4) Condition & 5) Commonsense **II)7 P' s :** i) Principle of productive purpose	**05**

		ii) Principle of personality iii) Principle of productivity iv) Principle of phased disbursement v) Principle of proper utilization vi) Principle of payment & vii) Principle of Protection.	

7	7th Lecture	**I) Repayment Plans :** 1) Single repayment plan/Lumpsum repayment plan 2) Partial Repayment plan 3) Amortized repayment plane a) Amortized decreasing repayment plane b) Amortized even repayment plan 4) Variable repayment plan 5) Optional repayment plan 6) reserve repayment plan	**05**
8	8th Lecture	**I) History of Financing agriculture in India** **II) Commercial Banks – Various Scheme Launched** 1) Lead Bank scheme. 2) Small farmers development agencies (SFDA) 3) Marginal Farmers & Agril. Laborer development (MFAL). 4) Village adoption Scheme. **III) Nationalization of commercial Bank :** 1) Central Bank of Ijndia 2) Bank of India. 3) Punjab National Bank 4) Bank of Baroda 5) United Commercial Bank 6) Canara Bank	**05**

		7) United Bank of India 8) Dena Bank 9) Allah bad Bank 10) Syndicate Bank 11) Indian Bank 12) Bank of Maharashtra 13) Union Bank of India 14) Indian Ovaerseas Bank	
9	9th Lecture	**I) Regional Rural Bank** History, Function & Management of Regional Rural Bank Characteristics Features of Regional Rural Bank. List of Regional Rural Banks. The list of RRBs 1st Opened in the country. 1) Syndicate Bank 2) State Bank of India 3) United Bank of India 4) Punjab National Bank 5) United Commercial Bank	**10**
10	10th Lecture	**Higher Financing Agencies** **1) World Bank** a) International Monetary Fund (IMF) b) International development Association (IDA) **2)Reserve Bank of India :** a) Genesis of the reserve Bank of India's Agricultural Credit department b)Provision of Finance c) Promotional of Finance. d) Functions of RBI. e) Credit Controls. f) Fiscal Policy. g) Credit Rational. **II) Scale of Finance :** Meaning, Concept and Importance of Scale of Finance	**05**

11	11thLecture	**I) National bank for Agriculture & Rural Development (NABARD)** 1) Genesis 2) Objective 3) Functions 4) Board of Management 5) Sources of Funds **II)Agricultural Finance Corporation (AFC)** 1)Financing Role2) Promotional Role	**07**
12	12th Lecture	**I)Asian development bank** **II)Insurance & Credit Guarantee Corporation of India (DICGC)** 1)Role of Corporation 2)Service Area Approach. a)Need for Service Area Approach. b) Objectives for Service Area Approach. **III)Assessment of Crop losses.** **IV)Determination of Compensation.** **V)Crop Insurance** : a) Comprehensive Crop Insurance Scheme b) Origin of Crop Insurance.C) Advantages of Crop Insurance d) Limitation in Application.e) Estimation of Crop Yield.	**03**
13	13th Lecture	**I) Agricultural Co-operation.** 1)Genesis & evolution of Co-operation as a system. 2) Principle of Co-operation. a)A voluntary association b) Democratic organizationc) Self help through Mutual helpd) Common balefiree)A spirit of service (OR) Non profit Motivef) distribution of profits. g) Open memberships. h) Political & religions Neutralityi) Thrift. j) Publicityk) Honorary Sevice	**05**
14	14th Lecture	**I)History & Origin of Co-operative Movement.** **II)Pre- Independence Post Independence Post Independence period.** 1)Period of Initial effort & Planning (bet'n. 1904 & 1912)	**05**

		2) Period of Hurried expansion (1912 to 1918) 3)Period of Unplanned Expansion. (1918-1929) 4)Period of Setback & Reorganization (1929-1939) 5)Period of recovery (1939-1946) 6) Period of planned development (Independence &After	

15	15th Lecture	**Co- operation in different plan period.** 1) Co- operation in first plan period. 2)Co-operation in first plan. Co-operation during the second plan. 3)Co-operation during the fourth Plan.4)Co-operation in the Fifth Plan. 5)Strategy for the sixth Plan. 6)Future of Co-operations in Eighties –Concluding observations.	**05**
16	16th Lecture	**I)Co-operative Credit Structure** 1) Short Term & Medium term loan. (Three tier system) State co-operative Bank, DCCB. PACS. 2) Long term loan (Two tier System) CLDB, PLDB. **II) Reorganization of Co-operative credit Structure in Andhara Pradesh & single Window system**. **1) Single Window system.** a) Credit (Three tier Structure) The A. P. State Co-operative Bank for Agaril. Rural Development (APCOBARD), District Co-operative Bank forAgril. Rural Development (DISCOBARD)., PACS. **2)Marketing (Two tier System)** a) The A.P.State co-operative Marketing Federation Ltd. (MARKFED). b) District Co-operative Marketing societies (DCMS) **III) Successful Co-operative systems in Gujarat,**	**10**

		Maharashtra & Punjab, etc.	

Text Book :

1) Agricultural Finance & Management by subbha Reddy and P. Raghu Ram

2) Farm Financial Management by S.S. Joshi & C.V. Morey

3) Rural Credit & Agricultural Co- operation in India by C.B. Mamoria

Reference Book :

4) Agril. Co operation India by C.B. mamoria and R.D. Saksena.

5) Theory, His try & Practices of Co-operation by K.D.Beca.

Practical :

1) Factors governing use of Capital & identification of Creadit Needs:

1st Practical : Assessment of Credit requirement for Food grain Crops : Jowar, Wheat , Paddy.

2nd Practical : Assessment of Credit requirement for Cash Crop : Cotton, sugarcane.

3rd Practical : Assessment of Credit requirement for Horticultural Crops : Mango,

2) Time value of Money (Compounding & Discounting).

4th Practical : Testing of economic viability of long term Investment.

Measures of Project worth are :-

A) Undiscounted Measures Project	**B) discounted Measures of**
1)Ranking by inspection	1) Net Present worth
2)Pay-back period	2) I.R.R.
3)Proceeds per Unit of out lay	3) B-C. Ratio
4)Average income on book value of Investment.	4) Net benefit investment ratio.

Explain with example

3) Tools of Financial Management : balance Sheet

5th **Practical** : To study the preparing the Balance sheets of a business Farms & Computation of different test Ratio & Financial Test ratio.

Balance sheet of a Business Farm : It shows financial condition & performance of farm i.e. assets & Liabilities Assets : Fixed, Working & Current Assets. Liabilities : Current, Intermediate & long term liabilities.

Test Rations :

1. Current ratio, 2.Intermedidate Ratio, 3.Net Capital Ratio, 4)Current Liability Ratio
2. Debt equity Ratio 6.Equity Value Ratio, 7.Fined assets to own fund Ratio. Income statement / profit & loss statement.

4) Financial Test Ratio :

1) Operating Ratio, 2) Fixed Ratio, 3) Gross Ratio, 4) Capital turn over Ratio, 5) Rate of return on investment, 6) Net farm income.

Explain with example.

5) Cash Flow statement

6th Practical: **study of Cash flow statement &Calculate the Break-even analysis of project involving large investment**.

Cash Flow Statment :

1) Cash receipts

i) Cash balance. Ii) Total operating sales, iii) Total capital sales.iv) Non farm income V) Borrowing vi) Total

2) Cash expense.

1) Operating expenses, 2)Capital investment, 3)Family living expenses,4)Payment of Previous year's debts, 5)Payment of ST loans & instalments on investment loans, 6)Total.

