

# **SYLLABUS**

**Based on**

**CHOICE BASED CREDIT SYSTEM (CBCS) under  
LEARNING OUTCOMES BASED CURRICULUM  
FRAMEWORK (LOCF)**

**M. Sc. (Rural Technology)**

**2021-2022**



**DEPARTMENT OF RURAL TECHNOLOGY AND SOCIAL  
DEVELOPMENT**

**GURU GHASIDAS VISHWAVIDYALAYA**

(A Central University)

**Koni- Bilaspur 495009 Chhattisgarh**

**Department of Rural Technology & Social Development**  
**Guru Ghasidas Vishwavidyalaya, Koni-Bilaspur (CG)**  
**Semester-wise syllabus for PG Course**

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**DEPARTMENT OF RURAL TECHNOLOGY & SOCIAL DEVELOPMENT,**  
**GURU GHASIDAS VISHWAVIDALAYA**  
**SEMESTER SCHEME**

**Year 2022-2023**

**Master of Science of Rural Technology**

**M. Sc. I SEMESTER**

Course Opted	Subject Code	Course	Marks Distribution			Marks
			Theory	Sessional	Practical	
Core-1	RTPATC-1	Concepts of Statistical Analysis	70	30	-	100
	RTPALC-1	Laboratory Concepts of Statistical Analysis	-	30	70	100
Core-2	RTPATC-2	Innovation, Appraisal and action for Rural Development	70	30	-	100
	RTPALC-2	Field based work/ Survey (Based on RTPATC-2)	-	30	70	100
Core-3	RTPATC-3	Sericulture	70	30	-	100
	RTPALC-3	Laboratory Sericulture	-	30	70	100
Open Elective	RTPATO-1	Natural Product and Processing Techniques	70	30	-	100
	RTPALO-1	Laboratory Natural Product and Processing Techniques		30	70	100
		Total	280	240	280	800

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**M. Sc. II SEMESTER**

Course Opted	Subject Code	Course	Marks Distribution			Marks
			Theory	Sessional	Practical	
Core-4	RTPBTC-1	Fundamentals of Medicinal Plant	70	30	-	100
	RTPBLC-1	Laboratory Fundamentals of Medicinal Plant	-	30	70	100
Core-5	RTPBTC-2	Concept of Remote Sensing and GIS-I	70	30	-	100
	RTPBLC-2	Laboratory Concept of Remote Sensing and GIS-I	-	30	70	100
Core-6	RTPBTC-3	Lac production technique	70	30	-	100
	RTPBLC-3	Laboratory Lac production technique	-	30	70	100
DSE-1	RTPBTD-1	Rural Waste Management	70	30	-	100
	RTPBPD-1	Laboratory Rural Waste Management	-	30	70	100
		<b>OR</b>				
	RTPBTD-2	Soil and Water Conservation Engineering	70	30	-	100
	RTPBPD-2	Laboratory Soil and Water Conservation Engineering	-	30	70	100
Research Methodology	RTPBTA-1	Research Methodology and Ethics	30	20	-	50
		Total	240	200	210	650

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**M. Sc. III SEMESTER**

Course Opted	Subject Code	Course	Marks Distribution			Marks
			Theory	Sessional	Practical	
Core-7	RTPCTC-1	Drug Formulation and Extraction	70	30	-	100
	RTPCLC-1	Laboratory Drug Formulation and Extraction	-	30	70	100
Core-8	RTPCTC-2	Geospatial Technology and its Application	70	30	-	100
	RTPCLC-2	Laboratory Geospatial Technology and its Application	-	30	70	100
DSE-2	RTPCTD-1	Mushroom Cultivation Technology	70	30	-	100
	RTPCLD-1	Laboratory Mushroom Cultivation Technology	-	30	70	100
		<b>OR</b>				
	RTPCTD-2	Beekeeping Techniques	70	30	-	100
	RTPCLD-2	Laboratory Beekeeping Techniques	-	30	70	100
DSE-3	RTPCTD-3	Instrumentation and Techniques	70	30	-	100
	RTPCLD-3	Laboratory Instrumentation and Techniques	-	30	70	100
		<b>OR</b>				
	RTPCTD-4	Food Preservation Techniques				
	RTPCLD-4	Laboratory Food Preservation Techniques				
		<b>*University elective/ tour/ sport/ industrial training/ others</b>				
	RTPCSA-1	Seminar	-	20	30	50
		Total	280	260	310	850

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**M. Sc. IV SEMESTER**

Course Opted	Subject Code	Course	Marks Distribution			Marks
			Theory	Sessional	Practical	
Core-9	RTPDTC-1	Rural Energy Sources and Green Technology	70	30	-	100
Core-10	RTPDTC-2	Rural Planning and Development	70	30	-	100
DSE-4	RTPDTD-2	Computer application	70	30	-	100
	OR					
	RTPDTD-3	Entrepreneurship				
	RTPDDC-1	Dissertation/ Project work followed by seminar	300	Viva-voce 100		400
						700

**Dissertation must be compulsory for all students. Students will have liberty to complete his dissertation work either in the Department or any other Department or Institution. If student desires to complete his dissertation work outside the Department, he/she will have to bear all expenses.**

**Program Outcomes (Pos) of Postgraduate Programs**

**PO1. Knowledge and Awareness:** Adequate information on basics and advance fields of the core and applied subjects will be provided to enhance knowledge and awareness so that a professionalism may be developed in students.

**PO2. Problem solving and Critical Thinking:** To enable the students to take informed actions after identifying the assumptions that frame our thinking and actions, checking out the degree to which these assumptions are accurate and valid, and looking at our ideas and decisions (intellectual, organizational, and personal) from different perspectives.

**PO3. Effective Communication and Social Interactions:** Speak, read, write and listen clearly individually and through electronic media in English and in one Indian language, and make meaning of the world by connecting people, ideas, books, media and technology. Realize and respect of views of others, mediate disagreements and cooperate to reach conclusions in group settings.

**PO4. Effective Citizenship and Ethics:** To groom the students in such a way that they perform empathetic social concern and equity centred national development, and the ability to act with an informed awareness of issues and participate in civic life through volunteering. Recognize different value systems including your own, understand the moral dimensions of your decisions, and accept responsibility for them.

**PO5. Environmental awareness and Sustainability:** Understand the issues of environmental contexts and sustainable development.

**PO6. Skill Development and Employability:** To generate special skill through vocational training, workshops, field visits, entrepreneurial and career development courses so that students may generate employability for themselves and others.

**PO7. Self-directed and Life-long Learning:** Acquire the ability to engage in independent and life-long learning in the broadest context of socio-technological, socio-economic and socio-cultural improvements.

**Program Specific Outcomes**  
**PSOs of M.Sc. Rural Technology**

**PSO1.** Understand nature and basic concept and applied aspects of Innovation, Appraisal and action for Rural Development, Sericulture, Natural Product and Processing Techniques, Concepts of Statistical Analysis, Fundamentals of Medicinal Plant, Concept of Remote Sensing and GIS-I, Lac production technique, Rural Waste Management, Soil and Water Conservation Engineering, Research Methodology and Ethics

**PSO2.** Understand nature and basic concept and applied aspects of Drug Formulation and Extraction, Geospatial Technology and its Application, Mushroom Cultivation Technology, Beekeeping Techniques, Instrumentation and Techniques, Rural Energy Sources, Rural Planning and Development, Computer application, Entrepreneurship.

**PSO3.** Perform procedures as per laboratory standards in the areas of Organic Farming, Dairy, Mushroom, Poultry, and Herbal Production, Sericulture, Aquaculture, Art and Crafts, Plant Propagation and Nursery Management.

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**Syllabus**  
**2021-22**

**Master of Science of Rural Technology**

<b>M.Sc. I SEMESTER</b>		
<b>Course Code: RTPATC1</b>	<b>Credit-4</b>	<b>Marks: 100</b>
<b>Course Title: CONCEPTS OF STATISTICAL ANALYSIS</b>		

**Course outcomes**

On completion of the course, the students will be able to:

1. Understand concepts of statistics and its applications in various fields.
2. Analyze the data and interpret it in logical manner.

**Course Outcomes and their mapping with Program Outcomes:**

CO	PO						PSO		
	PO1	PO2	PO3	PO4	PO5	PO6	PSO1	PSO2	PSO3
CO1	3	2	2	1	1	3	3	1	-
CO2	3	3	1	-	1	3	3	1	-

**Weightage: 1- Slightly; 2- Moderately; 3- Strongly**

Introduction, concept, meaning, definition and importance of statistics, concept of variables, data coding and decoding, classification (parametric and non parametric), tabulation, graphical and diagrammatic representation of numerical data.

Measurement of central tendency- mean, mode, median, dispersion- Mean deviation, Standard deviation.

Probability Concept, various definition of probability, Addition theorem of probability, Probability distributions (viz. Binomial, Poisson and normal) and their applications.

Coefficient of Variation, Skewness and Kurtosis, Correlation and Regression Analysis, Analysis of variance (ANOVA).

Sampling Methods- Statistical Test Hypothesis, Barrier test- z, t, F and Chi square distribution.



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<b>M.Sc. I SEMESTER</b>		
<b>Course Code: RTPALC1</b>	<b>Credit-1</b>	<b>Marks: 100</b>
<b>Course Title: Laboratory Concepts of Statistical Analysis</b>		

**Course outcomes**

On completion of the course, the students will be able to:

1. Organize, manage and present data.
2. Analyze statistical data using measures of central tendency, dispersion and ANOVA. And analyze statistical data graphically using frequency distributions and cumulative frequency distributions.

