RAMAKRISHNA MISSION VIVEKANANDA EDUCATIONAL AND RESEARCH INSTITUTE

(RKMVERI)

(Deemed-to-be-University)

(Declared by Government of India under section 3 of UGC Act, 1956)

P.O. Belur Math, District- Howrah, West Bengal: 711202

School of Agriculture and Rural Development

FACULTY CENTRE FOR INTEGRATED RURAL DEVELOPMENT AND MANAGEMENT (IRDM)

Ramakrishna Mission Ashrama, Narendrapur

Two-years M. Sc. (Ag) in 'Agronomy'

PROPOSED COURSE CONTENT

(with effect from academic year 2020-21)

RAMAKRISHNA MISSION VIVEKANANDA EDUCATIONAL AND RESEARCH INSTITUTE

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School of Agriculture and Rural Development

FACULTY CENTRE FOR INTEGRATED RURAL DEVELOPMENT AND MANAGEMENT (IRDM)

Narendrapur Campus, Kolkata-700103, West Bengal

M.Sc. (Ag.) in Agronomy

Course No.	Course Title	Credit(s)
1st Semester		
AGRON 101*	Modern Concepts in Crop Production	2+1
AGRON 102*	Soil Fertility and Nutrient Management	2+1
AGRON 103*	Principles and Practices of Weed Management	2+1
AGRON 104*	Principles and Practices of Water Management	2+1
SCH 101*	Spiritual and Cultural Heritage of India – I	1+0
2nd Semester		
AGRON 201	Agronomy of *Kharif* Cereals and Pulse Crops	2+1
AGRON 202	Agronomy of Fibre and *Kharif* Oilseed Crops	2+1
AGRON 203	Agronomy of Medicinal, Aromatic and Narcotic Crops	2+1
AGRON 204	Agronomy of Fodder and Forage Crops	2+1
AGRON 205	Seed Production of Major Field Crops	2+1
AGRON 206	Cropping System and Sustainable Agriculture	2+1
AGRON 207	Factors Affecting Crop Quality	2+0
SCH 201*	Spiritual and Cultural Heritage of India – II	1+0
3rd Semester		
AGRON 301	Agronomy of *Rabi* Cereals and Pulse Crops	2+1
AGRON 302	Agronomy of Sugar and *Rabi* Oilseed Crops	2+1

Course No.	Course Title	Credit(s)
AGRON 303	Agronomy of Tuber and Under-utilized Crops	2+1
AGRON 304	Organic Farming	2+1
AGRON 305	Rainfed Farming and Watershed Management	2+1
AGRON 306	Agrostology and Agro-forestry	2+1
AGRON 307	Dryland Farming	2+1
AGRON 309	Seminar I (Masters' Seminar on Proposed Plan of Project / Thesis Work)	1+0
4th Semester		
AGRON 409	Seminar II (Masters' Seminar on Research Work)	1+0
	Project / Thesis Work	0 + 20 (NC)

***Core course** **NC = Non-Credit**

Minimum credit requirement according to the Indian Council of Agriculture Research (ICAR) Guideline

Particulars	Credit Requirement
Course work (Major and Departmental)	34
Minor and Supporting (Outside the Departmental course)	06
Seminar (Seminar I and Seminar II)	02
Master's Research	0 + 20 (NC)*

***NC = Non-Credit**

M.Sc. (Ag.) in Agronomy: 1st Semester

Course No.	Course Title	Credit	Nature
AGRON-101	Modern Concepts in Crop Production	2 + 1	**Core Course**
AGRON-102	Soil Fertility and Nutrient Management	2 + 1	**Core Course**
AGRON-103	Principles and Practices of Weed Management	2 + 1	**Core Course**
AGRON-104	Principles and Practices of Water Management	2 + 1	**Core Course**
SCH 101	**Spiritual and Cultural Heritage of India – I**	**1+0**	**Core Course**

AGRON- 101: Modern Concepts in Crop Production (2+1)

Theory

Unit	Content	No. of Classes [Tentative]
I	Geo-ecological zones of India; Crop growth analysis in relation to environment	4
II	Quantitative agro-biological principles and inverse yield nitrogen law; Mitscherlich yield equation, its interpretation and applicability; Baule unit;	5
III	Physiology of grain yield in different crops; optimization of plant population and planting geometry in relation to different resources; Effect of lodging in cereals; Concept of ideal plant type and crop modeling for desired crop yield;	8
IV	Scientific principles of crop production; Crop response production functions; Concept of soil-plant relations; Yield and environmental stress; Crop insurance: concept, scope, methodology and applications;	7
V	Integrated farming systems, organic farming, and resource conservation technology including modern concept of tillage; Nutrient needs for yield potentiality of crop plants; Energy requirement in cultivation; Precision and sustainable agriculture.	8

Practical

Sl. No.	Content	No. of Classes [Tentative]
1	Field demonstration of different types of tillage methods	1
2	Study on sowing / planting pattern and determination of planting density	1
3	Working outgrowth indices (LAI, CGR, NAR, RGR, LAD, etc.), aggressiveness, relative crowding coefficient, monetary yield	2

