Suggested Learning Resources:

Books

1.Designing for Mixed Reality, Kharis O'Connell Published by O'Reilly Media, Inc., 2016

2. Sanni Siltanen Theory and applications of markerbased augmented reality. Julkaisija

Web links and Video Lectures (e-Resources):

https://www.vttresearch.com/sites/default/files/pdf/science/2012/S3.pdf https://docs.microsoft.com/en-us/windows/mixedreality/ https://docs.microsoft.com/en-us/archive/msdnmagazine/2016/november/hololensintroductiontotheholoLens MOOC Courses: https://www.coursera.org/learn/ar https://www.udemy.com/share/101XPi/

Activity Based Learning (Suggested Activities in Class)/ Practical Based learning

- Quizzes
- Assignments
- Seminars
- Mini Projects

DAIRY AND FOOD ENGINEERING		Semester	**VII**
Course Code	**BAG701**	CIE Marks	50
Teaching Hours/Week (L:T:P: S)	3:0:2:0	SEE Marks	50
Total Hours of Pedagogy	40 Hr + 8-10 sessions	Total Marks	100
Credits	04	Exam Hours	3
Examination nature (SEE)	**Theory**		

Course Objectives:

- Knowledge on milk and food processing unit operations offer strength to students
- To handle pasteurization, sterilization, packaging, etc. of dairy products
- Control spoilage of food through process operations such as evaporation, freezing, membrane processing etc.

Teaching-Learning Process (General Instructions)

These are sample Strategies, which teacher can use to accelerate the attainment of the various course outcomes.

1. Adopt different types of teaching methods to develop the outcomes through PowerPoint presentations and Video demonstrations or Simulations.
2. Chalk and Talk method for teaching basic concepts.
3. Arranging visits to farmers' fields to expose pupils to real time farming situations.
4. Adopt collaborative (Group Learning) Learning in the class.
5. By giving assignments and presentation tasks to students.
6. Exploring information from research publications and regulatory documents

Module-1

Dairy development in India and dairy technology- Indian dairy industry products Concentrated whole milk products, – Composition of milk, physico-chemical properties of milk, water content, acidity, pH, developed acidity, natural acidity, total acidity, density, specific gravity, freezing point of milk colour of milk, flavor.

Unit operations of various dairy and food processing systems- introduction, sampling, pasteurization, sterilization, packaging, cleaning grading, evaporation, drying, filtration and freezing.

Module-2

Receiving of milk, quality determination, cleaning and disinfection of milk cans and tankers. Process flow charts for product manufacture – Pasteurized milk, Pearson square method and mass balance method for making balances method for milk standardization.

Pasteurization- Purpose, Methods of heating, design and mode of operation heating equipment (tubular heat exchanger, plate heat exchanger), **Sterilization –** UHT method (Direct and indirect heating), sterilization in the package (temperature and pressure patterns), equipment for sterilizing goods in the package (Batch autoclaves). **Thermal processing** - Thermal death time curve, reaction kinetics of the heat treatment of milk.
Module-3
Homogenization –Working of homogenization valve, Emulsifying, types of emulsions, emulsifiers, application, mode of operation, effect on the product. Centrifugation and cream separation- working of disc centrifuge, working of cyclone separator. **Preparation methods**- Manufacture of cheese, paneer, butter and ice cream. **Dairy plant design and layout** – factors in planning, importance of site selection. Location of building, size and type of dairy building, advantages of good plant layout, functional design, plant utilities requirement – electricity, water and power requirement.
Module-4
Deterioration in food product and their controls- causes of food spoilage and classification of food with respect to spoilage and consumption. Principles of food preservation - Physical, chemical and biological methods of food preservation. Canning and aseptic processing. **Evaporation** – Applications, functions, factors affecting rate of evaporation, basic evaporator construction. Types of evaporation equipment- Batch type, horizontal short tube, vertical short tube, long tube, forced circulation. **Drying-**Drying methods**–**fluidized bed, freeze , spray drying.
Module-5
Freezing – Introduction, freezing point curve for food, freezing time calculation by using Planks equation, types of freezing equipment. **Filtration:** Membrane separation – Membrane separation methods. Composition and proximate analysis of food products- Carbohydrates, protein, lipids. Change undergone by food components during processing –Changes during heating, evaporation, drying, freezing, filtration.

PRACTICAL COMPONENT OF IPCC	
	Course objectives: • Knowledge on milk and food processing unit operations • To handle pasteurization, sterilization, packaging, etc. of dairy products • Control spoilage of food through process operations such as evaporation, freezing, membrane processing etc.
Sl.NO	**Experiments**
1	To study the Vat pasteurizer
2	To study the HTST pasteurizer
3	To study and evaluate the performance of the Homogenizers
4	To study the Sterilization
5	To study and evaluate the performance of the Butter churns
6	To study the Spray dryers
7	To study and evaluate the performance of the Freezers
8	To study the different food preservative used in food industry
9	To study the various Drying methods of food products

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10	Demonstrate the working of the Evaporators
11	Demonstrate the working of the Cyclone separator
12	Demonstrate the working of the Heat exchangers

Course outcome (Course Skill Set)

At the end of the course the student will be able to:

- CO1: Enable the students to understand the dairy development and Indian dairy products
- CO2: Understanding of physico-chemical properties of milk
- CO3: Summarizing the methods of pasteurization and its importance
- CO4: To acquaint the students with various dairy engineering operations such as homogenization, pasteurization, thermal processing, evaporation, freezing and drying of milk.
- CO5: Control spoilage of food through process operations such as evaporation, freezing, membrane processing etc.

Assessment Details (both CIE and SEE)

The weightage of Continuous Internal Evaluation (CIE) is 50% and for Semester End Exam (SEE) is 50%. The minimum passing mark for the CIE is 40% of the maximum marks (20 marks out of 50) and for the SEE minimum passing mark is 35% of the maximum marks (18 out of 50 marks). A student shall be deemed to have satisfied the academic requirements and earned the credits allotted to each subject/ course if the student secures a minimum of 40% (40 marks out of 100) in the sum total of the CIE (Continuous Internal Evaluation) and SEE (Semester End Examination) taken together.

CIE for the theory component of the IPCC (maximum marks 50)

- IPCC means practical portion integrated with the theory of the course.
- CIE marks for the theory component are **25 marks** and that for the practical component is **25 marks**.
- 25 marks for the theory component are split into **15 marks** for two Internal Assessment Tests (Two Tests, each of 15 Marks with 01-hour duration, are to be conducted) and **10 marks** for other assessment methods mentioned in 22OB4.2. The first test at the end of 40-50% coverage of the syllabus and the second test after covering 85-90% of the syllabus.
- Scaled-down marks of the sum of two tests and other assessment methods will be CIE marks for the theory component of IPCC (that is for **25 marks)**.
- The student has to secure 40% of 25 marks to qualify in the CIE of the theory component of IPCC.

CIE for the practical component of the IPCC

- **15 marks** for the conduction of the experiment and preparation of laboratory record, and **10 marks** for the test to be conducted after the completion of all the laboratory sessions.
- On completion of every experiment/program in the laboratory, the students shall be evaluated including viva-voce and marks shall be awarded on the same day.
- The CIE marks awarded in the case of the Practical component shall be based on the continuous evaluation of the laboratory report. Each experiment report can be evaluated for 10 marks. Marks of all experiments' write-ups are added and scaled down to **15 marks**.
- The laboratory test **(duration 02/03 hours)** after completion of all the experiments shall be conducted for 50 marks and scaled down to **10 marks.**
- Scaled-down marks of write-up evaluations and tests added will be CIE marks for the laboratory component of IPCC for **25 marks**.
- The student has to secure 40% of 25 marks to qualify in the CIE of the practical component of the IPCC.

SEE for IPCC

Theory SEE will be conducted by University as per the scheduled timetable, with common question papers for the course (**duration 03 hours**)

- The question paper will have ten questions. Each question is set for 20 marks.

- There will be 2 questions from each module. Each of the two questions under a module (with a maximum of 3 sub-questions), **should have a mix of topics** under that module.
- The students have to answer 5 full questions, selecting one full question from each module.
- Marks scored by the student shall be proportionally scaled down to 50 Marks

The theory portion of the IPCC shall be for both CIE and SEE, whereas the practical portion will have a CIE component only. Questions mentioned in the SEE paper may include questions from the practical component.