**Course Outcomes and their mapping with Program Outcomes:**

CO	PO						PSO		
	PO1	PO2	PO3	PO4	PO5	PO6	PSO1	PSO2	PSO3
CO1	3	2	2	1	1	3	3	1	3
CO2	3	3	1	-	1	3	3	1	3

**Weightage: 1- Slightly; 2- Moderately; 3- Strongly**

1. Coding and decoding of data.
2. Problems based measurement of central tendency.
3. Problems based measurement of dispersion
4. Testing of hypothesis.
5. Analysis of variance (ANOVA).
6. To study the statistical software.
7. Graphical representation of numerical data

**Reference Books**

An Introduction to Statistical Methods - Gupta C.B.  
 Quantitative approach to managerial decision- Hien, L.W.  
 Statistics for Business & Economics, Lawrence B. Morse.  
 Statistics for Management, Levin, Richard I. and David S. Rubin.  
 Fundamentals of Statistics- D.N. Elhance, Veena Elhance and B. M. Aggrawal  
 Basic concept in statistics, K.S. Kushwaha

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<b>M.Sc. I SEMESTER</b>		
<b>Course Code: RTPATC2</b>	<b>Credit-4</b>	<b>Marks: 100</b>
<b>Course Title: INNOVATION, APPRAISAL AND ACTION FOR RURAL DEVELOPMENT</b>		

**Course outcomes**

On completion of the course, the students will be able to:

- Learn about the characteristic of innovation and diffusion process among the social system.
- Conduct PRA, RRA and formulate the social planning.

**Course Outcomes and their mapping with Program Outcomes:**

CO	PO						PSO		
	PO1	PO2	PO3	PO4	PO5	PO6	PSO1	PSO2	PSO3
CO1	3	2	2	1	1	3	3	1	1
CO2	3	3	1	-	1	3	3	1	1

**Weightage: 1- Slightly; 2- Moderately; 3- Strongly**

Innovation- Definition, Characteristic of innovation, importance of innovation in day today life, Technology diffusion –Definition, innovation decision process and factors that affect diffusion process.

Adoption process – concept, stages in adoption process, rate of adoption, adopter categories, adopter’s characteristics, factor that affect adoption process.

Communication– Definition, concepts and various models of communication, types of communication, barriers in communication. Transfer of Technology – Concept of Technology, Appropriate Technology- Definition and characteristics, different Models of technology transfer, barriers in Transfer of Technology.

PRA- Definition, Principles and Approaches of PRA, PRA Tools- Mapping, Types of mapping- social resource/ land use pattern map, enterprise map, transect walk, time line, change and trends, Matrix ranking, Mobility map, Venn diagram. RRA and PLA: Introduction, foundation, process, difference between RRA and PRA, Project appraisal.

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<b>Course Code RTPALC2</b>	<b>Credit-1</b>	<b>Marks:100</b>
<b>Field based course (Based on RTPATC2)</b>		

**Course outcomes**

On completion of the course, the students will be able to:

1. Know the tools and techniques of PRA and prepare the action plan to combat the social issues.
2. Perceive the importance of extension education in respect to technology transfer among the famers.
3. Understand the different strategies to disseminate and diffuse demand driven technologies among the farmers and provide location specific solutions to solve farmers problem through communication model.

**Course Outcomes and their mapping with Program Outcomes:**

CO	PO						PSO		
	PO1	PO2	PO3	PO4	PO5	PO6	PSO1	PSO2	PSO3
CO1	3	2	2	1	1	3	3	1	3
CO2	3	3	1	-	1	3	3	1	3
CO3	3	3	1	-	1	3	3	1	3

**Weightage: 1- Slightly; 2- Moderately; 3- Strongly**

**Field based exercises:**

1. Exercise based on PRA Approaches
2. To study communication models.
3. To study adoption process.

**Reference Books**

Gandhian Thought – J. B. Kripalani.  
 Challenging the Professions - Robert Chambers  
 Human Problems in Technological Change – E. E. Russel  
 Communication of Technological innovations- O.P. Dhama  
 Participatory rural appraisal in agricultural animal husbandory- Shagufta Jamal and H. P. S. Arya  
 Participatory rural appraisal and questionnaire survey-Neela Mukharjee  
 Participatory rural appraisal methodology and application-Neela Mukharjee  
 Participatory learning and action- Neela Mukharjee  
 Participatory rural appraisal methods and application in rural planning-Amitava Mukharjee

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<b>M.Sc. I SEMESTER</b>		
<b>Course Code: RTPATC3</b>	<b>Credit-4</b>	<b>Marks:100</b>
<b>Course Title: SERICULTURE</b>		

**Course outcomes**

On completion of the course, the students will be able to:

1. Understand scientific method of silk production technique and management.
2. Aware various Government schemes / programs related to sericulture.

**Course Outcomes and their mapping with Program Outcomes:**

CO	PO						PSO		
	PO1	PO2	PO3	PO4	PO5	PO6	PSO1	PSO2	PSO3
CO1	3	2	2	1	1	3	3	1	1
CO2	3	3	1	-	1	3	3	1	1

**Weightage: 1- Slightly; 2- Moderately; 3- Strongly**

General sericulture: Definition, silk types, history and importance of sericulture, Geographical distribution of various species and economic races of silkworms, Government schemes / programs related to sericulture.

Basic biology of silk insect: Silkworm taxonomy based on mulberry and non-mulberry silk worms-Tasar, Eri and Munga, life cycle including moulting and metamorphosis, Diseases of silkworm, Pests of silkworm.

Host plant management: Host plants for sericulture and their propagation, effects of agro-climatic conditions on the growth of host plants with special reference to mulberry, Diseases of mulberry plant, Mulberry pest management.

Silkworm rearing: Mud house rearing, silkworm rearing (C.S.B. proposed model rearing house), Rearing appliances, disinfection, disinfectants, bed cleaning, feeding of worms, Maintaining optimum condition of rearing, brushing, frequency of spacing, care during moulting, Mounting and mountage, process of spinning, cocoon harvesting, Rearing method: chawki rearing or young age worm rearing, Late age silkworm rearing (according to 100 dfl).

Post cocoon technology and silk technology: method of cocoon testing and grading, cocoon stifling, storage of cocoon, deflossing, cocoon riddling, mixing or blending, cocoon cooking, brushing, Concept of difference reeling machines, reeling operation, reeling end formation, testing and grading of raw silk, Degumming, bleaching, dyeing of silk yarn, Twisting, Reeling, Re-reeling, lacing, skeining, weaving of silk.

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<b>M.Sc. I SEMESTER</b>		
<b>Course Code: RTPALC3</b>	<b>Credit-1</b>	<b>Marks:100</b>
<b>Course Title: Laboratory Sericulture</b>		

**Course outcomes**

On completion of the course, the students will be able to:

1. Gain the skill with hands on training on mulberry cultivation and carry forward to field.
2. Understand the procedure of silkworm egg production and support grainage activity.
3. Acquire knowledge and develop skill in silkworm rearing and support silkworm farming.

**Course Outcomes and their mapping with Program Outcomes:**

CO	PO						PSO		
	PO1	PO2	PO3	PO4	PO5	PO6	PSO1	PSO2	PSO3
CO1	3	2	2	1	1	3	3	1	3
CO2	3	3	1	-	1	3	3	1	3
CO3	3	3	1	-	1	3	3	1	3

**Weightage: 1- Slightly; 2- Moderately; 3- Strongly**

1. Study of host plants of silk worms.
2. Plantation techniques (pit and row) of host plants.
3. Study of propagation techniques of host plants.
4. Study of morphological characters of silk worm.
5. Identification of pests and predators of silk worm.
6. Dissection of alimentary canal and silk gland and study of their various parts.
7. Visit to nearest silk worm rearing centers.
8. Visit to rearing centers to observe the silk worm diseases and collection of diseased worms.
9. Comparative study of good and defective cocoons.

**Reference Books:**

Sericulture introduction - Ganga, G.  
 Seri Manual - FAO Manual  
 Appropriate Sericulture - Jolly, M.S.  
 Sericulture in India- Vol. I to IV, H.O. Agrawal and M.K. Seth.  
 An introduction to Sericulture -G.J. Sulochana  
 Principle of temperate Sericulture - Dr. A.S. Kamal, Kamayani Publisher

<b>M.Sc. I SEMESTER</b>		
<b>Course Code: RTPATO1</b>	<b>Credit-4</b>	<b>Marks: 100</b>
<b>Course Title: NATURAL PRODUCT AND PROCESSING TECHNIQUES</b>		

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**Course outcomes**

On completion of the course, the students will be able to:

1. Understand different types of natural products and its importance.
2. Learn processing of important natural products.

**Course Outcomes and their mapping with Program Outcomes:**

CO	PO						PSO		
	PO1	PO2	PO3	PO4	PO5	PO6	PSO1	PSO2	PSO3
CO1	3	2	2	1	1	3	3	1	1
CO2	3	3	1	-	1	3	3	1	1

**Weightage: 1- Slightly; 2- Moderately; 3- Strongly**

**Natural products:** Introduction, plants as a source of various products, types of natural products, natural products and tribal connection, dependence of tribes on forest, various method of collection, storage and marketing of natural products, .

**Fibre:** Introduction, classification of fibres, plant origin fibres, types, study of cotton, flax and jute fibre, various fibre industries and economic importance.

**Gum and Resin:** Introduction, classification, physical and chemical composition, plant origin gum and resins, collection techniques, processing and economic importance.

**Dye:** Sources, types of dyes, chemical nature, characteristics of natural dyes, preparation of natural dyes, extraction of dye, processing and uses.

