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by 23rd Academic council (Agenda no-03)

B.Tech. AGRICULTURE TECHNOLOGY (Agriculture Technology)

SCHEME OF TEACHING – B. TECH. AT II YEAR

S.No.	Subject	Subject	Credit	L	T	P
Semester III						
HSS-308	Management Concept and Practices		3	3	0	0
BAS- 311	Biology for Engineers		3	3	0	0
BAS- 312	Engineering Statistics		3	3	0	0
AIC-301	Production Technology of Field Crops		4	3	1	0
AIC-302	Data structure using 'C'		3	3	0	0
AIC-303	Agriculture for Engineers		3	3	0	0
AIC-351	Field Crops Lab.		1	0	0	2
AIC-352	Data structure using 'C' Lab.		1	0	0	2
AIC -371	**Minor Project-I**		1	0	0	2
MCC-301	Essence of Indian Traditional Knowledge		-----			
Total			**22**			
Semester IV						
HSS-403	Entrepreneurship		3	3	0	0
CSC-403	Operating System		3	3	0	0
AIC-401	Soil and Water Conservation Engineering		4	3	1	0
AIC-402	Internet and Web Technology		4	3	1	0
AIC- 403	Agricultural informatics		3	3	0	0
AIC- 451	Soil and water conservation engineering Lab.		1	0	0	2
AIC- 452	Internet and Web Technology Lab.		1	0	0	2
AIC -453	Agricultural informatics Lab.		1	0	0	2
AIC -471	**Minor Project-II**		1	0	0	2
MCC- 401	Environmental Sciences		-----			
Total			**21**			

SCHEME OF TEACHING – B. TECH. AI III YEAR

Subject Code	Subject		Credit	L	T	P
Semester V						
AIC-501	Object Oriented Programming using C++		4	3	1	0
AIC-502	Natural Resources Management		3	3	0	0
AID-501	Agriculture Marketing, Trade and Prices		3	3	0	0
AID-502	Post-Harvest Engineering		3	3	0	0
CSC-503	Database Management Systems		3	3	0	0
CEC-502	Watershed Planning and Management		3	3	0	0
AIC-551	Object Oriented Programming using C++ Lab.		1	0	0	2
AIC-571	**Minor Project-III**		1	0	0	2
MCC- 501	Cyber Security		-----			
Total			**21**			
Semester VI						
AIC-601	Agricultural Meteorology		4	3	1	0
AIC-602	Artificial Intelligence		3	3	0	0
AID-601	Supply Chain Management		3	3	0	0
AID-602	Precision Agriculture		3	3	0	0
CSC-607	Multimedia Computing		3	3	0	0
DCS-603	Cloud Computing		3	3	0	0
AIC-651	Agricultural Meteorology Lab.		1	0	0	2
AIC-652	Artificial Intelligence Lab.		**1**	0	0	2
AIC-671	**Minor Project-IV**		1	0	0	2
MCC-601	Indian Constitution		-----			
Total			**22**			

SCHEME OF TEACHING – B. TECH. AI IV YEAR

Subject	Subject		Credit	L	T	P
Semester VII						
AIC-701	Bioinformatics for Agriculture		3	3	0	0
AIC-702	IoT for Agriculture		3	3	0	0
AID-701	Extension Methodologies for Transfer of Agriculture Technology		3	3	0	0
AID-702	Post-Harvest Engineering of Agricultural Crops		3	3	0	0
ECC-708	Remote Sensing and GIS Techniques		3	3	0	0
CSC-709	Data Warehousing and Data Mining		3	3	0	0
AIC-751	Bioinformatics Lab.		1	0	0	2
AIC-752	IoT Lab.		1	0	0	2
AIC-771	**Minor Project-V**		1	0	0	2
MCC-708	Technical Report Writing		---			0
Total			**21**			
Semester VIII						
AIC-	Seminar ,Project Work and Internship (CAI_ 61/_71/_81)		**15**			

Discipline Specific Electives *(DAI)*

S.No.	Subject Code	Subjects	Cr	L	T	P	Semester
1.	AID-501	Agriculture Marketing, Trade and Prices	3	3	0	0	V
2.	AID-502	Post-Harvest Engineering	3	3	0	0	
3.	AID-503	Food and Dairy Engineering	3	3	0	0	
4.	AID-504	Bioinformatics for Agriculture	3	3	0	0	
5.	AID-505	Agricultural Biotechnology	3	3	0	0	
6.	AID-601	Supply Chain Management	3	3	0	0	VI
7.	AID-602	Precision Agriculture	3	3	0	0	
8.	AID- 603	Farm Power & Machinery Engineering	3	3	0	0	
9.	AID -604	Wasteland Management	3	3	0	0	

10.	AID -605	Ground water engineering	3	3	0	0	
11.	AID-701	Extension Methodologies for Transfer of Agriculture Technology	3	3	0	0	VII
12.	AID-702	Post-Harvest Engineering of Agricultural Crops	3	3	0	0	
13.	AID -703	Soil mechanics & Soil Physics	3	3	0	0	
14.	AID -704	Natural Resources Management	3	3	0	0	
15.	AID -705	Nanotechnology for agriculture	3	3	0	0	

SEMESTER 3

Course code	**HSS-308**				
Category	**Humanities and Social Sciences**				
Course title	**Management Concept and Practices**				
Scheme and Credits	**Credit**	**L**	**T**	P	
	3	3	0	0	
Objectives	1. To help the students gain understanding of the functions and responsibilities of managers. 2. To provide them tools and techniques to be used in the performance of the managerial job. 3. To enable them to analyse and understand the environment of the organization. 4. To help the students to develop cognizance of the importance of management principles.				
Outcomes	CO1. Describe the influence of historical forces on the current practice of management. CO2. Identify and evaluate social responsibility and ethical issues involved in business situations and logically articulate own position on such issues. CO3. Explain how organizations adapt to an uncertain environment and identify techniques managers use to influence and control the internal environment. CO4. Describe the process of management's four functions: planning, organizing, leading, and controlling. CO5. Identify and properly use vocabularies within the field of management to articulate one's own position on a specific management issue and communicate effectively with varied audiences. CO6. Evaluate leadership styles to anticipate the consequences of each leadership style.				

Course Content

Unit	Content	Hours
Unit I	Definition of Management – Nature- Science or Art – Management and Administration – Development of Management Thought – Contribution of Taylor and Fayol – Functions of Management – Types of Business Organisation.	**06**
Unit II	PLANNING: Nature & Purpose – Steps involved in Planning – Objectives – Setting Objectives – Process of Managing by Objectives – Strategies, Policies & Planning Premises- Forecasting – Decision-making.	**06**
Unit III	Nature and Purpose – Formal and informal organization – Organization Chart – Structure and Process–Departmentation by difference strategies – Line and Staff authority – Benefits and Limitations–De-Centralization and Delegation of Authority – Staffing – Selection Process - Techniques .	**06**
Unit IV	Scope – Human Factors – Creativity and Innovation – Harmonizing Objectives – Leadership – Types of Leadership Motivation – Hierarchy of needs – Motivation theories – Motivational Techniques – Job Enrichment – Communication – Process of Communication – Barriers and Breakdown – Effective Communication – Electronic media in Communication.	**06**

Unit-V	System and process of Controlling – Requirements for effective control–The Budget as Control Technique–Information Technology in Controlling – Use of computers in handling the information– Productivity –Problems and Management –Control of Overall Performance – Direct and Preventive Control–Reporting–The Global Environment–Globalization and Liberalization–International Management and Global theory of Management.	**06**
References	1. Harold Kooritz & Heinz Weihrich "Essentials of Management", Tata McGraw-Hill, 1998. 2. Joseph L Massie "Essentials of Management", Prentice Hall of India, (Pearson) Fourth Edition, 2003. 3. Tripathy PC And Reddy PN, "Principles of Management", Tata McGraw-Hill, 1999. Decenzo David, Robbin Stephen A, "Personnel and Human Reasons Management", Prentice Hall of India, 1996 4. JAF Stomer, Freeman R. E and Daniel R Gilbert, Management, Pearson Education, Sixth Edition, 2004. 5. Fraidoon Mazda, " Engineering Management", Addison Wesley,-2000	

Course code	**BAS- 311**				
Category	**Applied Science**				
Course title	**Biology for Engineers**				
Scheme and Credits	**Credit**	**L**	**T**	P	
	3	3	0	0	
Objectives	1.To understand Biological concepts from an engineering perspective 2.To understand the inter-connection between biology and future technologies 3.To motivate technology application for biological and life science challenges				
Outcomes	CO1: Understand the biological concepts from an engineering perspective CO2: Understand the concepts of biological sensing and its challenges CO3: Understand development of artificial systems mimicking human action CO4: Integrate biological principles for developing next generation technologies.				

Unit	**Content**	**Hours**
Unit I	Basic cell biology -Introduction: Methods of Science-Living Organisms: Cells and Cell theory Cell Structure and Function, Genetic information, protein synthesis, and protein structure, Cell metabolism-Homoeostasis- Cell growth, reproduction, and differentiation.	**06**
Unit II	Biochemistry and molecular aspects of life -Biological Diversity --Chemistry of life: chemical bonds--Biochemistry and Human biology--Protein synthesis—Stem cells and Tissue engineering.	**06**
Unit III	Enzymes and industrial applications -Enzymes: Biological catalysts, Proteases, Carbonic anhydrase, Restriction enzymes, and Nucleoside monophosphate kinases—Photosynthesis	**06**
Unit IV	Mechanochemistrymolecularmachines/Motors,Cytoskeleton,Bioremediation, Biosensors	**06**
Unit-V	Nervous system, immune system, and cell signaling -Nervous system--Immune system- General principles of cell signaling.	**06**

References

1. Jeremy M. Berg, John L. Tymoczko and Lubert Stryer, “Biochemistry,” W.H. Freeman and Co. Ltd., 6th Ed., 2006.
2. Robert Weaver, “Molecular Biology,” MCGraw-Hill, 5th Edition, 2012.
3. Jon Cooper, “Biosensors A Practical Approach” Bellwether Books, 2004.
4. Martin Alexander, “Biodegradation and Bioremediation,” Academic Press, 1994.
5. Kenneth Murphy, “Janeway's Immunobiology,” Garland Science; 8th edition, 2011.
6. Eric R. Kandel, James H. Schwartz, Thomas M. Jessell, “Principles of Neural Science, McGraw-Hill, 5th Edition, 2012.
7. S. ThyagaRajan, N. Selvamurugan, M. P. Rajesh, R. A. Nazeer, Richard W. Thilagaraj, S. Barathi, and M. K. Jaganathan, “Biology for Engineers,” Tata McGraw-Hill, New Delhi, 2012.