Sl. No.	Content	No. of Classes [Tentative]
	advantage and ATER of prominent intercropping systems of different crops	
4	Working important intercultural operations in different crop fields	3
5	Use of leaf colour chart, leaf area meter, lux meter, line quantum sensor, etc. in crop fields and interpretation of data	2
6	Judging of synchronous, non-synchronous maturity and harvesting of different crops	1
7	Estimation of yield and working out harvest index of various crops	1
8	Determination of cost of cultivation, net return and B:C ratio of different crops	1
9	Calculation of energy requirement in crop production	1
10	Making the lists of traditional and modern farm implements / equipment's with specifications and uses	1
11	Preparation of map for geo-ecological zones of India	1
11	Collection of literature on a specific topic of crop production and preparation of Term Paper	1

AGRON- 102: Soil Fertility and Nutrient Management (2+1)

Theory

Unit	Content	No. of Classes [Tentative]
I	Factors affecting soil fertility and productivity; Features of good soil management; Problems of availability of nutrients; Relation between nutrient supply and crop growth; Organic farming - basic concepts and definitions	5
II	Criteria of essentiality of nutrients; Essential plant nutrients – their functions, nutrient deficiency symptoms; Transformation and dynamics of major plant nutrients	5
III	Preparation, composition, availability and use of farmyard manure, compost, green manures, vermicompost, bio-fertilizers and other organic concentrates; Nutrient availability from manures and crop residues; Recycling of organic wastes and residue management	8
IV	Commercial fertilizers: composition, relative fertilizer value and cost; Crop response to different nutrients, residual effects and fertilizer use efficiency; Fertilizer mixtures and grades; Agronomic, chemical, physiological and biological methods of increasing fertilizer use efficiency, slow release fertilizers; nutrient interactions	8
V	Time and methods of manures and fertilizers application; Foliar applications and purposes; Relative performance of organic and	6

	inorganic manures; Integrated nutrient management; Site-specific nutrient management; Economics of manure and fertilizer use.	

Practical

Sl. No.	Content	No. of Classes [Tentative]
1	Determination of soil pH, EC, organic C, total N, available N, P, K and S in soils	6
2	Determination of total N, P and K in plants	3
3	Interpretation of interaction effects, and computation of economic and yield optima	2
4	Calculation on nutrient uptake by crops and nutrient balance in soil	1
5	Field demonstration on various methods and combinations in application of fertilizers and manures in crop fields	2
6	Isolation of beneficial micro-organisms for fertility-building	1
7	Calculation on fertilizer use efficiency, N- use efficiency, etc.	1

AGRON- 103: Principles and Practices of Weed Management (2+1)

Theory

Unit	Content	No. of Classes [Tentative]
I	Weed biology and ecology, crop-weed competition including allelopathy; Principles and methods of weed control; Weed indices	5
II	Herbicides: introduction and history of development; Classification based on chemical, Physiological application and selectivity; Mode and mechanism of action of herbicides	6
III	Herbicides: classification, structure, activity and factors affecting efficiency, formulations, mixtures; Degradation and persistence of herbicides in soil and plants; Herbicide resistance in weeds and crops; Herbicide rotation; Weed control through bio-herbicides, myco-herbicides and allelo-chemicals	8
IV	Weed management in major crops and cropping systems; parasitic weeds; weed flora shifts in cropping systems; aquatic and perennial weed control	8
V	Integrated weed management; Benefit: cost analysis of weed management	5

Practical

Sl. No.	Content	No. of Classes [Tentative]
1	Identification of important weeds including invasive ones in different crops fields	2

Sl. No.	Content	No. of Classes [Tentative]
2	Weed survey in crop field and cropping systems in the region	1
3	Preparation of a weed herbarium	1
4	Study on crop-weed competition	1
5	Weed count study in different crop fields	1
6	Calculation on weed density and weed control efficiency	1
7	Calculation of herbicidal requirement	1
8	Use of various types of spray pumps and nozzles and calculation of swath width	1
9	Preparation of spray solutions of herbicides for high and low-volume sprayers and application in fields	2
10	Economics of weed control	1
11	Herbicide resistance analysis in plant and soil	1
12	Bioassay of herbicide resistance	1
13	Making a list of weed management related equipments equipments including specifications and uses	1
14	Visit to nearby villages for understanding various methods of weed management	1

AGRON- 104: Principles and Practices of Water Management (2+1)

Theory

Unit	Content	No. of Classes [Tentative]
I	Water and its role in plants; Water resources of India; Major irrigation projects; Extent of area and crops irrigated in India and different states	6
II	Soil water movement in soil and plants; Transpiration; Soil-water-plant relationships; Water absorption by plants; Plant response to water stress; Crop plant adaptation to moisture stress conditions	5
III	Soil, plant and meteorological factors determining water needs of crops; Scheduling, depth and methods of irrigation; Micro-irrigation system; Fertigation; Management of water in controlled environments and poly-houses	8
IV	Water management of the crops and cropping systems; Quality of irrigation water and management of saline water for irrigation; Water use efficiency	8
V	Excess of soil water and plant growth; Water management in problem soils; Drainage requirement of crops and methods of field drainage, their layout and spacing	5