Suggested Learning Resources:

Books

1. Fundamentals of Food Engineering-Rao, D.G. 2010. PHI learning Pvt. Ltd. New Delhi.
2. Introduction to Food Engineering - Singh, R.P. & Heldman, D.R. 2001. Academic Press.
3. Ahmed, T. 1997. Dairy Plant Engineering and Management. 4th Ed. Kitab Mahal
4. McCabe, W.L. and Smith, J. C. 1999. Unit Operations of Chemical Engineering. McGraw Hill.
5. Rao, D.G. Fundamentals of Food Engineering. PHI learning Pvt. Ltd. New Delhi. 171
6. Singh, R.P. & Heldman, D.R. 1993. Introduction to Food Engineering. Academic Press
7. Principles of foundry technology, 4th edition, P L Jain, Tata McGraw Hill, 2006.
8. Advanced Welding Processes technology and process control, John Norrish, Wood Head Publishing, 2006.

Web links and Video Lectures (e-Resources):

- http://ecoursesonline.iasri.res.in/course/view.php?id=47
- https://onlinecourses.nptel.ac.in/noc18_ar10/preview
- http://www.niftem.ac.in/site/Internal_NIFTEM.aspx?menulevel=4&MenuID=18
- http://ecoursesonline.iasri.res.in/course/index.php?categoryid=9

Activity Based Learning (Suggested Activities in Class)/ Practical Based learning

- Quizzes
- Assignments
- Seminars
- Field Experiments
- Mini Projects

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IRRIGATION AND DRAINAGE ENGINEERING		Semester	VII
Course Code	**BAG702**	CIE Marks	50
Teaching Hours/Week (L:T:P: S)	3:0:2:0	SEE Marks	50
Total Hours of Pedagogy	40 Hr + 8-10 lab session	Total Marks	100
Credits	04	Exam Hours	3
Examination nature (SEE)	**Theory**/practical/Viva-Voce /Term-work/Others		

Course Objectives:

- To illustrate the knowledge of irrigation concept, terminology and its effecting factors
- To make the students use the knowledge of different irrigation systems and its efficiencies for optimization of irrigation water at filed level.
- To enlighten the students with appropriate design techniques of drainage systems for effective land and water management.
- To impart the knowledge on importance of drainage and the design of different drainage structures and their mechanisms.

Teaching-Learning Process (General Instructions)

These are sample Strategies, which teacher can use to accelerate the attainment of the various course outcomes.

1. Adopt different types of teaching methods to develop the outcomes through PowerPoint presentations and Video demonstrations or Simulations.
2. Chalk and Talk method for teaching basic concepts.
3. Arranging visits to farmers' fields to expose pupils to real time farming situations.
4. Adopt collaborative (Group Learning) Learning in the class.
5. By giving assignments and presentation tasks to students.
6. Exploring information from research publications and regulatory documents

Module-1

Irrigation Schemes: Major and medium irrigation schemes of India, purpose of irrigation, source of irrigation water, **Hydraulic Measurements:** measurement of irrigation water: weir, flumes and orifices and other methods; open channel water conveyance system : design and lining of irrigation field channels, on farm structures for water conveyance, control & distribution of water

Module-2

Land grading, land levels design methods, soil water plant relationship: soil properties influencing irrigation management, soil water movement, infiltration, soil water potential, soil moisture characteristics, soil moisture constants. water requirement of crops: concept of evapotranspiration (ET), measurement and estimation of ET, water and irrigation requirement of crops, depth of irrigation, frequency of irrigation, irrigation efficiencies;

Module-3

Surface methods of water application: border, check basin and furrow irrigation- adaptability, specification and design considerations. **Sprinkler irrigation**: adaptability, components, types of sprinkler irrigation systems; design of sprinkler irrigation system: layout selection, hydraulic design of sprinkler components. **Drip irrigation**: adaptability, components, design of drip irrigation system: layout selection, hydraulic design of drip components

Module-4

Drainage-objectives, purpose and benefits. Sources of Excess Water, types of drainage system, Design of Surface Drainage Systems, Design of Subsurface Drainage Systems, Drainage Coefficient, Concept and Determination of Drainable Porosity, concept of hydraulic conductivity.

Module-5

Steady-State Flow to Drains, Unsteady-State Flow to Drains, Special Drainage Situations: Drainage of Sloping Land, Inceptor Drains, Artesian Relief Wells , Drainage of Heavy Clay Soil, vertical drainage, Materials for Drain Pipe ,Drain Envelopes, Reclamation of: Saline Soils, Alkali Soils, Acid Soils

PRACTICAL COMPONENT OF IPCC	
Sl.NO	**Experiments**
1	Measurement of soil moisture by different soil moisture measuring instruments
2	Measurement of irrigation water using weir, flume and orifice
3	Measurement of infiltration characteristics by using double ring infiltrometer
4	Determination of bulk density, field capacity and wilting point
5	Measurement of evapotranspiration
6	Design of open channel
7	Determination of soil intake characteristics using cylinder infiltrometer
8	Exercises on laser leveler
9	Field in-situ measurement of hydraulic conductivity by single auger hole method
10	Determination of drainage coefficient
11	Determination of drainable porosity
12	Design of Pipe Drainage Systems

Course outcome (Course Skill Set)

At the end of the course the student will be able to :
CO1: Apply irrigation terminology, soil moisture characteristic curves and evapotranspiration methods to quantify crop water requirement.
CO2: Choose appropriate irrigation methods, advantages, disadvantages, hydraulics design and components
CO3: Estimate irrigation canals capacity by lacey's and kennedy's methods.
CO4: Identify types, functions, components and factors affecting on surface and subsurface drainage systems.
CO5: Determine drain spacing under unsteady and steady state conditions by Hooghoudt's and Glover dumm equations.

Assessment Details (both CIE and SEE)

The weightage of Continuous Internal Evaluation (CIE) is 50% and for Semester End Exam (SEE) is 50%. The minimum passing mark for the CIE is 40% of the maximum marks (20 marks out of 50) and for the SEE minimum passing mark is 35% of the maximum marks (18 out of 50 marks). A student shall be deemed to have satisfied the academic requirements and earned the credits allotted to each subject/ course if the student secures a minimum of 40% (40 marks out of 100) in the sum total of the CIE (Continuous Internal Evaluation) and SEE (Semester End Examination) taken together.

CIE for the theory component of the IPCC (maximum marks 50)

- IPCC means practical portion integrated with the theory of the course.
- CIE marks for the theory component are **25 marks** and that for the practical component is **25 marks**.
- 25 marks for the theory component are split into **15 marks** for two Internal Assessment Tests (Two Tests, each of 15 Marks with 01-hour duration, are to be conducted) and **10 marks** for other assessment methods mentioned in 22OB4.2. The first test at the end of 40-50% coverage of the syllabus and the second test after covering 85-90% of the syllabus.
- Scaled-down marks of the sum of two tests and other assessment methods will be CIE marks for the theory component of IPCC (that is for **25 marks)**.
- The student has to secure 40% of 25 marks to qualify in the CIE of the theory component of IPCC.

CIE for the practical component of the IPCC

- **15 marks** for the conduction of the experiment and preparation of laboratory record, and **10 marks** for the test to be conducted after the completion of all the laboratory sessions.
- On completion of every experiment/program in the laboratory, the students shall be evaluated including viva-voce and marks shall be awarded on the same day.
- The CIE marks awarded in the case of the Practical component shall be based on the continuous evaluation of the laboratory report. Each experiment report can be evaluated for 10 marks. Marks of all experiments' write-ups are added and scaled down to **15 marks**.
- The laboratory test **(duration 02/03 hours)** after completion of all the experiments shall be conducted for 50 marks and scaled down to **10 marks.**
- Scaled-down marks of write-up evaluations and tests added will be CIE marks for the laboratory component of IPCC for **25 marks**.
- The student has to secure 40% of 25 marks to qualify in the CIE of the practical component of the IPCC.

SEE for IPCC

Theory SEE will be conducted by University as per the scheduled timetable, with common question papers for the course (**duration 03 hours**)

- The question paper will have ten questions. Each question is set for 20 marks.
- There will be 2 questions from each module. Each of the two questions under a module (with a maximum of 3 sub-questions), **should have a mix of topics** under that module.
- The students have to answer 5 full questions, selecting one full question from each module.
- Marks scored by the student shall be proportionally scaled down to 50 Marks

The theory portion of the IPCC shall be for both CIE and SEE, whereas the practical portion will have a CIE component only. Questions mentioned in the SEE paper may include questions from the practical component.

Suggested Learning Resources:

Books

1. Irrigation Engineering, Mazumdar S K, Tata McGraw Hill Publishing Co. Ltd., New Delhi.
2. Irrigation Theory and Practice, Michael A M, Vikas Publishing House, New Delhi.
3. Land and Water Management Engineering, Murthy VVN and Madan K Jha,Kalyani Publishers, New Delhi.
4. Soil and Water Conservation Engineering, Schwab G O, Frevert R K, Edminister T W and Barner K K, Jhon-Wiley and Sons, New Delhi.
5. Drainage Engineering, Luthin J M, Wiley Esatern Ltd., New Delhi.