Course code	**AIC-301**				
Category	**Core**				
Course title	Production Technology of Field Crops				
Scheme and Credits	**Credit**	**L**	**T**	P	
	4	3	1	0	
Objectives	This course expresses the basic principles involved in the production of field crops stressing the importance of field crop management and other agronomic practices that can bring about improve crop yield under good management practices.				
Outcomes	CO1: To know the Origin, geographical distribution, economic importance, soil and climatic requirements, varieties, cultural practices and yield of rabi crops. CO2: Identify weeds in rabi season crops, Pulses-chickpea, lentil, peas; oilseeds-rapeseed, mustard and sunflower; sugar crops-sugarcane, Medicinal and aromatic crops-mentha, lemon grass and citronella, Forage crops-berseem, lucerne and oat. CO3: Through proper knowledge of irrigation scheduling in rabi crops, additional area can be increased of low water requiring crops. CO4: Constraints in production of oilseeds and pulses maybe identified through course content. CO5: Production technology of kharif cereals and millets fulfill the need of human consumption and milch cattle. CO6: Analysis of comparative benefits of the different kharif crops				

Unit	**Content**	**Hours**
Unit I	Kharif Crop: Origin, geographic distribution, economic importance, soil and climatic requirement, varieties, cultural practices and yield of kharif crops, Cereals – rice, maize, sorghum, pearl millet and minor millets; Pulses : pigeonpea, mungbean and urdbean; Oilseeds: groundnut, sesame and soybean; Fibre crops: cotton, jute and sunhemp; and Forage crops: sorghum, maize, cowpea, cluster bean and napier.	08
Unit II	Rabi Crop: Origin, geographical distribution, economic importance, soil and climatic requirements, varieties, cultural practices and yield of rabi crops; Cereals: wheat, barley; Pulses: chickpea, lentil, peas, french bean; Oilseeds: rapeseed and mustard, sunflower, safflower and linseed; Sugar crops: sugarcane and sugarbeet, Medicinal and aromatic crops such as citronella, palma rosa and isabgol; Commercial crops: potato and tobacco, Forage crops: lucerne and oat.	08
Unit III	Pests of Field Crops and Stored Grain and their management: Coleopteran and Lepidopteran pests, their biology and damage, preventive and curative methods	08
Unit IV	Distribution, biology, nature and symptoms of damage, and management strategies of insect and non-insect pests of rice, sorghum, maize, ragi (Eleucine coracana), wheat, sugarcane, cotton, sunhemp, pulses, groundnut, castor, gingerly, safflower, sunflower, mustard, cumin, fennel, spinach, amaranthus and tobacco,. Common phytophagous mites, rodents and bird pests	08
Unit-V	Diseases of Field Crops and their Management, Economic importance, symptoms, cause, epidemiology and disease cycle and integrated management of diseases of rice, sorghum, bajra, maize, wheat, sugarcane,	**08**

	turmeric, tobacco, groundnut, sesamum, sunflower, cotton, redgram, bengalgram, blackgram, greengram, soybean, castor, mustard, hill millet and jatropha	
References	1. Rajendra Prasad. 2006. Text book of field crops production. ICAR, New Delhi. 2. Reddy, S.R. and Reddi Ramu. 5th edition. 2016. Agronomy of field crops. Kalyani publishers, Ludhiana. 3. Gururaj hunsigi and Krishna, K.R. 2007. Scientific field crop production. Oxford &IBH Publishing Co.Pvt.LTD.	

Course code	**AIC-302**				
Category	**Core**				
Course title	**Data structure using 'C'**				
Scheme and Credits	**Credit**	**L**	**T**	P	
	3	3	0	0	
Objectives	To introduce the fundamental concept of data structures and to emphasize the importance of data structures in developing and implementing efficient algorithms. In addition, another objective of the course is to develop effective software engineering practice, emphasizing such principles as decomposition, procedural abstraction, and software reuse				
Outcomes	CO1: After completing this course satisfactorily, a student will be able to: CO2: Describe how arrays, records, linked structures, stacks, queues, trees, and graphs are represented in memory and used by algorithms CO3: Describe common applications for arrays, records, linked structures, stacks, queues, trees, and graphs CO4: Write programs that use arrays, records, linked structures, stacks, queues, trees, and graphs CO5: Demonstrate different methods for traversing trees CO6: Compare alternative implementations of data structures with respect to performance				

Unit	**Content**	**Hours**
Unit I	Overview of 'C': Introduction, flow of control, input-output functions, Arrays and structures, functions. Data Structure and algorithm: Concept of data structures, choice of data structures, type of data structures, Basic Terminology, Algorithms, Design and development of algorithms, stepwise refinement, use of accumulators and counters; algorithm analysis, complexity of algorithms, Big–oh notation.	06
Unit II	Arrays, Sorting and Searching: One dimensional Arrays, Operations on arrays: traversal, selection, searching, insertion, deletion and sorting. Searching: linear search, binary search. Sorting: selection sort, bubble sort, insertion sort, merge sort, quick sort, shell sort. Multidimensional arrays, address calculation of a location in arrays	06
Unit III	Stacks: Array representation and implementation of stacks, operations on stacks: Push and Pop, prefix, infix and postfix expressions and their inter-conversion, Expression evaluation. Recursion: Definition and process, recursion in 'C', examples of recursion. Queues: Circular queues, array representation of queues, D-queues, Priority Queues and application of queues.	06
Unit IV	Pointers: Pointer variables, pointer arrays, arrays of pointers, pointers and structures, Dynamic allocation. Linked lists: Concept of linked lists, Circular linked lists, doubly linked lists, operations on linked lists. Concept of header linked lists. Applications of linked lists, linked stacks and linked queues. Trees: Introduction to Trees, Binary Trees, Representation and Traversal of trees, operation on Binary trees, types of binary trees, Threaded Binary trees, Application of	06

	trees,	
Unit-V	Graphs: Introduction, terminology, set linked and matrix representation, operations on graphs, applications of graphs. File Handling: Introduction to file handling, data and information, file concept, file organization, files and streams, working with files. Advanced Data Structures- B-trees, AVL Trees, Sets, Skip lists.	**06**
References	1. A.M. Tanenbaum, Langsam, Moshe J. Augentem, "*Data Structures using C and C++"*, 2nd Edition, 2007, PHI Publication. 2. A. K. Sharma , "*Data Structure using C",* 1st Edition, 2011, Pearson Publication. 3. Seymour Lipschutz, "*Data Structures"*, 2nd Edition, 2008, TataMcGraw Hill.	

Course code	**AIC-303**				
Category	**Core**				
Course title	**Agriculture for Engineers**				
Scheme and Credits	**Credit**	**L**	**T**	P	
	3	3	0	0	
Objectives	The main aim of this programme is to train and graduate agricultural engineers. At the end, the programme will produce an engineer who will be able to: 1. Prepare an agricultural engineer to plan, design, modify, and direct the manufacture of agricultural machinery & implements for different agricultural production systems. 2.Prepare an engineer to plan and design Soil & Water conservation engineering structures and modern irrigation and drainage systems. 3. Provide practical training to the engineer to contribute practical solutions to agricultural production problems. 4. Inculcate the engineer with sound theoretical knowledge in engineering principles, sciences, research and in consultancy. 5. Impart positive and responsive out-reach attitudes, initiative and creative thinking in their mission as engineers. 6. Produce a professional engineer who understands ethical issues and responsibility of serving the society and the environment at large. 7. Train an engineer equipped with effective written and oral communication skills.				
Outcomes	CO1: knowledge of appropriate agricultural, and/or biological sciences, and/or natural resource topics CO2:Competencies in relevant fields such as: biological materials, computer and automatic control systems, information systems, machine systems, modified environment design, natural resource systems, processing systems, and structural design CO3:An ability to apply engineering design to produce solutions that meet specified needs with consideration of public health, safety, and welfare, as well as global, cultural, social, environmental, and economic factor CO4:To Understand to use the techniques, skills and modern engineering tools necessary for engineering practice. CO5:an ability to identify, formulate, and solve complex engineering problems by applying principles of engineering, science, and mathematics CO6:an ability to apply engineering design to produce solutions that meet specified needs with consideration of public health, safety, and welfare, as well as global, cultural, social, environmental, and economic factors				

Unit	**Content**	**Hours**
Unit I	Soils : Nature and origin of soil; soil forming rocks and minerals, their classification and composition, soil forming processes, classification of soils – soil taxonomy orders; important soil physical properties; and their importance; soil particle distribution; soil inorganic colloids – their composition, properties and origin of charge; ion exchange in soil and nutrient availability.	06
Unit II	Soil organic matter: its composition and decomposition, effect on	06

	soil fertility; soil reaction – acid, saline and sodic soils; quality or irrigation water; essential plants nutrients – their functions and deficiency symptoms in plants; important inorganic fertilizers and their reactions in soils.	
Unit III	Horticulture: Scope of horticultural and vegetable crops. Soil and climatic requirements for fruits, vegetables and floriculture crops, improved varieties,	06
Unit IV	Criteria for site selection, layout and planting methods, nursery raising, macro and micro propagation methods, plant growing structures, pruning and training, fertilizer application, fertigation, irrigation methods, harvesting, grading and packaging, post-harvest practices, Garden tools, management of orchard, Extraction and storage of vegetables seeds.	06
Unit-V	Water and soil conservation: Soil erosion, water erosion, wind erosion, gullies and their classification, stages of gully development; soil loss estimation - universal soil loss equation and modified soil loss equation, erosion control measures – agronomical measures, mechanical measures, bunds - contour bunds, graded bunds and their design; gully and ravine reclamation; introduction to water harvesting techniques.	**06**
References	1. ICAR, 1997. Hand Book of Agriculture, ICAR Pub. New Delhi. 2. Martin, J.M., Leonard, W.H. and Stamp, D.L. 1976. Principles of Field crop production. Macmillon Publishing Co. Inc. New York. 3. Singh, Chidda, 2001. Modem Techniques of raising field crops. Oxford and IBH Publishing Co. Pvt. Ltd., New Delhi. 4. Brady, N.C. 1999. The Nature and Properties of Soils. Tenth Ed. Prentice-Hall ofIndia Pvt. Ltd., New Delhi. 5. Rai, M.M. 1998. Principles of Soil Science. Macmillon India Ltd., New Delhi.	

Course code	AIC-351				
Category	Practical				
Course title	Field Crops Lab.				
Scheme and Credits	Credit	L	T	P	
	1	0	0	2	

1. Digitization of a map with the help of a digitizer; Map editing;
2. Geo-referencing and map projections;
3. Creation of attribute database and linking with spatial data;
4. General analysis of the data with the help software;
5. Applications of digital elevation models using GIS;
6. Spatial interpolations using GIS;
7. Visual interpretations of remote sensing data;
8. Geometric corrections of remote sensing digital data;Methods for improving quality of digital data and Techniques of image classifications

Course code	AIC-352			
Category	Practical			
Course title	Data structure using 'C' Lab.			
Scheme and Credits	Credit	L	T	P
	1	0	0	2

1. Explain & Practice of Recursive Functions.
2. Explain & Practice of Array, row and columnar representation of Array.
3. Explain & Practice of pointers and Dynamic memory allocation.
4. Explain & Practice of Stack and its operations.
5. Explain & Practice of Queue and its operations.
6. Explain & Practice of Linked list and its operations.
7. Explain & Practice of Doubly Linked list and its operations.
8. Explain & Practice of Linear search and Binary Search.
9. Explain & Practice of Linear, bubble, Selection, Insertion, Quick, Shell, Merge and Heap sort.
10. Explain & Practice of Trees and traversal methods

SEMESTER 4

Course code	**HSS-403**				
Category	**Humanities and Social Sciences**				
Course title	**Entrepreneurship**				
Scheme and Credits	**Credit**	**L**	**T**	P	
	3	3	0	0	
Objectives	This course will help students to understand the basic concepts of entrepreneurship, entrepreneurship connected with land, labour, natural resources and capital can generate a profit and to understand that entrepreneurial vision is an indispensable part of a nation's capacity to succeed in a competitive global marketplace.				
Outcomes	After completion of this course, students will be able to learn: CO1: Basic concepts and elements of entrepreneurship. CO2: Entrepreneurship success and failure and involvement of women. CO3: Elements of business plan, market analysis and management. CO4: Financial schemes offered by various financial institution. CO5: Role of central government and state government in promoting entrepreneurship.				

Course Content

Unit	Content	Hours
Unit I	Concept and need of Entrepreneurship, Definition of Entrepreneur, Entrepreneurship innovation, Creativity, Business idea, Entrepreneurship as a career, Entrepreneurship as a style of management, the changing role of the entrepreneur, Entrepreneurial traits	**06**
Unit II	Influences on entrepreneurship development, External influences entrepreneurship development, Socio-cultural, political, economical, personal entrepreneurial success and failure: reasons and remedies, women entrepreneurs, Challenge to women entrepreneurs, achievements of women entrepreneurs	**06**
Unit III	The business plan as an entrepreneurial tool; elements of businessman ;objectives ;market analysis; development of product/idea; marketing, finance, organization and management ;ownership; critical risk contingencies of the proposal ;scheduling and milestones	**06**
Unit IV	Technical ,financial ,marketing personnel ,and management feasibility reports; financial schemes offered by various financial institution, like commercial Banks, IDBI, ICICI, SIDBI, SFCs.	**06**
Unit-V	Role of central government and state government in promoting entrepreneurship with various incentives, subsidies, grants, etc.	**06**
References	1. Khanka,S.S.,*Entrepreneurial Development*,S.Chand, New Delhi. 2. Hisrich D.robert ,Michael P.Peters, dean A.Shepherd, *Entrepreneurshipand Small Business Management* ,PHI,4th Ed . 3. Patel ,V.G.,*The Seven Business Crises and How To Beat Them* ,Tata McGraw-Hill, New Delhi, 1995. 4. Holt H. David, *Entrepreneurship : New Venture Creation*, Prentice –Hall of India, New Delhi		

Course code	**CSC-403**				
Category	**Engineering Sciences**				
Course title	**Operating System**				
Scheme and Credits	**Credit**	**L**	**T**	P	
	3	3	0	0	
Objectives	This course will help students to understand the basic concepts of operating system and various elements of computers, different languages, Hardware and software understanding and various memory components.				
Outcomes	After completion of this course, students will be able to learn: CO1: Basic concepts and elements of operating system. CO2: Process management and scheduling. CO3: Process synchronization and deadlock characteristics. CO4: Basic concepts of memory management and different file structures. CO5: Components of hardware and software and different computer languages.				