Practical

Sl. No.	Content	No. of Classes [Tentative]
1	Determination of soil moisture and study on soil-moisture characteristics curves	1
2	Measurement of soil water potential by using tensiometer, pressure plate and membrane apparatus	2
3	Determination of irrigation requirements for different crops	1
4	Water flow measurements using different devices (V- notch, parshall flume, etc.)	1
5	Calculation of irrigation efficiency and economics of water management	1
6	Determination of infiltration rate and hydraulic conductivity	1
7	Field study on micro-irrigation methods (drip, sprinkler, etc.)	1
8	Field study on different drainage systems	1
9	Determination of water balance in soil for different crops and seasons	1
10	Analysis of pH, EC, SAR and other parameters of irrigation water	2
11	Making a list of equipment/ devices related to irrigation	1
12	Visit to Central Library for books, journals, e-books etc. related to water management	1
13	Visit to field experiments for crop-water relationships in farm/research station	1
14	Visit to nearby villages for understanding various types of irrigation methods in different crops	1

SCH 101: Spiritual and Cultural Heritage of India – I

Credit = 1 (Theory) + 0 (Practical) / Total (18 + 0) hours

Course Objectives: This course is designed to familiarize the students with Swami Vivekananda's comprehensive philosophy of education and its scope in its individual and social dimensions. The student will be exposed to the high ideals of education through selected teachings of Swami Vivekananda and guided to understand and approach their role as a citizen with the right attitude. The student would be given a clear picture of the challenges faced by the society and the effective method for addressing them. The course would cover in detail the idea of education in all its aspects– the effective method for acquiring knowledge, the way to apply education to solve the problems of an individual, and the role of education in addressing the short-term and long-term needs of the society.

Student Learning Outcomes:

On completion of this course, students should be able to:

- ❖ Embrace their role as a student and an individual-in-the-making holding immense promise to the society.
- ❖ Understand the problems faced by the society/nation and the effective approach for solving them.
- ❖ Develop a comprehensive idea of education in all its aspects in light of Swami Vivekananda's teachings.
- ❖ Understand how to apply education to solve the challenges faced in life;
- ❖ Develop an understanding of the effective method of acquiring and transferring knowledge.

Syllabus:

- Shanti Mantras and some selected *Vedic* hymns. **(2 hours)**
- Life of Swami Vivekananda (Journey from Narendranath Datta to Swami Vivekananda) and his speech at Parliament of Religion. **(4 hours)**
- Swami Vivekananda on India: India's eminence, Life centre, Mission and Future **(2 hours)**
- **India's decadence:** Its Causes - We are to blame, Ignoring the past, Narrowing our outlook, Perversion of religion, Tyaranny over massesn Neglect of women. **(2 hours)**
- It's symptoms and Cure – Cultural heresey and fanaticism, Physical weakness, Lack of faith in ourselves etc. **(2 hours).**
- Essentials for Regeneration: Training Sincere Workers, Deluging the Land with Spiritual Ideals, Social Reform, Its Method. **(3 hours)**
- Education the Panacea of all social evils: The present system, True Education, Ideal Method – Concentration and Detachment, Brahmacharya, Shraddha, Character, Communion with Nature, Gurukula system, Psychological approach, Present Need and Swami's Plan. **(3 hours)**

M.Sc. (Ag.) in Agronomy: 2nd Semester

Course No.	Course Title	Credit(s)
AGRON 201	Agronomy of *Kharif* Cereals and Pulse Crops	2+1
AGRON 202	Agronomy of Fibre and *Kharif* Oilseed Crops	2+1
AGRON 203	Agronomy of Medicinal, Aromatic and Narcotic Crops	2+1
AGRON 204	Agronomy of Fodder and Forage Crops	2+1
AGRON 205	Seed Production of Major Field Crops	2+1
AGRON 206	Cropping System and Sustainable Agriculture	2+1
AGRON 207	Factors Affecting Crop Quality	2+0
SCH 201*	Spiritual and Cultural Heritage of India – II	1+0

AGRON 201: Agronomy of *Kharif* Cereals and Pulse Crops (2+1)

Theory

Unit	Content	No. of Classes [Tentative]
	Origin and history, area and production, economic importance, classification, improved varieties, adaptability, climate, soil, cultural practices, nutrition, weed and water management, cropping system, harvesting, threshing, processing, quality components, constraints and important research reports of:	
I	*Kharif* cereals: Rice, Maize, Sorghum, Pearl Millet and Minor millets	18
II	*Kharif* pulses: Mungbean, Urdbean, Piegonpea, Horsegram and Cowpea	14

