Semester	**:**	**I**		
Course No.	**:**	**COMP-111**	**Credit Hrs.**	**: 3(2+1)**
Course Title	**:**	**Agricultural Informatics and Artificial Intelligence**		

SYLLABUS

Objectives:

(i) To acquaint students with the basics of computer applications in Agriculture, multimedia, database management, application of mobile apps and decision-making processes etc.,

(ii) To provide basic knowledge of computer with applications in Agriculture,

(iii) To make the students familiar with Agricultural-Informatics, its components and applications in Agriculture and Artificial Intelligence.

THEORY

Introduction to Computers, Anatomy of Computers, Memory Concepts, Units of Memory, Operating System: Definition and types, Applications of MS-Office for creating, Editing and Formatting a document, Data presentation, Tabulation and graph creation, Statistical analysis, Mathematical expressions, Database, concepts and types, creating database, Uses of DBMS in Agriculture, Internet and World Wide Web (WWW): Concepts and components. Computer programming: General concepts, Introduction to Visual Basic, Java, Fortran, C/C++, etc. concepts and standard input/output operations. e-Agriculture, Concepts, design and development; Application of innovative ways to use information and communication technologies (IT) in Agriculture, Computer Models in Agriculture: Statistical, weather analysis and crop simulation models, concepts, structure, input-output files, limitation, advantages and application of models for understanding plant processes, sensitivity, verification, calibration and validation, IT applications for computation of water and nutrient requirement of crops, Computer-controlled devices (automated systems) for Agri-input management, Smartphone mobile apps in agriculture for farm advice: Market price, postharvest management etc. Geospatial technology: Concepts, techniques, components and uses for generating valuable agri-information, Decision support systems: Concepts, components and applications in Agriculture. Agriculture Expert System, Soil Information Systems etc. for supporting farm decisions. Preparation of contingent crop planning and crop calendars using IT tools, Digital India and schemes to promote digitalization of agriculture in India. Introduction to artificial intelligence, background and applications, Turing test. Control strategies, Breadth-first search, Depth-first search, Heuristics search techniques: Best-first search, A*algorithm, IoT and Big Data; Use of AI in Agriculture for autonomous crop management, and health, monitoring livestock health, intelligent pesticide application, yield mapping and predictive analysis, automatic weeding and harvesting, sorting of produce, and other food processing applications; Concepts of Smart Agriculture, Use of AI in food and nutrition science etc.

PRACTICAL

Study of computer components, accessories, practice of important DoS Commands, Introduction of different operating systems such as Windows, Unix/ Linux, creating files and folders, File Management. Use of MS-WORD and MS PowerPoint for creating, editing and presenting a scientific document, MS- EXCEL - Creating a spreadsheet, Use of statistical tools, Writing expressions, Creating graphs, Analysis of scientific data, Handling macros. MS-ACCESS: Creating Database, preparing queries and reports, Demonstration of Agri- information system, Introduction to World Wide Web (WWW) and its components, Introduction of programming languages such as Visual Basic, Java, Fortran, C, C++, Hands on practice on Crop Simulation Models (CSM), DSSAT/Crop-Info/Crop Syst/ Wofost, Preparation of inputs file for CSM and study of model outputs, computation of water and nutrient requirements of crop using CSM and IT tools, Use of smart phones and other devices in agro-advisory and dissemination of market information, Introduction of Geospatial Technology, Hands on practice on preparation of Decision Support System, Preparation of contingent crop planning, India Digital Ecosystem of Agriculture (IDEA).

TEACHING SCHEDULE

THEORY [COMP-111]

Lecture No.	Topic	Sub-topics/ Key Points	Weightage (%)
1-3	**Introduction to Computers,** **Anatomy of Computers** **Memory Concepts:** **Operating System:**	Definitions Characteristics of Computer Components of Computer CPU: CU, ALU, MU Input Devices; Output Devices; Units of Memory: bit to TB, Types: Primary, Secondary Definitions and Types: Single user, Multiuser and features. OS Special Types (Brief Overview): Batch, Real-Time, Time Sharing, Distributed, Network OS. Functions of operating system	7
4-6	**Applications of MS-Office**	MS Word: Creating a New Document formatting option features Insertion of Table MS Excel: creating work sheet and graph, Functions for Data Analysis: AVERAGE, COUNT, SUM, MIN, MAX, MEDIAN, MODE, STDEV, STDEVP, VAR, VARP, CORREL, PERCENTILE Mathematical functions in excel: SUM, AVERAGE, AVERAGEIF, COUNT, COUNTIF, MOD, ROUND	7
7-9	**Database and DBMS**	Database, concepts and types, creating database, Uses of DBMS in Agriculture. Database concepts Database- Definition: Characteristics of Database Structure of Database Management System Tables: Concept of view, Primary key, Foreign key Creating database: SQL query: Create, Insert, Select, Delete, Update. Form: Steps for Creating Forms, Entering Data in forms Report using MS-ACCESS: Steps for Creating Reports, Printing reports.	7