3) Cash Balance

Break even analysis :

1) Linear approach.
2) Curvilinear approach.

Algebraic Method, Break even point, Magrin of safety in units, Margin of safety in Rs., Percentage of Margin of safety.

6)Preparation & analysis of loan proposals :

7th Practical : Formulation of loan proposal (Crop loan) for Agriculture Crop. Along with the loan application following basic document or required.

1. Financial Statement /Net worth statement, 2)Income statement/record of Past performance,3)Particular affined & working assets owned, 4)Particulars of presently outstanding loan, 5)Future Crop loan.

Fixed capital loan (Medium & long term), working, Capital loan.

- Documents to be furnished.
- Security of the loan.

Assignment: Give the blank application form of DCCB for crop loan & Ask students to fill up the given form.

8th Practical : **Formulation of loan proposal for Horticultural commodities Medium Term loan.**

1. Technical consideration for project formulation of mango garden.2)Economic feasibility. 3)Estimate the capital requirement.
    a. Estimate initial investment for Mango/Orange up to 5 year.
    b. Estimate per ha expenditure during bearing years.
    c. And enclose the above statement in Medium Term loan application form of DCCB & ask the Student to fill up

9th Practical : **Formulation of loan proposal for drip/sprinkler irrigation : Long- term loan proposal.**

- Per ha cost of drip/ sprinkler irrigation system.

Enclose : Blank application of long term loan of LDB & ask student's to fill up.

7)Types of Repayment loans :

10th Practical : **Assessment of repayment capacity of farmers.**

--Conventional approach.

--Modern approach.

a. Repayment capacity for self liquidating loans.

b. Non-Liquidation loans.

--Give the example for estimation of repayment capacity for self liquidating (without with loan) estimation of R. C. For self liquidating (without with loan)

11th Practical : Assessment of Risk bearing ability of farmers.

1. Production Risk, 2.Technological Risk,3. Risk caused by illiteracy, 4.Inefficiency by sickness of the farness, 5.Institutional Risk, 6)Weather Uncerainty 7.Price uncertainty etc.
    - Repayment capacity under risk
    - Estimation of Risk Bearing ability.
    - Measures to strengthen Risk bearing ability.

8)Study of financial institutions :

12th Practical : To study of primary Agricultural Co-operative Credit society.

Organization,Object, Function.Area of operation,Member ships, Management,Sources of working capital,Rate of interest, Security, Repayment of loans.

13th Practical : **To study of District Central Co-operative Bank.**

Organization,Object, Function.Area of operation,Member ships, Management,Sources of working capital,Rate of interest, Security, Repayment of loans.

14th Practical : **Apex Bank /state Co-operative Bank Organization.**

Need for S.C.B.,Function of S.C.Bs,His try & Development of SCBs.Branch Banking, Management, Membership, Sources of working capital, Owned funds, Over dues, Suggestion for improvement

15th Practical : **Study of Regional Rural Bank.**

Objectives,Evolution & Growtah of Regional Rural Banks,Functions of RRB,Area of Operation, Capital Structure, Progress of RRBs, Suggestion for improvement.

16th Practical : **Study of NABARD**.

Objective, Function, Board of Management

Course No. : ECON-354

Course Title : AGRICULTURAL MARKETING, TRADE & PRICES.

Course Credit : 1+1=2

Theory :

Sr. No	Lecture No.	Details of Topic	Weightage
1	1st Lecture	**Agricultural Marketing.** iv) Concepts & Definition of Agril. Marketing. v) Objectives of the study. vi) Scope & Subject matter of Agril. Marketing. **Market & Marketing :** 1) Meaning & Definition of Market & Marketing & what marketing Is ? 2) Components of a Market. 3) Dimension of a Market.	07
2	2nd Lecture	**Classification of Markets.** 1) on the basis of location. 2) on the basis of Area/ Coverage. 3) on the basis of Time span. 4) on the basis of Volume of Transaction. 5) on the basis of Nature of Transaction. 6) on the basis No. of commodities in which	10

		Transaction takes place. 7) on the basis of Degree of Competition. 8) on the basis of Nature of Commodities. 9) on the basis of stage of Marketing. 10) on the basis of Extent of Public intervention. 11) on the basis of type of population served. 12) on the basis of Accrual of Marketing Margins.	
3	3rd Lecture I II	**Market Structure :** 1) Meaning. 2) Components of Market structure. a) concentration of market power. b) Degree of Product differentiation. c) Conditions for Entry of Firms in the Market. d) Flow of Market Information. e) Degree of Integration. Dynamics of Market structure conduct & performance.	03
4	4th Lecture	**Marketing Function :** Marketing function classified in Various way. 1) Thomsen Classification. 2) Kohl's & ULI 3) Huegy & Mitchell **Major Function of Marketing.** **1) Packaging** a) Meaning of packing & packaging. b) Advantages of Packing & Packaging. c) Packing Material **2) Transportation.** a) Advantage of Transport Function. b) Means of Transport. c) Transportation Cost. d) Problems in Transportation of Agricultural Commodities	05

		e) Suggestions for Improvement.	
5	5th Lecture	**3) Grading & Standardization.** a) Meaning. b) Types of Grading. c) Criteria for Grade Standards. d) Inspection & Quality Control. e) Labeling. f) Advantages of Grading. g) Procedure for Formulation of Indian Standards of for Processed Product. h) Producers difficulties in Grading. i) International Organization for Standardization	05
6	Lecture No. 6	**4) storage & Warehousing :** **<u>Storage :</u>** a) storage meaning & Need. b) Storage Practices in India c) Risks in Storage d) Storage Structures e) Essentials of Good Food grain f) Storage Structure g) Improved Grain Storage structure **<u>Warehousing :</u>** a) types of Warehouses b) Warehousing in India c) Working of Warehouses d) License for running warehouses e) No. & Capacity of warehouses f) Causes for low utilization of g) Warehouses by Farmers h) Suggestion i) Cold Storage	05

7	Lecture No 7	**5) processing** a) Meaning b) Advantages of Processing **6) Buying & Selling** a) Meaning b) Methods of Buying & Selling c) Demand Creation **7) Price Discovery & Price Determination** a) Characteristics of Price Discovered **8) Market Information** a) Meaning b) Importance c) Types of Market information d) Criteria for good Market information e) Suggestion for improvement in Market information f) Market Intelligence in India **9) financing :** a) Factors affecting Capital Requirements of an Agril. Marketing Firm. **10) Risk Bearing / Risk Taking** a) Meaning & Importance of Risk. b) Types of Risk c) Minimization of Risk d) Future Trading	06
8	Lecture No. 8 I	**Producers surplus of Agricultural** 1) Meaning 2) Types of Producer surplus a) Marketable surplus b) Marketed surplus 3) Relationship bet'n Marketable surplus & marketed surplus 4) Importance of Marketed surplus & marketable surplus.	07

		5) Factors affecting Marketable surplus a) size of Holding b) Production c) Price of the commodity d) Size of Family e) Requirement of Seeds & Feed f) Nature of Commodity g) Consumption Habits	
	II	**Marketing Channels;** 1) Definition of Marketing Channels.\ 2) Channels for different products a) Marketing channels for Food grains b) Marketing Channels for Oilseeds c) Marketing Channels for Fruits & Vegetable d) Marketing channels for Eggs. e) Marketing channels for pulses	05
9	Lecture No. 9 I	**Market Integrations.** 1) Meaning & Definition of Market Integration 2) Types of Market Integration a) Horizontal Integration b) Vertical Integration c) Conglomeration	07
	II	**Marketing Efficiency.** 1) Meaning & Definition of Marketing efficiency 2) Marketing Cost, Margin & Price Spread a) Concept of marketing Margin b) Importance of study of Marketing Margin & Cost c) Definition of Marketing Cost, Marketing Marin & Price Spread d) Factors Affecting the cost of marketing i) Perish ability of the product ii) Extent of loss in storage &	