Course Content

Unit	Content	Hours
Unit I	Introduction, Role of an OS computer system, types of operating system. Operating system structures, System documents, OS services, system calls, system structure, concept of virtual machines	**06**
Unit II	Process management, Process concept, process scheduling, cooperating processes, Inter process communication. CPU scheduling Basic concept, scheduling criteria, scheduling algorithms	**06**
Unit III	Process synchronization Critical section problem, synchronization hardware, semaphores, classical problems of synchronization, critical regions, monitors. Deadlocks Deadlock characteristics, methods for handling deadlocks, deadlock prevention, deadlock avoidance, deadlock detection, recovery from deadlocks, combined approach for deadlock handling.	**06**
Unit IV	Memory Management Logical versus Physical Address space, Swapping, Contiguous Allocation, Paging, Segmentation, Segmentation with Paging Virtual Memory Demand Paging, Performance of Demand Paging, Page Replacement, Page-replacement algorithms, Allocation of frames, Thrashing, Other Considerations, Demand segmentation File-System Interface File concept, Access methods, Directory Structure, Protection, Consistency File-System Implementation File-System Structure, allocation methods, Free-space Management, Directory Implementation, Efficiency and performance	**06**
Unit-V	I/O subsystems I/O Hardware, Application I/O interface Protection Goals of protection, domain of protection, access matrix, implementation of access matrix, revocation of access rights, capability based systems, languages based protection. Security The problem, authentication, one-time password program threats, system threats, threat monitoring, encryption, computer security classification Case studies (UNIX, LINUX, WinNT)	**06**

References

1. Operating System Concept: Silbertschatz, Galvin, 5ed.Addison Wesley.
2. Operating system Concepts: Milan Malinkovic, TMH, 2nd ed.
3. Operating System: William Stallings, PHI, 2nd ed.

Course code	**AIC-401**				
Category	**Core**				
Course title	**Soil and Water Conservation**				
Scheme and Credits	**Credit**	**L**	**T**	P	
	4	3	1	0	
Objectives	This course will help students to understand the basic concepts of soil and water conservation through efficient management of land, irrigation water and nutrients with the help of modern techniques.				
Outcomes	After completion of this course, students will be able to learn: CO1: Basic concepts and elements of soil and water conservation. CO2: Erosion of soil and various control strategies. CO3: Elements of irrigation and their management. CO4: Basic concepts of irrigation management, types and water harvesting technology.				

Course Content

Unit	Content	Hours
Unit I	Introduction to Soil and Water Conservation, causes of soil erosion. Definition and agents of soil erosion, water erosion: Forms of water erosion. Gully classification and control measures. Soil loss estimation by universal Loss Soil Equation. Soil loss measurement techniques.	**06**
Unit II	Principles of erosion control: Introduction to contouring, strip cropping. Contour bund. Graded bund and bench terracing. Grassed water ways and their design. Water harvesting and its techniques. Wind erosion: mechanics of wind erosion, types of soil movement. Principles of wind erosion control and its control measures	**06**
Unit III	Introduction to irrigation - Classification of irrigation projects. Importance of irrigation water measurements - Volumetric, area velocity, discharge methods, Weirs, orifice, flumes, Open channel hydraulics - Discharge calculations.	**06**
Unit IV	Types of wells - Water lifting devices - Classification of pumps, their capacity, power requirement and discharge calculations. Functional components and working principle of underground pipeline systems. Functional components of micro irrigation systems and its design like drip, sprinkler irrigation systems etc. Water harvesting techniques - Lining of ponds, tanks and canal systems.	**06**

References

1. Irrigation Engineering. Mazumdar. S.K. 1983. TMH Publishing Co. Ltd., New Delhi.
2. Irrigation Water Resources. Modi P N. 1990. Standard Book House. Post Box No. 1074. New Delhi.
3. Hydrology and Soil Conservation Engineering. Ghanshyam Das 2009 PHI Learning Private Limited, New Delhi

Course code	**AIC-402**				
Category	**Core**				
Course title	**Internet and Web Technology**				
Scheme and Credits	**Credit**	**L**	**T**	P	
	4	3	1	0	
Objectives	This course will help students to understand the basic concepts of internet and web technology through learning of HTML, Javascript, jsp and active server pages.				
Outcomes	After completion of this course, students will be able to learn: CO1: Basic concepts and elements of internet technology. CO2: HTML commands, text formatting, text styles and their elements. CO3: Functioning and advantages of javascript and its command. CO4: jsp files and commands. CO5: Active server pages, cookies and their elements.				

Course Content

Unit	Content	Hours
Unit I	**Internet Basics** communicating on the internet, internet domains, establishing connection on the internet, client IP address, TCP/IP and its services, transmission control protocol, WWW, intranet, extranet.	**06**
Unit II	**Introduction to HTML** commonly used HTML commands, text formatting, text styles, Lists – types of lists, adding graphics to HTML documents, tables, links – external document references, internal document references, frames.	**06**
Unit III	**Javascript** javascript in web pages, the advantages of javascript, building javascript syntax – data types, type casting, creating variables, javascript array, operators and expressions, conditional checking, fuctions – build in functions, user defined functions, dialog boxes – alert dialog box, prompt dialog box, confirm dialog box, javascript document object model – understanding objects, forms object methods	**06**
Unit IV	**JSP** jsp execution model, components of jsp, using java beans in jsp, directives in jsp-page directive, include directive, taglib directive, standard action tags- <jsp:include>,<jsp:forward>,<jsp:init>, implicit objects in jsp-application, session, pagecontext, out, request, response, error handling in jsp, database connectivity using jsp.	**06**
Unit-V	**Active Server Pages:** Basics, Integrating Script, ASP Objects and Components, configuring and troubleshooting,: Request and response objects, Retrieving the contents of a an HTML form, Retrieving a Query String, Cookies, Creating and Reading Cookies. Using application Objects and Events	**06**

References

1. Ivan Bayross, “HTML, DHTML, Java Script, Perl cgi”, BPB publication,
2. James Godwill, “Pure JSP”, Sams publications, edition-2000
3. Bryan Basham, “Head First in Servlets and Jsp”, O’Rielly publications, March 2008

Course code	**AIC-403**				
Category	**Core**				
Course title	**Agricultural informatics**				
Scheme and Credits	**Credit**	**L**	**T**	P	
	3	3	0	0	
Objectives	This course will help students to understand the basic concepts of internet and web technology for agricultural information, concept modelling and use of geospatial technology in agriculture.				
Outcomes	After completion of this course, students will be able to learn: CO1: Basic concepts and elements of internet technology. CO2: Basic concepts of e-agriculture and ICT. CO3: Concepts and structure of computer modelling in agriculture. CO4: Use of geospatial technology and various IT tools in agriculture. CO5: Basic concepts of smart agriculture and use of smart apps, smart market and smart sensors.				

Course Content

Unit	Content	Hours
Unit I	Introduction to Computers, Operating Systems, definition and types, Applications of MSOffice for document creation & Editing, Data presentation, interpretation and graph creation, statistical analysis, mathematical expressions, Database, concepts and types, uses of DBMS in Agriculture, World Wide Web (WWW): Concepts and components. Introduction to computer programming languages, concepts and standard input/output operations.	**06**
Unit II	e- Agriculture, concepts, design and development. Role of ICT in Agriculture, ICT Initiatives for Agricultural in India, Major components used for ICT initiatives, Framework of ICT in agriculture.	**06**
Unit III	Computer models in agriculture: Statistical, weather analysis and crop simulation models- Concepts, structure, files, limitations and advantages.	**06**
Unit IV	Geospatial technology for generating valuable agri-information .need and component of Precision Agriculture**,** Decision support systems: concepts, components and applications in Agriculture, Agriculture Expert System, Soil Information Systems etc for supporting Farm decisions. Communication process, Preparation of contingent crop-planning using IT tools	**06**
Unit-V	Computer Models for understanding plant processes. IT application for computation of water and nutrient requirement of crops, Computer-controlled devices (automated systems) for Agri-input management, Smart Agriculture Sensors, Smartphone Apps in Agriculture for farm advises, market price, postharvest management etc	**06**
References	1. John Walkenbach, Herb Tyson, Michael R. Groh, Faithe Wempen, Microsoft Office 2010. 2. Bangia,Learning Ms Office 2010 3. Prof. Satish Jain and M. Geetha, MS-Office 2010 Training Guide.	

Course code	**AIC- 451**				
Category	**Practical**				
Course title	**Soil and water conservation engineering Lab.**				
Scheme and Credits	**Credit**	**L**	**T**	P	
	1	0	0	2	

1. **Practical(s)** General status of soil conservation in India.
2. Calculation of erosion index.
3. Estimation of soil loss.
4. Measurement of soil loss.
5. Preparation of contour maps.
6. Design of grassed waterways.
7. Design of contour bunds.
8. Design of graded bunds.
9. Design of bench terracing system.
10. Problem on wind erosion.

Course code	**AIC- 452**				
Category	**Practical**				
Course title	**Internet and Web Technology Lab.**				
Scheme and Credits	**Credit**	**L**	**T**	P	
	1	0	0	2	

Practical(s)

1. Create a registration form in html containing student name, student roll no, branch, session, email id, phone no., address etc.
2. Create a document with two links to an external document. The first link should lead to the beginning of the external document. The second link should lead to a particular section in the external document.
3. Create a specimen of corporate web page. Divide the browser screen into two frames, The frame on the left will be a menu consisting of hyper links. Clicking on one of these links will lead to a new page, which must open in the target frame, which is on the right hand side.
4. Using scripting language validate a registration form whether the user enter character in the username textfield, in the password filed the no. of characters not more than 6.
5. Create a web page using two image files, which between one another as the mouse pointer moves over the images.
6. Crate a web page which accepts user information and user comments on the web site. Design the web page using form elements and check if all the text fields have begin entered with data else display an alert.
7. Create a JSP for inserting a employee information in a database.
8. Create an application which displays how many times a JSP is visited.
9. Create a JSP showing the use of application implicit object.
10. Create a jsp showing the use of jsp error handling.

Course code	**AIC- 453**				
Category	**Practical**				
Course title	**Agricultural informatics Lab.**				
Scheme and Credits	**Credit**	**L**	**T**	P	
	1	0	0	2	

Practical(s)

1. Study of Computer Components, accessories, practice of important DOS Commands.
2. Introduction of different operating systems such as windows, Unix/ Linux, Creating, Files &
3. Folders, File Management.
4. Use of MS-WORD and MS Power-point 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.
5. MS-ACCESS: Creating Database, preparing queries and reports, demonstration of Agri-information system. Introduction to World Wide Web (WWW). Introduction of programming languages.
6. Hands on Crop Simulation Models (CSM) such as DSSAT/Crop-Info/CropSyst/ Wofost; Computation of water and nutrient requirements of crop using CSM and IT tools.
7. Introduction of Geospatial Technology for generating valuable information for Agriculture. Hands on Decision Support System.
8. Preparation of contingent crop planning.

SEMESTER 5

Course code	**AIC-501**				
Category	**Core**				
Course title	**Object Oriented Programming using C++**				
Scheme and Credits	**Credit**	**L**	**T**	P	
	4	3	1	0	
Objectives	1.To perform object oriented programming solution and develop solutions to problems demonstrating usage of control structure, modularity, classes, I/O and the scope of the class members 2.To demonstrate adeptness of object oriented programming in developing solution to problems demonstrating usage of data abstraction, encapsulation and inheritance 3.To demonstrate ability to implement one or more patterns involving dynamic binding and utilization of polymorphism in the solution of problems 4.To learn syntax and features of exception handling 5.To demonstrate the ability to implement solution to various I/O manipulation operations and the ability to create two-dimensional graphic components using applets				
Outcomes	At the end of this course, students will demonstrate ability to: CO1: Understand object-oriented programming features in C++, CO2: Apply these features to program design and implementation, CO3: Develop applications using Object Oriented Programming Concepts. CO4: Implement features of object oriented programming to solve real world problems.				

