### AGRONOMY

**Course Structure – at a Glance**

<table>
<thead>
<tr>
<th>CODE</th>
<th>COURSE TITLE</th>
<th>CREDITS</th>
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<tbody>
<tr>
<td>AGRN 711*</td>
<td>MODERN CONCEPTS IN CROP PRODUCTION</td>
<td>3+0</td>
</tr>
<tr>
<td>SS 732*</td>
<td>PRINCIPLES AND PRACTICES OF SOIL FERTILITY AND NUTRIENT MANAGEMENT</td>
<td>2+1</td>
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<tr>
<td>AGRN 713*</td>
<td>PRINCIPLES AND PRACTICES OF WEED MANAGEMENT</td>
<td>2+1</td>
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<td>SWLE 730*</td>
<td>PRINCIPLES AND PRACTICES OF WATER MANAGEMENT</td>
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<tr>
<td>AGRN 723</td>
<td>AGRONOMY OF MAJOR CEREALS AND PULSES</td>
<td>2+1</td>
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<tr>
<td>AGRN 724</td>
<td>AGRONOMY OF OILSEED, FIBRE AND SUGAR CROPS</td>
<td>2+1</td>
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<tr>
<td>AGRN 725</td>
<td>AGRONOMY OF MEDICINAL, AROMATIC AND UNDER UTILIZED CROPS</td>
<td>2+1</td>
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<tr>
<td>AGRN 811</td>
<td>AGRONOMY OF FODDER AND FORAGE CROPS</td>
<td>2+1</td>
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<tr>
<td>AGM716</td>
<td>AGROMETEOROLOGY AND CROP WEATHER FORECASTING</td>
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<tr>
<td>AGRN 813</td>
<td>CROPPING SYSTEMS AND SUSTAINABLE AGRICULTURE</td>
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<tr>
<td>AGRN 814</td>
<td>DRYLAND FARMING AND WATERSHED MANAGEMENT</td>
<td>2+1</td>
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<tr>
<td>AGF 716</td>
<td>AGROSTOLOGY AND AGROFORESTRY</td>
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<tr>
<td>AGRN 815</td>
<td>PRINCIPLES AND PRACTICES OF ORGANIC FARMING</td>
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<tr>
<td>AGRN 780</td>
<td>MASTER’S SEMINAR</td>
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<tr>
<td>AGRN 899</td>
<td>MASTER’S RESEARCH</td>
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*Compulsory for Master’s programme
Department of Agronomy
Course Structure for M. Sc. (Ag.) Agronomy

<table>
<thead>
<tr>
<th>Major Courses</th>
<th>Semester</th>
<th>Course Code</th>
<th>Course Title</th>
<th>Credits</th>
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<tr>
<td>First</td>
<td>AGRN 711</td>
<td>Modern Concepts in Crop Production</td>
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<tr>
<td></td>
<td>AGRN 713</td>
<td>Principles &amp; Practices of Weed Management</td>
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<td></td>
<td>AEAB 704</td>
<td>Research Methodology</td>
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<td>AGRN 780</td>
<td>Master’s Seminar</td>
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<tr>
<td>Second</td>
<td>AGRN 723</td>
<td>Agronomy of Major Cereals and Pulses</td>
<td>3 (2 + 1)</td>
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<td>AGRN 724</td>
<td>Agronomy of Oilseed, Fibre and Sugar Crops</td>
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<td>AGRN 725</td>
<td>Agronomy of Medicinal, Aromatic and Under-utilized Crops</td>
<td>3 (2 + 1)</td>
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<td></td>
<td>AGRN 899</td>
<td>Master’s Research (Synopsis Presentation)</td>
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<tr>
<td>Third</td>
<td>AGRN 731</td>
<td>Agronomy of Fodder &amp; Forage Crops</td>
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<td>AGRN 733</td>
<td>Cropping Systems &amp; Sustainable Agriculture</td>
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<td>AGRN 734</td>
<td>Dryland Farming &amp; Watershed Management</td>
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<td>Principles &amp; Practices of Organic Farming</td>
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<tr>
<td>First</td>
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<td>Principles &amp; Practices of Soil Fertility &amp; Nutrient Management</td>
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<td>Agrometeorology &amp; Crop Weather Forecasting</td>
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<td>AGFO 716</td>
<td>Agrostology and Agroforestry</td>
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<tr>
<td>First</td>
<td>MLI 501</td>
<td>Library and Information Services</td>
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<td>LNG 502</td>
<td>Technical Writing And Communication Skills</td>
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<td>ENVS 506</td>
<td>Disaster Management (e-Course)</td>
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<td>Basic Concepts in Laboratory Techniques</td>
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<td>AEAB 505</td>
<td>Agricultural Research, Research Ethics and Rural Development Programs (e-Course)</td>
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Minimum Credit Requirements as per Recommendations of 32nd Academic Council held on September 6, 2013