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<b>Course Code: RTPALO1</b>	<b>Credit-1</b>	<b>Marks 100</b>
<b>Course Title: Laboratory Natural Product and Processing Techniques</b>		

**Course outcomes**

On completion of the course, the students will be able to:

1. Gain knowledge of the major classes of natural products with detailed examples.
2. Understand the need, when developing product concepts, to consider issues around indigenous knowledge, traditional use, cultural perspectives and ownership of native flora and fauna.
3. Gain fundamental practical laboratory skills in the extraction, purification and analysis of natural products.

**Course Outcomes and their mapping with Program Outcomes:**

CO	PO						PSO		
	PO1	PO2	PO3	PO4	PO5	PO6	PSO1	PSO2	PSO3
CO1	3	2	2	1	1	3	3	1	3
CO2	3	3	1	-	1	3	3	1	3
CO3	3	3	1	-	1	3	3	1	3

**Weightage: 1- Slightly; 2- Moderately; 3- Strongly**

**Laboratory exercises:**

1. Identification of fibre producing plants.
2. Study of fibre processing techniques.
3. Identification of gum producing plants & characteristics.
4. Tapping & collection of gums from various plant sources.
5. Study of various types of resin & their sources
6. Identification of dye producing plants.
7. Study on dye preparation techniques.
8. Microscopic study of fibres.
9. Preparation of herbaria.

**Master of Science of Rural Technology**  
**Second Semester**

<b>M.Sc. II SEMESTER</b>		
<b>Course Code: RTPBTC1</b>	<b>Credit-4</b>	<b>Marks: 100</b>
<b>Course Title: FUNDAMENTALS OF MEDICINAL PLANTS</b>		

**Course outcomes**

On completion of the course, the students will be able to:

1. Understand medicinal important of secondary metabolites of plants.
2. Learn the Government policies and marketing potential of crude drugs.

**Course Outcomes and their mapping with Program Outcomes:**

CO	PO						PSO		
	PO1	PO2	PO3	PO4	PO5	PO6	PSO1	PSO2	PSO3
CO1	3	2	2	1	1	3	3	1	1
CO2	3	3	1	-	1	3	3	1	1

**Weightage: 1- Slightly; 2- Moderately; 3- Strongly**

Methods of plant classification, Taxonomic keys, Herbarium, Taxonomic study of important plant families of Chhattisgarh with special reference to family Asclepiadaceae, Apiaceae, Chenopodiaceae, Euphorbiaceae, Combretaceae, Liliaceae.

Medicinal plant found in Chhattisgarh: General aspects and Medicinal values of– *Aegle marmelos*, *Cinnamomum sps.*, *Gloriosa superba*, *Ipomoea nil*, *Mucuna pruriens*, *Piper nigrum*, *Vitex nigundo*.

Alkaloids: Properties, isolation and extraction, classification and alkaloid containing drug;  
 Terpenes and Terpenoids: Properties, Isolation, classification and drugs containing terpenes and terpenoids.

Tannins: Properties, isolation and extraction, classification and tannin containing drugs.  
 Marine drug: Properties, classification uses; Mineral drug: Sources, constituents and uses.

Legislation and policy of medicinal plants: National and State Medicinal Plant Board, Conservation of medicinal plants, Market potential of crude drugs, Goals of national policy, Future action plans.

**Reference Books**

- Medicinal plants of India Vol 1 & 2 ICAR – Kirtikar & Basu.
- Compendium of Indian Medicinal plants Vol 1-4 – R. P. Rastogi & B.N. Mahrotra.
- Indigenous medicinal specialties - U.S. Narayan Rao.
- Useful plant of Neotropical origin – Heing Brucher.



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Cultivation and utilization of Aromatic plants - C.K. Atal and B.M. Kapoor.  
 Cultivation and utilization of medicinal plants - C.K. Atal and B.M. Kapoor.  
 Plant Taxonomy- O.P. Sharma  
 Essential of Plant Taxonomy and Ecology-M.P. Singh and S.G. Abbas

<b>M.Sc. II SEMESTER</b>		
<b>Course Code:</b> RTPBLC1	<b>Credit-1</b>	<b>Marks: 100</b>
<b>Course Title: Laboratory Fundamentals of Medicinal Plants</b>		

**Course outcomes**

On completion of the course, the students will be able to:

1. Acquire operative knowledge and be able to carry out technical regarding medicinal plants.
2. Learn about the medicinal plants and their derivatives for use in herbal, food and cosmetic products.
3. Learn the skill of recognition, collection and preservation of medicinal plants.

**Course Outcomes and their mapping with Program Outcomes:**

CO	PO						PSO		
	PO1	PO2	PO3	PO4	PO5	PO6	PSO1	PSO2	PSO3
CO1	3	2	2	1	1	3	3	1	3
CO2	3	3	1	-	1	3	3	1	3
CO3	3	3	1	-	1	3	3	1	3

**Weightage: 1- Slightly; 2- Moderately; 3- Strongly**

1. Study of locally available plants of families Asclepiadaceae, Apiaceae, Chenopodiaceae, Euphorbiaceae, Combretaceae, Liliaceae.
2. To study extraction process, chemical test to identify Alkaloids
3. To study extraction process, chemical test to identify Terpenes and Terpenoids.
4. To study extraction process, chemical test to identify Tannins.
5. To study source of mineral drugs and their uses.

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<b>M.Sc. II SEMESTER</b>		
<b>Course Code: RTPBTC2</b>	<b>Credit-4</b>	<b>Marks: 100</b>
<b>Course Title: CONCEPTS OF REMOTE SENSING AND GIS-I</b>		

**Course outcomes**

On completion of the course, the students will be able to:

1. Understand the concept and application of remote sensing and GIS software.
2. Learn the basic of satellite images and toposheets.

**Course Outcomes and their mapping with Program Outcomes:**

CO	PO						PSO		
	PO1	PO2	PO3	PO4	PO5	PO6	PSO1	PSO2	PSO3
CO1	3	2	2	1	1	3	3	1	1
CO2	3	3	1	-	1	3	3	1	1

**Weightage: 1- Slightly; 2- Moderately; 3- Strongly**

Concepts of Remote Sensing with introduction, Early History, Energy Sources & Radiation Principles, Energy Interactions in atmosphere, Energy interactions with earth surface features, Spectral Reflectance of vegetation, Soil & water.

Satellite: Indian satellite, Earth Resource satellite, Ocean satellite, Resource-sat satellite, Carto-sat satellite etc. and their uses.

Photogrammetry-Introduction, Types of Aerial Photographs including UAV, Basic principles of Photogrammetry, Geometry of a vertical aerial photograph, photographic Scale, Applications of vertical aerial photograph. Thematic Cartography: Commitments, concern and solution. Influence of thematic Atlases, Influences of distant cartography, and Innovative trends in mapping.

Digital Image Processing (DIP)-Introduction, Pre-processing of image-Image interpretation, Geometric & Radiometric Correction, Resolution, Image Enhancement, Contrast Stretching, Filters, Edge Enhancement.

Microwave Remote Sensing-Introduction, sensors, instruments, radar operating principles, synthetic aperture RADAR, radar returns and image signatures, radar image characteristics, basics of LIDAR.

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<b>M.Sc. II SEMESTER</b>		
<b>Course Code: RTPBLC2</b>	<b>Credit-1</b>	<b>Marks: 100</b>
<b>Course Title: Laboratory Concepts Of Remote Sensing And Gis-I</b>		

**Course outcomes**

On completion of the course, the students will be able to:

1. Identify, analyze and solve geospatial problems.
2. Develop practical and executable solutions to the challenges of growing field of Remote Sensing and GIS.
3. Interpret the remotely sensed data.

**Course Outcomes and their mapping with Program Outcomes:**

CO	PO						PSO		
	PO1	PO2	PO3	PO4	PO5	PO6	PSO1	PSO2	PSO3
CO1	3	2	2	1	1	3	3	1	3
CO2	3	3	1	-	1	3	3	1	3
CO3	3	3	1	-	1	3	3	1	3

**Weightage: 1- Slightly; 2- Moderately; 3- Strongly**

1. Geometric and radiometric correction of satellite data, Image enhancement techniques, Principal component analysis,
2. Supervised classification, Supervised classification schemes (Maximum likelihood, nearest neighbor and artificial neural network classification), Vegetation indices.
3. Creation of digital elevation model through contour digitization and surface hydrology.
4. Digitization of different features of given topo-sheet. Editing attributes of geo-database features. Creating different features like polygon line, tic, polyline etc.
5. Creation of personal geo-database.

**Reference Books**

Remote Sensing – Principles & interpretation - F.F. Sabins  
 Digital Remote Sensing - Dr. P. Nag, Dr. M. Kudrat  
 Principles of Remote Sensing - P.J. Curran.  
 Basics of Remote Sensing – S. Joseph  
 Basics of remote sensing and photogrammetry – Lillisand

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M.Sc. II SEMESTER		
Course Code: RTPBTC3	Credit-4	Marks: 100
Course Title: LAC PRODUCTION TECHNICQUE		

**Course outcomes**

On completion of the course, the students will be able to:

1. Understand economic importance of lac insect and lac produces.
2. Enhance their knowledge and technical skills to produce lac in various host plants.

**Course Outcomes and their mapping with Program Outcomes:**

CO	PO						PSO		
	PO1	PO2	PO3	PO4	PO5	PO6	PSO1	PSO2	PSO3
CO1	3	2	2	1	1	3	3	1	1
CO2	3	3	1	-	1	3	3	1	1

**Weightage: 1- Slightly; 2- Moderately; 3- Strongly**

Lac insect: meaning, concept and economic importance of lac cultivation. Classification and morphology and life cycle of lac insect, types of lac insect, history of lac cultivation, area and geographical distribution of lac insect, natural habitat of lac insect, types of lac and its characteristics.