Web links and Video Lectures (e-Resources):

Activity Based Learning (Suggested Activities in Class)/ Practical Based learning

- Quizzes
- Assignments
- Seminars
- Field Experiments
- Mini Projects

Post-Harvest Processing of Horticultural Crops		Semester	VII
Course Code	**BAG703**	CIE Marks	50
Teaching Hours/Week (L:T:P: S)	4:0:0:0	SEE Marks	50
Total Hours of Pedagogy	52	Total Marks	100
Credits	04	Exam Hours	3
Examination nature (SEE)	**Theory**		

Course Objectives:

- To enable the students to understand Concept of post-harvest losses
- Maturity indices in horticultural produce, post-harvest operation.
- Will study the methods of preservation, concept of drying, freezing.
- Understand the concept of traditional and modern methods of storage of horticultural crops
- Will study the post-harvest disorders in horticultural crops

Teaching-Learning Process (General Instructions)

These are sample Strategies, which teacher can use to accelerate the attainment of the various course outcomes.

1. Adopt different types of teaching methods to develop the outcomes through PowerPoint presentations and Video demonstrations or Simulations.
2. Chalk and Talk method for teaching basic concepts.
3. Arranging visits to farmers' fields to expose pupils to real time farming situations.
4. Adopt collaborative (Group Learning) Learning in the class.
5. By giving assignments and presentation tasks to students.
6. Exploring information from research publications and regulatory documents

Module-1

Importance of Post Harvest Technology in in Horticultural Crops. Causes of Postharvest losses. Factors affecting fruits and vegetables quality: Pre-harvest factors, environmental factors, cultural factors and post-harvest factors. Maturity indices in horticultural produce. Methods for determination of harvesting indices. Handling and transportation of fruits and vegetables. Determination of quality parameters for fruits and vegetables: aroma, fruit ripening, leaf changes, firmness, juice content, sugar content, skin color, total soluble solids, pH and acidity

Module-2

Post-Harvest Operations: Pre-cooling, Cleaning of fruits & vegetables: soaking, rinsing, sanitizing, washing methods: agitating, spraying water, wet and dry brushing, chemical washing. Peeling of fruits and vegetables: hand peeling, mechanical peeling, peeling by heat treatment and lye peeling. Grading of fruits & vegetables, factors affecting grading, types of graders: screen grader, roller grader, rope and cable type grader and weight grader. Canning of fruits and vegetables: grading, washing, peeling, cutting, blanching, cooling, filling, syruping/brining, exhausting, sealing, retorting, cooling, storage, labeling.

Module-3

Principles of Preservation of Fruits & Vegetables: Asepsis, preservation by high temperature: pasteurization, sterilization. Chemical preservation with sulphur dioxide and benzoic acid, advantages, disadvantages. Fruit coating-Waxing. Drying and dehydration of fruits & vegetables (flow chart), types of dryers: cabinet dryer, tray dryers, tunnel dryer, freeze drying, Rehydration ratio. Freezing: Definition and methods - slow freezing, quick freezing and IQF, advantages and disadvantages. Types of freezing - direct immersion, indirect contact with refrigerant, air blast, cryogenic freezing. Cooling methods - pre-cooling, room cooling, hydro cooling, refrigerated trucks.

Module-4

Storage of Horticultural crops: Traditional storage, Improved storage methods, controlled atmospheric storage (CAS), factors effecting on CAS, modified atmosphere storage/packaging (MAS/MAP), maintenance of MAP, active modification, passive modification. Packaging of fruits and vegetables, advantages and disadvantages. Packaging materials: Corrugated fibre-board boxes, cellophane, poly vinyl chloride, polyethylene, ethyl vinyl alcohol.

Module-5

Post-harvest disorders in horticultural produce: Causes of physiological disorders, Mineral deficiency disorders, Low-temperature disorders, Important physiological disorders of vegetable crops. Quality and grades specification of horticultural produce.

Course outcome (Course Skill Set)

At the end of the course the student will be able to :

CO1: Explain about the properties and factors affecting quality of fruits and vegetables
CO2: Classify post harvest operations involved in horticulture processing.
CO3: Identify preservation techniques for processed foods.
CO4: Apply advanced packaging technology in food preservation.
CO5: Identify post harvest disorders in horticultural produce.

Assessment Details (both CIE and SEE)

The weightage of Continuous Internal Evaluation (CIE) is 50% and for Semester End Exam (SEE) is 50%. The minimum passing mark for the CIE is 40% of the maximum marks (20 marks out of 50) and for the SEE minimum passing mark is 35% of the maximum marks (18 out of 50 marks). A student shall be deemed to have satisfied the academic requirements and earned the credits allotted to each subject/ course if the student secures a minimum of 40% (40 marks out of 100) in the sum total of the CIE (Continuous Internal Evaluation) and SEE (Semester End Examination) taken together.

Continuous Internal Evaluation:

- For the Assignment component of the CIE, there are 25 marks and for the Internal Assessment Test component, there are 25 marks.
- The first test will be administered after 40-50% of the syllabus has been covered, and the second test will be administered after 85-90% of the syllabus has been covered
- Any two assignment methods mentioned in the 22OB2.4, if an assignment is project-based then only one assignment for the course shall be planned. The teacher should not conduct two assignments at the end of the semester if two assignments are planned.
- For the course, CIE marks will be based on a scaled-down sum of two tests and other methods of assessment.

Internal Assessment Test question paper is designed to attain the different levels of Bloom's taxonomy as per the outcome defined for the course.

Semester-End Examination:

Theory SEE will be conducted by University as per the scheduled timetable, with common question papers for the course (**duration 03 hours).**

- The question paper will have ten questions. Each question is set for 20 marks.
- There will be 2 questions from each module. Each of the two questions under a module (with a maximum of 3 sub-questions), **should have a mix of topics** under that module.
- The students have to answer 5 full questions, selecting one full question from each module.
- Marks scored shall be proportionally reduced to 50 marks

Suggested Learning Resources:

Books

1. Fruits and Vegetable Preservation: Principles and Practices, Srivastava, R.P. & Kumar, S. CBS Publishing, 3rd edition, 2014.
2. Food Science by Potter N. and Hotchkiss J. H, An Aspen Publication, 5th edition, 2007.
3. The Complete Technology Book on Processing, Dehydration, Canning, Preservation of Fruits &Vegetables by NIIR Project Consultancy Services, 3rd edition, 2016.
4. Fruits: Tropical and subtropical, Bose T. K & Mitre, S. K. Naya Prakash, 3rd edition, 2001.
5. Fruits and Vegetable processing, Bhatti, S. and Varma U., 1st edition, CBS Publishers, 2007.
6. Food Processing and Preservation, Sivasenkar, B., CBS Publications, 2002.

Web links and Video Lectures (e-Resources):
• 1. http://ecoursesonline.iasri.res.in/course/view.php?id=164 • 2. https://k8449r.weebly.com/uploads/3/0/7/3/30731055/1php.pdf • 3. http://ecoursesonline.iasri.res.in/mod/page/view.php?id=1098 • 4. http://www.rpaulsingh.com/animations/animaitons_master3.html
Activity Based Learning (Suggested Activities in Class)/ Practical Based learning • Quizzes • Assignments • Seminars • Mini Projects

Remote Sensing and GIS Applications		Semester	**VII**
Course Code	**BAG714A**	CIE Marks	50
Teaching Hours/Week (L:T:P: S)	3:0:0:0	SEE Marks	50
Total Hours of Pedagogy	40	Total Marks	100
Credits	03	Exam Hours	3
Examination nature (SEE)	**Theory**/practical/Viva-Voce /Term-work/Others		

Course Objectives:

- To equip the students with the knowledge on techniques of Remote Sensing and GIS applications for land and water resources management.
- To impart the knowledge on advance techniques such as hyper spectral, thermal and LiDAR units scanning for mapping, modelling and monitoring.
- To enable the students to use GIS software to perform different spatial and satellite image analysis.

Teaching-Learning Process (General Instructions)

These are sample Strategies, which teacher can use to accelerate the attainment of the various course outcomes.

1. Adopt different types of teaching methods to develop the outcomes through PowerPoint presentations and Video demonstrations or Simulations.
2. Chalk and Talk method for teaching basic concepts.
3. Arranging visits to farmers' fields to expose pupils to real time farming situations.
4. Adopt collaborative (Group Learning) Learning in the class.
5. By giving assignments and presentation tasks to students.