		Transportation iii) Volume of the product Handled iv) Regularity in the supply of the product v) Extent of packaging vi) Extent of Adoption of Grading vii) Necessity of Demand creation viii)Bulkiness of the product ix) Need for Retailing x) Necessity of storage xi) Extent of Risk xii) Facilities Extended by the dealers to the Consumers. e) Reasons for Higher Marketing Costs of Agril. Commodities. f) Way of Reducing Marketing Cost i) Increase the Efficiency ii) Reduce Profits in Marketing.	
10	Lecture No. 10 I II	**Theories of International Trade** 1) Domestic Trade 2) Free trade 3) International Trade 4) GATT 5) WTO Implications of AOA	05
11	Lecture No. 11 I	**Co-operative Marketing :** 1) Meaning of Co-operative marketing 2) Function of Co-operative Marketing societies 3) Types of Co-operative Marketing Societies a) single CommodityCo-operative Marketing Societies b) Multi Commodity Co-operative marketing Societies c) Multipurpose, Multi Commodity Co-operative Marketing Societies.	05

		4) Structure of Co-operative marketing Society i) Base level ii) District level iii) State Level	
12	Lecture No. 12 I	**State Trading** 1) Objectives of State Trading 2) Types of State Trading. **Ware Housing :** 1) Important Functions of Ware housing a) Scientific Storage b) Financing c) Price Stabilization d) Market Intelligence. **2) Types of Ware houses.** a) On the Basis of Ownership i) Private Ware houses. ii) Public Warehouses iii) Bonded ware houses b) On the basis of Type of Commodities Stored i) General Ware houses ii) Special Commodity Ware houses iii) Refrigerated Warehouses. **3) Ware housing In India.** a) General Warehousing Corporation i) Objective ii) Functions iii) Advantages. b) State Warehousing Corporation i) Objective ii) Functions iii) Advantages	08
13	Lecture No. 13 I	**Food corporation of India.** i) Objective ii) Functions.	05

	II	**Quality Control :** 1) Agricultural Product 2) Inspection & quality Control i) AGMARK.	
14	Lecture No. 14	**Price :** 1) Meaning of Price 2) Characteristics of Agricultural Product Process. 3) Need for Agricultural Price Policy	02
15	Lecture No. 15 I	**Risk in Marketing :** 1) Meaning & Importance of Risk 2) Types of Risk in Marketing a) Physical Risk b) Price Risk c) Institutional Risks 3) Speculation & Hedging A) Speculation : Meaning Types of Speculation Economics Benefits of Speculation B) Hedging • Meaning & Definition • Benefits of Hedging • Illustration of Hedging C) Difference bet'n Speculation & Hedging	10
16	Lecture No 16 I	**Future Trading** 1) Meaning Commodities for future Trading **Contract Farming** 1) Meaning 2) Why Contract Framing 3) Contract Farming Model	05

Reference Books -

1) Agricultural Marketing in India
   S.S.Acharya & N.L.Agrawal
2) Principles & Practice of Marketing in India

Dr. C.B. Momoria & R.L. Joshi

3) Rural Credit & Agril. Co-operation in India

Dr. C.B. Momoria

Practical:-

Sr. No.	Particular
1	Study of different crops of Marketing Channel. 1. Definition of Marketing Channel 2. Marketing Channel for seed Grains. 3. Marketing Channel for Oil Seeds. 4. Marketing Channel for Pulses. 5. Marketing Channel for Vegetables and Fruits.
2	Study of Rythu Bazars, Regulated Markets, Unregulated Markets.
3	Study of Model Act.
4	Study of live Stock Markets.
5	Estimation of Marketing cost and Price spread for Food Grains. (Wheat, Jowar, Paddy etc.)
6	Estimation of Marketing cost and Price spread for Fruits and Vegetables.
7	Estimation of Marketing cost and Price spread for Pulses.
8	Study of National Agriculture Co-operative Marketing Federation of India. (NAFED) Genesis, Objectives, Management, Share Capital Funds, Operation of the NAFED.
9	Study of State ware housing corporation (SWC,CWC) Genesis, Working Operation, Contribution of the economy of country.
10	Study of State Trading corporation.
11	Study of Seasonal Indices of Arrivals and prices of cereals.
12	Study of Seasonal Indices of Arrivals and prices of Pulses.
13	Estimation of the Marketable and Marketed surplus for different Agri commodities.
14	To study and visit to different Market Institutions.

Course No. : ECON-365

Course Title : AGRI-BUSINESS MANAGEMENT

Course Credit : 1+1=2

Theory :

Sr. No	Lecture No	Details of Topic	Weightage
1	Lecture 1	**Agribusiness:** 1) Meaning of Agribusiness 2) Definition of Agribusiness 3) System of Agribusiness. a) Agricultural Input Sector b) Production Sector c) Processing Manufacturing Sector d) Distribution – Marketing Sector 4) Structure of Agribusiness Breakdown of the Input, Farm & Product Market Sector a) Farm Supplies : • Seed • Fertilizer & Chemicals • Machinery & Equipment • Petroleum • Transportation • Feed • Others b) Farming c) Processing • Industrial • Food : Supermarkets, Mall, Restaurants Institution etc. • Retail • Other	10
2	Lecture 2	**Importance of Agribusiness in India Economy** **Agribusiness management** 1) The role of Management 2) What is Management	05

		3) What about Agribusiness manger 4) Importance of Good management 5) Function of Management : 4 Management functions a) Planning b) Organizing c) Directing d) Controlling	
3	Lecture 3	**Planning** 1) Meaning 2) Definition of Planning 3) Function of Planning 4) Types of Plan/ Planning Process a) Purpose b) Objective c) Policies d) Procedure e) Practices 5) Characteristics of Sound Plan	05
4	Lecture 4	**Steps in Planning Process 6 Steps are there** Step : 1- Gathering Facts. Step : 2- Analyzing the Facts Step : 1- Forecasting Change Step : 1- Setting Goals & Results Step : 1- Developing Alternatives Step : 1- Evaluation Progress	06
5	Lecture 5	**Organization.** 1) Meaning 2) Legal Structure a) The sole Proprietorship • Creating a sole proprietorship • Advantages & Disadvantage b) The partnership - Creating partnership	02

		- Characteristics of Partnership f) The Corporation - Creating Corporation - Characteristics of Corporation (Limited, Liability, Continuity, Tax Aspects, Estate Planning)	
6	Lecture 6	**Organization Structure** • Responsibility • Authority • Accountability **Directing :** 1) Meaning 2) Objective of Directing a) Personnel Management b) Finding or Recruiting people c) Selecting the Right Person d) Job Orientation e) Compensation & Fringe Benefits f) Evaluating performance g) Training & Development h) Promotion & Advancement i) Terminations & dismissal	05
7	Lecture 7	**Motivation** - Meaning - Different ideas for managing & Motivation People a) Mallow's Need Hierarchy b) Motivators & Hygienic Factors	05
8	Lecture 8	**Controlling :** 1) Meaning and Concept	05
		Ordering 1) Meaning and Concept	
		Leading 1) Meaning and Concept	