Continued…

10	**Internet and World Wide Web (www)**	Concepts and components Internet: Introduction Definition of LAN, WAN, MAN and Internet Internet Service Provider (ISP) World Wide Web; Hypertext Web Browser Web Page and Websites E-Mail: Creating Email, Email Addresses, Using Email, Sending the message, CC and BCC; Search Engine	7
11-12	**Computer Programming**	General concepts, Introduction to Visual basic, java, FORTRAN, C, C++ etc.: concepts and standard input/output operations. C 'language - character set, data type, concepts and standard input/output – scanf( ), printf( ) operations Assignment - any five C simple language program	7
13-14	**e-Agriculture**	Concepts, Importance of IT in e-Agril., AGRINET: Introduction, Objectives. Advantages and Challenges in Agriculture.	7
15-16	**Crop Simulation Models**	Crop Simulation Models Definition, Concept: Requirement of Good Modeling. Input-output files, limitation, advantages Types: Statistical Models, weather analysis Dynamic Models, Mechanistic Models, Functional Models and Crop Modeling. Classifications of Models based on their Applications: Primary Model, Comprehensive Model, Summary of Model, Characteristics of Models, Uses of Models	7
17-19	**IOT and IT Applications in Agriculture**	IoT Definition, Challenges and Benefits of IOT in Agriculture Use of IoT Applications in Agriculture: Precision Farming, Agricultural Drones, Smart Greenhouses. IT Applications in Agriculture for Computation of Water and Nutrient Requirement of Crop. Role of IT Application in water and nutrient requirement. Brief introduction of: Computation of water and nutrient requirement using weather parameters. Advantages	7

Continued…

20-21	**Computer-controlled Devices (Automated systems), Smartphone Apps and GPS**	Computer-controlled devices (automated systems) for Agri-input management- Examples of Automation Devices: Robotics Application in Planting, Drones for Irrigation, Harvest Automation Tools, Automated Tractors etc. AWS - Automatic Weather Station. AIS - Automatic Irrigation System. Smartphone Mobile Apps in Agriculture: Introduction- Irrigation Systems, Fertilizer Application, Pest and Disease Management Seeding and Planting, Harvesting Systems Weather Forecasting, Soil Testing and Analysis, Crop Management, Market Prices Farm Management, Financial and Insurance Services; Introduction and Uses to Geospatial Technology.	7
22-23	**Decision Support System (DSS)**	Decision support systems (DSS) Introduction, Concepts, Components, Types and Applications in Agriculture.	7
24-25	**Agriculture Expert System (AES)**	Introduction, Concepts, Components and Applications in Agriculture.	7
26-27	**Contingent / Crop Planning Calendars using IT Tools**	Introduction, Definition, Benefits, Steps to Prepare Contingent Crop Planning using IT Tools.	7
28-30	**Introduction and Uses to Artificial Intelligence and Overview**	Introduction and its uses to Artificial Intelligence and Overview and Examples of AI in Agriculture - Turing test. Control strategies, Breadth-first search, Depth-first search, Heuristics search techniques: Best-first search, A* algorithm, IoT and Big Data; (Autonomous crop management and health, monitoring livestock health, intelligent pesticide application, yield mapping and predictive analysis, automatic weeding and harvesting, sorting of produce and other food processing applications).	8
31-32	**Digital India and Schemes to promote Digitalization of Agriculture in India**	Digital India and Schemes to promote Digitalization of Agriculture in India: Digital Agriculture in India: Status, Challenge, Digital India and Initiatives in Agriculture Sector. Digital Agriculture or NeGP-A 2.0	8
		Total	**100**

TEACHING SCHEDULE

PRACTICAL [COMP-111]

Exercise No.	Exercise Title
1-2	Study of computer components, accessories, practice of important DOS command Introduction to different Operating systems such as Windows, Unix/ Linux Creating files and folders, Files Management.
3-4	Use of MS-WORD, creating files and folders, files management and MS-POWERPOINT Presentation for creating, editing and presenting scientific documents. MS-EXCEL- Mathematical calculations, Preparation of Spread sheets. Use of statistical tools, Writing expressions, Creating graphs, Analysis of scientific data Handling Macros, MS-EXCEL chart-Line, XY, Bar and Pie
5-6	MS-ACCESS- Creating Database, Preparing queries and reports.
7-8	Program in C-Language: a) Program to enter name and print name. b) Program to calculate sum and subtraction of numbers. c) Program to calculate Area of Circle. d) Program to calculate Area of Triangle e) Program to calculate Area of Rectangle.
9	Introduction to Internet, World Wide Web (WWW).
10-11	Hands-on Practice on Crop Simulation Model (CSM)(:- CROPWAT 8.0.
12-13	Use of Smartphone Apps (Developed by SAU).
14-15	Hands-on Practice on Decision Support System (DSS).
16	Introduction to India Digital Ecosystem of Agriculture (IDEA).