   Exploring information from research publications and regulatory documents

Module-1

Remote sensing: Introduction to Remote Sensing, stages of remote sensing, Data acquisition and analysis, Sensors- Remote sensing types and applications, important features of Indian Remote Sensing Satellites, Electromagnetic spectrum: Different bands, Resolution, Spectral response Pattern-multi spectral data use, modern remote sensing technology versus conventional aerial photography

Module-2

Visual image interpretation: Image interpretation, Basic principles of image interpretation, Factors governing the quality of an image, Factors governing interpretability, visibility of objects, Elements of image interpretation, Techniques of image interpretation, Digital image processing- Digital image, pixel, resolution, Image processing overview; Image restoration- Radiometric correction-DN (Digital Number value) – Noise removal and correction, Atmospheric error and correction, Geometric Error and correction;.

Module-3

Image enhancement -Contrast manipulation-gray level thresholding-level slicing-contrast stretching, Digital image processing-spatial Feature Manipulation-spatial filtering convolution edge enhancement. Vegetation Indices: Digital image processing, vegetation components, supervised and unsupervised image classification and output stage data merging,

Module-4

Remote sensing in agriculture: Progress and prospects of yield assessment, remote sensing application in water resources development, remote sensing in soil conservation, aerial photo interpretation for water resources development and soil conservation survey. Remote sensing in geology and soil mapping.

Module-5

Geographical Information System: History of development of GIS: Definition, Basic components and standard GIS packages. Date entry, storage and maintenance, Data types – spatial, non-spatial (attribute-date), Data structure, data format, point line vector-raster polygon, Object structural model, files, files organization, Data base management, systems (DBMS), Entering data in computer-digitizer-scanner data compression

Course outcome (Course Skill Set)

At the end of the course the student will be able to:

1. Understand the importance of protected cultivation in precision farming
2. Discuss on various components, shape, types of green houses
3. Explain about design and construction of green houses in different agro-climatic zones
4. Explain on greenhouse cooling and heating systems, environmental parameter and control, ventilation systems
5. Assess different root media, micro-irrigation, fustigation, planting techniques in green house cultivation
6. Describe Hydroponics, post-harvest management, pest management and economic aspects of a green house.

Assessment Details (both CIE and SEE)

The weightage of Continuous Internal Evaluation (CIE) is 50% and for Semester End Exam (SEE) is 50%. The minimum passing mark for the CIE is 40% of the maximum marks (20 marks out of 50) and for the SEE minimum passing mark is 35% of the maximum marks (18 out of 50 marks). A student shall be deemed to have satisfied the academic requirements and earned the credits allotted to each subject/ course if the student secures a minimum of 40% (40 marks out of 100) in the sum total of the CIE (Continuous Internal Evaluation) and SEE (Semester End Examination) taken together.

Continuous Internal Evaluation:

- For the Assignment component of the CIE, there are 25 marks and for the Internal Assessment Test component, there are 25 marks.
- The first test will be administered after 40-50% of the syllabus has been covered, and the second test will be administered after 85-90% of the syllabus has been covered
- Any two assignment methods mentioned in the 22OB2.4, if an assignment is project-based then only one assignment for the course shall be planned. The teacher should not conduct two assignments at the end of the semester if two assignments are planned.
- For the course, CIE marks will be based on a scaled-down sum of two tests and other methods of assessment.

Internal Assessment Test question paper is designed to attain the different levels of Bloom's taxonomy as per the outcome defined for the course.

Semester-End Examination:

Theory SEE will be conducted by University as per the scheduled timetable, with common question papers for the course (**duration 03 hours).**

- The question paper will have ten questions. Each question is set for 20 marks.
- There will be 2 questions from each module. Each of the two questions under a module (with a maximum of 3 sub-questions), **should have a mix of topics** under that module.
- The students have to answer 5 full questions, selecting one full question from each module.
- Marks scored shall be proportionally reduced to 50 marks

Suggested Learning Resources:

Books

1. Remote sensing and Geographical information system, B.S. publications.
2. Introduction to remote sensing, James B and Compell, Published by Taylor & Francis Limited.
3. Remote Sensing and Image Interpretation, Lillesand, Kiefer and Chipman Published by Wiley.
4. Basics of remote Sensing and GIS, University Science Persons.
5. Remote Sensing and GIS by Basudeb Bhatta, Oxford University Persons, NewDelhi.
6. Fundamentals of Remote Sensing, George Joseph and C. Jeganathan, Universities Press Publisher.
7. Remote Sensing and Geographic Information System Paper, Chandra, Narosa Publisher

Web links and Video Lectures (e-Resources):

1. http://nptel.ac.in/downloads/105108077/
2. http://civil.iisc.ernet.in/~nagesh/rs_gis.htm
3. http://geology.wlu.edu/harbor/geol260/lecture_notes/notes.html

Activity Based Learning (Suggested Activities in Class)/ Practical Based learning

- Quizzes
- Assignments
- Seminars
- Mini Projects

Bio-Energy Systems: Design and Applications		Semester	**VII**
Course Code	**BAG714B**	CIE Marks	50
Teaching Hours/Week (L:T:P: S)	3:0:0:0	SEE Marks	50
Total Hours of Pedagogy	40	Total Marks	100
Credits	03	Exam Hours	3
Examination nature (SEE)	**Theory**/practical/Viva-Voce /Term-work/Others		

Course Objectives:

- To provide in depth knowledge on basic principles of Bio-energy systems
- To provide skills in design and operation of major bio-energy systems like, improved biomass stoves, biomass furnaces, biogas plants, biomass gasifiers etc. and related appliances

Teaching-Learning Process (General Instructions)

These are sample Strategies, which teacher can use to accelerate the attainment of the various course outcomes.

1. Adopt different types of teaching methods to develop the outcomes through PowerPoint presentations and Video demonstrations or Simulations.
2. Chalk and Talk method for teaching basic concepts.
3. Arranging visits to farmers' fields to expose pupils to real time farming situations.
4. Adopt collaborative (Group Learning) Learning in the class.
5. By giving assignments and presentation tasks to students.

   Exploring information from research publications and regulatory documents

Module-1

Fermentation processes and its general requirements: an overview of aerobic and anaerobic fermentation processes and their industrial application. Heat transfer processes in anaerobic digestion systems, land fill gas technology and potential.

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Module-2
Biomass Production: Wastelands, classification and their use through energy plantation, selection of species, methods of field preparation and transplanting. Harvesting of biomass and coppicing characteristics.
Module-3
Biomass preparation techniques for harnessing (size reduction, densification and drying). Thermochemical degradation. History of small gas producer engine system. Chemistry of gasification. Gas producer – type, operating principle.
Module-4
Gasifier fuels, properties, preparation, conditioning of producer gas. Application, shaft power generation, thermal application and economics. Transesterification for biodiesel production.
Module-5
A range of bio-hydrogen production routes. The environmental aspect of Bio-Energy, assessment of greenhouse gas mitigation potential.
Course outcome (Course Skill Set) At the end of the course the student will be able to : CO 1: Apply their knowledge and Understand methods of Cultivation of biomass CO2: Analyze the problems and principle of different types of biomass gasifier CO3: Apply and develop new type of models of gasifiers CO4: Apply their knowledge in biodiesel production CO5 : Analyze the production of hydrogen energy
Assessment Details (both CIE and SEE) The weightage of Continuous Internal Evaluation (CIE) is 50% and for Semester End Exam (SEE) is 50%. The minimum passing mark for the CIE is 40% of the maximum marks (20 marks out of 50) and for the SEE minimum passing mark is 35% of the maximum marks (18 out of 50 marks). A student shall be deemed to have satisfied the academic requirements and earned the credits allotted to each subject/ course if the student secures a minimum of 40% (40 marks out of 100) in the sum total of the CIE (Continuous Internal Evaluation) and SEE (Semester End Examination) taken together. **Continuous Internal Evaluation:** • For the Assignment component of the CIE, there are 25 marks and for the Internal Assessment Test component, there are 25 marks. • The first test will be administered after 40-50% of the syllabus has been covered, and the second test will be administered after 85-90% of the syllabus has been covered • Any two assignment methods mentioned in the 22OB2.4, if an assignment is project-based then only one assignment for the course shall be planned. The teacher should not conduct two assignments at the end of the semester if two assignments are planned. • For the course, CIE marks will be based on a scaled-down sum of two tests and other methods of assessment. **Internal Assessment Test question paper is designed to attain the different levels of Bloom's taxonomy as per the outcome defined for the course.** **Semester-End Examination:** Theory SEE will be conducted by University as per the scheduled timetable, with common question papers for the course (**duration 03 hours).** • The question paper will have ten questions. Each question is set for 20 marks. • There will be 2 questions from each module. Each of the two questions under a module (with a maximum of 3 sub-questions), **should have a mix of topics** under that module. • The students have to answer 5 full questions, selecting one full question from each module. • Marks scored shall be proportionally reduced to 50 marks

Suggested Learning Resources:

Books

1. British BioGen. 1997, Anaerobic digestion of farm and food processing practices- Good practice guidelines, London, available on www.britishbiogen.co.UK.
2. Butler, S. 2005. Renewable Energy Academy: Training wood energy professionals.
3. Centre for biomass energy. 1998. Straw for energy production; Technology Environment- Ecology.
4. Mathur, A.N. and Rathore N.S. 1992. Biogas production, management and utilization. Himanshu Publication. Delhi.
5. Mital, K.M., 1996, Biogas systems; Principles and applications, New Age International (P) ltd. Publishers, New Delhi.
6. Rai G.D. 1989. Non-conventional Sources of energy. Khanna Publishers. Delhi.