		Supervision 1) Meaning and Concept	
		Communication 1) Meaning and Concept	
9	Lecture 9	1**) Financial Management of Agribusiness** Importance of Financial Statement Balance Sheet a) Meaning b) Concept c) Importance d) Precautions in preparing the balance sheet of a business farm e) Study of different test ratios • Current Ratio • Intermediate Ratio • Net Capital Ratio • Current liability Ratio • Debt enquiry Ratio • Equity Value Ratio	10
10	Lecture 10 II	**3) Profit & Loss Statement** a) Meaning b) Concept c) Hypothetical Farm of Profit & loss, statement **4) Study of different Financial Test Ratio** • Capital turn over ratio • Rate of return of investment • Net farm Income • Net return to total capital	05
11	Lecture 11	**Agro-based Industries** 1) Importance of Agro based Industries 2) Need of Agro-based Industries 3) Classification of Agro-based Industries 4) Types of Agro-based Industries a) Sugar Mills	07

		b) Cotton Ginning Mills c) Dal Mills d) Rice Mill e) Poha Mills f) Fruit Processing Industries etc. 5) Institutional Arrangement 6) Procedure to set up agro-based Industries 7) Constraints in establishing Agro-based Industries	
16	Lecture 12	**Marketing Management** 1) Meaning of Marketing 2) Definition of Marketing 3) Concepts of Marketing a) Exchange concept b) Product concept c) Marketing Myopia d) Sales concept 4) Differences between Marketing and selling 5) Features of Marketing Concept a) Consumer Orientation b) Integrated management action c) Consumer Satisfaction d) Realizing the organization goals including profit **Market Mix** 1) Meaning of Marketing Mix 2) 4 Ps of Marketing a) Product Variable b) Place Variable c) Price Variable d) Promotion Variables.	16
13	Lecture 13	**Market Segmentation** 1) Meaning and Concept of Market	05

		Segmentation 2) Important Role of Market Segmentation 3) Methods of Market **Product Life Cycle** 1) Meaning 2) Stages of Product Life Cycle a) Market Pioneering stage b) Market growth stage c) Market Maturity stage d) Market decline stage **Price Policy :** 1) Meaning of Price Policy 2) Objective of Price Policy 3) Pricing Methods 4) Prices at various stages of Marketing	
14	Lecture 14	**Project :** **1) Meaning of Project** **2) Definition of Project** 3) **Concept of Project** 4) Types of Agricultural Project Water Resource Development Projects Agricultural Credit Projects Agricultural Development Projects Agro – Industries & Commercial Development Projects **5) Phases in Project Cycle.** a) Conception or Identification b) Formulation or Preparation of the Project c) Appraisal or Analysis d) Implementation e) Monitoring f) Evaluation	10
15	Lecture No 15	Methods of Projects Appraisal. 1) Undiscounted Measures.	05

		2) Discounted Measures. **1) Undiscounted Measures.** a) Payback Period b) Proceeds per Rupee of Outlay c) Average, Annual Proceeds of Rupee Outlay **2) Discounted Measures.** a) Net Present worth (NPW) b) Benefit Cost Ratio (B-C Ratio) c) Profitability India II) Appropriate Selection of Choice Indicator III) Sensitivity Analysis	
19	Lecture No 16	Preparation of project report for various Activities in Agriculture & allied sectors : Daiging, Poultry, Fisheries, Agro-Industries etc. **Guide lines for Project preparation report** 1) Summary & Conclusion 2) Introduction 3) Back ground 4) Project Rationale 5) Project Area 6) The Project 7) Organization & management 8) Production, Markets & Financial result 9) Benefits & Justification 10) Outstanding Issues	05

Text Book :

1) Agricultural Finance & management
   S.Subha Reddy, & P. Raghu Ram.
2) Economics Analysis of Agricultural Projects J.Price Gittinger.

Reference Book :

Agribusness management Conceptual Over vide.
Prof. V.P.,S. Arora.

Practical Syllabus :

1) Study of Input Market : Seed Fertilizer, Pesticides.
2) Study of Output : Grain, Fruits, Vegetable, Flower.
3) Study of Product Market : Retail trade commodity trading, value added products
4) Study of Financing Institution Co-operative Commercial Banks.
5) Study of Regional Rural Bank.
6) Study of agribusiness Finance Limited
7) Study of NABARD.
8) Study of Financial Criteria for appraisal of the project.
9) Appraisal of Irrigation Project.
10) Study of Financial Test Ratios for Evaluating Agro-based Industries.
11) Study of Methods of Project Evaluation
12) Case study of Agro-based Industries
13) Visit to Financial Institution
14) Visit to Export Market of Fruits, Vegetable and Flower.
15) Visit to Export Market of Grains.
16) Visit to Processed Industries and Malls.

Revised in the Co-ordination Committee meeting held at Rahuri on 10.12.2007

SYLLABUS

Course No. : ENGG-121

Course Title : FUNDAMENTALS OF SOIL & WATER CONSERVATION ENGINEERING

Course Credit : 1+1=2

Theory :

Surveying: survey equipment, chain survey, cross staff survey, calculations of area of regular and irregular fields. Plane table survey, Levelling – levelling equipment, terminology, methods of calculation of reduced levels, types of levelling, contouring. Water lifting devices – pumps (for open and tube well), discharge, head and power calculations, Irrigation water measurement through

weirs, flumes and orifices. Soil and water conservation – soil erosion, types of engineering control measures, run off estimation, watershed development.

Practical:

Chain survey; Chain triangulation; Cross staff survey; Plotting of chain triangulation; Plane table survey, Levelling equipment – dumpy level, levelling staff, temporary adjustments and staff reading; Simple and Differential leveling; Contour survey – grid method; Plotting of contours; Types of pumping system and irrigation water measuring devices; Run off estimation; Study of soil and water conservation structures, Concept of watershed development.

LESSON PLAN/TEACHING SCHEDULE

Text Books –

1. Surveying & Levelling Part-I (Edition, 1997)
   T.P.Kanetkar &Kulkarni S.V.
2. Irrigation Theory and Practice
   A.M.Michael
3 Soil and Water Conservation Engg. (II Revised Edition, 1997) R.Suresh

Theory :

Sr. No.	Topics	Books No.	Article No. / Page No.
1	Introduction to surveying, definition, object, principles and classification of surveying	1	1 to 5
2	Chain surveying	1	74-76
3	Plane table surveying	1	289-294
4	Methods for setting right angle with tape, cross staff, prismatic compass and optical square	1	95-106
5	Computation of areas –regular and irregular fields	1	309-317
6	Leveling – terms and definitions, simple and differential leveling	1	345-348, 368-371
7	Definition of contour, concept of contour map and characteristics of contours	1	431-432

8	Principles of soil and water conservation, Types of erosion	3	3.1, 3.2, 3.5, 3.6, 3.7, 3.8, 3.9
9	Runoff – Definition, types and factors affecting runoff,	3	2.1, 2.2, 2.3
10	Measures for soil and water conservation, Biological, Agronomical and Engineering	3	10.1, 10.2, 10.3, 10.4, 10.5, 10.6, 11.1, 12.1
11	Runoff measuring devices – weirs, flumes and orifices	2	4.4, 4.5, 4.6, 4.7
12	Estimation of runoff – Rational method and Runoff volume as function of rainfall	3	2.4.1, 2.10
13	Type of pumps for open and tube wells and related terminology	2	3.5, 3.6, 3.10, 3.14
14	Calculation of discharge, head and H.P. of pumps	2	3.5
15	Concept of watershed development, definition, classification, steps and characteristics of watershed	3	24.1, 24.4, 24.8
16	Steps in evaluation of watershed	3	24.12