Lac production in *Butea monosperma*: Introduction, history, natural habitat, merits and limitations, lac insect and crop, stages of rangeeni lac insect, selection of trees, pruning of trees, inoculation of host tree, removal of used-up broodlac, pest management, crop harvesting, scraping of lac from sticks, primary processing of lac, storage, transport and marketing of lac.

Lac production in *Ziziphus mauritiana*: Introduction, history, natural habitat, merits and limitations, lac insect and crop, stages of rangeeni and kusmi lac insect, selection of trees, pruning of trees, inoculation of host tree, removal of used-up broodlac, pest management, crop harvesting, scraping of lac from sticks, primary processing of lac, storage, transport and marketing of lac.

Lac production in *Schleichera oleosa*: Introduction, history, natural habitat, merits and limitations, lac insect and crop, stages of kusmi lac insect, selection of trees, pruning of trees, inoculation of host tree, removal of used-up broodlac, pest management winter and summer crops, crop harvesting, scraping of lac from sticks, primary processing of lac, storage, transport and marketing of lac.

Lac production in *Flemingia semialata*: Introduction, history, natural habitat, merits and limitations, lac insect and crop, stages of kusmi lac insect, propagation and nursery

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management, planting and nutrient management, pruning of trees, inoculation of host tree, removal of used-up broodlac, pest management winter and summer crops, crop harvesting, scraping of lac from sticks, primary processing of lac, storage, transport and marketing of lac.

<b>M.Sc. II SEMESTER</b>		
<b>Course Code: RTPBLC3</b>	<b>Credit-1</b>	<b>Marks: 100</b>
<b>Course Title: Laboratory Lac Production Technicque</b>		

**Course outcomes**

On completion of the course, the students will be able to:

1. Acquire skill about identification and selection of host trees and their pruning, selection of brood lac stick and inoculation of lac hosts through various methods.
2. Learn to apply harvest and post-harvest techniques for lac cultivation.
3. Learn to implement pest and disease management activities for lac cultivation.

**Course Outcomes and their mapping with Program Outcomes:**

CO	PO						PSO		
	PO1	PO2	PO3	PO4	PO5	PO6	PSO1	PSO2	PSO3
CO1	3	2	2	1	1	3	3	1	3
CO2	3	3	1	-	1	3	3	1	3
CO3	3	3	1	-	1	3	3	1	3

**Weightage: 1- Slightly; 2- Moderately; 3- Strongly**

1. Identification and preparation of different host plants for lac cultivation.
2. Selection and inoculation of broodlac in host plant.
3. Removal of used-up broodlac sticks from host plants.
4. Processing of lac.
5. Lac crop protection.
6. Study of equipments used in lac cultivation.
7. Identification of lac insect and lac crops.

**Reference Books:**

Chapman: The Insects: structure and function 94<sup>th</sup> ed, 1998, ELBS)  
 Imms: A general text book of entomology, 2 vol. (1997, Asia publishing house)  
 Mcgavin: Essential Entomology 92001, Oxford Univ Press)  
 Srivastava: A textbook of applied entomology, vol.I & vol II (1993, Kalyani publishers)  
 The Insect. Ramesh Arora and G. S. Dariwal  
 Atlas of Indian Lac, Ajit Prasad Jain.  
 Lac cultivation in India. M.G.Kamath  
 A handbook of shellac Analysis. G.N.Bhattacharya and P.K.Bose.

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<b>M.Sc. II SEMESTER</b>		
<b>Course Code: RTPBTC1</b>	<b>Credit-4</b>	<b>Marks: 100</b>
<b>Course Title: RURAL WASTE MANAGEMENT</b>		

**Course outcomes**

On completion of the course, the students will be able to:

1. Aware about sanitation and waste water management.
2. Adopt different methods of waste management.

**Course Outcomes and their mapping with Program Outcomes:**

CO	PO						PSO		
	PO1	PO2	PO3	PO4	PO5	PO6	PSO1	PSO2	PSO3
CO1	3	2	2	1	1	3	3	1	1
CO2	3	3	1	-	1	3	3	1	1

**Weightage: 1- Slightly; 2- Moderately; 3- Strongly**

Introduction of Rural waste, Type of waste, different methods of systematic collection and disposal of waste, Types of sewer.

Concept of sewage treatment, principle of primary, secondary treatment and Tertiary treatment of wastewater, General composition of sewage, method of determination of B.O.D. and C.O.D.

Rural Sanitation- Provision of safe and potable water for domestic purposes, collection and disposal of dry refuse, collection and disposal of sullage, disposal of excretal waste, night soil disposal without water carriage, Construction of low cost latrines in rural areas- Septic tanks, soak pit, privy pit and bore hole privy, can privy, concrete vault privy, aqua privy, PRAI latrine.

Waste water management- performance criteria for waste water management system, house drainage plan, classification of traps- P-trap, Q-trap, S trap, floor trap, gully trap, intercepting trap, grease trap, principle for efficient drainage system.

Solid waste management- classification of solid waste, quantity and composition of refuse, collection and removal of refuse, transport of refuse, disposal of refuse- controlled tipping, landfill, trenching, dumping into sea, pulverization, incineration; composting- composting by trenching, open window composting, mechanical composting, composting adopted in India, Biogas technology-properties of biogas, types of biogas plant recognized by MNES (Ministry of Non-conventional Energy Sources).

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M.Sc. II SEMESTER		
<b>Course Code:</b> RTPBLD1	<b>Credit-1</b>	<b>Marks: 100</b>
<b>Course Title: Laboratory Rural Waste Management</b>		

**Course outcomes**

On completion of the course, the students will be able to:

1. Learn broader understandings on various aspects of waste management practiced in industries.
2. Learn about the recovery of products from waste to compost and biogas, incineration and energy recovery, hazardous waste management and treatment, and integrated waste management.

**Course Outcomes and their mapping with Program Outcomes:**

CO	PO						PSO		
	PO1	PO2	PO3	PO4	PO5	PO6	PSO1	PSO2	PSO3
CO1	3	2	2	1	1	3	3	1	3
CO2	3	3	1	-	1	3	3	1	3

**Weightage: 1- Slightly; 2- Moderately; 3- Strongly**

- 1) To study types of waste material.
- 2) To study the physical treatment of waste water.
- 3) To study the biological treatment of waste water.
- 4) To study the chemical treatment of waste water.
- 5) Visit to sewage treatment plants.
- 6) To study biogas technology of solid waste management.
- 7) To study landfill method of solid waste management.
- 8) To study various model of privy.
- 9) To study biogas technology as solid waste management.

**Reference Books**

Rangwala S.C, Water Supply & Sanitary Engineering, Charotar Publishing House (P) Ltd., Anand.

Gurcharan Singh, Water Supply & Sanitary Engineering, Standard Publishers Distributors, Delhi.

Garg, S.K., Water Supply Engineering, Khanna Publishers, Delhi.

Gupta, D.V. Water Supply & Sanitary Engineering, Asian Publishers, Muzaffarnagar

Modi, P.N. Water Supply Engineering, Standard Book House, Delhi

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<b>M.Sc. II SEMESTER</b>		
<b>Course Code: RTPBTD2</b>	<b>Credit-4</b>	<b>Marks: 100</b>
<b>Course Title: SOIL AND WATER CONSERVATION ENGINEERING</b>		

**Course outcomes**

On completion of the course, the students will be able to:

1. Understand the soil formation, soil profile, soil structure and different type of soil nutrients.
2. Understand the basic concept of soil water conservation and watershed management.

**Course Outcomes and their mapping with Program Outcomes:**

CO	PO						PSO		
	PO1	PO2	PO3	PO4	PO5	PO6	PSO1	PSO2	PSO3
CO1	3	2	2	1	1	3	3	1	1
CO2	3	3	1	-	1	3	3	1	1

**Weightage: 1- Slightly; 2- Moderately; 3- Strongly**

Soil- Definition, Soil as a three phase system, Soil-Plant-Water relationship, soil moisture content, soil profile, density, void ratio, porosity, soil texture, soil structure and degree of saturation.

Basic concept of soil erosion, control of soil erosion, soil loss estimation, concept of runoff and its estimation, water budgeting, estimation of rainfall erosivity and erodibility.

Planning, design, construction and maintenance of water harvesting structure, soil and water conservation structure, GIS application in Planning, designing, construction and maintenance of water harvesting structure.

Watershed management concept- objectives, characterization, type of watershed, planning, execution, integrated community participation and evaluation, GIS application in watershed management.

Irrigation- Definition, Types of irrigation, Source of irrigation water. Irrigation methods and efficiencies, Drainage - Definition, surface and sub-surface drainage, factors influencing drainage.



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<b>Course Code: RTPBLD2</b>	<b>Credit-1</b>	<b>Marks100</b>
<b>Course Title: Laboratory Soil and Water Conservation Engineering</b>		

**Course outcomes**

On completion of the course, the students will be able to:

1. Gain the knowledge on essential nutrients, soil fertility, nutrient transformations in soil, manures, fertilizers and soil fertility management through various approaches.
2. Understand the concepts of watershed management and its effect on land, water and ecosystem resources and develop control and mitigation techniques for watershed problems

**Course Outcomes and their mapping with Program Outcomes:**

CO	PO						PSO		
	PO1	PO2	PO3	PO4	PO5	PO6	PSO1	PSO2	PSO3
CO1	3	2	2	1	1	3	3	1	3
CO2	3	3	1	-	1	3	3	1	3

**Weightage: 1- Slightly; 2- Moderately; 3- Strongly**

**Laboratory exercises:**

1. Study of different water harvesting structure.
2. Study of GIS Application in watershed management
3. Study of different components of sprinkler and drip irrigation system
4. Study of continuous and staggered contour trenches
5. Study of different components of farm pond
6. Water budgeting.