Web links and Video Lectures (e-Resources):

Activity Based Learning (Suggested Activities in Class)/ Practical Based learning

- Quizzes
- Assignments
- Seminars
- Mini Projects

Food Plant Design and Management		Semester	**VII**
Course Code	**BAG714C**	CIE Marks	50
Teaching Hours/Week (L:T:P: S)	3:0:0:0	SEE Marks	50
Total Hours of Pedagogy	40	Total Marks	100
Credits	03	Exam Hours	3
Examination nature (SEE)	**Theory**/practical/Viva-Voce /Term-work/Others		

Course Objectives:

Students will be trained in organization of food and agricultural processing plant machinery as per process flow, site selection, layout procedures, project design concepts, etc. will be explained for bringing the talent to establish an engineering industry.

Teaching-Learning Process (General Instructions)

These are sample Strategies, which teacher can use to accelerate the attainment of the various course outcomes.

1. Adopt different types of teaching methods to develop the outcomes through PowerPoint presentations and Video demonstrations or Simulations.
2. Chalk and Talk method for teaching basic concepts.
3. Arranging visits to farmers' fields to expose pupils to real time farming situations.
4. Adopt collaborative (Group Learning) Learning in the class.
5. By giving assignments and presentation tasks to students.
6. Exploring information from research publications and regulatory documents

Module-1

Plant layout – Definition, and principles, factors in planning layouts. Methods of layout planning – Unit areas concept, two – dimensional layouts, scale models. Principles of plant layout – Storage layout, equipment layout, safety, plant expansion, floor space, utilities servicing, building, materials handling equipment, rail road's and roads.

Module-2

Types of plant layout – salient features of horticultural, rice, maize, pulses, oil seeds, poultry, fish, meat, milk and milk product plants.

Module-3
Location selection criteria – Plant location, factors in selecting a plant, selection of the plant site, preparation of the layout. Selection of processes – Comparison of different processes, batch versus continuous operation. Plant capacity – Equipment design and specifications, scale – up in design, safety factors, specifications, materials of construction. Project design – Process design development, general overall design considerations, cost estimation, factors affecting profitability of investments, optimum design (economic and operation). Project design – Practical considerations in design, approach. Project design – Types of designs, feasibility survey, process development, design, construction and operation
Module-4
Flow diagrams-qualitative and quantitative flow diagrams. Selection of equipment – Preliminary design, problem statement, literature survey, material and energy balance, equipment design and selection, problems, economics. Process and controls-Control systems, instrumentation control, maintenance, computer aided design. Handling equipment - Selection, factors, pumps, piping, fittings, solid feeders, plant layout. Plant elevation - Requirement of plant building and its components, foundation for equipment and dynamic loading, flooring, walls, roof, illumination, air-conditioning. Labor requirement for processing plant - Labor costs, maintenance.
Module-5
Food plant sanitation-Environmental protection, regulations, pollution control, air pollution abatement, particulate removal, noxious gas removal, thermal pollution control, recycling, CIP. Cost analysis cost indexes - Cash flow for industrial operations, factors affecting investment and production costs, capital investment, and estimation of capital investment. Cost analysis – Cost indexes, cost factors in capital investment, estimation of total product cost. Preparation of feasibility report -Types of repots, organization of reports, organization of a design report, preparing the report, rhetoric, checklist for the final report
Course outcome (Course Skill Set) At the end of the course the student will be able to: CO1: Explain the principles of plant layout CO2: Select a suitable plant layout for a given product CO3: Use principal considerations for plant location and design of layout CO4: Describe the design criteria of plant building CO5: Estimate Cost indices, total product cost
Assessment Details (both CIE and SEE) The weightage of Continuous Internal Evaluation (CIE) is 50% and for Semester End Exam (SEE) is 50%. The minimum passing mark for the CIE is 40% of the maximum marks (20 marks out of 50) and for the SEE minimum passing mark is 35% of the maximum marks (18 out of 50 marks). A student shall be deemed to have satisfied the academic requirements and earned the credits allotted to each subject/ course if the student secures a minimum of 40% (40 marks out of 100) in the sum total of the CIE (Continuous Internal Evaluation) and SEE (Semester End Examination) taken together. **Continuous Internal Evaluation:** • For the Assignment component of the CIE, there are 25 marks and for the Internal Assessment Test component, there are 25 marks. • The first test will be administered after 40-50% of the syllabus has been covered, and the second test will be administered after 85-90% of the syllabus has been covered • Any two assignment methods mentioned in the 22OB2.4, if an assignment is project-based then only one assignment for the course shall be planned. The teacher should not conduct two assignments at the end of the semester if two assignments are planned. • For the course, CIE marks will be based on a scaled-down sum of two tests and other methods of assessment. **Internal Assessment Test question paper is designed to attain the different levels of Bloom's taxonomy as per the outcome defined for the course.**

Semester-End Examination:

Theory SEE will be conducted by University as per the scheduled timetable, with common question papers for the course (**duration 03 hours).**

- The question paper will have ten questions. Each question is set for 20 marks.
- There will be 2 questions from each module. Each of the two questions under a module (with a maximum of 3 sub-questions), **should have a mix of topics** under that module.
- The students have to answer 5 full questions, selecting one full question from each module.
- Marks scored shall be proportionally reduced to 50 marks

Suggested Learning Resources:

Books

1. Dairy and Food Engineering, Farall F W 1992. John Wiley & Sons, New York.
2. Plant Layout and Design, James M Moor, Macmillan, New York.
3. Milk Plant Layout, Hall H S and Y. Rosen, FAO publications, Rome.
4. Principles of Food Sanitation, Marriott N G 1985. Van Nostrand Reinhold Company, New York.
5. Food Technology Processing and Aylward F 2001. Allied Scientific Publishers, Bikaner. Laboratory Control.

Web links and Video Lectures (e-Resources):

Activity Based Learning (Suggested Activities in Class)/ Practical Based learning

- Quizzes
- Assignments
- Seminars
- Mini Projects

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Precision Agriculture and System Management		Semester	VII
Course Code	**BAG714D**	CIE Marks	50
Teaching Hours/Week (L:T:P: S)	3:0:0:0	SEE Marks	50
Total Hours of Pedagogy	40	Total Marks	100
Credits	03	Exam Hours	3
Examination nature (SEE)	**Theory**/practical/Viva-Voce /Term-work/Others		

Course Objectives:

- Precision agriculture aims to achieve maximum crop productivity using information and technology (IT) based farming.
- The spatial-temporal variability at farm level is optimized with the use of IT based farming resources in order to facilitate productivity of land resources with minimized production costs

Teaching-Learning Process (General Instructions)

These are sample Strategies, which teacher can use to accelerate the attainment of the various course outcomes.

1. Adopt different types of teaching methods to develop the outcomes through PowerPoint presentations and Video demonstrations or Simulations.
2. Chalk and Talk method for teaching basic concepts.
3. Arranging visits to farmers' fields to expose pupils to real time farming situations.
4. Adopt collaborative (Group Learning) Learning in the class.
5. By giving assignments and presentation tasks to students.
6. Exploring information from research publications and regulatory documents

Module-1

Definition, need and its functional requirements, history of green revolution, issues related to natural resources, farm level constraints for crop production, field level spatio-temporal variability in crop productivity, sources of variability and its influence on morphology, analysis of variability, crop land and productivity in India Familiarization with precision agriculture problems and issues, calculation of variability of resource map e.g., soil, land resources in terms of percentage, acreage and corresponding descriptive statistics.

Module-2

Familiarization with equipment for precision agriculture including sowing and planting machines, power sprayers, land clearing machines, laser guided land levellers, straw-chopper, straw-balers, grain combines, etc. Global Positioning System (GPS), differential GPS, grid sampling, remote sensors - aerial and satellite sensors, proximate sensors–drones, overview of indirect measurement of plant-soil health using spectral reflectance, replacing soil testing with sensor-based technology.

