

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

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**Syllabus**

**2019-20**

**Master of Science of Rural Technology**

**First Semester**

<b>Course Code</b>	<b>Soil and Water Conservation Engineering</b>	<b>Marks</b>
<b>RT-101</b>		<b>100</b>

**General Objective** – To aware students with prospects and potential of soil and water conservation.

**Specific Objective**- To provide the knowledge about the soil and water conservation techniques.

**Outcomes** – Implement the technique properly in the village area.

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.

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

Watershed management concept- Objective, characterization, 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.

**Reference Books**

Introduction to soil and water conservation engineering, Mal, B C, Kalyani publishers

Irrigation Engineering-Agarwal G.D., B. BhartiPrakashan, 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

<b>Course Code</b>	<b>Laboratory course (Based on RT-101)</b>	<b>Marks</b>
<b>RT-102</b>		<b>50</b>

**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.

<b>Course Code</b>	<b>NATURAL PRODUCT PROCESSING TECHNIQUES</b>	<b>Marks</b>
<b>RT-103</b>		<b>100</b>

**General Objective**- To learn about the forest and its product and their utility.

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**Specific Objective** – To promote the entrepreneurship and conservation strategies of forest.

**Out Comes** – Know the technique of collection and processing.

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, .

Fiber: Introduction, classification of fibers, plant origin fibers, types, study of cotton, flax and jute fiber, various fiber 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.

<b>Course Code</b>	<b>Laboratory course (Based on RT-103)</b>	<b>Marks</b>
<b>RT-104</b>		<b>50</b>

**Laboratory exercises:**

1. Identification of fiber producing plant & herbaria formation.
2. Study of fiber 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 methods.
8. Microscopic observation of fibres

<b>Course Code</b>	<b>INSTRUMENTATION AND TECHNIQUES</b>	<b>Marks</b>
<b>RT-105</b>		<b>100</b>

**General Objective** – To learn about the equipment's their principle and uses.

**Specific Objective** - During research practical student must aware of instrument and their working. They also know how to interpretation of the result.

**Out Comes** – Student become aware of handling and working of instruments.

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, cluorimetry and atomic absorption apetrophotometry.

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

**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

<b>Course Code</b>	<b>Laboratory course (Based on RT-105)</b>	<b>Marks</b>
<b>RT-106</b>		<b>50</b>

**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.

<b>Course Code</b>	<b>INNOVATION, APPRAISAL AND ACTION FOR RURAL DEVELOPMENT</b>	<b>Marks</b>
<b>RT-107</b>		<b>100</b>

**General Objective** – To learn the concept of technology, innovation Adoption of technology and communication model of communication.

**Specific Objective** – Students aware with the technology and its development and Improvement of technology also which is the need of today. It develops the communication skill among the student.

**Out Comes** - Student will know the technology diffusion and Adoption of technology. Student identify the adopters and their categories. Straight way war able to the students will attached with the rural sectors.

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, identification of adopters.

Communication– Definition, concepts and model of communication, types of communication Barriers. 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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**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 husbandry- 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

Course Code	Laboratory course (Based on RT-107)	Marks
RT-108		50

**Laboratory exercises:**

1. Exercise based on PRA Approaches
2. Visit to print media offices
3. To study communication models.
4. To study adoption process.

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

M.Sc. II SEMESTER		
Course Code: RT-201		Marks: 100
Course Title: FUNDAMENTALS OF MEDICINAL PLANTS		

**General Objective** - The main Objective of this course is to study the plant and their uses found in Chhattisgarh.

**Specific Objective** – Preservation strategies and cultivation of medicinal plant which promote the economic status of farmer.

**Outcome** – To know the utility of secondary metabolites and their medicinal uses.

Methods of plant classification, Taxonomic keys, Herbarium, Taxonomic study of important 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.
- 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: RT-202</b>	<b>Marks: 50</b>
<b>Course Title: Laboratory Course (Based on RT- 201)</b>	

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.

<b>M.Sc. II SEMESTER</b>		
<b>Course Code: RT-203</b>		<b>Marks: 100</b>
<b>Course Title: APPLICATION OF REMOTE SENSING AND GIS-I</b>		

**General Objective** – To attain a fundamental knowledge of remote sensing and gain basic experience in hands on application of remote sensing.

**Specific Objective** – Student must aware with the prospect and potential of remote sensing and its application in the field of rural development.

**Out Comes**- Students will have understanding in using s/w to carryout remote sensing and GIS application in the field of rural development.

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.

Photogrammetry-Introduction, Types of Aerial Photographs, 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, NNRMS activates and thematic mapping.