Practical

Sl. No.	Content	No. of Classes [Tentative]
1	Sowing/ transplanting and important intercultural operations in different crops	3
2	Study on morphological characteristics and phenophases of different crops	1
3	Working outgrowth indices at different stages and nutrient use efficiency	1
4	Judging of synchronous and non-synchronous maturity in different crops	1
5	Estimation of crop yield and working out of harvest index	1
6	Determination of cost of cultivation, net return and B:C ratio of different crops	1
7	Formulation of cropping schemes for various farm sizes and calculation of cropping and rotational intensities	1
8	Determination of quality characteristics of rice	2
9	Estimation of protein content in pulses	1
10	Making an abstract based on research findings of a specific crop	1
11	Visit of field experiments for varietal differences and agronomic management practices of different crops in farm and research station	1
12	Visit to Paddy Processing Centre/ Rice Mill and preparation of flow-chart for milling of paddy	1
13	Visit to nearby villages for cultivation aspects and identification of constraints in crop production	1

AGRON 202: Agronomy of Fibre and *Kharif* Oilseeds (2+1)

Theory

Unit	Content	No. of Classes [Tentative]
	Origin and history, area and production, economic importance, classification, improved varieties, adaptability, climate, soil, cultural practices, nutrition, weed and water management, cropping system, harvesting, threshing, processing, quality components, constraints and important research reports of:	
I	*Kharif* oilseeds: Groundnut, Sesame, Soybean, Castor, etc.	14
II	Fibre crops: Jute, Cotton, Mesta, Sunhemp, Ramie, Sisal, Flax, etc.	18

Practical

Sl. No.	Content	No. of Classes [Tentative]
1	Sowing and agronomic management of different crops in field	3
2	Morphological and phenological studies at various growth stages of crop	2
3	Working out growth indices of different crops	1
4	Judging of physiological maturity and estimation of duration of different crops and varieties	1
5	Estimation of yield (groundnut, jute, cotton, etc.) and working out harvest index	2
6	Harvesting, retting and extraction of jute fibre including modern methods	1
7	Grading of quality of jute fibre	1
8	Formulation of cropping schemes for various farm sizes and calculation on cropping and rotational intensities	1
9	Determination of economics of cultivation of different crops	1
10	Determination of oil content in oilseeds and computation of oil yield	1
11	Visit of field experiments on cultural, fertilizer, weed control and water management aspects	1
12	Visit to nearby villages for identification of constraints in production of fibre and *kharif* oilseeds	1

AGRON 203: Agronomy of Medicinal, Aromatic and Narcotic Crops (2+1)

Theory

Unit	Content	No. of Classes [Tentative]
I	Importance of medicinal and aromatic plants in national economy and related industries; Classification of medicinal and aromatic plants according to botanical characteristics and uses; Types of narcotic crops and their effects on human health	8
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*, Rosadle, etc.	8
III	Climate and soil requirements, cultural practices, yield and important constituents of aromatic plants: Citronella, Palmarosa, Mentha, Basil, Lemongrass, Rose, Patchouli, Geranium, etc.	8
IV	Climate and soil requirements, cultural practices, yield and important constituents of Narcotic crops: Tobacco, Arecanut, Betelvine, Poppy, *Cannabis*, etc.	8

Practical

Sl. No.	Content	No. of Classes [Tentative]
1	Identification of crops based on morphological and seed characteristics	2
2	Preparation of herbarium of medicinal, aromatic and narcotic crops	2
3	Sowing and cultural practices in medicinal, aromatic and narcotic crops	4
4	Estimation on yield of economic produce of different crops	1
5	Curing of tobacco including a flow-chart	1
6	Analysis of essential oil and other important chemicals in medicinal and aromatic plants	2
7	Making a list of products made from medicinal and aromatic plants and their uses	1
8	Preparation on a Term Paper on a specific crop	1
9	Field visit to experimental plots of medicinal, aromatic and narcotic crops in farm/ research station	1
10	Visit to nearby villages to understand cultivation aspects, market-linkage, etc.	1

AGRON 204: Agronomy of Fodder and Forage Crops (2+1)

Theory

Unit	Content	No. of Classes [Tentative]
I	Adaptation, distribution, varietal improvement, agro-techniques and quality aspects including anti-quality factors of important fodder crops: Maize, Sorghum, Bajra, Guar, Cowpea, Oats, Barley, Berseem, Ricebean, Lucern, etc.	14
II	Adaptation, distribution, varietal improvement, agro-techniques and quality aspects including anti-quality factors of important forage crops/grasses: Stylo, Guineagrass, Paragrass, Setaria, Humidicola, Napier × Bajra-hybrid, *Panicum, Lasiuras, Cenchrus*, etc.	8
III	Year-round fodder production and management, preservation and utilization of forage and pasture crops; Economics of forage cultivation uses and seed production techniques.	4
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.	6

Practical

Sl. No.	Content	No. of Classes [Tentative]
1	Sowing and agronomic management of fodder and forage crops in field	4
2	Study on growth, development and canopy measurement of different fodder and forage crops	2
3	Harvesting of green foliage through single and multi-cuts	2
4	Estimation of green forage yield and economics of cultivation	1
5	Estimation of quality parameters (crude protein, NDF, ADF, lignin, silica, cellulose, etc.) in green and dry forage	2
6	Making of hay and silage and economics of their preparation	2
7	Preparation of plan for inclusion of fodder or forage crop in crop sequence under different agro-ecological conditions	1
8	Visit to field experiments on fodder and forage crops in farm/ research station	1
9	Visit to nearby village for identification of constraints in production of fodder and forage crops and preparation of suggestive measures	1