**Reference Books**

Introduction to soil and water conservation engineering, Mal, B C, Kalyani publishers  
 Irrigation Engineering-Agarwal G.D., B. Bharti Prakashan, Merrut.  
 Irrigation Engineering, -Modi P.N., Standard Book House, Delhi.  
 Irrigation Engineering- Dr. Bharat Singh, Nem Chand & Bros., Roorkee  
 Introductory Soil Science, Dilip Kumar Das, Kalyani Publishers.  
 Soil and water conservation engineering, R. Suresh  
 Irrigation: Theory and practices, A.M. Michael

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<b>M.Sc. II SEMESTER</b>		
<b>Course Code: RTPBTA1</b>	<b>Credit-2</b>	<b>Marks: 50</b>
<b>Course Title: RESEARCH METHODOLOGY AND ETHICS</b>		

**Course outcomes**

On completion of the course, the students will be able to:

1. Understand the nature, types and importance of research methodology and ethics.
2. Apply research methodology procedures according to their nature of research.

**Course Outcomes and their mapping with Program Outcomes:**

CO	PO						PSO		
	PO1	PO2	PO3	PO4	PO5	PO6	PSO1	PSO2	PSO3
CO1	3	2	2	1	1	3	3	1	2
CO2	3	3	1	-	1	3	3	1	2

**Weightage: 1- Slightly; 2- Moderately; 3- Strongly**

Research, types of research, Nature, scope of research and importance of research methodology, steps of scientific inquiry and study of social phenomenon, research problems, criteria for identification of research problems, formulations and statement of research objectives.

Hypothesis- Meaning and role in research, type of hypothesis, testing of hypothesis, method of data collection, level of measurement, data sources; observational and survey methods, case studies, types of schedule, questionnaires.

Research design- Exploratory, descriptive, and experimental research design, qualitative and quantitative research. Complete Randomized Block Design (CRD), Randomized Block Design (RBD), Latin Squares Design (LSD) and factorial design.

Research reporting and scientific writing- Preparation of research proposal, compilation of thesis, dissertation, compiling bibliography, reports, compilation of research paper, paper presentation, research ethics.

**Reference Books**

Survey Method

Exploring research

Guide to the successful thesis and dissertation V<sup>th</sup> Edition

Fundamentals of Statistics

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**Master of Science of Rural Technology**  
**Third Semester**

<b>M.Sc. III SEMESTER</b>		
<b>Course Code: RTPCTC1</b>	<b>Credit-4</b>	<b>Marks: 100</b>
<b>Course Title: DRUG FORMULATION AND EXTRACTION</b>		

**Course outcomes**

On completion of the course, the students will be able to:

1. Understand the constitution of drug and drug delivery system.
2. Learn drug formulation and extraction phenomenon.

**Course Outcomes and their mapping with Program Outcomes:**

CO	PO						PSO		
	PO1	PO2	PO3	PO4	PO5	PO6	PSO1	PSO2	PSO3
CO1	3	2	2	1	1	3	1	3	2
CO2	3	3	1	-	1	3	1	3	2

**Weightage: 1- Slightly; 2- Moderately; 3- Strongly**

Introduction to Dosage forms- Desirable properties, classification and application of dosage forms, New drug delivery system.

Principles and methods of extraction, theory of drug extraction, Hydro-distillation, expression, quality assurance of essential oils maceration, digestion, percolation, soxhlation, super critical fluid extraction, other extraction methods.

Aromatic Plants- History, Revenue potential, industrial significance, medicinal uses; cultivation and management of aromatic plants – Camphor, Citronella, Eucalyptus, Lavender, Lemongrass, Mints, Palmarosa, Sandalwood.

Analytical pharmacognocny- Drug adulteration, Drug evaluation- morphological, microscopic, chemical. Phytochemical investigation, physical, biological evaluation, hepatoprotective activity, hypoglycemic activity, antifertility testing.

Drug formulation- Pharmacopoeial preparations, principles and methods of preparation of aromatic waters, spirits, elixirs, syrups, tincture solution and special preparation of mouthwashes.

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<b>M.Sc. III SEMESTER</b>		
<b>Course Code: RTPCLC1</b>	<b>Credit-1</b>	<b>Marks: 100</b>
<b>Course Title: Laboratory Drug Formulation And Extraction</b>		

**Course outcomes**

On completion of the course, the students will be able to:

1. Perform various types of extraction, preparation and evaluation of drug formulations.
2. Carry out evaluation of marketed ayurvedic and herbal formulations.
3. Conduct parameters and in vitro assays for correlation with Biological efficacy of drugs.

**Course Outcomes and their mapping with Program Outcomes:**

CO	PO						PSO		
	PO1	PO2	PO3	PO4	PO5	PO6	PSO1	PSO2	PSO3
CO1	3	2	2	1	1	3	1	3	3
CO2	3	3	1	-	1	3	1	3	3
CO3	3	3	1	-	1	3	1	3	3

**Weightage: 1- Slightly; 2- Moderately; 3- Strongly**

1. Study of traditional plant and their part used as folklore medicine.
2. Extraction and distillation of Eucalyptus, Lemongrass, Mints, Sandalwood.
3. Extraction of volatile oil, Extraction of tannin.
4. Formation of Aromatic water, spirits, tinctures.
5. Extraction of Alkaloids, Chemical test for tannin, alkaloid, maceration, percolation.
6. Extraction of medicinal plants by Soxhlet method, Distillation method.
7. Drug formulation- Antimicrobial activity of medicinal plant.

**Reference Books**

Medicinal plants of India Vol 1 & 2 ICAR by Kirtikar & Basu .  
 Indigenous medicinal specialties: U.S. Narayan Rao  
 Useful plant of Neotropical origin: Heing Brucher  
 Cultivation and utilization of Aromatic plants: C.K. Atal and B.M. Kapoor  
 Pharmacognocoy - Trease & Evans.  
 Pharmacognocoy- Gokhale, kokate & Purohit  
 Cultivation and Utilization of Aromatic plants - L.K. Atal& B.M. Kapoor.  
 Professional Pharmacy - Jain & Sharma.  
 Aromatic Plants- Baby S. Skaria, P.P. Joy, G. Mathew, A. Joseph and R. Joseph  
 Medicinal Plants- A.Kurian and M.A. Sankar  
 Medicinal Plants ethnobotanical Approach- P.C. Trivedi  
 Aromatic Plants- Baby S. Skaria, P.P. Joy, G. Mathew, A. Joseph and R. Joseph  
 Compendium of Indian Medicinal plants Vol 1-4 R.P. Rastogi& B.N. Mahotra.

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<b>M.Sc. III SEMESTER</b>		
<b>Course Code:</b> RTPCTC2	<b>Credit-4</b>	<b>Marks: 100</b>
<b>Course Title: GEOSPATIAL TECHNOLOGY AND ITS APPLICATION</b>		

**Course outcomes**

On completion of the course, the students will be able to:

1. Understand the basic concept of GPS and GIS.
2. Learn the data base management system and application.

**Course Outcomes and their mapping with Program Outcomes:**

CO	PO						PSO		
	PO1	PO2	PO3	PO4	PO5	PO6	PSO1	PSO2	PSO3
CO1	3	2	2	1	1	3	1	3	2
CO2	3	3	1	-	1	3	1	3	2

**Weightage: 1- Slightly; 2- Moderately; 3- Strongly**

Basics of GIS: Definition, components of GIS, DBMS: data base approach, advantage and disadvantage, data model – classic data model, hierarchical data model, network and relational data models, various interpolation techniques.

Types of data structure, raster and vector format, image data format – BSQ, BIL, BIP, advantage and disadvantage of various data structure, data input – digitization and scanning method, web GIS, map projection, elements of map, introduction to GPS and DGPS its application.

Application of remote sensing and GIS – Mapping and monitoring of land use land cover, forest resource management, principal and approaches of crop production forecasting, soil classification, surface hydrology analysis.

Urban and rural area planning – urban and rural area sprawl and change detection studies, population estimation, site suitability analysis for – settlement, transportation irrigation system, storage and other facilities.

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<b>M.Sc. III SEMESTER</b>		
<b>Course Code:</b> RTPCLC2	<b>Credit-1</b>	<b>Marks: 100</b>
<b>Course Title: Laboratory Geospatial Technology and its Application</b>		

**Course outcomes**

On completion of the course, the students will be able to:

1. Understand basics of GIS and acquire skill to explore mapped data, relate GIS with remote sensing technologies.
2. Analyze spatial data, using GIS analysis tools and develop and manage geo-databases
3. Create maps, images and apps to communicate spatial data in a meaningful way to others.

**Course Outcomes and their mapping with Program Outcomes:**

CO	PO						PSO		
	PO1	PO2	PO3	PO4	PO5	PO6	PSO1	PSO2	PSO3
CO1	3	2	2	1	1	2	3	1	3
CO2	3	3	1	-	1	2	3	1	3
CO3	3	3	1	-	1	2	3	1	3

**Weightage: 1- Slightly; 2- Moderately; 3- Strongly**

1. Practice based on ArcGIS and QGIS
2. To generate various Indices map – NDVI, NDWI, NDBI, SAVI
3. Data Collection and Interpolation methods for map layout.
4. Surface analysis.
5. Layout preparation.
6. Creation of personal and geo-data base.