Unit	**Content**	**Hours**
Unit I	Introduction to OOPs and C++ Element, Introduction to OOPs, Features & Advantages of OOPs, Different element of C++ (Tokens, Keywords, Identifiers, Variable, Constant, Operators, Expression, String).	08
Unit II	Program Control Statements, Sequential Constructs, Decision Making Construct, Iteration / Loop Construct, Arrays, Functions (User defined Function, Inline Function, Function Overloading), User Defined Data Types (Structure, Union and Enumeration).	08
Unit III	Class, Object, Constructor & Destructor, Class, Modifiers (Private, Public & Protected), Data Member, Member Function, Static Data Member, Static Member Function, Friend Function, Object, Constructor (Default Constructor, Parameterized Constructor and Copy Constructor), Destructor.	08
Unit IV	Pointer, Polymorphism & Inheritance, Pointer (Pointer to Object, this Pointer, Pointer to Derive Class), Introduction to Polymorphism (Runtime Polymorphism, Compiletime Polymorphism), Operator Overloading, Virtual Function, Inheritance (Single Inheritance, Multiple Inheritance, Multilevel Inheritance, Hierarchical Inheritance, Hybrid Inheritance), Virtual Base Class, Abstract Class.	08

Unit-V	File Handling, Exception Handling, Files I/O, Exception Handling (Exception Handling Mechanism, Throwing Mechanism, Catching Mechanism, Re-throwing an Exception).	**08**
References	1. E. Balaguruswami – Object Oriented programming with C++ 2. Kris James – Success with C++ 3. David Parsons – Object Oriented programming with C++	

Course code	**AIC-551**			
Category	**Practical**			
Course title	Object Oriented Programming using C++ Lab			
Scheme and Credits	**Credit**	**L**	**T**	P
	1	0	0	2

1. Write a program for understanding of C++ program structure without any CLASS declaration. Program may be based on simple input output, understanding of keyword using.
2. Write a Program to Understand Structure & Unions.
3. Write a C++ program to demonstrate concept of declaration of class with public & private member, constructors, object creation using constructors, access restrictions, defining member functions within and outside a class. Scope resolution operators, accessing an object's data members and functions through different type of object handle name of object, reference to object, pointer to object, assigning class objects to each other.
4. Write a Program, involving multiple classes (without inheritance) to accomplish a task &demonstrate composition of class.
5. Write a Program to Demonstrate Friend function, classes and this pointer.
6. Write a Program to Demonstrate Inline functions.
7. Write a Program to Demonstrate pointers to derived classes.
8. Write a Program to demonstrate dynamic memory management using new & delete & static class members.
9. Write a Program to demonstrate an operator overloading, operator functions as member function and/ or friend function, overloading stream insertion and stream extraction, operators, overloading operators etc.
10. Write a Program to demonstrate use of protected members, public & private protected classes, multilevel inheritance etc.
11. Write a Program for multiple inheritance, virtual functions, virtual base classes, abstract classes
12. Write a Program to Demonstrate use of Constructors and Destructors.
13. Write a Program to Develop with suitable hierarchy, classes for Point, Shape, Rectangle, Square, Circle, Ellipse, Triangle, Polygon, etc. Design a simple test application to demonstrate dynamic polymorphism.
14. Write a Program to Show how file management is done in C++.
15. Write a Program to demonstrate class templates

Course code	**AIC-502**				
Category	**Core**				
Course title	**Natural Resources Management**				
Scheme and Credits	**Credit**	**L**	**T**	P	
	3	3	0	0	
Objectives	1.To introduce the principles for "successful" NRM 2.To discuss the process of recognizing and defining NRM issues within an ecosystem management framework 3.To explore the techniques of collecting, handling and interpreting NR data 4.To consider a range of management methods and their applicability in different situations				
Outcomes	CO1:To develop the ability to relate principles of NRM to successful NRM planning CO2:To assess what data is needed for specific NRM projects and how to gather it and analyze it. CO3:To describe a range of management methods and gauge their appropriateness to the solution of particular problems CO4:To gain exposure to comprehensive NRM projects CO5:To develop the ability to critically evaluate NRM projects				

Unit	**Content**	**Hours**
Unit I	Introduction to Natural Resource Bases: Concept of resource, classification of natural resources. Factors influencing resource availability, distribution and uses. Interrelationships among different types of natural resources. Ecological, social and economic dimension of resource management Natural resources and development.	06
Unit II	Introduction Inter-relationship within Environmental system Natural Resource ecosystem Urban ecosystem Principal of Natural Resource Conservation and Management Theory and Approach	06
Unit III	Mineral : Problems and management, Energy : Problems and management	06
Unit IV	Soil : Problems and management, Forestry & wildlife: Problems and management Air : Problems and management	06
Unit-V	Water Resource : Problems and management Marine Resource : Problems and management Coastal Resource: Problems and management.	06
References	1. Jha, Mrityunjay M., and R.B. Singh. 2008. Land Use, Reflection on Spatial Informatics, Agriculture and Development. Concept Publishing Company, New Delhi.318p. 2. Amit Hazra. Land Reforms, Myths and Realities. Concept Publishing Company, New Delhi. 3. Sundaram, K.V., M.Moni, and Mrityunjay M. Jha (ed.). Natural Resources Management and Livelihood Security. Concept Publishing Company, New Delhi.	

Course code	**CSC-503**				
Category	**Open Elective**				
Course title	**Database Management Systems**				
Scheme and Credits	**Credit**	**L**	**T**	P	
	3	3	0	0	
Objectives	The course should enable the students to: 1. Understand the role of database management system in an organization and learn the database concepts. 2. Design databases using data modeling and Logical database design techniques. 3. Construct database queries using relational algebra and calculus and SQL. 4. Understand the concept of a database transaction and related concurrent, recovery facilities. 5. Learn how to evaluate a set of queries in query processing.				
Outcomes	At the ends of this course students will have: CO1: Awareness of database management basics and different models that we use for database. CO2: Design and architecture of relational model, relational algebra and SQL queries. CO3: Implement different form of normalization. CO4: Logical representation of internet database. CO5: Analysis and concepts of transaction, concurrency and recovery systems				

Unit	**Content**	**Hours**
Unit I	Introduction to Data bases: Purpose of Database Systems, View of Data, Data Models, Database Languages, Database Users, Various Components of overall DBS architecture, Various Concepts of ER Model, Basics of Relational Model	06
Unit II	Relational algebra and calculus: Relational algebra, selection and projection, set operations, renaming, joins, division, examples of algebra queries, relational calculus: Tuple relational calculus, Domain relational calculus, expressive power of algebra and calculus.	06
Unit III	SQL – Data Definition commands, Queries with various options, Mata manipulation commands, Views, Joins, views, integrity and security; Relational database design: Pitfalls of RDBD, Lossless join decomposition, Functional dependencies , Armstrong Axioms, Normalization for relational databases 1st , 2 nd and 3rd normal forms, Basic definitions of MVDs and JDs, 4th and 5th normal forms	06
Unit IV	Transaction processing: Transaction Concept, Transaction State, Implementation of Atomicity and Durability, Concurrent Executions, Serializability, Recoverability. Concurrency Control: Lock-Based Protocols, Timestamp-Based Protocols, Validation-Based Protocols, Multiple Granularity, Multiversion Schemes, Deadlock Handling. Recovery: Failure Classification, Storage Structure ,Recovery and	06

	Atomicity, Log-Based Recovery, Shadow Paging, Recovery With Concurrent Transactions Buffer Management	
Unit-V	Data storage: Overview of Physical Storage Media, Magnetic Disks, Storage Access, File Organization, Organization of Records in Files. Indexing and Hashing: Basic Concepts: Ordered Indices, B+-Tree Index Files, B-Tree Index Files, Static Hashing, Dynamic Hashing, Comparison of Ordered Indexing and Hashing. Query Processing: Overview, Measures of Query Cost	**06**
References	1. Ramez Elmasri, Shamkant B. Navathe, "Fundamental Database Systems", Pearson Education, 6th Edition, 2014. 2. Raghu Ramakrishnan, "Database Management System", Tata McGraw-Hill Publishing Company, 3rd Edition, 2007. 3. Hector Garcia Molina, Jeffrey D. Ullman, Jennifer Widom, "Database System Implementation", Pearson Education, United States, 1st Edition, 2000. 4. Peter Rob, Corlos Coronel, "Database System, Design, Implementation and Management", Thompson Learning Course Technology, 5th Edition, 2003	

Course code	**CEC-502**				
Category	**Open elective**				
Course title	**Watershed Planning and Management**				
Scheme and Credits	**Credit**	**L**	**T**	P	
	3	3	0	0	
Objectives	The course is designed to: 1. introduce the concept of watershed management 2. understand the watershed characteristics 3. learn the principles of soil erosion and measures to control erosion 4. Appreciate various water harvesting techniques. 5. Learn land management practices for various land use/land cover. 6. Introduce concepts of watershed modelling.				
Outcomes	At the end of the course the student will be able to CO1: Calculate watershed parameters and analyse watershed characteristics to take appropriate management action. CO2: Quantify soil erosion and design control measure CO3: Apply land grading techniques for proper land management. CO4: Suggest suitable harvesting techniques for better watershed management. CO5: Apply appropriate models for watershed management.				

Unit	**Content**	**Hours**
Unit I	**Introduction**: Concept of watershed development, objectives of watershed development, need for watershed development, Integrated and multidisciplinary approach for watershed management.	06
Unit II	**Characteristics of Watersheds**: Size, shape, physiography, slope, climate, drainage, land use, vegetation, geology and soils, hydrology and hydrogeology, socio-economic characteristics, basic data on watersheds.	06
Unit III	**Principles of Erosion:** Types and causes of erosion, factors affecting erosion, estimation of soil loss due to erosion- Universal soil loss equation. Measures to Control Erosion: Contour techniques, ploughing, furrowing, trenching, bunding, terracing, gully control, check dams , rock-fill dams, brushwood dam, Gabion.	06
Unit IV	**Water Harvesting:** Techniques of rain water harvesting- rain water harvesting from roof top, surface flow harvesting, subsurface flow harvesting, stop dams, farm ponds and dugout ponds, percolation tanks.	06
Unit-V	**Watershed Modelling**: Data of watershed for modelling, application and comparison of watershed models, model calibration and validation, advances of watershed models **Land Management:**Land use and Land capability classification, management of forest, agricultural, grassland and wild land, land grading operation, Reclamation of saline and alkaline soils	06
References	1. 'Watershed Management' by Das MM and M.D Saikia, PHI Learning Pvt. Ltd, 2013.	

	2. ‘Land and Water Management’ by Murthy.VVN, Kalyani Publications, 2007. 3. ‘Watershed Management’ by Murthy J V S, New Age International Publishers, 2006. 4. ‘Water Resource Engineering’by Wurbs R A and James R A, Prentice Hall Publishers, 2002. 5. ‘Watershed Hydrology’ by Black P E, Prentice Hall, 1996

SEMESTER 6

Course code	**AIC-601**				
Category	**Core**				
Course title	**Agricultural Meteorology**				
Scheme and Credits	**Credit**	**L**	**T**	P	
	4	3	1	0	
Objectives	To impart theoretical knowledge of physical processes occurring in atmosphere in relation to plants.				
Outcomes	1. To learn different metrological parameters like rainfall, temperature, RH and other weather parameters. 2. To learn about various instruments and devices used for weather forecasting and other weather parameters.				