<table>
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<tr>
<th>Parameters</th>
<th>Minimum Credit Requirement</th>
<th>Credits offered by the Department</th>
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<tbody>
<tr>
<td>Course Work</td>
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<tr>
<td>a) Major Courses (including Seminar)</td>
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<tr>
<td>b) Minor Courses</td>
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<tr>
<td>c) Basic &amp; Supporting Courses</td>
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<td>06</td>
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<tr>
<td>Research Work</td>
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<tr>
<td>Total Credits</td>
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AGRN711 MODERN CONCEPTS IN CROP PRODUCTION 3+0

Theory

UNIT I
Crop growth analysis in relation to environment; agro-ecological zones of India.

UNIT II
Quantitative agro-biological principles and inverse yield nitrogen law; Mitscherlich yield equation, its interpretation and applicability; Baule unit.

UNIT III
Effect of lodging in cereals; physiology of grain yield in cereals; optimization of plant population and planting geometry in relation to different resources, concept of ideal plant type and crop modeling for desired crop yield.

UNIT IV
Scientific principles of crop production; crop response production functions; concept of soil plant relations; yield and environmental stress.

UNIT V
Integrated farming systems, organic farming, and resource conservation technology including modern concept of tillage; dry farming; determining the nutrient needs for yield potentiality of crop plants, concept of balanced nutrition and integrated nutrient management; precision agriculture.
Theory

UNIT I
Weed biology and ecology, crop-weed competition including allelopathy; principles and methods of weed control and classification; weed indices.

UNIT II
Herbicides introduction and history of their development; classification based on chemical, physiological application and selectivity; mode and mechanism of action of herbicides.

UNIT III
Herbicide structure - activity relationship; factors affecting the efficiency of herbicides; herbicide formulations, herbicide mixtures; herbicide resistance and management; weed control through bio-herbicides, myco-herbicides and allelochemicals; Degradation of herbicides in soil and plants; herbicide resistance in weeds and crops; herbicide rotation.

UNIT IV
Weed management in major crops and cropping systems; parasitic weeds; weed shifts in cropping systems; aquatic and perennial weed control.

UNIT V
Integrated weed management; cost : benefit analysis of weed management.

Practical
• Identification of important weeds of different crops
• Preparation of a weed herbarium
• Weed survey in crops and cropping systems
• Crop-weed competition studies
• Preparation of spray solutions of herbicides for high and low-volumes sprayers
• Use of various types of spray pumps and nozzles and calculation of swath width
• Economics of weed control
• Herbicide resistance analysis in plant and soil
• Bioassay of herbicide resistance
• Calculation of herbicidal requirement

**Theory**

Origin and history, area and production, classification, improved varieties, adaptability, climate, soil, water and cultural requirements, nutrition, quality components, handling and processing of the produce for maximum production of

UNIT I
*Rabi* cereals.

UNIT II
*Kharif* cereals.

UNIT III
*Rabi* pulses.

UNIT IV
*Kharif* pulses.

**Practical**

- Phenological studies at different growth stages of crop
- Estimation of crop yield on the basis of yield attributes
- Formulation of cropping schemes for various farm sizes and calculation of cropping and rotational intensities
- Working out growth indices (CER, CGR, RGR, NAR, LAD), aggressiveness, relative crowding coefficient, monetary yield advantage and ATER of prominent intercropping systems of different crops.
- Estimation of protein content in pulses
- Planning and layout of field experiments
- Judging of physiological maturity in different crops
- Intercultural operations in different crops
- Determination of cost of cultivation of different crops
- Working out harvest index of various crops
- Study of seed production techniques in various crops
- Visit of field experiments on cultural, fertilizer, weed control and water management aspects
- Visit to nearby villages for identification of constraints in crop production
AGRNM 724 AGRONOMY OF OILSEED, FIBRE AND SUGAR CROPS 2+1

Theory
Origin and history, area and production, classification, improved varieties, adaptability, climate, soil, water and cultural requirements, nutrition quality component, handling and processing of the produce for maximum production of:

UNIT I
Rabi oilseeds – Rapeseed and mustard, linseed, etc.

UNIT II
Kharif oilseeds - Groundnut, sesame, castor, sunflower, soybean etc.