**Reference Books**

Remote Sensing – Principles & interpretation - F.F. Sabins  
 Digital Remote Sensing - Dr. P. Nag, Dr. M. Kudrat  
 Principles of Remote Sensing - P.J. Curran.

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<b>M.Sc. III SEMESTER Elective (PG)</b>		
<b>Course Code:</b> RTPCTD1	<b>Credit-4</b>	<b>Marks: 100</b>
<b>Course Title: MUSHROOM CULTIVATION TECHNOLOGY</b>		

**Course outcomes**

On completion of the course, the students will be able to:

1. Understand the importance of Single Cell Protein.
2. Learn the commercial production of mushroom and its marketing potential.

**Course Outcomes and their mapping with Program Outcomes:**

CO	PO						PSO		
	PO1	PO2	PO3	PO4	PO5	PO6	PSO1	PSO2	PSO3
CO1	3	2	2	1	1	3	1	3	3
CO2	3	3	1	-	1	3	1	3	3

**Weightage: 1- Slightly; 2- Moderately; 3- Strongly**

Introduction, General characteristics of Mushroom, history of mushroom cultivation; biology of mushrooms; Identification of mushroom, Nutritional and Medicinal value of mushrooms; Poisonous mushrooms and its poisoning; edible mushrooms and its cultivation in India and world.

Cultivation technology, infrastructure, equipments and substrates in mushroom cultivation, mushroom unit or mushroom house, pure culture, Spawn, preparation of spawn, raw materials for the cultivation of mushroom, Compost: materials used for compost preparation, compost technology in mushroom production; Casing; raw material used for casing, preparation of casing material.

Cultivation of important mushrooms: General process for the cultivation of *Agaricus bisporus*, *Pleurotus ostreatus*, *Calocybe indica*, *Volvariella volvaceae* and *Ganoderma lucidum*, Pests and Pathogens of mushrooms and their management.

Storage and food preparation from mushrooms: Methods of storage of mushroom, Long term and short term storage of mushrooms, Foods/recipes from mushrooms; Mushroom research centers/farms: National level and regional level, Marketing of mushrooms in India and world.

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<b>Course Code:</b> RTPCLD1	<b>Credit-1</b>	<b>Marks:100</b>
<b>Course Title: Laboratory Mushroom Cultivation Technology</b>		

**Course outcomes**

On completion of the course, the students will be able to:

1. Identify edible types of mushroom and gain the knowledge of cultivation of different types of edible mushrooms and spawn production
2. Manage the diseases and pests of mushrooms.
3. Learn a means of self-employment and income generation.

**Course Outcomes and their mapping with Program Outcomes:**

CO	PO						PSO		
	PO1	PO2	PO3	PO4	PO5	PO6	PSO1	PSO2	PSO3
CO1	3	2	2	1	1	2	3	1	3
CO2	3	3	1	-	1	2	3	1	3
CO3	3	3	1	-	1	2	3	1	3

**Weightage: 1- Slightly; 2- Moderately; 3- Strongly**

**Laboratory Exercises**

1. Morphology and identification of local mushroom and preserved specimen of mushroom.
2. Sterilization of glassware, equipments, and culture media used in mushroom cultivation.
3. Preparation of culture media and mother culture.
4. Preparation of spawn: Grain spawn, Straw spawn, Sawdust spawn.
5. Preparation of compost and known compost formulations.
6. Cultivation procedure for *Agaricus bisporus*.
7. Cultivation procedure for *Pleurotus ostreatus*.
8. Criss-cross bed and out-door method for cultivation of *Volvariella volvaceae*.
9. Cultivation procedure for *Ganoderma lucidum*.
10. Cultivation procedure for *Calocybe indica*.
11. Storage and preservation of mushroom.

**Reference Books:**

- The Mushroom Identifier- David Pegler & B. Sproner.  
Mushroom Cultivation- B.Tripathi & H.P.Shukla  
Mushroom Growing- S.C.Day  
A handbook of Mushroom- Neeta Bhale



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<b>M.Sc. III SEMESTER</b>		
<b>Course Code:</b> RTPCTD2	<b>Credit-4</b>	<b>Marks:100</b>
<b>Course Title: BEEKEEPING TECHNIQUES</b>		

**Course outcomes**

On completion of the course, the students will be able to:

1. Understand economic importance and ecological benefits of beekeeping.
2. Enhance their knowledge and technical skills on beekeeping.

**Course Outcomes and their mapping with Program Outcomes:**

CO	PO						PSO		
	PO1	PO2	PO3	PO4	PO5	PO6	PSO1	PSO2	PSO3
CO1	3	2	2	1	1	3	1	3	2
CO2	3	3	1	-	1	3	1	3	2

**Weightage: 1- Slightly; 2- Moderately; 3- Strongly**

**Introduction:** Introduction to beekeeping, beekeeping in India, benefits of beekeeping, honey bee products, potential market of bee products, nature of work, the world of honey bees: honey bee species of economic importance, bee biology, castes of bees, stages of development in honey bees, sex differential in honey bees, bee food plants, communication among bees.

**Beekeeping equipments:** Fixed comb hives, movable-comb hives, movable-frame hives, specifications of beehives-Langstroth ten-frame hive; Newton's bee hive; advantages of rearing bees in modern beehives, other beekeeping equipments- hive stand, smoker, protective equipments, comb foundation sheet, dummy division board/movable wall, porter bee escape board, drone excluder or drone trap, swarm trap, pollen trap, division board / sugar feeder and various hive tools.

**Site selection and management:** Selection of site, starting a colony, establishment of a beehive-capturing a swarm of bees, purchase a packaged bee colony, using nucleus; division of colony, inspecting the bee colony, safety measures; apiary management- colony inspection, cleaning in beehive, feeding bees with sugar syrup, addition of artificial comb foundation sheets, bee swarming and its management- control of swarming, collecting swarms; uniting bee colonies (newspaper method), crop management for beekeeping, extraction of honey; Seasonal management, precautions while handling the bees, beekeeping records, management of bee colonies for pollination, advantages of bee pollination.

**Rearing and protection management:** Bee breeding and queen rearing- bee breeding, rearing of queen bees, types of queen rearing, biological basis of queen rearing, selection of mother stock, production of better quality queens, methods of queen rearing- Alley's method, Miller's method, grafting method (Doolittle method); queen rearing time table, queen cell builders, instrumental insemination, equipments, scope, benefits of bee breeding, migration of bee

colonies, migratory beekeeping problems, various pests and diseases of honey bees and their management.

**Harvesting, processing and marketing of bee products:** Collection of nectar and honey, harvesting of honey, composition of fully ripened honey, physical properties of honey, grading of honey, packaging and labelling, uses of honey, storage, honey standards, Indian honey regulations, bee wax- composition and property, processing, uses of bee wax; bee venom- properties, production, uses; propolis- propolis collection technology, properties and uses; royal jelly- properties, production and uses; pollen- composition, pollen collecting technology; marketing of bee products, constraints in honey production, government schemes and policies related to beekeeping.

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<b>M.Sc. III SEMESTER</b>		
<b>Course Code: RTPCLD2</b>	<b>Credit-1</b>	<b>Marks:100</b>
<b>Course Title: Laboratory Beekeeping Techniques</b>		

**Course outcomes**

On completion of the course, the students will be able to:

1. Learn and handle honey bees' colony.
2. Learn the life cycle & economic importance of Apiculture.
3. Learn the process of feeding & honey extraction methods and management of bee diseases.

**Course Outcomes and their mapping with Program Outcomes:**

CO	PO						PSO		
	PO1	PO2	PO3	PO4	PO5	PO6	PSO1	PSO2	PSO3
CO1	3	2	2	1	1	2	3	1	3
CO2	3	3	1	-	1	2	3	1	3
CO3	3	3	1	-	1	2	3	1	3

**Weightage: 1- Slightly; 2- Moderately; 3- Strongly**

1. Identification of honey bee.
2. Study of equipments used in bee keeping.
3. Study of methods of queen rearing techniques.
4. Study of extraction and processing of honey.
5. Microscopy of different pollens.
6. Study of different diseased condition of honey bees.
7. Identification of pests of honey bees.
8. Study of honey quality.

**Reference Books:**

- Chapman: The Insects: structure and function 94<sup>th</sup> ed, 1998, ELBS)  
 Imms: A general text book of entomology, 2 vol. (1997, Asia publishing house)  
 Mcgavin: Essential Entomology 92001, Oxford Univ Press)  
 Srivastava: A textbook of applied entomology, vol.I & vol II (1993, Kalyani publishers)  
 The Insect. Ramesh Arora and G. S. Dariwal  
 The World of Honey Bee. A.S.Atwal  
 Bee Keeping for pleasure and profit. Moh. Naim.  
 Honeybee Disease and Management. D.P.Abrol.  
 Perspective In Indian Apiculture. R.C.Mishra

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<b>M.Sc. III SEMESTER</b>		
<b>Course Code: RTPCTD3</b>	<b>Credit-4</b>	<b>Marks: 100</b>
<b>Course Title: INSTRUMENTATION AND TECHNIQUES</b>		

**Course outcomes**

On completion of the course, the students will be able to:

1. Understand principle and functioning of various instruments generally used in drug evaluations.
2. Enhance their technical skills on slide preparation for histomorphology.

**Course Outcomes and their mapping with Program Outcomes:**

CO	PO						PSO		
	PO1	PO2	PO3	PO4	PO5	PO6	PSO1	PSO2	PSO3
CO1	3	2	2	1	1	3	1	3	2
CO2	3	3	1	-	1	3	1	3	2

**Weightage: 1- Slightly; 2- Moderately; 3- Strongly**

Principle, structure, functioning and applications. Type of microscopy- Light microscopy, Phase contrast microscopy, Fluorescence microscopy, Transmission Electron Microscopy (TEM) and Scanning Electron Microscopy (SEM).