Unit	**Content**	**Hours**
Unit I	Earth's atmosphere – Composition – division of atmosphere; Sun-earth relationship – season, weather and climate; Pressure and global wind systems – cyclone and anticyclone; Condensation – precipitation, clouds, Frost and Indian monsoon.	05
Unit II	Meaning and scope of Agricultural meteorology. Importance of weather and climatic parameters in agricultural production; Microclimate – yield-pest disease-weather relationship.	07
Unit III	Climatic hazards in crop production – droughts, flood, dry spell, heat and cold wave and frost; Heat unit concept and its application in agriculture	05
Unit IV	Evapotranspiration and its estimation; Weather forecasting, Types of weather forecasting, methods of weather forecasting, Satellite meteorology – Satellite systems: IRS and INSAT	06
Unit-V	Conventional techniques for measurement of meteorological parameters; Self-recording instruments – Automatic weather stations, Net work in Gujarat and data monitoring system; Agro-climatic zones of India in general and Gujarat in particular.	07
References	1.Agrometeorology – J. H. Chang 2. Crops and Weather – by Venkatraman& 3. Climate, Weather, and Crop in India – by D. Lenka 4.Principles of Agricultural Meteorology – by Bisnoi O. P. (2007). Oxford &IBH Publishing Co. Pvt. Ltd., New Delhi	

Course code	**AIC-602**				
Category	**Core**				
Course title	**Artificial Intelligence**				
Scheme and Credits	**Credit**	**L**	**T**	P	
	3	3	0	0	
Objectives	The primary objective of this course is to introduce the basic principles, techniques, and applications of Artificial Intelligence				
Outcomes	1. Demonstrate fundamental understanding of the history of artificial intelligence (AI) and its foundations. 2. Apply basic principles of AI in solutions that require problem solving, inference, perception, knowledge representation, and learning. 3. Demonstrate awareness and a fundamental understanding of various applications of AI techniques in intelligent agents, expert systems, artificial neural networks and other machine learning models				

Unit	**Content**	**Hours**
Unit I	Introduction to Artificial Intelligence (AI); Scope of AI: natural language processing, robotics, expert system, Games, theorem proving,	05
Unit II	Knowledge: Acquisition of knowledge, Knowledge based system, Representation of knowledge, Knowledge organization and manipulation.	07
Unit III	Symbolic approach: Syntax and Semantics for Prepositional Logic (PL) and First order predicates logic (FOPL), Conversion to clausal form, Inference rules, Non deductive inference methods	05
Unit IV	Search and Control strategies: Blind search, Breadth first search, Depth first search, Hill climbing method, Best First search, Branch and Bound search.	06
Unit-V	Expert System: Introduction to expert system, Characteristics and features of expert system, Applications of Expert System, Importance of Expert system, Rule based system architecture; Software Agents.	07

References	1. Rich, E. and Knight, K. 2002. Artificial Intelligence. Tata McGraw Hill. 2. Bratko, Prolog Programming for Articial Intelligence, Pearson. 3. Gonzalez, A. and Dankel, D. 2004. The Engineering of Knowledge -Based Systems. Prentice Hall

Course code	**CSC-607**				
Category	**Elective**				
Course title	**Multimedia Computing**				
Scheme and Credits	**Credit**	**L**	**T**	P	
	3	3	0	0	
Objectives	To provide the foundation knowledge of multimedia computing, e.g. media characteristics, compression standards, multimedia representation, data formats, multimedia technology development				
Outcomes	At the end of the course the student will be able to: • understand the characteristics of different media; understand the representations of different multimedia data; • understand different data formats; be able to take into considerations in multimedia system designs; • understand the characteristics of human's visual system; understand the characteristics of human's audio system; be able to take into considerations in multimedia techniques design and implementation; • understand different compression principles; understand different compression techniques; understand different multimedia compression standards; be able to design and develop multimedia systems according to the requirements of multimedia applications. • program multimedia data and be able to design and implement media applications				

Unit	**Content**	**Hours**
Unit I	**Fundamental concepts in Text and Image**: Multimedia and hypermedia, World Wide Web, overview of multimedia software tools. Graphics and image data representation graphics/image data types, file formats, Color in image and video: color science, color models in images, color models in video	05
Unit II	**Fundamental concepts in video and digital audio:**Types of video signals, analog video, digital video, digitization of sound, MIDI, quantization and transmission of audio.	07
Unit III	**Multimedia data compression I:**Lossless compression algorithm: Run-Length Coding, Variable Length Coding, Dictionary Based Coding, Arithmetic Coding, Lossless Image Compression,	05
Unit IV	**Multimedia data compression II:**Lossy compression algorithm: Quantization, Transform Coding, Wavelet-Based Coding, Embedded Zerotree of Wavelet Coefficients Set Partitioning in Hierarchical Trees (SPIHT).	06
Unit-V	**Basic Video Compression Techniques**: Introduction to video compression, video compression based on motion compensation, search for motion vectors, MPEG, Basic Audio Compression Techniques.	07

	Multimedia Networks: Basics of Multimedia Networks, Multimedia Network Communications and Applications: Quality of Multimedia Data Transmission, Multimedia over IP, Multimedia over ATM Networks, Transport of MPEG-4, Media-on-Demand (MOD).	
References	TEXT BOOKS • Fudamentals of Multimedia by Ze-Nian Li and Mark S. Drew Pearson Education. REFERENCE BOOKS • Digital Multimedia, Nigel chapman and jenny chapman, Wiley-Dreamtech • Macromedia Flash MX Professional 2004 Unleashed, Pearson. • Multimedia and communications Technology, Steve Heath, Elsevier (Focal Press). • Multimedia Applications, Steinmetz, Nahrstedt, Springer. • Multimedia Basics by Weixel Thomson • Multimedia Technology and Applications, David Hilman , Galgotia	

Course code	**DCS-603**				
Category	**Elective**				
Course title	**Cloud Computing**				
Scheme and Credits	**Credit**	**L**	**T**	P	
	3	3	0	0	
Objectives	To give an overview of the field of Cloud Computing, and an in-depth study into its enabling technologies and main building blocks. Students will gain hands-on experience solving relevant problems through projects that will utilize existing public cloud tools. I				
Outcomes	1. Explain the core concepts of the cloud computing paradigm: how and why this paradigm shift came about, the characteristics, advantages and challenges brought about by the various models and services in cloud computing. 2. Apply fundamental concepts in cloud infrastructures to understand the tradeoffs in power, efficiency and cost, and then study how to leverage and manage single and multiple datacenters to build and deploy cloud applications that are resilient, elastic and cost-efficient. 3. Discuss system, network and storage virtualization and outline their role in enabling the cloud computing system model. 4. Illustrate the fundamental concepts of cloud storage and demonstrate their use in storage systems such as Amazon S3 and HDFS.				

Unit	**Content**	**Hours**
Unit I	**Introduction to Cloud Computing:** Cloud computing, Properties & Characteristics, Service models, Deployment models, Virtualizationconcepts.	05
Unit II	**Cloud as IaaS(Infrastructure as a Service):** Introduction to IaaS,Private Cloud Environment,Public Cloud Environment, Managing Hybrid Cloudenvironment	07
Unit III	**Platform as a Service (PaaS):** Introduction to PaaS, Cloud platform & Management, Computation,Storage,Case studies	05
Unit IV	**Software as a Service (SaaS):** Introduction to SaaS, Web services, Web 2.0, Web OS, Case studies	06
Unit-V	**Cloud issues and challenges:m**Cloud provider Lock-in, Security and Privacy issues in the Cloud, VM-Ware ESX Memory ManagementCapacity Planning and Disaster Recovery in Cloud Computing	07
References	1. KailashJayaswal,JagannathKallakurchi,Donald J. Houde, Dr. DevenShah "*Cloud ComputingBlack Book"*Kogent Learning 2. 3. "*Cloud Computing"*, Das Gupta, et al., PHI Learning 4. "*Cloud Computing: Concepts, Technology & Architecture"* (The Prentice Hall ServiceTechnology Series from Thomas Erl)Kindle Edition 5. "*Cloud Computing Explained: Implementation Handbook for Enterprises"* 2nded. Edition by JohnRhoton	

Course code	**AIC-651**				
Category	**Practical**				
Course title	**Agricultural Meteorology Lab.**				
Scheme and Credits	**Credit**	**L**	**T**	P	
	1	0	0	2	

1. Visit of Agrometeorological Observatory, site selection of observatory, exposure of instruments and weather data recording.
2. Measurement of total, shortwave and longwave radiation, and its estimation using Planck's intensity law.
3. Measurement of albedo and sunshine duration, computation of Radiation Intensity using BSS. Measurement of maximum and minimum air temperatures, its tabulation, trend and variation analysis.
4. Measurement of soil temperature and computation of soil heat flux. Determination of vapor pressure and relative humidity.
5. Determination of dew point temperature. Measurement of atmospheric pressure and analysis of atmospheric conditions.
6. Measurement of wind speed and wind direction, preparation of wind rose. Measurement, tabulation and analysis of rain.
7. Measurement of open pan evaporation and evapotranspiration. Computation of PET and AET.

Course code	**AIC-652**				
Category	**Practical**				
Course title	**Artificial Intelligence Lab.**				
Scheme and Credits	**Credit**	**L**	**T**	P	
	1	0	0	2	

Practical(s)

1. Search and Control strategies: Blind search, Breadth - first search, Depth First search, Hill climbing method, Best First search, Branch and Bound search.

2. Programming in Prolog Syntax and meaning of Prolog Programs. Using Data Structures. Controlling Back- tracking. Input and Output. Built-in Predicates. Using Prolog Grammar Rules. Higher level assignments/exercises for implementation using Prolog.

3. Expert system design: Using the Expert System Shell for development of an Expert System in areas like Financial, Industrial, Social or other Engineering problems, Case study of a rule based expert system

SEMESTER 7

Course code	**AIC-701**				
Category	**Core**				
Course title	**Bioinformatics for Agriculture**				
Scheme and Credits	**Credit**	**L**	**T**	P	
	3	3	0	0	
Objectives	The course is designed to help students to learn different biological databases, sequence alignments, how to access them, their use in molecular biology and their applications in agriculture.				
Outcomes	At the end of the course the student will be able to learn: CO1: Basic concepts of different biological databases (nucleotide and protein). CO2: Protein databases and the process to access and use them. CO3: Methods of sequence alignments (pairwise and multiple) and use of BLAST , FASTA etc, and their applications. CO4: Alignment search tools.				

Unit	**Content**	**Hours**
Unit I	**Biological Databases:** Introduction, File Formats, Flat File, Primary, Secondary, Composite databases. **Nucleotide databases:** NCBI, GeneBank, EMBL, DDBJ etc; Protein databases: UniProt, PIR, SwissProt, Expasy, etc.	05
Unit II	**Structural Databases:** Protein Data Bank, Nucleic Acid Data Bank, MMDB; Protein Classification Databases: SCOP, CATH; Metabolic Pathways Databases: KEGG; Protein family/domain databases: PROSITE, PRINTS, Pfam, BLOCK, etc.	07
Unit III	**Sequence Alignment:** Pair wise alignment: Local, Global alignment and Semi global alignment – Algorithms, Dot matrix, Dynamic Programming, Heuristic alignment algorithm: BLAST, FASTA.	05
Unit IV	**Sequence Alignment:** Multiple Sequence Alignment: Progressive method and Iterative method, Scoring matrices, Profile analysis, BLOCK analysis, Pattern.	06
Unit-V	Vector alignment search tool, DALI, PALI, SSAP, Genome sequence assembly, Gene finding methods (Gene Builder, GENE SCAN, GENSCAN, etc.).	07
References	**Reference Books:** 1. David W. Mount. 2004. Bioinformatics: Sequence and Genome analysis, Cold Spring Harbor Laboratory Press. 2. Jones, N.C. and Pevzner, P. A. 2004. An Introduction to Bioinformatics Algorithms. The MIT Press.	

Course code	**AIC-702**				
Category	**Core**				
Course title	**IoT for Agriculture**				
Scheme and Credits	**Credit**	**L**	**T**	P	
	3	3	0	0	
Objectives	The course enables student to understand the basics of Internet of things and protocols. It introduces some of the application areas where Internet of Things can be applied. Students will learn about the middleware for Internet of Things. To understand the concepts of Web of Things.				
Outcomes	At the end of the course the student will be able to learn: CO1: Basic concepts and elements of IoT. CO2: Standardization of protocols and issues related with IoT. CO3: Architecture, design and principles of IoT and resource modlling and abstraction. CO4: Basic concepts of WoT and its comparison with IoT. CO5: Smart and Industrial applications IoT.				