Module-3

Introduction to GIS, create maps and tables of properties associated with layer, create new layers using geospatial analysis of land and water resource layers, summarization of results as tables, maps and graphs, creation of geo database Using QGIS GIS software to add layers of soil and water resources, sensor data for a field level analysis of agricultural production and create a table and graph of yield data

Module-4

System concept in precision agriculture, need of a system concept, precision farming system strategy, capacity of system, system approach in farm machinery management, problems on machinery selection, maintenance, monitoring and scheduling of operations. Problems on system limitation, pattern efficiency, system capacity

Module-5

Planning and scheduling of precision agriculture, techniques and tools used for project planning – critical activities, minimum project time, Critical Path Method(CPM), Cost-time-trade-off, Project Evaluation and Review Technique (PERT), machinery system management using PERT and CPM, cost analysis and inflation, selection of equipment, replacement , break-even analysis and time value of money.

Course outcome (Course Skill Set)

At the end of the course the student will be able to :

CO1: Understand the issues and importance of precision agriculture
CO2: Explain tools and equipment used in precision agriculture
CO3: Apply the knowledge of GIS technology in precision agricultural operation and management
CO4: Explain the importance of system concept in precision agriculture
CO4: Apply the learnt knowledge to maximize crop productivity using precision farming

Assessment Details (both CIE and SEE)

The weightage of Continuous Internal Evaluation (CIE) is 50% and for Semester End Exam (SEE) is 50%. The minimum passing mark for the CIE is 40% of the maximum marks (20 marks out of 50) and for the SEE minimum passing mark is 35% of the maximum marks (18 out of 50 marks). A student shall be deemed to have satisfied the academic requirements and earned the credits allotted to each subject/ course if the student secures a minimum of 40% (40 marks out of 100) in the sum total of the CIE (Continuous Internal Evaluation) and SEE (Semester End Examination) taken together.

Continuous Internal Evaluation:

- For the Assignment component of the CIE, there are 25 marks and for the Internal Assessment Test component, there are 25 marks.
- The first test will be administered after 40-50% of the syllabus has been covered, and the second test will be administered after 85-90% of the syllabus has been covered
- Any two assignment methods mentioned in the 22OB2.4, if an assignment is project-based then only one assignment for the course shall be planned. The teacher should not conduct two assignments at the end of the semester if two assignments are planned.
- For the course, CIE marks will be based on a scaled-down sum of two tests and other methods of assessment.

Internal Assessment Test question paper is designed to attain the different levels of Bloom's taxonomy as per the outcome defined for the course.

Semester-End Examination:

Theory SEE will be conducted by University as per the scheduled timetable, with common question papers for the course (**duration 03 hours).**

- The question paper will have ten questions. Each question is set for 20 marks.
- There will be 2 questions from each module. Each of the two questions under a module (with a maximum of 3 sub-questions), **should have a mix of topics** under that module.
- The students have to answer 5 full questions, selecting one full question from each module.
- Marks scored shall be proportionally reduced to 50 marks

Suggested Learning Resources:

Books

1. Kent Shannon, D., Clay, D.E., and Kitchen, Newell, R., 2020. Precision agriculture basics, Wiley, USA
2. Zhang, Q., 2015. Precision agriculture technology for crop farming. CPC Press, Taylor Francis Group, USA
3. Snapp, S., and Pound, B., 2017. Agricultural systems, Agroecology and rural innovation for development. 2nd edition, Academic Press, Elsevier, UK.
4. James P. Lewis, 2004. Project planning, scheduling and control. 3 rd edition, Tata McGraw-Hill Publishing Company limited, New Delhi.

Web links and Video Lectures (e-Resources):

Activity Based Learning (Suggested Activities in Class)/ Practical Based learning

- Quizzes
- Assignments
- Seminars
- Mini Projects

Solar Photovoltaic System		Semester	VII
Course Code	**BAG755A**	CIE Marks	50
Teaching Hours/Week (L:T:P: S)	3:0:0:0	SEE Marks	50
Total Hours of Pedagogy	40	Total Marks	100
Credits	03	Exam Hours	3
Examination nature (SEE)	**Theory**/practical/Viva-Voce /Term-work/Others		

Course Objectives:

- To develop a comprehensive technological understanding in solar PV system components
- To provide in-depth understanding of design parameters to help design and simulate the performance of a solar PV power plant
- To pertain knowledge about planning, project implementation and operation of solar PV power generation

Teaching-Learning Process (General Instructions)

These are sample Strategies, which teacher can use to accelerate the attainment of the various course outcomes.

1. Adopt different types of teaching methods to develop the outcomes through PowerPoint presentations and Video demonstrations or Simulations.
2. Chalk and Talk method for teaching basic concepts.
3. Arranging visits to farmers' fields to expose pupils to real time farming situations.
4. Adopt collaborative (Group Learning) Learning in the class.
5. By giving assignments and presentation tasks to students.
6. Exploring information from research publications and regulatory documents

Module-1

Introduction

Sources of renewable energy; global potential for solar electrical energy systems. Solar radiation. Extra terrestrial and terrestrial solar spectrum; clear sky direct-beam radiation; total clear sky insulation on a collecting surface; radiation on the collector in tracking systems; calculation of average monthly insolation from measured data

Module-2

PV cells and modules

Solar Cell and its function, Solar Technologies, Solar Cell Parameters, Efficiency of Solar Cell, Solar PV Module, Rating of Solar PV Module, PV Module Parameters, Efficiency of PV Module, Measuring Module Parameters

Module-3

Solar Photovoltaic Module Array

Connection of PV Module in Series and Parallel, Estimation and Measurement of PV Module Power, Selection of PV Module.

Module-4

Solar PV System Design and Integration

Solar Radiation Energy Measurements, Estimating Energy requirement, Types of Solar PV System, Design methodology for SPV system, Design of Off Grid Solar Power Plant, Case studies of 3KWp Off grid Solar PV Power Plant, Design and Development of Solar Street Light and Solar Lantern, Off Grid Solar Power Plant.

Module-5

Solar collectors and Solar energy storage

Different types of solar collectors, Flat plate and concentrated type collectors, Fundamental Terminologies of thermal storage, Sensible heat storage materials, Latent heat storage materials, Solar thermo-chemical energy storage systems, Advantages and disadvantages of solar thermal storage, application of thermal storage.

Course outcome (Course Skill Set)

At the end of the course the student will be able to :

CO1: Understand of renewable and non-renewable sources of energy

CO2: Gain knowledge about working principle of various solar energy systems

CO3: Analyse the solar power PV power generation

CO4: pplying the knowledge on to installation and integration of PV modules for different applications

CO5: Understand the operation of different solar collectors in the market

CO6: Understand the solar thermal energy storage systems

Assessment Details (both CIE and SEE)

The weightage of Continuous Internal Evaluation (CIE) is 50% and for Semester End Exam (SEE) is 50%. The minimum passing mark for the CIE is 40% of the maximum marks (20 marks out of 50) and for the SEE minimum passing mark is 35% of the maximum marks (18 out of 50 marks). A student shall be deemed to have satisfied the academic requirements and earned the credits allotted to each subject/ course if the student secures a minimum of 40% (40 marks out of 100) in the sum total of the CIE (Continuous Internal Evaluation) and SEE (Semester End Examination) taken together.

Continuous Internal Evaluation:

- For the Assignment component of the CIE, there are 25 marks and for the Internal Assessment Test component, there are 25 marks.
- The first test will be administered after 40-50% of the syllabus has been covered, and the second test will be administered after 85-90% of the syllabus has been covered
- Any two assignment methods mentioned in the 22OB2.4, if an assignment is project-based then only one assignment for the course shall be planned. The teacher should not conduct two assignments at the end of the semester if two assignments are planned.
- For the course, CIE marks will be based on a scaled-down sum of two tests and other methods of assessment.

Internal Assessment Test question paper is designed to attain the different levels of Bloom's taxonomy as per the outcome defined for the course.

Semester-End Examination:

Theory SEE will be conducted by University as per the scheduled timetable, with common question papers for the course (**duration 03 hours).**

- The question paper will have ten questions. Each question is set for 20 marks.
- There will be 2 questions from each module. Each of the two questions under a module (with a maximum of 3 sub-questions), **should have a mix of topics** under that module.
- The students have to answer 5 full questions, selecting one full question from each module.
- Marks scored shall be proportionally reduced to 50 marks

Suggested Learning Resources:

Books

1. Chetansingh Solanki, *Solar Photovoltaic* PHI, Learning private ltd., New Delhi- 2018
2. G.D Rai, *Non-conventional Sources of Energy* Khanna Publishers, Delhi, 2012
3. Chetan Singh Solanki, *Renewable Energy Technologies; A Practical Guide for Beginners* PHI School Books (2008)
4. Kothari D.P. and Signal K.C, *Renewable Energy Sources and Emerging Technologies*, New Arrivals –PHI; 2nd Edition (2011)

Web links and Video Lectures (e-Resources):

Activity Based Learning (Suggested Activities in Class)/ Practical Based learning

- Quizzes
- Assignments
- Seminars
- Mini Projects

Principles of Agronomy & Soil Science		Semester	VII
Course Code	**BAG755B**	CIE Marks	50
Teaching Hours/Week (L:T:P: S)	3:0:0:0	SEE Marks	50
Total Hours of Pedagogy	40	Total Marks	100
Credits	03	Exam Hours	3
Examination nature (SEE)	**Theory**/practical/Viva-Voce /Term-work/Others		

Course Objectives:

- To impart Knowledge on Soil genesis, properties etc, so as to enable students to design implements in related to soil, soil conservation, irrigation and drainage applications.
- Also, to enable students to understand farming principles, to grow agricultural field and orchard crop and farming practices.