Electrophoresis- Principle of electrophoresis, types of electrophoresis, factors affecting migration, staining in gel electrophoresis, application of electrophoresis.

Centrifugation- Principle of centrifugation, Types of centrifuge, Types of rotors, Caring of rotors, Determination of centrifugal force, Sedimentation of cellular organs.

Spectrophotometry- Principle, Functioning and application of colorimetry, UV-Vis spectrophotometry, fluorimetry and atomic absorption spectrophotometry.

Microtomy and Histology- Handling of tissues for pathological studies, Rotary microtome and its working, Fixation and Staining, Histological localization and its significance.

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<b>Course Code RTPCLD3</b>	<b>Credit-1</b>	<b>Marks 100</b>
<b>Laboratory Instrumentation and Techniques</b>		

**Course outcomes**

On completion of the course, the students will be able to:

1. Learn the principle and applications of various laboratory equipment and instruments.
2. Gain knowledge and practical skills of using instruments in various fields.

**Course Outcomes and their mapping with Program Outcomes:**

CO	PO						PSO		
	PO1	PO2	PO3	PO4	PO5	PO6	PSO1	PSO2	PSO3
CO1	3	2	2	1	1	2	3	1	3
CO2	3	3	1	-	1	2	3	1	3

**Weightage: 1- Slightly; 2- Moderately; 3- Strongly**

**Laboratory exercises:**

1. Microscopic observations of biological materials.
2. Separation of biological material using Centrifuge, paper chromatography and electrophoresis.
3. Biochemical analysis of samples using spectrophotometer.
4. Microtomy and preparation of permanent mounts.

**Reference Books**

Techniques in Microscopy and Cell Biology- VK Sharma  
 Stereo, Image processing and Quantitative Image Analysis in Biochemical Research- Shashi Wadhawa and Amit Dinda  
 Introduction to Electron Microscopy III<sup>rd</sup> Ed.-Soul Wischnitzer.  
 An introduction to Electrophoresis- K Anbalgan  
 Electrophoresis- Smith.  
 Instrumental Method of Chemical Analysis- BK Sharma  
 Principles and Techniques of Practical Biochemistry- Keith Wilson and John Walker  
 Laboratory Techniques- Swaroop and Pathak.  
 Instrumental Analysis for Science and Technology-W Faren  
 Instrumental Method of Analysis- Willard Merritt, Dean and Settle

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<b>M.Sc. III SEMESTER</b>		
<b>Course Code: RTPCTD4</b>	<b>Credit-4</b>	<b>Marks:100</b>
<b>Course Title: FOOD PRESERVATION TECHNIQUES</b>		

**Course outcomes**

On completion of the course, the students will be able to:

1. Understand the importance microorganisms in food preservation
2. Learn various food processing and preservation technologies.

**Course Outcomes and their mapping with Program Outcomes:**

CO	PO						PSO		
	PO1	PO2	PO3	PO4	PO5	PO6	PSO1	PSO2	PSO3
CO1	3	2	2	1	1	3	1	3	2
CO2	3	3	1	-	1	3	1	3	2

**Weightage: 1- Slightly; 2- Moderately; 3- Strongly**

**Food Microbiology:** Microorganisms associated with foods- bacteria, yeast and mold, importance of bacteria, yeast and molds in foods. Classification of microorganisms based on temperature, Ph, water activity, nutrient and oxygen requirement. Classification of food based on pH, food infection, food intoxication, definition of shelf life, perishable food, semi perishable foods, shelf stable foods. Principles of Food Preservation.

**Food preservation by manipulating temperature:** *Preservation with low temperature: Freezing and Refrigeration:* Introduction to refrigeration, cool storage and freezing, definition, principle of freezing, freezing curve, changes occurring during freezing, types of freezing i.e., slow freezing, quick freezing, introduction to thawing, changes during thawing and its effect on food. *Preservation with high temperature: Thermal Processing:* Commercial heat preservation methods- Sterilization, commercial sterilization, pasteurization, and blanching.

**Food Preservation by Moisture Control:** *Drying and Dehydration:* Definition, drying as a means of preservation, differences between sun drying and dehydration (i.e., mechanical drying), factor affecting rate of drying, names of types of driers used in food industry.

*Evaporation:* Definition, factors affecting evaporation, names of evaporators used in food industry.

**Food Preservation by Irradiation:** Introduction, units of radiation, kinds of ionizing radiations used in food irradiation, mechanism of action, uses of radiation processing in food industry, concept of cold sterilization.

**Foods additives and Contaminants:** Foods Additives: Need of food additives in food processing and preservation, Characteristics and classification of food additives, Chemical, technological and toxicological aspects. Food Contaminants: Physical and Chemical (heavy metals, pesticide residues, antibiotics, veterinary drug residues, dioxins, environmental pollutants, radionucleides, solvent residues, chemicals, natural toxins).

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<b>Course Code RTPCLD4</b>	<b>Credit-1</b>	<b>Marks 100</b>
<b>Course Title: Laboratory Food Preservation Techniques</b>		

**Course outcomes**

On completion of the course, the students will be able to:

1. Apply the principles and methods involved in the processing of different foods.
2. Learn different method of food preservation.

**Course Outcomes and their mapping with Program Outcomes:**

CO	PO						PSO		
	PO1	PO2	PO3	PO4	PO5	PO6	PSO1	PSO2	PSO3
CO1	3	2	2	1	1	2	3	1	3
CO2	3	3	1	-	1	2	3	1	3

**Weightage: 1- Slightly; 2- Moderately; 3- Strongly**

1. Methods of Sampling
2. Concept of shelf life of different foods.
3. To study the concept of Asepsis and sterilization.
4. Determination of pH of different foods using pH meter.
5. Study of quality characteristics of foods preserved by drying/ dehydration/ freezing.
6. To perform pasteurization of fluids using different methods.
7. To perform blanching of different plant foods.

**Reference Books:**

- B. Srilakshmi, Food Science, New Age Publishers, 2002  
 Bawa. A.S, O.P Chauhan *et al.* Food Science. New India Publishing agency, 2013  
 Deman JM, 2007, Principles of Food Chemistry, 3<sup>rd</sup> ed. Springer  
 Frazier WC and Westhoff DC, Food Microbiology, TMH Publication, New Delhi, 2004  
 Meyer, Food Chemistry, New Age, 2004  
 Potter NH, 1998, Food Science, CBS Publication, New Delhi

<b>M.Sc. III SEMESTER</b>		
<b>Course Code: RTPCSA1</b>	<b>Credit-1</b>	<b>Marks: 50</b>
<b>Course Title: SEMINAR</b>		

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<b>M.Sc. IV SEMESTER</b>		
<b>Course Code: RTPDTC-1</b>	<b>Credit-4</b>	<b>Marks: 100</b>
<b>Course Title: RURAL ENERGY SOURCES AND GREEN TECHNOLOGY</b>		

**Course outcomes**

On completion of the course, the students will be able to:

1. Understand various energy resources and need for rural energy development.
2. Understand the problems in rural energy sector and application of various form of energy sources.

**Course Outcomes and their mapping with Program Outcomes:**

CO	PO						PSO		
	PO1	PO2	PO3	PO4	PO5	PO6	PSO1	PSO2	PSO3
CO1	3	2	2	1	1	3	1	3	2
CO2	3	3	1	-	1	3	1	3	2

**Weightage: 1- Slightly; 2- Moderately; 3- Strongly**

Rural Energy Systems, Role of Energy in Human Development, Energy demand in rural and urban sector, future energy challenges, Need for rural energy development.

Various renewable energy sources, Green energy, Green Hydrogen and need for native energy systems

Bio-gas technology, anaerobic fermentation process, hydrolysis acidification and methanol-genesis, factors affecting gas yield, retention time, composition and characteristics of bio-gas, bio-gas uses, bio-gas model.

Solar Energy- Solar radiation, solar water heating, solar drying, solar greenhouse, solar energy use in rural areas. Solar cell, PV Cells, Type of PV system, Efficiency of solar cells, application of solar photovoltaic.

Bio-fuel: properties, Farm forestry, energy plantation, harvest flexibility

**Literature:**

**Text Books**

1. National Energy: Policy, Crisis and Growth, V.S.Mahajan, Ashish Publishing House.
2. Advance in Bio-gas technology, O.P.Chawla, Indian Council of agriculture and research.

**Reference books:**

1. Renewable Energy by Godfrey Boyle
2. Renewable Energy Resources by John Twidell and Tony Weir.



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<b>M.Sc. IV SEMESTER</b>		
<b>Course Code: RTPDTC-2</b>	<b>Credit-4</b>	<b>Marks: 100</b>
<b>Course Title: RURAL PLANNING AND DEVELOPMENT</b>		

**Course outcomes**

On completion of the course, the students will be able to:

1. Perform critical analysis on rural development programs and planning of execution.
2. Understand the problems of rural sector and able to develop the good planning for rural area

**Course Outcomes and their mapping with Program Outcomes:**

CO	PO						PSO		
	PO1	PO2	PO3	PO4	PO5	PO6	PSO1	PSO2	PSO3
CO1	3	2	2	1	1	3	1	3	2
CO2	3	3	1	-	1	3	1	3	2

**Weightage: 1- Slightly; 2- Moderately; 3- Strongly**

Concepts of Rural Area and Rural Development, Definition and Scope of Rural Development, Causes of Rural Backwardness, Need for Rural Development Historical Evolution of the Concept of Rural Development in the Indian Context, Rural Reconstruction, Community Development, Sectoral Development, Area Development, Target Group Development, Integrated Rural Development, Holistic Development, Sustainable Development, Participatory Development.