UNIT III
Fiber crops - Cotton, jute, sunhemp etc.

UNIT IV
Sugar crops – Sugar-beet and sugarcane.

Practical
• Planning and layout of field experiments
• Cutting of sugarcane setts, its treatment and methods of sowing, tying and propping of sugarcane
• Determination of cane maturity and calculation on purity percentage, recovery percentage and sucrose content in cane juice phenological studies at different growth stages of crop.
• Intercultural operations in different crops
• Cotton seed treatment
• Working out growth indices (LER, CGR, RGR, NAR, LAD) aggressivity, relative crowding coefficient, monetary yield advantage and ATER of prominent intercropping systems
• Judging of physiological maturity in different crops and working out harvest index
• Working out cost of cultivation of different crops
• Estimation of crop yield on the basis of yield attributes
• Formulation of cropping schemes for various farm sizes and calculation of cropping and rotational intensities
• Determination of oil content in oilseeds and computation of oil yield
• Estimation of quality of fibre of different fibre crops
• Study of seed production techniques in various crops
• Visit of field experiments on cultural, fertilizer, weed control and water management aspects
• Visit to nearby villages for identification of constraints in crop production
AGRN 725  AGRONOMY OF MEDICINAL, AROMATIC AND UNDER-UTILIZED CROPS

Theory

UNIT I
Importance of medicinal and aromatic plants in human health, national economy and related industries, classification of medicinal and aromatic plants according to botanical characteristics and uses.

UNIT II
Climate and soil requirements; cultural practices; yield and important constituents of medicinal plants (Isabgol, Rauwolfia, Poppy, Aloe vera, Satavar, Stevia, Safed Musli, Kalmegh, Asaphoetida, Nux vomica, Rosadleetc).

UNIT III
Climate and soil requirements; cultural practices; yield and important constituents of aromatic plants (Citronella, Palmarosa, Mentha, Basil, Lemon grass, Rose, Patchouli, Geranium etc.).

UNIT IV
Climate and soil requirements; cultural practices; yield of under-utilized crops (Rice bean, Lathyrus, Sesbania, Clusterbean, French bean, Fenugreek, Grain Amaranth, Coffee, Tea and Tobacco).

Practical
- Identification of crops based on morphological and seed characteristics
- Raising of herbarium of medicinal, aromatic and under-utilized plants
- Quality characters in medicinal and aromatic plants
- Methods of analysis of essential oil and other chemicals of importance in medicinal and aromatic plants
Theory

UNIT I
Adaptation, distribution, varietal improvement, agro-techniques and quality aspects including anti-quality factors of important fodder crops like maize, bajra, guar, cowpea, oats, barley, berseem, senji, lucerne etc.

UNIT II
Adaptation, distribution, varietal improvement, agro-techniques and quality aspects including anti-quality factors of important forage crops/grasseslime, napier grass, Panicum, Lasiuras, Cenchruse etc.

UNIT III
Year-round fodder production and management, preservation and utilization of forage and pasture crops.

UNIT IV
Principles and methods of hay and silage making; chemical and biochemical changes, nutrient losses and factors affecting quality of hay and silage; use of physical and chemical enrichments and biological methods for improving nutrition; value addition of poor quality fodder.

UNIT V
Economics of forage cultivation uses and seed production techniques.

Practical
• Practical raining of farm operations in raising fodder crops;
• Canopy measurement, yield and quality estimation, viz. crude protein, NDF, ADF, lignin, silica, cellulose etc. of various fodder and forage crops
• Anti-quality components like HCN in sorghum and such factors in other crops
• Hay and silage making and economics of their preparation
Theory

UNIT I
Cropping systems: definition, indices and its importance; physical resources, soil and water management in cropping systems; assessment of land use.

UNIT II
Concept of sustainability in cropping systems and farming systems, scope and objectives; production potential under monoculture cropping, multiple cropping, alley cropping, sequential cropping and intercropping, mechanism of yield advantage in intercropping systems.

UNIT III
Above and below ground interactions and allelopathic effects; competition relations; multi-storied cropping and yield stability in intercropping, role of non-monetary inputs and low cost technologies; research need on sustainable agriculture.

UNIT IV
Crop diversification for sustainability; role of organic matter in maintenance of soil fertility; crop residue management; fertilizer use efficiency and concept of fertilizer use in intensive cropping system.

UNIT V
Plant ideotypes for drylands; plant growth regulators and their role in sustainability.
Theory
UNIT I
Definition, concept and characteristics of dry land farming; dry land versus rainfed farming; significance and dimensions of dry land farming in Indian agriculture.