Practicals :-ENGG-121

Sr. No.	Practical
1	Study of surveying instruments
2	Measurement of the area of field by chain triangulation method
3	Setting of right angle with tape, cross staff and optical square
4	Measurement of area by plane table survey
5	Study of dumpy level, leveling staff and staff reading
6	To find out reduced levels of points by simple and differential leveling
7	To carry out the contour survey by grid method
8	Plotting of the contour map
9	Determination of peak rate of runoff by rational method
10	Measurement of flow through notches, weirs and orifice
11	Design of farm pond
12	Study of continuous contour trench, platform terraces, bunds, etc.
13	Study of gully, plugs, nala band, check dams and KT weirs

14	Visit to watershed/case study of watershed
15	Determination of discharge, head and horse power for given cropping pattern

Course No. : ENGG-232

Course Title : INTRODUCTION TO COMPUTER APPLICATIONS

Course Credit : 1+1=2

Theory :

Introduction to Computers, Anatomy of Computers, Input and Output Devices, Units of Memory, Hardware, Software and Classification of Computers. Personal Computers, Types of Processors, booting of computer, warm and cold

booting, Computer Viruses, Worms and Vaccines, Operating System – WINDOWS. Disk Operating System, Some fundamental DOS Commands, FORMAT, DIR, COPY, PATH, LABEL, VOL, MD, CD and DELTREE, Rules for naming files in DOS and Types of files. WINDOWS : GUI, desktop and its elements, WINDOWS Explorer, working with files and folders; setting time and date, starting and shutting down of WINDOWS. Anatomy of a WINDOW, Title Bar, Minimize, Maximize and Close Buttons, Scroll Bars, Menus and Tool Bars. Word processing features of word-processing packages. Creating, Editing, Formatting and Saving a document; Electronic Spreadsheets, concept, packages, Creating, Editing and Saving a spreadsheet. Use of in-built Statistical and other functions and writing expressions. Use of Data Analysis Tools, Correlation and Regression, t-test for two-sample and ANOVA with One-way Classification. Creating Graphs, Features of slide presentation package. Concept of Database (RDBMS), creating database. Principles of Programming: Flow Charts and Algorithms, illustration through examples. Internet: World Wide Web (WWW), Concepts, Web Browsing and Electronic Mail.

Practical :

Study of Computer Components; Booting of Computer and its Shut Down; Practice of some fundamental DOS Commands, TIME, DATE, DIR, COPY, FORMAT, VOL, LABEL, PATH; Practicing WINDOWS Operating System, Use of Mouse, Title Bar, Minimize, Maximize and Close Buttons, Scroll Bars, Menus and Tool Bars; Window explorer , creating folders copy and paste operations. Creating a Document, Saving and Editing; Use of options from Tool Bars, Format, Insert and Tools (Spelling & Grammar) Alignment of text; Creating a Table, Merging of Cells, Column and Row width; Creating a Spread sheet, Alignment of rows, columns and cells using Format tool bar; Entering Expressions through the formula toolbar and use of in-built functions, SUM, AVERAGE, STDEV; Data Analysis using inbuilt Tool Packs, Correlation & Regression; Creating Graphs and Saving with and without data; Creating Database (RDBMS), Structuring with different types of fields; Preparation of slides; Transforming the data within different Applications; Internet Browsing: Browsing Web Page and Creating E-Mail ID.

Books :

1) Computer Fundamentals by Pradeep K. Sinha and Priti Sinha, III edition, BPB Publications, B-14, Connaught Place, New Delhi – 110 001.
2) Computer Fundamentals by P.K. Sinha, BPB Publications, B-14, Connaught Place, New Delhi – 110 001.
3) Fundamentals of computer by V. Rajavaman, 2nd edition, Prentice Hall of India Pvt. Ltd., New Delhi.
4) DOS for Dummies, 3rd edition, Comdex Computer Publishing Pustak Mahal, Delhi.
5) Rapidex Computer course by Vikas Gupta, Pustak Mahal, Delhi.
6) Mastering Office Professional for window 95, BPB Publications, B-14, Connaught Place, New Delhi – 110 001.
7) Statistical Methods for Agricultural workers by V.G. Panse and P.V. Sukhatma, ICAR, New Delhi.

LESSON PLAN

Theory :

Lecture No.	Book No.	Article No./ Page No.	Topic/s
1	1 2	1-3, 15-19 1-2, 9-11	Introduction to Computer, Anatomy of Computers
2	1 2	139-158 95-110	Input – output devices
3	2 1 3 1	75-78 162-165 257-259 362-367	Units of Memory Hardware, Software Classification of Computers, personal computers
4	1 4 4	97-102 7-12 252-254	Types of processor Booting of computers – warm and cold booting Computer Viruses, Worms and Vaccines
5	1 1 5	237-238 257-259 61-85	Disk operating system (DOS) some fundamental DOS Commands – FORMAT, DIR, COPY, PATH, LABEL, VOL, MD, CD,

	4	237-292	DEL, TREE , DELTREE
6	5	55-60	Rules for naming files in DOS and types of files
7	6	15-43	WINDOWS : GUI, Desktop & its elements, windows Explorer, working with files & folders, setting time & date, starting & shutting down of windows
8	6	92-107	Anatomy of window, Title bar, Minimize. Maximize and close buttons, scroll bars, menus and Tool bars.
9	6	114-206	Word, Processing, features of word processing packages, creating, editing, formatting and saving a document
10	6	368-376	Electronic spread sheet, Concept, packages, creating, editing & saving a spread sheet
11	6	435-441	Use of in built statistical and other functions and writing expressions
12	6 7 7 6	567-596 53-58 97-113 471-482	Use of data analysis tools, correlation and regression, t-test for two samples and ANOVA with one way classification Creating graphs
13	6	672-686	Features of slide presentation software
14	6	836-861	Concept of database, creating and updating database (RDBMS)
15	2	118-138	Principles of programming, Flow charts and algorithms. Illustrations through examples.
16	1	341-346	Internet : World wide web (www), concept, web Browsing and electronic mail.

Practical :

Practical No.	Title
1	Study of Computer Components, Booting, shutdown of Computers

2	Operating System – DOS
3	Operating System (O.S.) – Windows – I
4	Operating System (O.S.) – Windows – II
5	Word processing – I
6	Word processing – II
7	Creation of spread sheet
8	Handling of in-built functions using spread sheet software
9 & 10	Data Analysis by in-built function in spread sheet software
11	Creation of graph with spread sheet
12	Creation of database (RDBMS)
13	Structuring/querying of database (RDBMS)
14 , 15	Preparation of slides , Data transfer between different applications.
16	Internet, Browsing and E-mail ID Creation.

Course No. : ENGG-353

Course Title : FARM POWER AND MACHINERY

Course Credit : 1+1=2

Theory:

Farm power in India : Sources, I.C. engines, working principles, two stroke and four stroke engines. I.C. engine terminology, different systems of I.C. engine. Tractors. Types, Selection of tractor and cost of tractor power. Tillage implements. Primary and secondary tillage implements, Implements for intercultural operations seed drill, paddy transplanters, plant protection equipment and harvesting equipment: Equipment for land development and soil conservation.

Practical:

Study of different components of I.C.Engine; Study of working of two stroke engine: Study of M. B. plough, Study of disc plough: Study of seed-cum-fertilizer drills-furrow opener, metering mechanism, and calibration; Study, maintenance and operation of tractor: Learning of tractor driving: Study, maintenance and operation of power tiller, study of different inter cultivation equipment in terms of efficiency, field capacity; Repairs and adjustments and operation of sprayers; Repairs and adjustments and operation of dusters; Study of paddy transplanters.