AGRON 205: Seed Production of Major Field Crops (2+1)

Theory

Unit	Content	No. of Classes [Tentative]
I	Classes of seed; Seed Act regulations; Seed certification and testing	6
II	Seed production and processing of principal crops: Cereals (Rice, Hybrid rice, Wheat, Maize, Hybrid maize), Pulses (Chickpea, Lentil, Greengram, Blackgram, Lathyrus), Oilseeds (Mustard and Rapeseed, Groundnut, Sunflower, Sesame), Tuber crops (Potato), Fibre crops (Jute), Fodder crops (Ricebean, Cowpea)	26

Practical

Sl. No.	Content	No. of Classes [Tentative]
1	Selection of land and study on specific cultivation practices (isolation distance, seed treatment, sowing / planting pattern, rouging, harvesting, etc.) in seed production plots	4
2	Varietal identification at different growth stages in seed production fields	1
3	Study on parental lines in hybrid seed production	1
4	Methodology of seed testing for physical purity, moisture content, viability, germination, vigour index, etc.	3
5	Calculation on seed production methods, economics and testing procedures	2
6	Visit to seed production plots of hybrid rice, greengram, rapeseed-mustard groundnut, sesame, jute, etc.	2
7	Understanding of seed certification process	1
8	Visit to Seed Processing Plant for post-harvest processing and storage	1
9	Visit to Seed Testing Laboratory and making a report	1

AGRON 206: Cropping System and Sustainable Agriculture (2+1)

Theory

Unit	Content	No. of Classes [Tentative]
I	Cropping systems: definition, types, indices and importance; Physical resources and their effective utilization, agronomic management in cropping systems; Assessment of land use; Cropping schemes;	10
II	Concept of sustainability in cropping systems and farming systems, scope and objectives; Production potential under monoculture cropping, multiple cropping, alley cropping, sequential cropping, intercropping and multi-storied cropping; Effect of weather aberrations on cropping programme; Mechanism of yield advantage in intercropping systems; Above and below ground interactions and allelopathic effects; Competition relations;	8
III	Crop diversification for sustainability; Plant ideotypes for drylands; Role of organic matter in maintenance of soil fertility; Crop residue management; Fertilizer use efficiency and concept of fertilizer use in intensive cropping system; Plant growth regulators and their role in sustainability;	8
IV	Study on various types of crop sequences under different land situations in agro-climatic zones of West Bengal; Role of non-monetary inputs and low cost technologies; Difference between modern and sustainable agriculture; Goal, advantages and limitations of sustainable agriculture; Research need for sustainable agriculture.	6

Practical

Sl. No.	Content	No. of Classes [Tentative]
1	Sowing and agronomic management of crops under mixed, intercropping and relay systems	4
2	Assessment of yield advantages under different cropping systems	2
3	Calculation on sustainability/ stability index (relative production efficiency, system water use efficiency, land use efficiency, mandays generation, energy use efficiency, etc.)	2
4	Evaluation on crop sequences under both irrigated and rainfed conditions	1
5	Relay crop production under various cropping systems	1
6	Study on scope of multiple cropping under monocropped rainfed situation	2
7	Preparation of suitable crop sequences for different agro-climatic zones of West Bengal	2
8	Visit of field experiments on mixed, inter, relay and multi-tier cropping in farm/ research station	1
9	Visit to nearby village to study on different cropping systems	1

AGRON- 207: Factors affecting crop quality (2+0)

Theory

Unit	Content	No. of Classes [Tentative]
I	Post harvesting management and processing of rice grain, rice grain quality evaluation procedures, parameters affecting grains during storage, agronomic management, agronomic, soil and climatic factors involved in aroma formation in aromatic rice	8
II	Bread wheat quality parameters, factors affecting grain hardness of wheat, nutritional quality of hybrid maize and specialty maize, factors influencing quality of maize	4
III	Nutritional quality parameters of pulse crops, anti-nutritional compounds affecting the quality of pulses, processing of pulses and their effect on quality, processing of different oilseeds and rice bran for oil, quality parameters of edible oil, genetic, factors affecting oil quality	8
IV	Sugarcane quality parameters; crop husbandry, pest management, genetic and environmental factors affecting cane quality, by-products of sugar industry, factors affecting bioethanol production from sugarcane	4
V	Fibre quality attributes of jute and cotton, improved processes of retting for better quality and quantity of jute fibre, factors affecting fibre quality for jute and cotton	4
VI	Processing of potato, morphological and bio-chemical characters of potato tuber, varietal development for potato processing, agronomic and environmental factors affecting tuber quality of potato	4

SCH 201: Spiritual and Cultural Heritage of India – II

Credit = 1 (Theory) + 0 (Practical) / Total (18 + 0) hours

Course Objectives: This course is designed to impart to the student a comprehensive understanding of various social challenges faced by modern India and its way forward in light of Swami Vivekananda's insightful study of these subjects. The course would familiarize the student with Swami Vivekananda's ideas on women empowerment combining ancient ideals of womanhood with scope for adapting to the needs of the modern society. The importance of improving the condition of the poorer classes, an essential feature of an enlightened society, will be discussed in detail. The greater role that an enlightened India would play in the modern world and the blueprint for its harmonious and beneficent relationship with the rest of the world will be discussed.