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

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

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

**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.

<b>M.Sc. II SEMESTER</b>		
<b>Course Code: RT-204</b>		<b>Marks: 50</b>
<b>Course Title: Laboratory Course (Based on RT- 203)</b>		

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), Modeling- Vegetation indices.
3. Creation of digital elevation model through contour digitization.
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. Finding the correcting topology. Creation of personal geo-database.

<b>M.Sc. II SEMESTER</b>		
<b>Course Code: RT-205</b>		<b>Marks: 100</b>
<b>Course Title: RURAL WASTE MANAGEMENT</b>		

**General Objective** – To know the problems related to the waste management and find out their mode of appurtenances.

**Specific Objective** – To initiate the awareness toward the cleanliness and waste disposal in rural area.

**Out Comes-** The small group of student can promote the rural people by teaching them about the waste disposal.

Introduction of Rural waste, Type of waste, Necessity of systematic collection and disposal of waste, Types of sewerage systems.

Sewage Treatment concept, Meaning and principle of primary and secondary treatment, constructional details of screening chamber, grit chamber, clarifier, trickling filters, General composition of sewage, importance & method of determination of B.O.D. and C.O.D.

Disposal of night soil, Village latrines- collection and disposal of garbage and refuse. Construction of low cost latrines in rural areas. Septic tanks, cess pools/soak pit, privy pit and bore hole latrines,

Waste water management, Drainage, topography, storm water, natural passage, development of drains. Technological options at household level management, leach pit, soakage pit, soakway channel, plantation with intercepting chamber.

Solid waste management, Prospects and problems of solid waste management in rural areas, approach and steps for effective management of solid waste through composting, biogas technology and landfills.

**Reference Books**

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

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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

<b>M.Sc. II SEMESTER</b>		
<b>Course Code: RT-206</b>		<b>Marks: 50</b>
<b>Course Title: Laboratory Course (Based on RT- 205)</b>		

1. Visit to sewage treatment plants.
2. To study types of waste material.
3. To study various method of solid waste management.
4. To study various model of latrines.
5. To study biogas technology and landfills.
6. To study the construction detail of various waste management models.

<b>M.Sc. II SEMESTER</b>		
<b>Course Code: RT-207</b>		<b>Marks: 100</b>
<b>Course Title: RESEARCH METHODOLOGY</b>		

**General Objective-** To build up the efficiency of students regarding research methodology.

**Specific Objective –** To study the data collection technique on the local research areas. It will help to learn about the idea of dissertation, thesis writings, selection of problems and thesis writing. It will help to presentation of papers. Provide idea of basic research.

**Out Comes-** Students will presentation their work. Students can write their thesis and paper for communication. Improve the language and thinking of the students.

Research, types of research, Nature, important and scope of research methodology, role and steps of scientific inquiry and study of social phenomenon, criteria for Identification of research problems, formulations and statement of research Objective.

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.

Hypothesis- Meaning and role in research, Hypothesis testing methods. Method of data collection and its measurement. Data sources, primary and secondary- Observational and survey methods. Case studies, schedule and questioner,

Research reporting and scientific writing- Preparation of research proposal, compilation of thesis, dissertation, reports.

Compilation of research paper, paper presentation, compiling bibliography.

**Reference Books**

Survey Method

Exploring research

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

Fundamentals of Statistics

<b>M.Sc. II SEMESTER</b>
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<b>Course Code: RT-208</b>		<b>Marks: 50</b>
<b>Course Title: Laboratory Course (Based on RT-207)</b>		

1. To study the identification of research problems.
2. To study the Objectiveive formation process.
3. To formulation and testing the hypothesis process.
4. To study the review and references writing styles.
5. To study the dissertation/thesis writing style/research paper/manual.
6. Research paper presentation skills.

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**Third Semester**

<b>M.Sc. III SEMESTER</b>		
<b>Course Code: RT-301</b>		<b>Marks: 100</b>
<b>Course Title: DRUG FORMULATION AND EXTRACTION</b>		

**General Objective** – To know about the drugs found in plants who enhance their Medicinal value and make them commercially important.

**Specific Objective** – To know the technique of formulation of drug.

**Out Comes** - The student know the medicinal value of plants and their uses.

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, soxhelation, 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.

<b>M.Sc. III SEMESTER</b>		
<b>Course Code: RT-302</b>		<b>Marks: 50</b>
<b>Course Title: Laboratory Course (Based on RT-301)</b>		

1. Study of traditional plant and their part used as folklore medicine.
2. Extraction and distillation of Citronela, Japani pudina (Mentha), Sarpganda, Ashwagandha, Safed Musli, Tulsi, Butch.
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 soxlet method, Distillation method.
7. Drug formulation- Antimicrobial activity of medicinal plant.



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**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 – Tyler  
 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. Mahrotra.