Text Books:

1. Principles of Agricultural Engineering Vol. 1. Reprint edition : 2001 by T.P.Ojha and A. M. Michael

2. Elements of Agricultural Engineering by Jagadishwar Sahay. Forth Edition,2004

Reference Book:

1. Farm Tractor –Repair and Maintenance by S.C. Jain and C.R. Rai.

Theory:

Sr. No.	Topic / Topics	Details	Weightage
1	Sources of farm power in India	Human, Animal, Mechanical, electrical, Wind Power ,Scope of Mechanization.	15
2-3	Principle of operation of I.C. engine	I.C. engine working principles, Two and Four stroke engine, Engine terminology and examples	20
4-5	I.C. Engine systems	Fuel supply system ,cooling system, Air cleaner	5
6-7	Tractor	Tractor types and their selection, fixed and operating cost of tractors with examples	10
8	Tillage	Tillage, objectives of tillage, classification & types of tillage, Tillage implements	15
9	Primary tillage implements	M. B. plough and Disc plough with examples, ploughing of land and method of ploughing	7
10	Secondary tillage implements	Harrows, cultivators & examples	7

11-12	Seed drills	Sowing methods, seed drill, components of seed drill, seed metering mechanism, types of furrow openers, calibration of seed drill, examples	5
13	Study of planter	Planter, Functions, seed metering devices, type of planters	2
14	Plant protection equipments	Classification, types of spraying and types of dusting machines.	10
15	Harvesting and threshing equipments	Definition of harvesting and threshing, harvesting/threshing methods implements and combine harvester-thresher	2
16	Equipment for land development and soil conservation	Clod crusher , leveler , bund former , animal drawn scoop, earth moving machinery	2

Course No. : ENGG-364

Course Title : PROTECTED CULTIVATION & POST HARVEST TECHNOLOGY

Course Credit : 1+1=2

Theory :

Green house technology, Introduction, Types of Green Houses, Plant response to Green house environment, Planning and design of greenhouses, Design criteria of greenhouse for cooling purposes. Materials of construction for green houses, Irrigation systems used in greenhouses, Choice of crops for cultivation under greenhouses, Growing media, soil culture, type of soil required, drainage, flooding and leaching soil pasteurization in peat moss and mixtures, rock wool and other inert media.

Drying, grain drying, types of drying, types of dryers, Storage, grain storage, types of storage structures, Cleaning machinery, Grading, methods of grading, equipment for grading of fruits and vegetables, Size reduction, equipment's for size reduction, Seed processing cleaning and grading, Separators, Storage structures, Quality standards FAQ, ASTA, FPO, FDA.

Practical :

Study of different types of green houses based on shape, construction and glazing materials, Calculation of air rate exchange in an active summer cooling system, Calculation of air rate exchange in an active winter cooling system. Visit to commercial green houses, Study of mechanical dryers, Study of improved

grain storage structures, Study of cleaners & graders. Study of size reduction machinery study of grain/seed processing machinery. Study of separators.

LESSON PLAN (Teaching Schedule)

Green House Technology

Sr. No.	Topics to be covered	Book No.	Article No.	Page No.
1.	Green house Technology --- Introduction, History of green house, advantages of Green house, Green house effect.	1	1.1, 1.2, 1.3	1-5
2	Classification of Green houses on the basis of shape, construction, covering material (Glazing material)	1	2.1, 2.2, 2.3, 2.4	7-16
3	Planning & design of greenhouse site selection & orientation, structural design, covering materials. Construction materials (Wood, G.I., Aluminum, Steel, RCC, Glass)	1	6.1, 6.2, 6.3, 7.1,7.2, 7.3	43-47 49-52
4	Growth media -- Introduction, principles, chemical properties, Properties of root media. Soil culture, types of soil, drainage, flooding and leaching, soil pasteurization in peat mass and mixtures, rock wool and other inert media.	2	2.1,2.2, 2.3, 2.4, 2.5, 2.6	57-70
5	Choice of crop for Greenhouses	2	6.5	346-353

6	Plant response to greenhouse environment Light, Relative Humidity, Temperature, Ventilation, Carbon dioxide	1	3.1 to 3.5	17-22
7	Greenhouse Cooling - Methods of Greenhouse Cooling : Ventilation, Ventilation with roof and side ventilators, Roof shading, Evaporative cooling (EC) (a) Fan and Pad system (b) High pressure mist system, (c) Low pressure mist system	Practi-cal manu-al	Ex.4	-
8	Greenhouse Irrigation system-rules of watering, hand watering, perimeter watering, overhead sprinklers, boom watering, drip irrigation	1	14.1 to 14.6	119-126

Post Harvest Technology

Sr. No.	**Topics to be covered**	**Book No.**	**Article No.**	**Pages/ Remarks**
9	Drying-Drying and its importance, Grain drying, Types of drying, Types of dryers. (L.S.U., Baffle, R.P.E.C.)	3	---- --	103-104, 125, 143-153
10	Storage Different types of storage	4	13.5 to 13.10	665 - 672

	structures- Morai, Bukhari, Kothar, Grain bin, cylindrical and rectangular, Bag storage structure, pusa bin, bunker storage CAP storage	3	--------	170-172
11	Seed processing	4	16.7	821 - 824
12	Cleaning-Vibratory air screen cleaners, Rotary air screen cleaner	3	--------	66, 79 to 81
13	Separators - Spiral, Specific gravity, Inclined draper, and Magnetic separator.	3	--------	89,90, 92, 94-96
14	Size reduction- Equipment for size reduction, Hammer mill, Burr mill, Jaw crusher, Ball mill.	3	--------	233, 235-241
15	Grading- Equipment for Grading of fruits & vegetables	Practical Manual	Ex.No. -12	-
16	Quality standard F.P.O. for fruits & vegetables	Practical Manual	Ex.No. -15	-

Text Books :

Sr. No.	**Author**	**Title**	**Year**	**Publisher**
1	K.Radha Manohar C.Igathinathane	Green House Technology & Management,	First Edition-2000	B.S.Publications 4-4-309, Sultan Bazar, Hyderabad -500 095
2	G.N.Tiwari, R.K.Goyal	Greenhouse Technology Fuundamanetals, Design, Modelling	First Edition-1998	Narosa Publishing House 6, Community Centre, Panchasheel Park, New Delhi-110

		& Applications		017
3	K.M. Sahay K.K.Singh	Unit Operations of Agricultural Processing	Second Edition 2002	Vikas publishing house Pvt.Ltd.New Delhi- 110 007
4	T.P.Ojha A.M.Michael	Principles of Agricultural Engineering (Vol-I)	Fifth Edition 2005	Jain Brother, 16/873, East Park Road, Karol Bagh, New Delhi- 110 005
Reference Books				
1	W.C.Cruess	Commercial fruits & vegetable products	1st 1997	Allied Scientific publisher Bikaner (Rajshtan)
2	R.P.Shrivastava & Sanjeev Kumar	Fruits & vegetable preservation, principles & practices	3rd 2002	International Book Distributing Company Charbagh, Lucknow
3	Jadishwar Sahay	Elements of Agricultural Engineering	2005	Standard Publisher Distributor New Delhi
4	B.P.Sawant J.M.Potekar, H.W.Awari	A Text Book of Greenhouse and Post Harvest Technology	1st Edition June 2008	Nikita Publication, C/o: Narendra Book Depot, Mukund Tara Building, Old Cloth Line, Latur-413512

Practicals :