Student Learning Outcomes:

On completion of this course, students should be able to:

- ❖ Chant selected Vedic hymns that bring the student in touch with the ideas of traditional Indian knowledge.
- ❖ Understand the traditional Indian ideal of womanhood and the way to bring back a respectable position for women in the society compatible with both the ancient ideals and the modern needs.
- ❖ Recognize the importance of serving equally the whole society, especially the lower classes, and feel inspired to dedicate their knowledge and skills to this cause.
- ❖ Understand the great future role that India has to play in the world and her relationship with other nations involving both teaching and learning, to the mutual benefit of both.

Syllabus:

- Selected Shlokas from Srimad Bhagavad Gita on shaping own destiny, secret of work and success, concentration of mind: Bhagavad Gita-6.5, Bhagavad Gita-6.6, Bhagavad Gita-2.3, Bhagavad Gita-2.47, Bhagavad Gita-2.48, Bhagavad Gita-6.38, Bhagavad Gita-6.35. **(3 hours)**
- Swami Vivekananda's Message on the Uplift of the Masses: Dedicate yourself; develop faith in equality and oneness of man; educate the masses, solution to the caste problem. **(3 hours)**
- Swami Vivekananda's view on caste problem and its solution: Caste is a social institution not a religious institution, Ideal of Brahmin-ness, Characteristics of noble-minded man, Untouchability is form of mental disease, Uplifting all to the state of ideal Brahminhood. **(3 hours)**
- Swami Vivekananda's Message on Women's Empowerment: The ideal of woman as mother; womanhood personified in Sita; as warrior; eligibility for the highest knowledge; common humanity grounds; respecting the women; all round education of women; develop their own solutions. **(3 hours)**
- Swami Vivekananda's Message on Restoring our National Glory: India's ideal is spirituality, India's mission is spiritual regeneration of the world, India's solution to life's challenges, India must share the spiritual knowledge with the West and gain material knowledge from them, India is readying for its time under the sun. **(3 hours)**
- Swami Vivekananda's thought on Karma Yoga: Karma in its effect on character is the most tremendous power that man has to deal with, what is duty, power of purity and chastity, How to make the duty sweeter in daily life. **(3 hours)**

M.Sc. (Ag.) in Agronomy: 3rd Semester

Course No.	Course Title	Credit(s)
AGRON 301	Agronomy of *Rabi* Cereals and Pulse Crops	2+1
AGRON 302	Agronomy of Sugar and *Rabi* Oilseed Crops	2+1
AGRON 303	Agronomy of Tuber and Under-utilized Crops	2+1
AGRON 304	Organic Farming	2+1
AGRON 305	Rainfed Farming and Watershed Management	2+1
AGRON 306	Agrostology and Agro-forestry	2+1
AGRON 307	Dryland Farming	2+1
AGRON 309	Seminar I (Proposed Plan of Project / Thesis Work)	1+0

AGRON 301: Agronomy of *Rabi* Cereals and Pulse Crops (2+1)

Theory

Unit	Content	No. of Classes [Tentative]
	Origin and history, area and production, economic importance, classification, improved varieties, adaptability, climate, soil, cultural practices, nutrition, weed and water management, cropping system, harvesting, threshing, processing, quality components, constraints and important research reports of:	
I	*Rabi* cereals: Wheat and Barley	12
II	*Rabi* pulses: Chickpea, Lentil, Field Pea, Lathyrus and Rajmah	20

Practical

Sl. No.	Content	No. of Classes [Tentative]
1	Sowing and important intercultural operations of different *rabi* cereals and pulse crops	2
2	Morphological and phenological studies of different crops in field	2
3	Seed inoculation with *Rhizobium* culture	1
4	Working out growth indices and nodulation at different stages	2
5	Judging of synchronous and non-synchronous maturity and harvesting of crops	1
6	Estimation of crop yield and working out harvest index of various crops	1
7	Estimation of protein content in pulses	1
8	Determination of economics of cultivation of different crops	1
9	Formulation of cropping schemes for different agro-climatic zones of West Bengal	1
10	Preparation of Term Paper on specific aspect of *rabi* cereals and pulse crops	1

Sl. No.	Content	No. of Classes [Tentative]
11	Visit of field experiments for varietal differences and agronomic management practices in farm / research station	1
12	Visit to Dal Mill and preparation of flow-chart for processing of pulses	1
13	Visit to nearby villages for cultivation aspects and identification of constrains in crop production	1

AGRON 302: Agronomy of Sugar and *Rabi* Oilseed Crops (2+1)

Theory

Unit	Content	No. of Classes [Tentative]
	Origin and history, area and production, economic importance, classification, improved varieties, adaptability, climate, soil, cultural practices, nutrition, weed and water management, cropping system, harvesting, threshing, processing, quality components, constraints and important research reports of:	
I	*Rabi* oilseeds: Rapeseed and Mustard, Sunflower, Safflower, Linseed, Niger, etc.	22
II	Sugar crops: Sugarcane and Sugar beet	10