Unit	**Content**	**Hours**
Unit I	What is the IoT and why is it important? Elements of an IoT ecosystem, Technology drivers, Business drivers, Trends and implications, Overview of Governance, Privacy and Security Issues.	06
Unit II	Protocol Standardization for IoT – Efforts – M2M and WSN Protocols – SCADA and RFID Protocols – Issues with IoT Standardization – Unified Data Standards – Protocols – IEEE802.15.4–BACNet Protocol– Modbus – KNX – Zigbee– Network layer – APS layer – Security	06
Unit III	IoT Open source architecture (OIC)- OIC Architecture & Design principles- IoT Devices and deployment models- IoTivity : An Open source IoT stack - Overview- IoTivity stack architecture- Resource model and Abstraction.	06
Unit IV	Web of Things versus Internet of Things – Two Pillars of the Web – Architecture Standardization for WoT– Platform Middleware for WoT – Unified Multitier WoT Architecture – WoT Portals and Business Intelligence	06
Unit-V	IoT applications for industry: Future Factory Concepts, Brownfield IoT, Smart Objects, Smart Applications. Study of existing IoT platforms /middleware, IoT- A, Hydra etc.	06
References	1. Honbo Zhou, "The Internet of Things in the Cloud: A Middleware Perspective", CRC Press,2012. 2. Dieter Uckelmann, Mark Harrison, Michahelles, Florian (Eds), "Architecting the Internet ofThings", Springer, 2011. 3. David Easley and Jon Kleinberg, "Networks, Crowds, and Markets: Reasoning About a HighlyConnected World", Cambridge University Press, 2010. 4. Olivier Hersent, David Boswarthick, Omar Elloumi , "The Internet of Things – Key applicationsand Protocols", Wiley, 2012.	

Course code	**ECC-708**				
Category	**Elective**				
Course title	Remote Sensing and GIS Techniques				
Scheme and Credits	**Credit**	**L**	**T**	P	
	3	3	0	0	
Objectives	This course will help students to understand the basic concepts of remote sensing and Geographical Information System (GIS) technology to capture, store, manipulate, analyze, manage, and present all types of geographical data in agriculture.				
Outcomes	After the completion of this course, students will be able to learn: CO1: Basic elements of Geographical Information System (GIS) technology and data modeling in agriculture. CO2: Various methods of spatial data analysis. CO3: Basic concepts of digitization process and use of maps and spatial information. CO4: Elements of remote sensing and its merits and demerits and use in spectral characterization of vegetation, soil and water. CO5: Basic learning of data acquisition and processing and use of GPS technology in agriculture.				

Unit	**Content**	**Hours**
Unit I	Introduction to Geographical Information System; Components of a GIS; Data Models in GIS-Raster and Vector	06
Unit II	Spatial Data Analysis- Raster and Vector, Data input, verification, storage and output	07
Unit III	Introduction- maps and spatial information; manual and automatic digitizing process; Spatial and nonspatial data linking; preparation of thematic maps, Data errors in GIS; Spatial modeling; Spatial interpolation; Current and potential uses of GIS in agricultural planning;	06
Unit IV	Physics of remote sensing, Satellites and their characteristics; Satellite Remote Sensing and Sensors; Spectral signatures of earth surface features, spectral characteristics of vegetation, soil and water	04
Unit-V	Data acquisition Data Reception, Transmission, Processing and data storage; Visual and digital image interpretation; Digital image processing, Applications of Remote Sensing in Agriculture, Basics of GPS; Observables and Biases; Errors and Limitations; Type and applications of GPS.	06

References

Annadurai, S. and Shanmugalakshmi, R. Fundamentals of Digital Image Processing. Pearson Education.

2. Burrough, P.A. Principles of Geographic Information System for Land Resources Assessment. Oxford University Press.

3. Curran, P.J. Principles of Remote Sensing. Longman Inc., New York.

4. Heywood, D. Ian, Murray, M. E. G. and Heywood, Ian.. An Introduction to Geographical Information Systems. Prentice Hall.

5. Jensen, J.R. Introductory Digital Image Processing. Prentice Hall

6. Lillesand, T.M. and Kiefer, R.W. Remote Sensing and Image Interpretation. John Wiley. 7. Peuquet, D. J. and Marble, D. F. 1990. Introductory Readings in Geographic Information System. Taylor and Francis, London.

Course code	**CSC-709**				
Category	**Elective**				
Course title	Data Warehousing and Data Mining				
Scheme and Credits	**Credit**	**L**	**T**	P	
	3	3	0	0	
Objectives	This course will help students to understand the basic concepts of data warehousing and data mining technology to capture, store, manipulate, analyze, manage, and present all types of data in agriculture.				
Outcomes	After the completion of this course, students will be able to learn: CO1: Basic elements of data warehousing and data mining and processing of multidimensional data in agriculture. CO2: Various methods of designing of data warehouse and concept hierarchy generation. CO3: Basic concepts of architecture of a data mining system. CO4: Elements of data mining and its merits and demerits. CO5: Basic learning of data mining processing and use of this technology in agriculture.				

Unit	**Content**	**Hours**
Unit I	Introduction What is data warehousing and data mining, A Multi-dimensional data model, Multi- dimensional Data Cubes, Star, Star Flakes, & Fact Constellation Schema, Concept Hierarchies, OLAP	06
Unit II	Data Warehouse Architecture Steps for design and construction of data warehouse, 3-tier data warehouse architecture, ROLAP, MOLAP, HOLAP, Data Pre-Processing, Overview, Need for pre-processing Issues related to efficient data handling (Extraction, Transformation, and updating of large databases Data Cleaning Data Integration & Transformation Data Reduction Discretization & Concept Hierarchy Generation	06
Unit III	Data mining Primitives, Language, & System Architecture What defines a data mining task? A data mining Query Language, Architecture of a Data mining System	07
Unit IV	Mining frequent patterns and associations, efficient and scalable frequent item set mining methods. Multilevel association rules, association mining and correlation analysis, constraint-based association rule.	08
Unit-V	Classification and prediction - basic concepts, decision tree, Bayesian classification, rule-based classification. Prediction. Cluster analysis - basic concepts, types of data in cluster analysis. Case Studies related to Data Mining in Agriculture.	06
References	1. Han, J., Kamber, M.: Data Mining: Concepts and Techniques. Second Edition. Elsevier Inc. 2. Dunham, M.H.: Data Mining. Introductory and Advanced Topics. Pearson Education	

Course code	**Bioinformatics Lab.**				
Category	**Practical**				
Course title	**AIC-751**				
Scheme and Credits	**Credit**	**L**	**T**	P	
	1	0	0	2	
Practicals	1. Usage of NCBI resources. 2. Retrival of sequence/structure from databases. 3. Visualization of structure. 4. Docking of ligand receptors. 5. BLAST exercises.				

Course code	**IoT Lab.**				
Category	**Practical**				
Course title	**AIC-752**				
Scheme and Credits	**Credit**	**L**	**T**	P	
	1	0	0	2	
Practicals	1. Elements of an IoT ecosystem, Technology drivers, Business drivers, Trends and implications. 2. Protocol Standardization for IoT. 3. IoT Open source architecture (OIC)- OIC Architecture & Design principles- IoT Devices and deployment models. 4. Web of Things versus Internet of Things. 5. Study of existing IoT platforms /middleware.				

Discipline Specific Electives

Course code	AID-501				
Category	**Discipline Specific Electives**				
Course title	Agriculture Marketing, Trade and Prices				
Scheme and Credits	**Credit**	**L**	**T**	P	
	3	3	0	0	
Objectives	To imparting knowledge of agriculture marketing, different systems, price analysis and trades, finance policy in Agriculture				
Outcomes	CO1.Enable students to gain knowledge on agricultural marketing, challenges and prospects for improving agricultural marketing system CO2. Gain skills to analyze Marketing Functions, Market Information and Intelligence CO3. Imparting knowledge of the marketing efficiency and agricultural prices CO4.Learn the Markets and Market Structure. CO5. Provide the platform to the students of Marketing of Agricultural Inputs.				

Unit	**Content**	**Hours**
Unit I	Agricultural Marketing: Concepts and Definition, Scope and subject matter, Market and Marketing: Meaning, Definitions, Components of a market, Classification. Market structure, Conduct, performance. Marketing structure, market functionaries or agencies. Producer's surplus: Meaning, Types of producers surplus, marketable surplus. Marketed surplus, importance, factors affecting marketable surplus.	8
Unit II	Marketing channels: Meaning, definition, channels for different products. Market integration, meaning, definition, types of market integration. Marketing efficiency: meaning, definition, marketing costs, margins and price spread, factors affecting the cost of marketing, reasons for higher marketing costs of farm commodities, ways of reducing marketing costs.	5
Unit III	Theories of international trade: Domestic trade, free trade, international trade, GATT, WTO, implications of AOA, market access, domestic support, export subsidies, EXIM-policy and ministerial conferences. Cooperative marketing. State trading. Ware housing corporation; central and state, objectives, functions, advantages.	8
Unit IV	Food corporation of India: objectives and functions. Quality control, agricultural products, AGMARK, price characteristics of agricultural product process, meaning, need for agricultural price policy. Risk in marketing: meaning and importance, types of	8

	risk in marketing, speculations and hedging, futures trading, contract farming	
References	1. Venugopal, P. and Kaundinya, R. 2014. Agri-input Marketing in India. SAGE Publishing 2.Singh, J and Lekhi R.K.2012. Agricultural Economics-An Indian Perspective. Kalyani Publishers. 3. Ghosh, N. 2013. India's Agricultural Marketing: Market Reforms and Emergence of New Channels. Springer.	

Course code	AID-502				
Category	**Discipline Specific Electives**				
Course title	Post-Harvest Engineering				
Scheme and Credits	**Credit**	**L**	**T**	P	
	3	3	0	0	
Objectives	• Know the different unit operations in the processing of major crops of the country and state. • Understand the working principles of different types of machinery used for the processing of agricultural crops. • Understand the basics of the selection of appropriate machines/equipment for various applications of processing of agricultural crops				
Outcomes	• Use the different types of sorting, grading, peeling, slicing, blanching and other equipment for processing of agricultural crops. • Identify the suitable equipment, materials, and methods for storage, processing, packaging, and value addition of agricultural crops. • Understand the technical and management aspects of the operation of agricultural crops.				

Unit	**Content**	**Hours**
Unit I	Introduction Post harvest engineering – introduction –objectives – post harvest losses of cereals, pulses and oilseeds – importance - optimum stage of harvest. Threshing – traditional methods mechanical threshers – types-principles and operation-moisture content –measurement –direct and indirect methods – moisture meters – equilibrium moisture content.	5
Unit II	Psychrometry and Drying Psychrometry – importance – Psychrometric charts and its uses – Drying – principles and theory of drying – thin layer and deep bed drying – Hot air drying – methods of producing hot air – Types of grain dryers – selection – construction, operation and maintenance of dryers – Design of dryers	6
Unit III	Cleaning and grading Principles - air screen cleaners – adjustments - cylinder separator-spiral separator – magnetic separator-colour sorter-inclined belt separator – length separators - effectiveness of separation and performance index.	5
Unit IV	Shelling and handling Principles and operation – maize sheller, husker sheller for maize – groundnut decorticator – castor sheller – material handling –belt conveyor –screw conveyor – chain conveyor – bucket elevators – pneumatic conveying.	5
Unit-V	Paddy and crop processing Paddy processing – parboiling of paddy – methods – merits and demerits – dehusking of paddy – methods – merits and demerits – rice polishers –types –	5

	constructional details – polishing –layout of modern rice mill - wheat milling – pulse milling methods – oil seed processing.	
References	1.Chakraverty, A.2000.Third Edition, Post harvest technology for Cereals, Pulses and oilseeds. Oxford &IBH publication Pvt Ltd, New Delhi 2.Sahay, K.M., and Singh, K.K. 1994. Unit operations of Agricultural Processing. Vikas publishing house Pvt. Ltd., New Delhi. 3. Pande, P.H. 1994. Principles of Agriculture Processing. Kalyani Publishers, Ludhiana 2. Mohsenin, N.N.1970. physical properties of plant and animal materials Grodon and Breach publishers, Ludhiana.	

Course code	AID-503

Category	**Discipline Specific Electives**				
Course title	Food and Dairy Engineering				
Scheme and Credits	**Credit**	**L**	**T**	P	
	3	0	0	0	
Objectives	• To impart knowledge on unit operations of dairy products and study of design and layout of dairy plants. • To understand the principle of Unit operation. • To acquaint with fundamentals of food engineering and its process • To understand the basics of designing of food plant and systems.				
Outcomes	• Understand the principles of Unit operation Acquaint with fundamentals of food engineering and its process • An understanding of different food packaging materials and packaging design and • Techniques used for various foods • Acquaint the students with various dairy engineering operations such as homogenization, pasteurization, thermal processing, evaporation, freezing, and drying of milk. • Understand the different types of equipment and their working principles used for processing and dairy and food products. • Learn to design a dairy plant layout.				