Sr.No.	Title of Practical
1	Study of Different types of Greenhouse
2	**Study of Greenhouse Covering and Construction Materials**
3	**Cost estimation of polyhouse**
4	Study of Cooling Systems and Ventilation of green house
5	Study of Quality of Soil and Water required for Greenhouse Crops
6	Study of Instruments for Greenhouse
7	Study of irrigation systems for Greenhouse
8	Visit to Commercial Greenhouse
9	Study of Grain Dryers
10	Study of Storage Structures and Design of Bag Storage Structure

11	Study of Size Reduction Machineries
12	Study of Grading Machineries for Fruits and Vegetables
13	Study of Grain/ Seed Cleaners
14	Study of Grain / Seed Separators
15	Study of Quality standard
16	Visit to Seed Processing Plant

MATHEMATICS

Course No. : MATH – 111

Course Title : MATHEMATICS (DEFICIENCY COURSE)

Course Credits : 1 + 1 = 2

Text Books Recommended:

1. Higher Algebra - by Hall and Knight
2. Plane Trigonometry – Part I - by S.L.Loney
3. Coordinate Geometry – Part I - by S.L.Loney
4. Mensuration – I - by Pierpoint
5. Differential Calculus - Shanti Narayan
6. Integral Calculus - Shanti Narayan

Sr.	Topic/Topics	Topic/Topics to be covered in	Book	Articles

No.	in Syllabus	theory period	No.	No.(s)
1.	Quadratic equation	Definition of quadratic equation, Roots of quadratic equation, Nature of roots, Sum and product of roots, Formation of quadratic equation, Examples based on above topics.	1	111,112,113 114,115
2.	Logarithm	Definition, Laws of logarithm and Change of base theorem (without proofs) Examples based on laws.	1	199,200,202 203,204,205 206,207,216, 217
3,4	Determinants	Definition of determinant (Statements) Minors of the determinant, Expansion of determinant, Properties of determinant (Statement only) Examples based on expansion of determinant.	1	486,487,488 489,490,491 492,493,494 495.
5	Point, Distance between two points, section formulae	Co-ordinate axes, origin, Quadrants, Distance between two points, section formulae for internal division (without proof). Examples based on distance and section formulae.	3	15,16,20,22
6	Locus of a point, different forms of straight lines.	Definition of locus, equation to a curve, equation to axes and straight lines parallel to axes, statements of equations of straight line in slope intercept form, double intercept form and two points form. General equation of straight line, Formula for angle between two straight lines (without proof), Conditions for two straight lines to be parallel and to be perpendicular.	3	36,42,46,47,5 0,54,55,58,62 ,66,67,69.

7	Circle	Definition of circle, Statements of standard form, centre-radius form, General form and the most general form of equation of circle (without proof) Examples based on these forms.	3	138,139,140, 142, 143,144
8	Trigonometry	Fundamentals of Trigonometry, Definition of angle of elevation and angle of depression with examples.	2	41,42, 45
9.	Mensuration	Illustration of ordinates of curve and common distance between ordinates, Statement of Simpson's rule and its application for measuring areas of irregular field. Examples based on Simpson's rule.	4	98,99,100,101
10 & 11	Function, Limit	Definition of function, Domain and rage of function, independent and dependent variables Illustration of different types of functions with examples only such as Algebraic (rational, polynomial and constant), Non algebraic function (Logarithmic, Trigonometric, Inverse trigonometric and exponential). Definition of limits, theorems and standard limits (only statements) Examples on evaluation of finite limits of polynomial, rational, trigonometric functions.	5	2.1, 2.12, 2.31,2.32, 2.62,2.7 3.2, 3.3, 3.71
12,13 & 14	Differential calculus, Theorems of differentiation	Definition of differentiation, Differential coefficient, Theorems of differentiations, Composite function and Chain Rule (without proofs, List of standard formulae for power,	5	4.11, 4.12,4.16, 4.31, 4.32, 4.33, 4.34

		trigonometric, logarithmic and exponential functions. Examples based on rules		
15,16	Integral calculus, Concept of indefinite Integral.	Definition of Integral of a function, Integrand and process of Integration, study of integral calculus, constant of Integration, table of elementary integrals, Theorems on integration (without proof), Examples on integration by decomposition method only, definition of definite integral and simple examples on definite integral.	6	1.1, 1.2, 1.3, 1.4, 1.51, 1.52, 1.6

Note :

1. The credit “+1” of (1+1) credit be used for tutorial periods
2. In these tutorial periods practice of solving examples using suitable theory portion, covered in theory periods.
3. To cover fundamental topics on trigonometry, differential and integral calculus any suitable book for XI and XII standard may be referred.

Course No. : **MATH – 121**

Course Title : **MATHEMATICS (DEFICIENCY COURSE)**

Course Credits : **1 + 1 = 2**

Books Recommended :

1. Higher Algebra - Hall and Knight
2. Plane Trigonometry Part I - S.L. Loney
3. Co-ordinate Geometry Part I - S.L. Loney
4. Mensuration - I - Pierpoint
5. Differential Calculus - Shanti Narayan
6. Integral Calculus - Shanti Narayan

Sr.No. of Theory	Topic / Topics in Syallabus	Topic/Topics to be covered in theory period	Book No.	Articles No.(s)

period				
1	Quadratic equation	Definition of quadratic equation, Method of perfect square (Statement only) for solving quadratic equation, Nature of roots, sum and Product of roots	1	111,112, 113 114,115
2	Logarithm	Definition of logarithm, laws of logarithm (Statements only)	1	199,200, 202,203, 204,205, 206, 216, 217
3,4	Determinants	Definition of second order and third order determinants (Statements) minors, Expansion of determinant, Elementary Properties of determinant (Statement only)	1	486,487, 488,489, 490,491, 492,493, 494,495
5	Point, Distance between two points, section formulae.	Co-ordinate axes, origin Quadrants, Distance between two points of rectangular axes, section formulae (statements)	3	15,16,20, 22
6	Locus of a point, different forms of straight lines	Definition of locus, equation to locus, equation to axes & straight lines parallel to axes, statements of equations, straight lines having slope interecept form, Statements of equation, only of St. line passing through two points form two General equation Angle between two straight lines (formula)	3	62,66,67, 69

7	Trigonometry	Define angle of elevation & angle of depression with examples	2	41,42,
8	Circle	Definition of circle, radius, centre, Equation to circle, centre and radius form,General equation, its radius and centre (formulae only)	3	138,140, 142,144
9	Mensuration	Ordinates & common distance between them. Simpson's rule statement and its application for measuring areas of irregular field and other Illustrations.	4	98,99,100,101, 102
10,11	Function Limit	Definition of function, Different types of functions, viz. Algebraic, Logarithmic, Trigonometric, Inverse, Expontial (Illustrations only) Definition of limits and continuity, theorems and standard limits (only statements)	5	1.51,1.52 1.53, 3.2,3.21, 3.3,3.53, 3.6
12,13,14	Differential calculus Theorems of differentiation	Definition of differentiation, List of standard formulae, Theorems of differentiation, Composite functions and Chain rule	5	4.11,4.12 4.13,4.21 4.22,4.31 4.32,4.33 4.34
15,16	Integral calculus Concept of indefinite Integral	Definition of Integral of a function, Integrand, process of Integration, constant of Integration, Integration as Inverse process of differentiation, illustration by list of simple examples, definition of definite integral, Integration by decomposition method	6	1.1,1.3,1.4,1.51, 1.52,1.6

Note :

1. The credit " + 1" of (1+1) credit be used for tutorial periods.
2. In the tutorial periods practice of solving examples using suitable theory portion, covered in theory periods, be made for which, in addition to the books, mentioned above books of Mathamatics for XI and XIIth standard of Maharashtra State used.