Practical

Sl. No.	Content	No. of Classes [Tentative]
1	Sowing and important intercultural operations (thinning, weeding, wrapping and propping, supplementary pollination, etc.) in sugar and *rabi* oilseeds crops	3
2	Morphological and phenological studies at different crop growth stages	1
3	Working outgrowth indices of different crops	2
4	Judging of physiological maturity in different crops and cane maturity in sugarcane	1
5	Estimation of crop yield and working out harvest index of various crops	2
6	Calculation on economics of cultivation of different crops	1
7	Formulation of cropping schemes and calculation of cropping and rotational intensities	1
8	Determination of oil content in oilseeds and computation of oil yield	1
9	Determination of sugar content in cane juice	1
10	Visit of field experiments on cultivation aspects of crops in farm and research stations	1
11	Visit to Oil Mill and preparation of a flow-chart on oil extraction process	1
12	Visit to nearby villages for cultivation methods, post-harvest processing and identification of constraints in crop production	1

AGRON 303: Agronomy of Tuber and Under-utilized Crops (2+1)

Theory

Unit	Content	No. of Classes [Tentative]
	Origin and history, area and production, economic importance, classification, improved varieties, adaptability, climate, soil, cultural practices, nutrition, weed and water management, cropping system, harvesting, threshing, processing, quality components, constraints and important research reports of:	
I	Tuber crops: Potato, Sweet potato, Yams, Yambean, Cassava, etc.	20
II	Underutilized crops: Colocasia, Water chestnut, Makhana, Amorphophallus, etc.	12

Practical

Sl. No.	Content	No. of Classes [Tentative]
1	Calculation of seed rate/ planting materials of tubers and underutilized crops	1
2	Sowing and agronomic management of crops in fields	3
3	Morphological and phenological studies of different tubers and underutilized crops	2
4	Working outgrowth parameters at different stages	2
5	Harvesting and estimation of yield of different tubers and underutilized crops	1
6	Grading of potato tubers	1
7	Assessment of quality parameters of various tuber and under-utilized crops	1
8	Calculation on economics of cultivation of different crops	1
9	Formulation of crop sequences including tubers and underutilized crops in different situations	1
10	Visit to field experimental plots and wetlands in farm and research stations	1
11	Visit to nearby villages/ areas to study the cultivation methods of different crops including wetland crops	1
12	Visit to cold storage to understand the principles and methodology of long-term storage	1

AGRON 304: Organic Farming (2+1)

Theory

Unit	Content	No. of Classes [Tentative]
I	Organic farming: concept and definition, its relevance to India and global agriculture and future prospects;	3
II	Choice of crop and varieties, suitable crop sequences and rotations; Farm enterprises and their relationships; Ecological aspects and economics of organic framing;	5
III	Soil fertility, nutrient recycling, soil biota and decomposition of organic residues, organic manures, composting, earthworms and vermicompost, green manures and biofertilizers; Permissible nutrient management inputs under NPOP;	8
IV	Physical, cultural, mechanical and biological methods of weed and insect-disease management; Potential bio-pesticides, botanical pesticides, bio-herbicides, etc.; Permissible pest management inputs under NPOP; Water management in organic farming system;	6
V	Organic certification standards: National and International; Accreditation and certification procedures under NPOP; Inspection, certification and labelling with organic logo; PGS: cluster formation, certification procedures and logos; Organic farming and national economy; Socio-economic impacts.	10

Practical

Sl. No.	Content	No. of Classes [Tentative]
1	Making of compost by aerobic and anaerobic methods	2
2	Making of vermicompost, uses in agriculture and economics of production	2
3	Preparation of liquid manures and their application in fields	2
4	Efficient use of bio-fertilizers (*Azotobacter*, *Azospirillum*, *Azolla* and PSB) in cereals and pulse crops	2
5	Growing and incorporation of green manures *in-situ* and use of green leaf manures in fields	1
6	Preparation of botanical pesticides and their applications in fields	1
7	Making a list of permissible organic inputs under NPOP	1
8	Preparation of stale seedbed for management of weeds	1
9	Soil solarization for pest management	1
10	Preparation of diagrammatic sketch of organic farm including production potential of enterprises and use of resources and wastes	1
11	Visit to a certified organic farm to understand production, inspection, certification, labelling, accreditation procedures and quality standards of farm produces	1
12	Making a list of organic standard logos used in the world	1

AGRON 305: Rainfed Farming and Watershed Management (2+1)

Theory

Unit	Content	No. of Classes [Tentative]
I	Rainfed area: Global and Indian scenario; Classification of rainfed ecology of India; Problems and prospects of rainfed farming in India; Socio-economic scenario of rainfed areas;	6
II	Soil properties of rainfed areas and land use pattern; Climate characteristics relevant to rainfall pattern and potential evapo-transpiration; Rainwater harvesting: methods, structures, and management;	8
III	Cropping pattern in rainfed areas; Soil and nutrient management in rainfed farming; agronomic management of crops for improving water use efficiency; Contingent crop planning for aberrant weather conditions;	8
IV	Watershed management: concept, objectives, principles and components; Selection criteria and procedure for watershed; Factors affecting watershed management; Development of cropping systems in watershed areas; Case studies of some important watersheds and their management in different agro-climatic regions.	10