<b>M.Sc. III SEMESTER</b>		
<b>Course Code: RT-303</b>		<b>Marks: 100</b>
<b>Course Title: GEOSPATIAL TECHNOLOGY AND ITS APPLICATION</b>		

**General Objective-** To know about Remote Sensing and its uses in various sectors like agriculture, forest, wild life and rural area planning.

**Specific Objective-** To get knowledge of study area through remote sensing Software.

**Out Comes-** Analysis and interpretation of data of study area at different time Interval can be done for research purpose.

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.

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, hydrological cycle, types of precipitation and 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.

<b>M.Sc. III SEMESTER</b>		
<b>Course Code: RT-304</b>		<b>Marks: 50</b>
<b>Course Title: Laboratory Course (Based on RT-303)</b>		

1. Practice based on ArcGIS and ERDAS
2. To generate various Indices map – NDVI, NDWI, NDBI, NDSI
3. Interpolation methods
4. Surface analysis
5. Layout preparation

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

<b>M.Sc. III SEMESTER</b>		
<b>Course Code: RT-305</b>		<b>Marks: 100</b>
<b>Course Title: CONCEPTS OF STATISTICAL ANALYSIS</b>		

**General Objective-** To study the basic concept of statistics and statistical tools regarding data analysis.

**Specific Objective-** To understand the different methods and software of data analysis.

**Outcome** – Efficiency will be built up regarding to statistical analysis. After analysis of data, it will be authentic to publish in national and international journals.

Introduction and Definition of statistics, Concept of Variables, Collection, Classification, tabulation, graphical and diagrammatic representation of numerical data.

Central Tendencies- Mean, Median, Mode; Dispersion- Mean deviation, Standard deviation.

Coefficient of Variation, Skew ness and Kurtosis. Correlation and Regression Analysis. Analysis of Variance (ANOVA).

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

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

<b>M.Sc. III SEMESTER</b>		
<b>Course Code: RT-306</b>		<b>Marks: 50</b>
<b>Course Title: Laboratory Course (Based on RT-305)</b>		

Practice of Statistical problem through XL and Statistical software.

**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

<b>M.Sc. III SEMESTER</b>		
<b>Course Code: RT-307</b>		<b>Marks: 100</b>
<b>Course Title: LAC AND APICULTURE</b>		

**General Objectiveive** - To provide the knowledge about Lac and Apiculture production techniques.

**Specific Objectiveive** – To create the Lac processing and marketing skills among the students. To enhance the skill of honey production and processing process among the students.

**Outcome-** student will start the lac and honey production and entrepreneurship activities in the field.

Lac insect: Classification and morphology and life cycle of lac insect, lac glands and their distribution, history of lac cultivation, geographical distribution.

Lac cultivation: Important host plant species for lac cultivation, lac crop cycle, selection and preparation of host plant. Lac cultivation operation –Pruning, selection and inoculation of broodlac, removing of used-up broodlac on the host tree, pest management, harvesting, scraping of lac from sticks. Processing technique of raw lac, commercial and domestic use of lac, enemies of lac culture and control measures.

Honey bees: Classification, morphology, geographical distribution of honey bee and their races, bee casts, internal anatomy of honey bee, life cycle of honey bee, swarming, absconding and supercedure, social organization in honey bee, morphology of bee-hive, bee communication, diseases and pests of honey bee.

Introduction to Apiculture: Definition and scope of apiculture, artificial bee keeping (Apiary), Queen rearing methods, collection techniques of honey from natural sites, honey processing, physical and chemical properties of honey, economic importance of honey.

Production technique of royal jelly, bee wax, bee pollen, Utilization of bee bread, royal jelly, bee pollen etc. and their commercial importance.

<b>M.Sc. III SEMESTER</b>		
<b>Course Code: RT-308</b>		<b>Marks: 50</b>
<b>Course Title: Laboratory Course (Based on RT-307)</b>		

1. Identification and preparation of different host plants for lac cultivation.
1. Selection and inoculation of broodlac in host plant.
2. Removal of used-up broodlac sticks from host plants.
3. Processing of lac.
4. Lac crop protection.
5. Study of equipments used in apiary.
6. Identification of honey bee.
7. To study the apiculture techniques.

**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  
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>Subject Code</b>	<b>Course</b>	<b>Marks</b>
<b>RT-401</b>	<b>Dissertation</b>	<b>250</b>

**General Objective-** To build up the efficiency of students regarding research.

**Specific Objective –** To study the data collection technique on the local research areas. It will help to learn about the idea of dissertation, thesis writings, selection of problems and thesis writing. It will help to presentation of papers. Provide idea of basic research.

**Out Comes-** Students will presentation their work. Students can write their Dissertation and paper for Publication. Improve the language and thinking of the students.