STATISTICS

Course No. : STAT-121

Course Title : STATISTICS

Course Credit : 1+1=2

Theory :

Definition of Statistics, its use, limitations; Frequency Distribution and Frequency Curves; Measures of Central Tendency; Characteristics of Ideal Average, Arithmetic Mean; Median, Mode and their Merits and Demerits; Measures of Dispersion;- Standard Deviation, Variance and Coefficient of Variation; Probability:- Definition and concept of probability; Normal Distribution and its properties; Introduction to Sampling:- Random Sampling; the concept of Standard Error, Tests of Significance – Types of Errors, Types of Hypothesis, Level of Significance and Degrees of Freedom, Steps involved in testing of hypothesis;- Large Sample Test – SND test for Means, Single Sample and Two Samples (all types); Small Sample Test for Means, Student's t-test for Single Sample, Two Samples and Paired t-test. F-test; Chi-Square Test in 2 X 2 Contingency Table, Yates' Correction for continuity; Correlation:- Types of Correlation, Scatter Diagram, Computation of Correlation Coefficient 'r' and its testing, Linear Regression: of Y on X and X on Y. Inter-relation between 'r' and

regession coefficients. Experimental Designs:- Basic Principles, Completely Randomized Design (CRD), Layout and analysis with equal and unequal number of observations, Randomized Block Design (RBD), Layout and analysis, Latin Square Design (LSD), Layout and analysis.

Practical:

Frequency Distribution and Frequency Curves; Computation of Arithmetic Mean, Median and mode for Un-Grouped and Grouped data; Computation of Mode for Un-Grouped and Grouped data; Computation of Standard Deviation, Variance and Coefficient of Variation for Un-Grouped and Grouped data; SND test for Means, Single Sample; SND test for Means, Two Sample, Student's t-test for Single Sample; Student's t-test for Two Samples; Paired t-test and F-test; Chi-Square Test in 2 X 2 Contingency Table, Yates' Correction for continuity; Computation of Correlation Coefficient 'r' and its testing; Fitting of regression equations- Y on X and X on Y; Analysis of Completely Randomized Design (CRD); Analysis of Randomized Block Design (RBD); Analysis of Latin Square Design (LSD).

ENGLISH

Course No. : LANG-111

Course Title : COMPREHENSION AND COMMUNICATION SKILLS IN ENGLISH.

Course Credit : 1+1=2

Text Book prescribed: English for practical purposes by Z.N.Patil, et al: Macmillan

The pattern of question paper for Semester End Examination should be as follows due nature of subject. In question paper there will be two Sections.

Section-A, will be descriptive type which content seven questions out of which five questions are to be attempted. All questions carry equal marks.

Section - B, will be three questions with the pattern of short notes, letter writing, press notes, memos, minutes of the meeting, summary abstracts etc.

Distribution of Syllabus for Theory and practical (Course plan)

Sr.No.	Theory	Practical
1	Reading Comprehension: To locate specific information for meaning of words, phrases and sentences for understanding logical relationship between statements	Selected passages to be given with questions
2	Taking and making notes	Case studies, articles, passages etc. to be given
3	Technical Reports: a. Structure b. Language	Case studies
4	Press notes/ articles	Examples, case studies
5	Précis, summary, abstracts	Case studies
6	Paragraph writing	Case studies
7	Job application & CV writing	Case studies
8	Notice, agenda and minutes	Samples analysis

	writing	
9	Personal and professional correspondence	Sample analysis
10	Stress and Intonation	Practice and drill using Audio- Visual-Aids, use of dictionary
11	Group discussion	Group discussion on any given topic
12	Interview (Interviewee & interviewer)	Mock interviews
13	Listening comprehension	Listening to lectures, speeches and talks
14	Power point presentation	Practice, sample presentation
15	Revision	
16	Revision	

Syllabus:

Theory:

Reading Comprehension: To locate specific information for meaning of words, phrases sand sentences for understanding logical relationship between statements. Taking and making notes

Technical Reports: Structure, Language. Press notes/ articles Precise, summary, abstracts. Paragraph writing. Job application & CV writing. Notice, agenda and minutes Personal and professional correspondence. Stress and Intonation, Group discussion. Interview (Interviewee & interviewer). Listening comprehension. Power point presentation.

Practical:

Reading Comprehension: Location of specific information, meaning of words, phrases. Sample analysis, writing analysis. Taking and making notes, case studies/Sample analysis, technical reports, press notes, news articles: Sample analysis and case studies, job application and CV writing, sample analysis, notice, agenda minutes writing: sample analysis and case studies, personal and professional correspondence. Sample analysis and case studies.

Stress and Intonation- Practice and Drill. Group discussion, mock interviews.
Listening Skills: Practice of listening to talks, speeches & lectures.
Power point presentation- Practice and sample analysis.

Following syllabus will not be included in the examination. But, it is decided in the meeting to cover following topics in the classroom

Word order, Subject- Verb Agreement, Preposition, Tenses, Voices, Phrasal verbs etc. Technical reports, Handling media, Business presentation, Referencing, E-mail, FAX etc.

Subject: English

Teaching Schedule for Theory :

Lecture No.	Course Contents	Weightage
1,2	**Reading Comprehension:** To locate specific information for meaning of words, phrases and sentences for understanding logical relationship between statements	05
3	Taking and making Notes	05
4	**Technical Reports:** (A) Structure (B)Language	05
5	Press notes	03
6	Articles	02
7	Précis, Summary, Abstracts	03
8	Paragraph writing	05
9,10	Job Application & CV Writing	03
11	Notice, agenda and minutes writing	03
12	Personal and Professional correspondence	03
13	Stress and Intonation	03
14	Revision	00
15	Revision	00
16	Revision	00

Note: Mid-Term Examination -10 Marks
Semester End Theory Examination-40 Marks

50 Marks

Subject: English

Teaching Schedule for Practical

Practical No.	Course Contents	Weightage
1	Reading passages for comprehension	05
2	Case Studies/Articles/Passages for note making	03
3	Case Studies of Technical reports	05
4	Examples/Case Studies of Press Notes and Articles	03
5	Practice of Précis/summary/abstract	03
6	Practice of Paragraph writing	03
7	Practice of Job Application and CV Writing	03
8	Sample analysis of Notice/Agenda/Minutes writing	02
9	Sample Analysis of Personal and Professional correspondence	03
10	Practice and Drill of Stress and Intonation using Audio-Visual Aids and dictionary	02
11	Group discussion	03
12	Mock interviews	03
13	Listening to lectures/talks/speeches on Radio/Television	02
14	Sample Power Point Presentation	00
15	Revision	00
16	Revision	00

Note: Practical Record Work - 05Marks

Viva-Voce - 05

Semester End Practical Examination-40 Marks

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50 Marks

Physical Education

Course No. : Phy-EDN-111

Course Title : PHYSICAL EDUCATION

Course Credit : 0+1=1

Theory :

Introduction to physical education. Posture, exercise for good posture, physical fitness exercises for agility, strength, coordination, endurance and speed. Rules regulations of important games, skill development in any one of the games, football, hockey, cricket, volleyball, badminton, throw ball, tennis. Participation in one of the indoor games, badminton, chess and table tennis. Rules and regulations of athletic events, participation in any one of the athletic events, long jump, high jump, triple jump, javelin throw, discuss throw, shot put, short and long distance running, Safety education, movement education, effective way of doing day-to-day activities. First-aid training, coaching for major games and indoor games. Asans and indigenous ways for physical fitness and curative exercises. Exercises and games for leisure time, use and experience.

Note:

Warming up and conditioning exercises are compulsory before the commencement of each class.