Teaching-Learning Process (General Instructions)

These are sample Strategies, which teacher can use to accelerate the attainment of the various course outcomes.

1. Adopt different types of teaching methods to develop the outcomes through PowerPoint presentations and Video demonstrations or Simulations.
2. Chalk and Talk method for teaching basic concepts.
3. Arranging visits to farmers' fields to expose pupils to real time farming situations.
4. Adopt collaborative (Group Learning) Learning in the class.
5. By giving assignments and presentation tasks to students.
6. Exploring information from research publications and regulatory documents

Module-1

Tillage and tilth, Objective of tillage, characteristic of good seed bed, effect of tillage on soil properties (Pore space, texture, structure, bulk density, color of the soil), Types of Tillage, preparatory cultivation, inter cultivation, after cultivation and preparatory cultivation for lowland rice pudding, implement used for seed bed preparation, sowing, inter-cultivation and special operation, Sowing, Methods and time of application of manure and fertilizers. Weeds-Influence of weeds on crop production, principles and practices of weed management, Basics on soil plant-water relationship, Types of Soil Erosion, Factors influencing soil erosion, Agronomic measures for soil and water conservation, Dry land Agriculture, Problems of Crop production in dry farming, Agronomic measure in reducing evapo-transpiration losses, Watershed management.

Module-2

Irrigation water: Quality of irrigation water-classification based on EC, SAR, RSC and Boron content-use of saline waters in agriculture, Soil taxonomy: New comprehensive system of soil classification (7^{th} approximation) soil orders and their characteristics, Important soil groups of India: Alluvial soils-black soils–red soils laterite soils and coastal soils Irrigation water: Quality of irrigation water-classification based on EC, SAR, RSC and Boron content-use of saline waters in agriculture, Soil taxonomy: New comprehensive system of soil classification (7^{th} approximation) soil orders and their characteristics, Important soil groups of India: Alluvial soils-black soils –red

Module-3

Classification of crops, Classification of field crops, According to Origin, Botanical Commercial, Economical, seasonal, Ontogeny, Agronomic, Lead Morphology and Special Purpose crops, Definition of climate and weather, Definition of meteorology, Climatology, Agri- meteorology, Introduction, scope and practical utility of Agricultural meteorology, composition and structure of atmosphere, Influence of weather on crop grain development, essential Resources for crop production, factors influencing plant growth, Biotic and Abiotic factors, Crop seasons, Kharif, Rabi and summer seasons in Karnataka.-Agro-climatic zones of Karnataka and India.

Module-4

Secondary silicate clay minerals (inorganic soil colloids) Kaolinitemontmoriloniteillite their structures and properties, Ion exchange, Cation and anion exchange–factors influencing ion exchange capacity of soils importance of ion exchange calculation of base saturation and exchangeable acidity, Soil organic matter: importance of organic matter CN ration of organic matter and its importance, Soil biology;-Soil flora and fauna their characteristics role of

beneficial organisms mineralization–immobilization, nitrogen fixation, nitrification, denitrification, solubilisation of phosphorus and sulphur, Soil fertility:- Concepts of soil fertility and soil productivity.

Module-5

Soil: Definition –soil as a three phase four component system-branches of Soil science difference between surface and sub surface soil, Rocks: Definition – classification of rocks based on mode of formation-igneous sedimentary and metamorphic rocks, Minerals: Definition, classification,Weathering:- Definition-types of weathering physical weathering of rocks, agents of physical weathering, temperature, water, wind and glaciers, Chemical weathering, solution, hydration, hydrolysis carbonation-oxidation-reduction biological weathering role of plants and animals in weathering. Soil formation: Soil forming factors–active and passive soil factors and their role in soil formation, Soil forming processes, Soil structure; Definition-classification, Soil structure; Definition-classification based on type, class and grade-factors influencing formation of aggregate.

Course outcome (Course Skill Set)

At the end of the course the student will be able to:

CO1: In modern terminology however, the word has come to mean and denote a branch of science dealing with all aspects of crop cultivation and production.

CO2: A study of agronomy often involves a summoning of resources from related disciplines such as Botany, Soil Science, Irrigation, plant protection, Plant Genetics and Breeding, Agrometeorology etc

CO3 : Cropping seasons of India. Soil formation, classification, physical, chemical properties. Identification of important crops and crop seeds.

CO.4: Knowledge about Indian Agriculture and importance, present status, scope and future prospect

Assessment Details (both CIE and SEE)

The weightage of Continuous Internal Evaluation (CIE) is 50% and for Semester End Exam (SEE) is 50%. The minimum passing mark for the CIE is 40% of the maximum marks (20 marks out of 50) and for the SEE minimum passing mark is 35% of the maximum marks (18 out of 50 marks). A student shall be deemed to have satisfied the academic requirements and earned the credits allotted to each subject/ course if the student secures a minimum of 40% (40 marks out of 100) in the sum total of the CIE (Continuous Internal Evaluation) and SEE (Semester End Examination) taken together.

Continuous Internal Evaluation:

- For the Assignment component of the CIE, there are 25 marks and for the Internal Assessment Test component, there are 25 marks.
- The first test will be administered after 40-50% of the syllabus has been covered, and the second test will be administered after 85-90% of the syllabus has been covered
- Any two assignment methods mentioned in the 22OB2.4, if an assignment is project-based then only one assignment for the course shall be planned. The teacher should not conduct two assignments at the end of the semester if two assignments are planned.
- For the course, CIE marks will be based on a scaled-down sum of two tests and other methods of assessment.

Internal Assessment Test question paper is designed to attain the different levels of Bloom's taxonomy as per the outcome defined for the course.

Semester-End Examination:

Theory SEE will be conducted by University as per the scheduled timetable, with common question papers for the course (**duration 03 hours).**

- The question paper will have ten questions. Each question is set for 20 marks.
- There will be 2 questions from each module. Each of the two questions under a module (with a maximum of 3 sub-questions), **should have a mix of topics** under that module.
- The students have to answer 5 full questions, selecting one full question from each module.
- Marks scored shall be proportionally reduced to 50 marks

Suggested Learning Resources:

Books

1. Principles of Agronomy, Yella Manda Reddy T & Shanka r Reddy, Publications.
2. Nature and Properties of soils. Brady Nyle C and Ray R Well 2002. Pearson Education Inc., New Delhi.
3. Fundamental of Soil Science. Indian Society of Soil Science1988. IARI, New Delhi.

Web links and Video Lectures (e-Resources):

Activity Based Learning (Suggested Activities in Class)/ Practical Based learning

- Quizzes
- Assignments
- Seminars
- Mini Projects

Fundamentals of Urban Planning		Semester	**VII**
Course Code	**BAG755C**	CIE Marks	50
Teaching Hours/Week (L:T:P: S)	3:0:0:0	SEE Marks	50
Total Hours of Pedagogy	40	Total Marks	100
Credits	03	Exam Hours	3
Examination nature (SEE)	**Theory**/practical/Viva-Voce /Term-work/Others		

Course Objectives:

- The course is meant primarily for students to familiarize with the urban planning issues, objectives, framework, process, techniques and components. The subject also exposes the students about various planning legislation and norms

Teaching-Learning Process (General Instructions)

These are sample Strategies, which teacher can use to accelerate the attainment of the various course outcomes.