Practical

Sl. No.	Content	No. of Classes [Tentative]
1	Study on rainfall analysis in rainfed areas	1
2	Study on cropping pattern of different rainfed areas in the state and country	1
3	Calculation on supplemental irrigation based on evapo-transpiration data	2
4	Field study on mulching, planting density, depth of sowing, nutrient management for mitigating moisture stress	2
5	Study on characterization and delineation of watershed models	2
6	Field demonstration of soil and moisture conservation techniques	2
7	Study on rain-water harvesting, structures and conservation	2
8	Visit to field experiments relating to rainfed farming technology in research station	2
9	Benefit / impact analysis of watershed development activities	1
10	Visit to watershed project areas in the district/region/state	1

AGRON 306: Agrostology and Agroforestry (2+1)

Theory

Unit	Content	No. of Classes [Tentative]
I	Agrostology: definition and importance; Grassland ecology: principle, community, climax, dominant species, succession, biotypes; Ecological status of grasslands and grass cover in India; Problems and management of grasslands.	6
II	Pasture: importance, classification, scope, status and research needs; Pasture establishment, their improvement and renovation; Natural pastures, cultivated pastures and common pasture grasses; Grazing management.	6
III	Agroforestry: definition and importance; agroforestry systems, agri-silviculture, silvipasture, agri-silvipasture, agri-horticulture, aqua-silviculture, alley-cropping and energy plantation.	8
IV	Crop production technology in agro-forestry, silvi-pastoral and agrostology system; Meaning and importance for wasteland development; Selection of species, planting methods, problems of seed germination, manuring and irrigation in agro-forestry systems; Associative influence in relation to aboveground and underground interferences; Lopping and coppicing in agro-forestry systems; Social acceptability and economic viability, Nutritive value of trees; Tender operation; Desirable tree characteristics.	12

Practical

Sl. No.	Content	No. of Classes [Tentative]
1	Preparation of charts and maps of India showing different types of agro-forestry systems and pastures	2
2	Identification of seeds and plants of common grasses, legumes and trees of economic importance with reference to agro-forestry	1
3	Seed treatment for better germination of farm vegetation	1
4	Methods of propagation/planting of grasses and trees in silvi-pastoral system	2
5	Fertilizer application in strip and silvi-pastroal systems	1
6	After-care of plantation in agroforestry system	2
7	Estimation of total biomass and fuel wood	1
8	Estimation of protein content in loppings of important fodder trees	1
9	Estimation of calorie value of wood of important fuel trees	1
10	Economics of agro-forestry systems	1
11	Calculation on number and size of paddock	1
12	Preparation of a Term Paper on status and research on agro-forestry in a particular state / region	1
13	Visit to important agro-forestry systems in farm/ research stations	1

AGRON 307: Dryland Farming (2+1)

Theory

Unit	Content	No. of Classes [Tentative]
I	Definition, concept and characteristics of dryland farming; Dryland versus rainfed farming; Significance and dimensions of dryland farming in Indian agriculture; Recent advances in dryland agriculture.	6
II	Soil and climatic parameters with special emphasis on rainfall characteristics; Constraints limiting crop production in dryland areas; Aridity and drought; Drought: types, causes and indices.	8
III	Stress physiology and resistance to drought, adaptation of crop plants to drought; Crop planning for dryland areas; Contingent plan for short, mid and terminal droughts; Alternate land use systems.	10
IV	Tillage, tilth, frequency and depth of cultivation, compaction in soil tillage; Concept of conservation tillage with relation to weed control and moisture conservation; Nutrient management strategies in dryland areas and efficient fertilizer use; Techniques of soil moisture conservation and methods of economic use of water; Mulches: kinds, effectiveness, uses and economics; Anti-transpirants; types, methods of application and effectiveness.	8

Practical

Sl. No.	Content	No. of Classes [Tentative]
1	Field study on seed treatment, germination and crop establishment in dryland situations	3
2	Study on moisture stress effects and recovery behaviour of important crops	2
3	Spray of anti-transpirants and their effects on crops	1
4	Estimation of moisture index and aridity index	1
5	Collection and interpretation of data for seasonal ET losses	1
6	Calculation on irrigation scheduling and water balance equations	2
7	Calculation on water use efficiency and economics of water use	1
8	Preparation of a map showing dryland areas in India	1
9	Formulation of cropping schemes in different dryland situations	1
10	Preparation of contingent crop plans for various drought conditions	1
11	Visit to field experiments on dryland farming in farm/ research station	1
12	Visit to dryland research stations	1

AGRON 309: Seminar I (1 + 0)

- Masters' Seminar on Proposed Plan of Project / Thesis Work

M.Sc. (Ag.) in Agronomy: 4th Semester

Course No.	Course Title	Credit(s)
AGRON 409	Seminar II (Masters' Seminar on Research Work)	1 + 0
	Project / Thesis Work	0 + 20 (NC)

NC = Non-Credit

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