UNIT II
Soil and climatic parameters with special emphasis on rainfall characteristics; constraints limiting crop production in dry land areas; types of drought, characterization of environment for water availability; crop planning for erratic and aberrant weather conditions.

UNIT III
Stress physiology and resistance to drought, adaptation of crop plants to drought, drought management strategies; preparation of appropriate crop plans for dry land areas; mid contingent plan for aberrant weather conditions.

UNIT IV
Tillage, tilth, frequency and depth of cultivation, compaction in soil tillage; concept of conservation tillage; tillage in relation to weed control and moisture conservation; techniques and practices of soil moisture conservation (use of mulches, kinds, effectiveness and economics); antitranspirants; soil and crop management techniques, seeding and efficient fertilizer use.

UNIT V
Concept of watershed resource management, problems, approach and components.

Practical
• Seed treatment, seed germination and crop establishment in relation to soil moisture contents
• Moisture stress effects and recovery behaviour of important crops
• Estimation of moisture index and aridity index
• Spray of anti-transpirants and their effect on crops
• Collection and interpretation of data for water balance equations
• Water use efficiency
• Preparation of crop plans for different drought conditions
• Study of field experiments relevant to dryland farming
Visit to dryland research stations and watershed projects

**AGRN735 PRINCIPLES AND PRACTICES OF ORGANIC FARMING 2+1**

**Theory**

**UNIT I**
Organic farming - concept and definition, its relevance to India and global agriculture and future prospects; land and water management - land use, minimum tillage; shelter zones, hedges, pasture management, agro-forestry.

**UNIT II**
Organic farming and water use efficiency; soil fertility, nutrient recycling, organic residues, organic manures, composting, soil biota and decomposition of organic residues, earthworms and vermicompost, green manures and biofertilizers.

**UNIT III**
Farming systems, crop rotations, multiple and relay cropping systems, intercropping in relation to maintenance of soil productivity.

**UNIT IV**
Control of weeds, diseases and insect pest management, biological agents and pheromones, biopesticides.

**UNIT V**
Socio-economic impacts; marketing and export potential: inspection, certification, labeling and accreditation procedures; organic farming and national economy.

**Practical**
- Aerobic and anaerobic methods of making compost
- Making of vermicompost
- Identification and nursery raising of important agro-forestry trees and trees for shelter belts
- Efficient use of biofertilizers, technique of treating legume seeds with *Rhizobium* cultures, use of *Azotobacter*, *Azospirillum*, and PSB cultures in field
- Visit to an organic farm
- Quality standards, inspection, certification and labeling and accreditation procedures for farm produce from organic farms
<table>
<thead>
<tr>
<th>Course Code</th>
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<tr>
<td>AGRN 780</td>
<td>Master’s Seminar</td>
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<tr>
<td>AGRN 899</td>
<td>Master’s Research</td>
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Non Credit Course Contents

MLI 501   LIBRARY AND INFORMATION SERVICES   0 + 1

Objective
To equip the library users with skills to trace information from libraries efficiently, to appraise them of information and knowledge resources, to carry out literature survey, to formulate information search strategies and to use modern tools (Internet, OPAC, search engines etc.) of information search.

Practical
Introduction to library and its services; Role of libraries in education, research and technology transfer; Classification systems and organization of library; Sources of information – Primary Sources, Secondary Sources and Tertiary Sources; Intricacies of abstracting and indexing services (Science Citation Index, Biological Abstracts, Chemical Abstracts, CABI Abstracts, etc.); Tracing information from reference sources; Literature survey; Citation techniques/ Preparation of bibliography; Use of CD-ROM Databases, Online Public Access Catalogue and other computerized library services; Use of Internet including search engines and its resources; e-resources access methods.
Objective
To equip the students/scholars with skills to write dissertations, research papers etc.
To equip the students/scholars with skills to communicate and articulate in English (verbal as well as writing).

Practical

**Technical Writing** – Various forms of scientific writings – theses, technical papers, reviews, manuals, etc., Various parts of thesis and research communications (title page, authorship contents page, preface, introduction, review of literature, material and methods, experimental results and discussion); Writing of abstracts, summaries, précis, citations etc.; commonly used abbreviations in the theses and research communications; illustrations, photographs and drawings with suitable captions; pagination, numbering of tables and illustrations; writing of numbers and dates in scientific write-ups; Editing and Proof-reading; Writing of a review article.