Suggested Readings [COMP-111]:

1. Fundamentals of Computer by V. Rajaraman.
2. Introduction to Information Technology by Pearson.
3. Introduction to Database Management System by C. J. Date.
4. Concepts and Techniques of Programming in C by Dhabal Prasad Sethi and Manoranjan, Wiley India.
5. Introductory A g r i Informatics by Mahapatra, Subrat K et al, Jain Brothers Publication.
6. Russell, Stuart, Artificial Intelligence: A Modern Approach, Pearson Edition 2013.
7. Nilson N.J. 2001. Principles of Artificial Intelligence. Narosa.
8. Agricultural Informatics and Artificial Intelligence for B Tech (Agricultural Technology) by Prashant Publication.

Online resources: ***(COMP-111)***

- https://en.wikipedia.org/wiki/Computer
- https://www.javatpoint.com/computer
- https://iasri.icar.gov.in/
- https://www.nrsc.gov.in/EO_Agr_Objective?language_content_entity=en
- https://www.agrimoon.com
- https://www.agriinfo.in
- https://eagri.org
- https://www.agriglance.com
- https://agritech.tnau.ac.in
- https://loksabhadocs.nic.in/Refinput/New_Reference_Notes/English/Agriculture_and_Digital_India.pdf
- https://www.investindia.gov.in/team-india-blogs/digitalisation-agriculture-india
- http://courseware.cutm.ac.in/wp-content/uploads/2020/06/Session-11-Preparation-of-Contingent-Crop-Planning-and-Crop-Calendars-Using-IT-Tools.pdf
- https://optimizeias.com/indias-digital-ecosystem-for-agriculture/
- https://www.igi-global.com/chapter/introduction-to-agricultural-information-systems/266572#:~:text=Agricultural%20Information%20Systems%3A%20Information%20system,knowledge%20utilization%20by%20agricultural%20producers.
- https://cropcalendar.apps.fao.org/#/home
- http://www.irdindia.in/journal_ijrdmr/pdf/vol4_iss1/7.pdf
- https://learn.microsoft.com/en-us/office365/servicedescriptions/office-applications-service-description/office-applications
- https://ebooks.inflibnet.ac.in/hsp16/chapter/application-of-software-in-statisticalanalysis-i-microsoft-excel/
- http://eagri.org/eagri50/STAM102/index.html
- https://edu.gcfglobal.org/en/internetbasics/using-a-web-browser/1/
- https://www.javatpoint.com/what-is-world-wide-web
- https://www.mdpi.com/journal/agriculture/special_issues/Decision_Support_Systems_Application
- https://apps.gov.in/ministry/ministry-agriculture
- http://courseware.cutm.ac.in/wp-content/uploads/2020/06/Session-11-Preparation-of-Contingent-Crop-Planning-and-Crop-Calendars-Using-IT-Tools.pdf
- https://apps.mgov.gov.in/apps_by_category;jsessionid=8206D0DAE69F48FB50962462A8922C23?name=Agriculture

Tools available for Student for Academic Purpose only: ***(COMP-111)***

1. DSSAT (Decision Support System for Agrotechnology Transfer)
   - Purpose: A comprehensive crop modeling tool.
   - Use: Simulates plant growth, development, and yield for various crops under different management and environmental conditions.
   - Download: https://dssat.net/
2. APSIM (Agricultural Production Systems Simulator)
   - Purpose: A powerful plant simulation tool.
   - Use: Models the effects of environmental variables like soil, climate, and management strategies on plant growth and crop yield.
   - Download: https://www.apsim.info/
3. Open Sim Root
   - Purpose: A root growth modeling software.
   - Use: Helps understand plant root growth processes, interactions with soil, and how they respond to environmental conditions.
   - Download: Available as open-source software via research platforms like Git Hub. https://gitlab.com/rootmodels/OpenSimRoot
4. Virtual Plant
   - Purpose: A tool for visualizing and modeling plant metabolic and regulatory networks.
   - Use: Helps in understanding complex plant processes such as gene regulation, metabolic pathways, and how they respond to environmental conditions.

     Download: https://sourceforge.net/projects/virtualplant/
5. R Studio (with Bioconductor and Plant Modeling Libraries)
   - Purpose: A programming environment for statistical computing.
   - Use: Using plant modeling libraries like plant and photosynthesis, researchers can model plant growth, carbon assimilation, and nutrient cycling.
   - Download: https://posit.co/downloads/
6. WOFOST (World Food Studies)
   - Purpose: A plant process and crop growth simulation model developed by the FAO.
   - Use: Helps in understanding crop development, photosynthesis, and biomass accumulation under different environmental and management conditions.
   - Download: https://www.wur.nl/en/research-results/research-institutes/environmental-research/facilities-tools/software-models-and-databases/wofost/downloads-wofost.htm
7. Green Lab
   - Purpose: A plant growth model focused on plant architecture and functional growth processes.
   - Use: Simulates plant organ development and growth processes, integrating functional and structural aspects of plant behavior.
   - Download: https://greenlab.cirad.fr/GLUVED/html/P3_Tools/Tool_simul_003.html