1. Adopt different types of teaching methods to develop the outcomes through PowerPoint presentations and Video demonstrations or Simulations.
2. Chalk and Talk method for teaching basic concepts.
3. Arranging visits to farmers' fields to expose pupils to real time farming situations.
4. Adopt collaborative (Group Learning) Learning in the class.
5. By giving assignments and presentation tasks to students.
6. Exploring information from research publications and regulatory documents

Module-1

EVOLUTION OF TOWN PLANNING: Evolution in planning and physical form, Concept of urban human settlement, Differentiation between rural and urban settlement, concept of town, Evolved and Created Town Characteristics, Features of urban planning process, Role of urban planner, Genesis of urban form; Social, Geographical and Cultural impacts, Contemporary developments in planning,

Module-2

URBANISATION: Demography and Census Statistics- Significance of Census and Demographics- Planning policies framed based on Census-Use of Census Data in Urban Planning Rural and urban Migration, impacts of urbanisation, socio – economic impacts of growth of population, Social and Economic Environmental Administrator, Levels of Urbanisation, Indian scenario - Issues and Policies, Global scenario, Future trends of urbanization - Impact of Government Policies on Urbanization

Module-3

GROWTH PATTERNS: Elements of town structure, Town classification: Functional and geographical; City Centre, Walled city and Urban Fringe areas; classification based on socio-cultural characteristics, changes with time and growth, growth theories, Characteristics of the urban environment and its components, land use, Modern urban forms. Peri- Urban Areas- Urban Fringe- Issues

Module-4

URBAN LAND USE PLANNING: Objectives and Principles of Urban planning; Different Land use planning norms, Environmental aspects of land use planning, Role of URDPFI guidelines in Town planning, Land use Structures, demand and supply of land relationship, Government policies of urban development, Role of Professional bodies

Module-5

PLANNING SURVEYS: Objectives, types, significance, methodology, analysis, and applications; Planning parameters, aims, objectives, principles, methodology and systems approach, environmental parameters.

AREA PLANNING: Concept of Neighbourhood Planning, Satellite Towns, Government Policies for small and medium towns, Urban and Rural Planning Rural-Urban Fring.

Course outcome (Course Skill Set)

At the end of the course the student will be able to :

CO1. Understand town planning concepts and theories
CO2. Recognize the concepts for different area planning
CO3. Identify different growth patterns and models
CO4. Implement different guidelines, norms, land use planning policies, and survey techniques

Assessment Details (both CIE and SEE)

The weightage of Continuous Internal Evaluation (CIE) is 50% and for Semester End Exam (SEE) is 50%. The minimum passing mark for the CIE is 40% of the maximum marks (20 marks out of 50) and for the SEE minimum passing mark is 35% of the maximum marks (18 out of 50 marks). A student shall be deemed to have satisfied the academic requirements and earned the credits allotted to each subject/ course if the student secures a minimum of 40% (40 marks out of 100) in the sum total of the CIE (Continuous Internal Evaluation) and SEE (Semester End Examination) taken together.

Continuous Internal Evaluation:

- For the Assignment component of the CIE, there are 25 marks and for the Internal Assessment Test component, there are 25 marks.
- The first test will be administered after 40-50% of the syllabus has been covered, and the second test will be administered after 85-90% of the syllabus has been covered
- Any two assignment methods mentioned in the 22OB2.4, if an assignment is project-based then only one assignment for the course shall be planned. The teacher should not conduct two assignments at the end of the semester if two assignments are planned.
- For the course, CIE marks will be based on a scaled-down sum of two tests and other methods of assessment.

Internal Assessment Test question paper is designed to attain the different levels of Bloom's taxonomy as per the outcome defined for the course.

Semester-End Examination:

Theory SEE will be conducted by University as per the scheduled timetable, with common question papers for the course (**duration 03 hours).**

- The question paper will have ten questions. Each question is set for 20 marks.
- There will be 2 questions from each module. Each of the two questions under a module (with a maximum of 3 sub-questions), **should have a mix of topics** under that module.
- The students have to answer 5 full questions, selecting one full question from each module.
- Marks scored shall be proportionally reduced to 50 marks

Suggested Learning Resources:

Books

1. A.B. Gillion and Simon Eisner, "The Urban Pattern", CBS Publishers and Distributors, Delhi.
2. Rishma A., "Town Planning in Hot Cities", Mir Publishers, Moscow.
3. Ward S (2002), "Planning the 20th Century City" John Wiler & Sons.
4. R. Ramachandran, "Urbanisation and Urban Systems in India", Oxford Publications.
5. K. C. Shivrama Krishnan, "Revisioning Indian Cities", Sage Publications.

Web links and Video Lectures (e-Resources):

Activity Based Learning (Suggested Activities in Class)/ Practical Based learning

- Quizzes
- Assignments
- Seminars
- Mini Projects

Generation of Energy through Waste		Semester	**VII**
Course Code	**BAG755D**	CIE Marks	50
Teaching Hours/Week (L:T:P: S)	3:0:0:0	SEE Marks	50
Total Hours of Pedagogy	40	Total Marks	100
Credits	03	Exam Hours	3
Examination nature (SEE)	**Theory**/practical/Viva-Voce /Term-work/Others		

Course Objectives:

- To enable students to understand of the concept of Waste to Energy.
- To link legal, technical and management principles for production of energy form waste.
- To learn about the best available technologies for waste to energy.
- To analyze of case studies for understanding success and failures.
- To facilitate the students in developing skills in the decision-making process.

Teaching-Learning Process (General Instructions)

These are sample Strategies, which teacher can use to accelerate the attainment of the various course outcomes.

1. Adopt different types of teaching methods to develop the outcomes through PowerPoint presentations and Video demonstrations or Simulations.
2. Chalk and Talk method for teaching basic concepts.
3. Arranging visits to farmers' fields to expose pupils to real time farming situations.
4. Adopt collaborative (Group Learning) Learning in the class.
5. By giving assignments and presentation tasks to students.
6. Exploring information from research publications and regulatory documents

Module-1

Introduction: The Principles of Waste Management and Waste Utilization. Waste Management Hierarchy and 3R Principle of Reduce, Reuse and Recycle. Waste as a Resource and Alternate Energy source.

Waste Sources & Characterization: Waste production in different sectors such as domestic, industrial, agriculture, postconsumer, waste etc. Classification of waste – agro based, forest residues, domestic waste, industrial waste (hazardous and non-hazardous). Characterization of waste for energy utilization. Waste Selection criteria.

Module-2

Technologies for Waste to Energy: Biochemical Conversion – Energy production from organic waste through anaerobic digestion and fermentation. Thermo-chemical Conversion – Combustion, Incineration and heat recovery, Pyrolysis, Gasification; Plasma Arc Technology and other newer technologies.

Module-3

Waste to Energy Options: Landfill gas, collection and recovery. Refuse Derived Fuel (RDF) – fluff, briquettes, pellets. Alternate Fuel Resource (AFR) – production and use in Cement plants, Thermal power plants and Industrial boilers. Conversion of wastes to fuel resources for other useful energy applications

Module-4

Centralized and Decentralized Waste to Energy: Plants Waste activities – collection, segregation, transportation and storage requirements. Location and Siting of 'Waste to Energy' plants. Industry Specific Applications – In-house use – sugar, distillery, pharmaceuticals, Pulp and paper, refinery and petrochemical industry and any other industry. Centralized and Decentralized Energy production, distribution and use. Comparison of Centralized and decentralized systems and its operations.

Module-5

Waste To Energy & Environmental Implications: Environmental standards for Waste to Energy Plant operations and gas clean-up. Savings on non-renewable fuel resources. Carbon Credits: Carbon foot calculations and carbon credits transfer mechanisms.

Course outcome (Course Skill Set)

At the end of the course the student will be able to :

CO1: Apply the knowledge about the operations of Waste to Energy Plants.
CO2:Analyse the various aspects of Waste to Energy Management Systems.
CO3:Carry out Techno-economic feasibility for Waste to Energy Plants.
CO4: Apply the knowledge in planning and operations of Waste to Energy plants.

Assessment Details (both CIE and SEE)

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- The students have to answer 5 full questions, selecting one full question from each module.
- Marks scored shall be proportionally reduced to 50 marks

Suggested Learning Resources:

Books

1. Desai Ashok V., Non Conventional Energy, Wiley Eastern Ltd., 1980.
2. Pichtel John, Waste Management Practices Municipal, Hazardous and Industrial, Taylor & Francis, 2005.
3. Industrial and Urban Waste Management in India, TERI Press. Wealth from Waste: Trends and Technologies by Banwari Lal and Patwardhan, TERI Press.
4. Fundamentals of waste and Environmental Engineering, S.N Mukhopadhyay, TERIPress. Gazette Notification on Waste Management Rules 2016.
5. CPCB Guidelines for Co-processing in Cement/Power/Steel Industry Waste-to-Energy in Austria – White Book – Figures, Data Facts, 2nd edition , May 2010 Report of the task Force on Waste to Energy, Niti Ayog (Formerly Planning Commission) 2014.
6. Municipal Solid Waste Management Manual, CPHEEO, 2016

Web links and Video Lectures (e-Resources):

- www.envfor.nic.in
- www.cpcb.nic.in
- www.mnre.gov.in
- www.eai.in/ref/ae/wte/typ/clas/india_industrial_wastes.html
- www.teriin.org/projects/green/pdf/National-Waste.pdf

Activity Based Learning (Suggested Activities in Class)/ Practical Based learning

- Quizzes
- Assignments
- Seminars
- Mini Projects

8th semester Syllabus

All courses in 8th semester are of online courses and hence syllabus need not to mention from VTU side.

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