**Communication Skills** – Grammar (Tenses, parts of speech, clauses, punctuation marks); Error analysis (Common errors); Concord; Collocation; Phonetic symbols and transcription; Accentual pattern; Weak forms in connected speech; Participation in group discussion; Facing an interview; presentation of scientific papers.

**Suggested Readings**


Objective

The main objective of this course is to equip students and stakeholders with knowledge of Intellectual Property Rights (IPR) related protection systems, their significance and use of IPR as a tool for wealth and value creation in a knowledge-based economy.

Theory

Historical perspectives and need for the introduction of Intellectual Property Right regime; TRIPs and various provisions in TRIPs Agreement; Intellectual Property and Intellectual Property Rights (IPR). Benefits of securing IPRs; Indian Legislations for the protection of various types of intellectual properties; Fundamentals of patents, copyrights, geographical indications, designs and layout, trade secrets and traditional knowledge, trademarks, protection of plant varieties and farmers’ rights and bio-diversity protection; Protectable subject matters, protection in biotechnology, protection of other biological materials, ownership and period of protection; National Biodiversity protection initiatives; convention on Biological Diversity; International Treaty on Plant Genetic Resources for Food and Agriculture; Licensing of technologies, Material transfer agreements, Research collaboration Agreement, License Agreement.

Suggested Readings

Objective
To acquaint the students about the basics of commonly used techniques in laboratory.

Practical
Safety measures while in Lab; Handling of chemical substances; Use of burettes, pipettes, measuring cylinders, flasks, separatory funnel, condensers, micropipettes and vacupets; washing, drying and sterilization of glassware; Drying of solvents/chemicals. Weighing and preparation of solutions of different strengths and their dilution; Handling techniques of solutions; Preparation of different agro-chemical doses in field and pot applications; Preparation of solutions of acids; Neutralisation of acid and bases; Preparation of buffers of different strengths and pH values. Use and handling of microscope, laminar flow, vacuum pumps, viscometer, thermometer, magnetic stirrer, micro-ovens, incubators, sand-bath, water-bath, oil-bath; Electric wiring and earthling. Preparation of media and methods of sterilization; Seed viability testing, testing of pollen viability; Tissue culture of crop plants; Description of flowering plants in botanical terms in relation to taxonomy

Suggested Readings
Objective

To enlighten the students about the organization and functioning of agricultural research systems at national and international levels, research ethics, and rural development programmes and policies of Government.

Theory

UNIT I

History of agriculture in brief; Global agricultural research system: need, scope, opportunities; Role in promoting food security, reducing poverty and protecting the environment; National Agricultural Research Systems (NA RS) and Regional Agricultural Research Institutions; Consultative Group on International Agricultural Research (CGIAR): International Agricultural Research Centers (IARC), partnership with NARS, role as a partner in the global agricultural research system, strengthening capacities at national and regional levels; International fellowships for scientific mobility.

UNIT II

Research ethics: research integrity, research safety in laboratories, welfare of animals used in research, computer ethics, standards and problems in research ethics.

UNIT III

Concept and connotations of rural development, rural development policies and strategies. Rural development programmes: Community Development Programme, Intensive Agricultural District Programme, Special group Area Specific Programme, Integrated Rural Development Programme (IROP) Panchayati Raj Institutions, Cooperatives. Voluntary Agencies/Non-Governmental Organizations. Critical evaluation of rural development policies and programmes. Constraints in implementation of rural policies and programmes.

Suggested Readings

Punia MS. Manual on International Research and Research Ethics. CCS, Haryana Agricultural University, Hisar.
Objectives
To introduce learners to the key concepts and practices of natural disaster management: to equip them to conduct thorough assessment of hazards, and risks vulnerability; and capacity building.

Theory
UNIT I
Natural Disaster management and nature of natural disasters, their types and effect. Floods, Drought, Cyclone, Earthquakes, Landslides, Avalanches, Volcanic eruptions, Heat and cold Waves, Climatic Change: Global warming, Sea Level rise, Ozone Depiction

UNIT II
Man Made Disasters- Nuclear disasters, chemical disasters, biological disasters, building fire, coal fire, forest fire. Oil fire, air pollution, water pollution, deforestation, Industrial wastewater pollution, road accidents, rail accidents. air accidents, sea accidents.

UNIT III
Disaster Management- Efforts to mitigate natural disasters at national and global levels. International Strategy for Disaster reduction. Concept of disaster management, national disaster management framework; financial arrangements; role of NGOs, Community-based organizations, and media. Central, State, District and local Administration; Armed forces in Disaster response; Disaster response: Police and other organizations.

Suggested Readings