**Administrative role in development:** Important elements of Development Administration; Participation, Devolution, Decentralization, Process of empowerment. Efficiency and Effectiveness, *planning, implementation, monitoring and evaluation*; Accountability of decision-makers, institution' stakeholders. Role of various District Departments, District Consultative and Coordination Committees, DRDAs, District Planning committees and Programme based Special Committees, village level Govt. functionaries.

**DEVELOPMENT SCHEMES:** Rural organization Rural Development Organizations and Extension Methods – NIRD –State Institute of Rural Development – Gandhigram Rural Institute – MORD, Government of India–Role of Extension in Rural Development–Recent Scenario.IRDP; Rural employment assurance scheme, MNREGA; *Kisan Samman Nidhi Yojana, Shram Yogi Maandhan Yojana, Krishonnati Yojana-Green Revolution*, Rural housing programmes (IAY, AAY & PAY etc.); Sanitation in India; Rural and Urban: *Swachhat Bharat* Mission (TSC), PM Social Security Schemes; *Pradhan Mantri Gram Sadak Yojana*. Health Programmes (NRHM), *Ayushman Bharat Abiyaan, Stree Swabhiman* initiative, PM *Surakshit Matritva Abhiyan*, ICDS, Panchayati Raj Institutions and Urban Local Bodies.

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**Rural Marketing:** Definition, Objectives, functions; Accelerated growth and importance of Rural Market. Principles, procedures and processes of Rural Marketing Management and applications of systems approach; Market structure; market classification Market Research, Survey Techniques, Report writing; State Market Intervention Operations, State Procurement, Minimum Support Price, Statutory Minimum Price, State Advised Price and price Management by the Union and State Governments.

**Project Planning-** Introduction to Project Planning, Identification of Projects and Preparation of Project Proposal, Project Management, Network Scheduling, Monitoring and Evaluation Techniques, Microlevel Planning, Functions and Conflict Resolution, Time Management, Conflict Management and Risk Management, Right based approach-Inclusive growth and development.

### **Suggested Books**

1. Newby, Howard. (1980): Trend report: Rural Sociology, Current Sociology, Sage Publication.
2. Breman, J. (1997): The Village in Focus, in The Village in India Revisited. Edited by J. Breman, P. Kloos, and A. Saith, Delhi, Oxford University Press.
3. Jodhka, S. (1997): From “Book-view” to “Field-view”: Social Anthropological Constructions of the Indian Village, QEH Working Paper Series, Working Paper No. 5. Oxford, Queen Elizabeth House, University of Oxford.
4. Gupta, Dipankar (2011): How rural is rural India – RNFE, Oxford Handbook of Agriculture.
5. Sharma, K. L. (1997): Country Town Nexus in India: A Macro View, Rural society in India, Rawat Publications.
6. Rawat, H. K. (2010): Sociology-Basic Concepts, Rawat Publications, Jaipur.
7. Thorner, Daniel & Dhanagare, D. N. (1991): Social Stratification: Readings in Sociology and Social Anthropology, Oxford University Press, New Delhi.
8. Doshi, S.L. & Jain, P.C. (2010): Rural Sociology, Rawat Publications, Jaipur.
9. Ahuja, Ram (1999): Society in India, Rawat Publications, Jaipur.
10. Jodhka, S. (2012): Caste, Oxford University Press, New Delhi.
11. Beteille, Andre (1969): Caste, Class and Power: Changing Patterns of Stratification in a Tanjore Village, University of California Press.
12. Sarathi De, Partha (2012): Rural Sociology, Pearson, New Delhi .
13. Jodhka, S. (2004): Agrarian Structure and Its Transformation, in Veena Das (ed.), Handbook of Indian Sociology, Oxford University Press, New Delhi.
14. Desai, A.R (1978): Rural Sociology in India, Popular Prakashan, Bombay.
15. Chitambar, J.B (1993): Introductory Rural Sociology: A synopsis of Concepts and Principles, Wiley Eastern Limited, New Delhi.
16. Jodhka, Surinder, S. (2012): Village Society: Essays From Economic and Political Weekly, Orient BlackSwan, New Delhi.

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<b>M.Sc. IV SEMESTER</b>		
<b>Course Code: RTPDTG1</b>	<b>Credit-4</b>	<b>Marks: 100</b>
<b>Course Title: COMPUTER APPLICATION</b>		

**Course outcomes**

On completion of the course, the students will be able to:

1. Learn basics of Hardware and Software.
2. Use the computer to prepare various documents.

**Course Outcomes and their mapping with Program Outcomes:**

CO	PO						PSO		
	PO1	PO2	PO3	PO4	PO5	PO6	PSO1	PSO2	PSO3
CO1	3	2	2	1	1	3	1	3	2
CO2	3	3	1	-	1	3	1	3	2

**Weightage: 1- Slightly; 2- Moderately; 3- Strongly**

Elementary knowledge of Computer, Characteristic of computers, Classification of Computers, functions and application, Limitations of computers.

Types of computers, Types of Processors, Input and Output Devices, Memory, volatile and non volatile and cache memory

Hardware and its component, software, network and network topology, Mesh network, star network, ring network, bus network.

Application- MS office: Creating, Editing and saving files; Use of inbuilt Statistical and other functions, Internet, email, video conferencing, e-learning, Edusat, power point presentation.

Computer Applications for Rural Development, constraints, Role of computer education in Rural Development.

**Reference Books:**

Computer organization and design-Pal Chaudhuri

Fundamental of Computers-4th Edition Raja Raman

Fundamental of Graphics and multimedia-Mukharjee

Programming in Basic-3rd edition Bala Guru samy

A Rural Computer consulting Business : John. D. Deans

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<b>M.Sc. IV SEMESTER</b>		
<b>Course Code: RTPDTG2</b>	<b>Credit-4</b>	<b>Marks: 100</b>
<b>Course Title: ENTREPRENEURSHIP</b>		

**Course outcomes**

On completion of the course, the students will be able to:

**Course Outcomes and their mapping with Program Outcomes:**

CO	PO						PSO		
	PO1	PO2	PO3	PO4	PO5	PO6	PSO1	PSO2	PSO3
CO1	3	2	2	1	1	3	1	3	2
CO2	3	3	1	-	1	3	1	3	2

**Weightage: 1- Slightly; 2- Moderately; 3- Strongly**

1. Understand entrepreneurship and qualities of an entrepreneur.
2. Start SSI/ cottage industries along with the various sources of financial support.

Entrepreneurship- Meaning, Definition, Factors stimulating Entrepreneurship, Phases of Entrepreneurship Development, factors affecting Entrepreneurship growth, Entrepreneurial behavior. International Entrepreneurship- meaning, Difference between domestic and International Business.

Entrepreneurship Development in India- History, Entrepreneurship development Programme, Importance of Entrepreneurship Development, Object of EDP, Phases of EDP, Problems.

Women Entrepreneurship-Concept, Factors Influencing of Women Entrepreneurship, Male vs. Women Entrepreneurs, Problems of Women Entrepreneurs, Remedial Measures, Scope and Opportunities for Women Entrepreneurs.

Starting a MSME- Business idea, Preparation of Preliminary Project Report, Detailed Project Report, Location, Apply for Registration, Apply for loan, Apply for subsidy, place order for Machinery, Arrangement of Power, Insurance, Government Clearance, Procurement of Raw Material.

Start Ups- Introduction, Start-up Initiatives by Government, Mentors, Accelerators, Incubators, Sources of Finance for start-ups, Failure, Strategies for Success, Start-Up-Innovation in India. Forms for ownership Sole Proprietorship, partnership, co-operative organization.

**Reference Books:**

M.B. Shukla : Entrepreneurship and Small Business Management, Kitab Mahal  
S.S. Kanka: Entrepreneurial Development  
Prasanna Chandra: Project Planning, Analysis, Selection, Implementation and Review  
Tata McGraw Hill.  
Vasantha Desai: Dynamics of Entrepreneurial Development  
C.B. Gupta & N.P. Sreenivasan: Entrepreneurial Development  
Nirmal K. Gupta: Small Industry – Challenges and Perspectives

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**M. Sc. IV SEMESTER**

<b>Subject Code: RTPDDC1</b>	<b>Credit-15</b>	<b>Marks: 400</b> (Thesis Evaluation 300+ Viva-Voce 100)
<b>Dissertation</b>		

**Dissertation must be compulsory for all students. Students will have liberty to complete his/her dissertation work either in the Department or any other Department or Institution. If student desires to complete his/her dissertation work outside the Department, he/she will have to bear all expenses related to complete the dissertation work.**

**Course outcomes**

On completion of this course, the students will be able to

1. Analyse the relationships among animals, plants microbes and use of Engineering and Computer Sciences for socio-economic development in rural areas.
2. Understand the applications of biological and computer sciences in Apiculture, Aquaculture, Agriculture, Medicine, Remote Sensing and GIS, Rural Engineering and Rural Planning.
3. Perform procedures as per laboratory standards in the areas of Organic Farming, Dairy, Mushroom, Poultry, and Herbal Production, Sericulture, Aquaculture, Art and Crafts, Plant Propagation and Nursery Management etc.

**Course Outcomes and their mapping with Program Outcomes:**

COs	POs						PSOs				
	PO1	PO2	PO3	PO4	PO5	PO6	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	3	3	1	-	2	3	-	-	3	3	3
CO2	3	3	1	-	2	3	-	-	3	3	3
CO3	3	3	1	-	2	3	-	-	3	3	3

**Weightage:** 1-Slightly; 2-Moderately; 3-Strongly