Unit	**Content**	**Hours**
Unit I	**Quality assurances in foods:**Food borne infections and intoxications; Mycotoxins in food, Quality assurance: Microbiological quality standards of food. Government regulatory practices and policies: PFA, Agmark, BIS, HACCP	5
Unit II	**Food preservation methods:**Temperature, Chemical and naturally occurring antimicrobials, Pasteurization and Food Preservation, Canning and Sterilization of Foods Preservation by Hurdle Technology, Food Preservation by Freezing	5
Unit III	**Industrial Food fermentations:**Starter cultures their biochemical activities, production and preservation of the following fermented foods: Fermented vegetables – Saurkraut, Fermented Meat – Sausages, Production and application of Bakers Yeast, Application of microbial enzymes in food industry	6
Unit IV	**Food Engineering & processing:** Scope and importance of food processing, hurdle technology, Juices and concentrates/membrane technology, storage of food, modified atmosphere packaging, nutritional boosts and flavor enhancers	6
Unit-V	**Dairy Technology:**Dairy development in India, thermal and chemical properties of milk and milk products, unit operation of	6

	various dairy and food processing systems, pasteurisation sterilization, homogenisation, filling & packaging, Fermentation of milk & milk products (acidophilus milk, yoghurt), Role of microorganisms in beverages – tea and coffee fermentations	
References	1.Biotechnology: Food Fermentation Microbiology, Biochemistry and Technology. Volume 2 by Joshi. 2. Fundamentals of Dairy Microbiology by Prajapati. 3. Essentials of Food Microbiology. Edited by John Garbult. Arnold International Students Edition. 4. Microbiology of Fermented Foods. Volume II and I. By Brian J. Wood.Elsiever Applied Science Publication. 5.Microbiology of Foods by John C. Ayres. J. OrwinMundt. William E. Sandinee. W. H. Freeman and Co	

Course code	AID-504				
Category	**Discipline Specific Electives**				
Course title	Bioinformatics for Agriculture				
Scheme and Credits	**Credit**	**L**	**T**	P	
	3	3	0	0	
Objectives	To impart an introductory knowledge about the subject of bioinformatics to the students studying any discipline of science.				
Outcomes	1.To get introduced to the basic concepts of Bioinformatics and its significance in Biological data analysis. 2. Describe the history, scope and importance of Bioinformatics and role of internet in Bioinformatics. 3. Explain about the methods to characterize and manage the different types of Biological data. 4.Classify different types of Biological Databases. 5. Introduction to the basics of sequence alignment and analysis. 6.Overview about biological macromolecular structures and structure prediction methods.				

Unit	**Content**	**Hours**
Unit I	**Biological Databases:** Introduction, File Formats, Flat File, Primary, Secondary, Composite databases. **Nucleotide databases:** NCBI, GeneBank, EMBL, DDBJ etc; Protein databases: UniProt, PIR, SwissProt, Expasy, etc.	5
Unit II	**Structural Databases:** Protein Data Bank, Nucleic Acid Data Bank, MMDB; Protein Classification Databases: SCOP, CATH; Metabolic Pathways Databases: KEGG; Protein family/domain databases: PROSITE, PRINTS, Pfam, BLOCK, etc.	6
Unit III	**Sequence Alignment** Pair wise alignment: Local, Global alignment and Semi global alignment – Algorithms, Dot matrix, Dynamic Programming, Heuristic alignment algorithm: BLAST, FASTA.	6
Unit IV	**Sequence Alignment** Multiple Sequence Alignment: Progressive method and Iterative method, Scoring matrices, Profile analysis, BLOCK analysis, Pattern.	5
Unit-V	Vector alignment search tool, DALI, PALI, SSAP, Genome sequence assembly, Gene finding methods (Gene Builder, GENE SCAN, GENSCAN, etc.).	6
References	1. David W. Mount. 2004. Bioinformatics: Sequence and Genome analysis, Cold Spring Harbor Laboratory Press. 2. Jones, N.C. and Pevzner, P. A. 2004. An Introduction to Bioinformatics Algorithms. The MIT Press.	

Course code	AID-505				
Category	**Discipline Specific Electives**				
Course title	Agricultural Biotechnology				
Scheme and Credits	**Credit**	**L**	**T**	P	
	3	3	0	0	
Objectives	To familiarize the students with the fundamental principles of Biotechnology, various developments in Biotechnology and its potential applications.				
Outcomes	1. Agricultural Biotechnology graduates will acquire knowledge about the range of approaches to manipulate and improve plants, animals and microorganisms. 2. Agricultural Biotechnology graduates will demonstrate the ability to develop, interpret, and critically evaluate modern approaches to scientific investigation. 3. Agricultural Biotechnology graduates will understand the relationship between society and science and the justification for biotechnological manipulation of plants, animals, and microorganisms. 4. [GCCR] Agricultural Biotechnology graduates will demonstrate their ability to communicate about science, as evidenced by their ABT395 presentations.				

Unit	**Content**	**Hours**
Unit I	**Genetic manipulation of herbicide tolerance:** Classes of herbicides, strategies for engineering herbicide tolerance, over expression of target protein, mutation of target protein, detoxification of herbicides, enhanced plant detoxification, environmental impact of herbicide tolerant crops, development of super weeds.	4
Unit II	**Genetic manipulation for pest resistance:** Common insect pests of major crops, uses of cry endotoxin, gene from Bacillus thuringiensis, use of Bacillus thuringiensis as a biopesticide, Starlink corn, environmental impact of Bt crops, 'copy nature' approach, development of cow pea trypsin inhibitors (CpTi) as pest control mechanism	5
Unit III	**Genetic manipulation for engineering for biotic and abiotic stress tolerance:** Plant- pathogen interactions, biotechnological approach to plant disease resistance, induction of HR and SAR in transgenic plants, native water deficit stress, salt stress, cold stress, heat stress	4

Unit IV	**Improvement of crop quality by GM approaches:** Genetic manipulation for delaying fruit ripening, genetic manipulation for ethylene biosynthesis, modification of nutritional quality e.g. provitamin A, carotenoids, Case study: Golden rice, Modification of flower color by genetic engineering of plants.	6
Unit-V	**Biopesticides and integrated pest management (IPM):** Plant biopesticides or botanical pest control (BPC), genetically engineered bacteria as biopesticides **Biofertilizers and integrated nutrient management (INM):** Principles and objectives of integrated nutrient management, components of integrated nutrient management, organic farming and organic food.	8
References	1. Primrose, S.B. and Twyman, R.M. 2006. Principles of gene manipulation and genomics (7^{th}eds.). Blackwell Publishing. 2. Henry, R.J. 2005. Practical applications of plant molecular biology (3^{rd}eds.). Chapman and Hall. 3. Ramawat, K.G. 2008. Plant biotechnology (3^{rd}eds.). S Chand and Co. Ltd. 4. Slater, A. Scott, N.W. and Fowler, M.R.2010. Plant Biotechnology: The genetic manipulation of plants (2^{nd} eds.). Oxford University.	

Course code	AID-601

Category	**Discipline Specific Electives**				
Course title	Supply Chain Management				
Scheme and Credits	**Credit**	**L**	**T**	P	
	3	3	0	0	
Objectives	The objective of the course is to impart knowledge and competencies for: **Designing supply chain strategies.** 1. Recognising supply chain integration to support products in various product life cycle. 2. Balancing logistics, manufacturing and inventory policies with demand and customer satisfaction. 3. Leveraging organisational capabilities and resources across supply chain business processes. 4. Designing lean but agile supply chains that integrate green initiatives. Implementing e-supply chains management systems.				
Outcomes	1. Understand the tactics to manage the interactions of the business functions 2. Gain insights on demand management function and its integration with supply chain. 3. Strategize on the enterprise knowledge and resources across the supply chain activities.				

Unit	**Content**	**Hours**
Unit I	**Introduction to supply chain management (S.C.M):** Basic Concepts, Scope and Philosophy of Supply Chain Management, Importance of Supply Chain Management, Supply Chain Decision, Evolution of Supply Chain Management.	5
Unit II	**Designing the Supply Chain:** Role of Distribution in Supply Chain, Factors Influencing Distribution Network, Process of Supply Network Design, Distribution Strategy, Models for Facilities Location and Capacity Allocation, Impact of Uncertainty on Supply Chain Design, Evaluation of Supply Chain Design, Demand Chain Management, Strategic Alliances.	8
Unit III	**Performance Measurement and Control:** Concept, Dimensions of Performance Measurement, Tools for Performance Improvement: Benchmarking: Introduction, Forms of Benchmarking, GAP Analysis, Benchmarking Study Report; Achieving Strategic Integration, Supply Chain Operations Reference (SCOR) Modeling, SCOR Analysis, Value Chain, Concept of Configurability, Evaluation of Supply Chain Performance (Supply Chain Cost Analysis), Impediments to Improved Performance.	8
Unit IV	**Logistics Management:** Concept of Logistics, Inbound and Outbound Logistics, Key Activities of Logistics, Managing the Costs of Logistics, Application of Logistics Management, Trade-Offs in Logistics Management, Bull-Whip Effect in Logistics, Third And Fourth Party Logistics, Emergence of IT in	8

	Logistics, International Issues in Logistics, Warehousing, Types of Warehouses, Site Selection, Layout and Design of Warehouses.	
Unit-V	**Emerging Trends in Supply Chain Management:** Role of Information Technology (IT) in Supply Chain Management: Electronic Data Interchange (EDI), E-Customer Relationship Management, Use of Data Mining Tools, E-Business Framework, Customer Profitability Analysis (CPA), International Issues in Supply Chain Management.	8
References	1.Chopra,-- and --. Meindl. Supply Chain Management: Strategic Planning and Operation, 2nd ed., Pearson Education, New Delhi. 2. Altekar, --. Supply Chain Management: Concepts and Cases, Prentice-Hall of India, New Delhi 3. Sahay, B.S.. Supply Chain Management, Macmillan, New Delhi	

Course code	AID-602				
Category	**Discipline Specific Electives**				
Course title	Precision Agriculture				
Scheme and Credits	**Credit**	**L**	**T**	P	
	3	3	0	0	
Objectives	1.Identify and understand the key terminology associated with various precision agriculture topics and be able to use those terms correctly when discussing material from the course. Demonstrate a familiarity with technology, precision ag data, data handling and management 2. Processes and software used in the course. Demonstrate knowledge of basic procedures discussed in lecture and be able to apply that 3.knowledge through hands-on laboratory skill activities.				
Outcomes	• Define precision agriculture from the managerial technological and social perspectives. • Understand the overall scope of precision agriculture. • Understand how global positioning system work and how this technology is used in precision agriculture.				

Unit	**Content**	**Hours**
Unit I	Introduction to Precision Agriculture-Background,Recordkeeping/software system, Analysis and decision making, Specialized implementation equipment, Evaluation and revision,	4
Unit II	Global Positioning System,How GPS works, Differential GPS,WAAS,Real time kinematic, Accuracy, GPS Guidance Technologies, Guidance aids,Auto-steer systems,Light bar guidance systems,	5
Unit III	Variable Rate Technologies,Seeding,Spraying Yield Monitoring Technologies,Grain, Hay/forage,	3
Unit IV	Site-specific Information-Grid sampling,Direct sampling, Crop mapping, Geographic Information Systems,Interpreting yield maps, Economics of Precision Agriculture Technologies-Cost savings of production,Benefits to the environment.	8
References	1.The Precision Farming Guide for Agriculturists, An Agricultural Primer, Deere & Company Supplementary Reading 2.Srinivasan, A. 2006. Handbook of Precision Agriculture: Principles and Applications. Brase, T. Precision Agriculture.	

Course code	AID- 603				
Category	**Discipline Specific Electives**				
Course title	Farm Power & Machinery Engineering				
Scheme and Credits	**Credit**	**L**	**T**	P	
	3	3	0	0	
Objectives	1. To provide a sound knowledge in the study of agricultural power and machinery in order to facilitates students interest in agricultural engineering; 2. To provide suitable materials with adequate illustrations based on local problems and issues that affect tropical agriculture. 3. Discuss various power sources available for agricultural work . 4. Be able to select, use, repair and maintain appropriate agricultural machinery 5. This knowledge will be highly useful in running an Agro Service Centre for farm machinery				
Outcomes	1.The students will be able to learn about different sources of farm power, construction and functioning of CI and SI engines, IC engine fuels, Coolants, anti freeze and anti corrosion materials. 2. To identify the need of farm mechanization in India. Also equip the students with technical knowledge and skills required for the operation, maintenance and evaluation of Tillage, Sowing and intercultural operational machinery needed for agricultural farms. 3.To abreast the students with mathematical, experimental and computational skills for solving different field problems. 4.To develop skills in the students required to develop and modification of indigenous farm machines as per the need of the area and farmers				

Unit	**Content**	**Hours**
Unit I	Sources of power on the farm-human, animal, mechanical, electrical, wind, solar and biomass; bio-fuels; design and selection of machine elements - gears, pulleys, chains and sprockets and belts; overload safety devices used in farm machinery; measurement of force, torque, speed, displacement and acceleration on machine elements.	5
Unit II	Soil tillage; forces acting on a tillage tool; hitch systems and hitching of tillage implements; mechanics of animal traction; functional requirements, principles of working, construction and operation of manual, animal and power operated equipment for tillage, sowing, planting, fertilizer application, inter-cultivation, spraying, mowing, chaff cutting, harvesting, threshing and transport; testing of agricultural machinery and equipment; calculation of performance parameters -field capacity, efficiency, application rate and losses; cost analysis of implements and tractors	8
Unit III	Thermodynamic principles of I.C. engines; I.C. engine cycles; engine components; fuels and combustion; lubricants and their properties; I.C. engine systems - fuel, cooling, lubrication, ignition, electrical, intake and exhaust; selection, operation, maintenance and repair of I.C. engines; power efficiencies and measurement; calculation of power, torque, fuel consumption, heat load and power losses.	8

Unit IV	Tractors and power tillers - type, selection, maintenance and repair; tractor clutches and brakes; power transmission systems - gear trains, differential, final drives and power take-off; mechanics of tractor chassis; traction theory; three point hitches- free link and restrained link operations; mechanical steering and hydraulic control systems used in tractors; human engineering and safety in tractor design; tractor tests and performance.	8
References	1. Sahay, J. 2006. Elements of Agricultural Engineering. Standard Publishers Distributor. 2. Singh, S. 2007. Farm Machinery - Principles and Applications. ICAR Publication. 3. Jain, S.C. and.Rai, C.R. 2012. Farm Tractor – Maintenance and Repair. Standard Publishers. 4. Ojha, T. P. and Michael, A.M. 2005. Principles of Agricultural Engineering. Vol. I, Jain Brothers**.**	

Course code	AID -604				
Category	**Discipline Specific Electives**				
Course title	Wasteland Management				
Scheme and Credits	**Credit**	**L**	**T**	P	
	3	3	0	0	
Objectives	This course will help students to understand the basic concepts of wasteland management and the techniques to manage and use wasteland.				
Outcomes	After the completion of this course, students will be able to learn: CO1: Basic elements of land degradation. Their planning and management. CO2: Various methods of conservation of land and water. CO3: Basic concepts of afforestation and other land use options. CO4: Factors affecting wasteland development and mine spoils. CO5: Basic learning of irrigation methods, various governmental policies for wasteland management.				

Unit	**Content**	**Hours**
Unit I	**Land degradation** – concept, classification - arid, semiarid, humid and sub-humid regions, denuded range land and marginal lands. Wastelands - factors causing, classification and mapping of wastelands, planning of wastelands development - constraints, agro-climatic conditions, development options, contingency plans.	08
Unit II	Conservation structures - gully stabilization, ravine rehabilitation, sand dune stabilization, water harvesting and recycling methods.	06
Unit III	**Afforestation** - agro-horti-forestry-silvipasture methods, forage and fuel crops - socioeconomic constraints. Shifting cultivation, optimal land use options.	05
Unit IV	**Wasteland development** – hills, semi-arid, coastal areas, water scarce areas, reclamation of waterlogged and salt-affected lands. Mine spoils- impact, land degradation and reclamation and rehabilitation, slope stabilization and mine environment management.	08
Unit-V	Micro-irrigation in wastelands development. Sustainable wasteland development - drought situations, socio-economic perspectives. Government policies. Participatory approach. Preparation of proposal for wasteland development and benefit-cost analysis.	06
References	1. Abrol, I.P., and V.V. Dhruvanarayana. 1998. Technologies for Wasteland Development. ICAR, New Delhi. 2. Ambast, S.K., S.K. Gupta and Gurcharan Singh (Eds.) 2007. Agricultural Land Drainage - Reclamation of Waterlogged Saline Lands. Central Soil Salinity Research Institute, Karnal, Haryana. Hridai Ram Yadav. 2013. Management of Wastelands. Concept Publishing Company. New Delhi. 3. Karthikeyan, C., K. Thangaraja, C. Cinthia Fernandez and K. Chandrakandon. 2009. Dryland Agriculture and Wasteland	

	Management. Atlantic Publishers and Distributors Pvt. Ltd., New Delhi. 4. Rattan Lal and B.A. Stewart (Ed.). 2015. Soil Management of Smallholder Agriculture. Volume 21 of Advances in Soil Science. CRC Press, Taylor and Francis Group, Florida, USA.

Course code	AID -605				
Category	**Discipline Specific Electives**				
Course title	Ground water engineering				
Scheme and Credits	**Credit**	**L**	**T**	P	
	3	3	0	0	
Objectives	This course will help students to understand the basic concepts of groundwater engineering, management, different parameters, quality and conservation.				
Outcomes	After the completion of this course, students will be able to learn: CO1: Basic elements of hydrogeological parameters, estimations of groundwater table, their planning and management. CO2: Basic learning of well hydraulics. CO3: Basic concepts of groundwater management and techniques. CO4: Factors affecting groundwater quality and its environmental concern and regulatory norms. CO5: Basic learning of different methods of groundwater conservation and various governmental policies for its management.				

Unit	**Content**	**Hours**
Unit I	**Hydrogeological Parameters** Introduction – Water bearing Properties of Rock – Type of aquifers – Aquifer properties – permeability, specific yield, transmissivity and storage coefficient – Methods of Estimation– Ground water table fluctuation and its interpretations – Groundwater development and Potential in India – GEC norms.	08
Unit II	**Well Hydraulics** Objectives of Groundwater hydraulics – Darcy's Law – Groundwater equation – steady state flow – Dupuit Forchheimer assumption – Unsteady state flow – Theis method – Jacob method - Slug tests – Image well theory – Partial penetrations of wells.	06
Unit III	**Groundwater Management** Need for Management Model – Database for groundwater management –groundwater balance study – Introduction to Mathematical model – Conjunctive use – Collector well and Infiltration gallery.	06
Unit IV	**Groundwater Quality** Ground water chemistry – Origin, movement and quality – Water quality standards – Health and aesthetic aspects of water quality – Saline intrusion – Environmental concern and Regulatory requirements	06
Unit-V	**Groundwater Conservation** Artificial recharge techniques – Remediation of Saline intrusion– Ground water management studies – Protection zone delineation, Contamination source inventory, remediation schemes – Ground water Pollution and legislation.	06
References	1. Raghunath H.M., "Ground Water Hydrology", New Age International (P) Limited, New Delhi, 2010.	

	2. Todd D.K., “Ground Water Hydrology”, John Wiley and Sons, New York, 2000. 3. Fitts R Charles, “Groundwater Science”. Elsevier, Academic Press, 2002. 4. Ramakrishnan, S, Ground Water, K.J. Graph arts, Chennai, 1998.

Course code	AID-701				
Category	**Discipline Specific Electives**				
Course title	Extension Methodologies for Transfer of Agriculture Technology				
Scheme and Credits	**Credit**	**L**	**T**	P	
	3	3	0	0	
Objectives	This course will help students to understand the basic concepts of extension education in agriculture and different methodologies used in transfer of technology in agriculture.				
Outcomes	After the completion of this course, students will be able to learn: CO1: Basic elements of communication and planning and steps of extension progamme development. CO2: Various methods of teaching extension and modern methodology used. CO3: Basic concepts of mass methods and teaching processes. CO4: Elements of agricultural journalism and its merits and demerits. CO5: Basic learning of innovative learning sources and use of mobile technology in agriculture.				

Unit	**Content**	**Hours**
Unit I	Communication – Meaning, Definition, Models, Elements and their Characteristics, Types and Barriers in communication. Extension Programme Planning – Meaning, Definitions of Planning, Programme, Project, Importance, Principles and Steps in Programme Development Process, Monitoring and Evaluation of Extension Programmes.	08
Unit II	Extension teaching methods – Meaning, Definition, Functions and Classification. Individual contact methods – Farm and Home visit, Result Demonstration, Field trials – Meaning, Objectives, Steps, Merits and Demerits. Group contact methods – Group discussion, Method demonstration, Field Trips – Meaning, Objectives, Steps, Merits and Demerits. Small group discussion techniques – Lecture, Symposium, Panel, Debate, Forum, Buzz group, Workshop, Brain Storming, Seminar and Conference.	08
Unit III	Mass contact Methods – Campaign, Exhibition, Kisan Mela, Radio & Television – Meaning, Importance, Steps, Merits & Demerits. Factors influencing in selection of Extension Teaching Methods and Combination (Media Mix) of teaching methods.	06
Unit IV	Agricultural Journalism – Meaning, Scope and Importance, Sources of news, Types, Merits and Limitations	04
Unit-V	ATIC, KVK, DVK, Innovative Information sources – Internet, Cyber Cafes, Motion picture or movies, chart, Kisan call centers; Mobile Technology in TOT- I-khedut, e-krishikiran, SMS, KKMS Video chatting, Video conferencing, Mobile Apps, Cloud computing etc and Consultancy clinics.	06
References	1. Teaching Extension Education by S. K. Waghmare published by Prashant Publishers, VVNagar 2. Extension and Communication for Agricultural Development by G. R. Ray	

	3. Integrated Extension Education by S. V. Supe published by Agrotech publishing Academy, Udaipur. 4. Agricultural by S. V. Supe published by Agrotech publishing Academy, Udaipur 5. Information Technology for Agricultural Production, Education and management by N. B. Chauhan, M. K. Zhala, and J. G. Sarvaiya ISBN: 81-89304-08-9

Course code	AID-702				
Category	**Discipline Specific Electives**				
Course title	Post-Harvest Engineering of Agricultural Crops				
Scheme and Credits	**Credit**	**L**	**T**	P	
	3	3	0	0	
Objectives	This course will help students to understand the basic concepts of post harvest engineering of agricultural crops, elements, tools and processing of various agricultural produce.				
Outcomes	After the completion of this course, students will be able to learn: CO1: Basic elements of post harvest engineering and methods and principles of threshing. CO2: Various methods of estimation of moisture content and methods and principles of drying. CO3: Basic concepts of sorting, grading, cleaning and sizing of agricultural produce. CO4: Elements of shelling and handling of agricultural produce. CO5: Basic learning of milling and various post harvest processing of cereals and pulses..				

Unit	**Content**	**Hours**
Unit I	Introduction Post harvest engineering – introduction –objectives – post harvest losses of cereals, pulses and oilseeds – importance - optimum stage of harvest. Threshing – traditional methods mechanical threshers – types-principles and operation-moisture content –measurement –direct and indirect methods – moisture meters – equilibrium moisture content.	08
Unit II	Psychrometry and Drying Psychrometry – importance – Psychrometric charts and its uses – Drying – principles and theory of drying – thin layer and deep bed drying – Hot air drying – methods of producing hot air – Types of grain dryers – selection – construction, operation and maintenance of dryers – Design of dryers	06
Unit III	Cleaning and grading Principles - air screen cleaners – adjustments - cylinder separator-spiral separator – magnetic separator-colour sorter-inclined belt separator – length separators - effectiveness of separation and performance index.	05
Unit IV	Shelling and handling Principles and operation – maize sheller, husker sheller for maize – groundnut decorticator – castor sheller – material handling –belt conveyor –screw conveyor – chain conveyor – bucket elevators – pneumatic conveying.	05
Unit-V	Paddy and crop processing Paddy processing – parboiling of paddy – methods – merits and demerits – dehusking of paddy – methods – merits and demerits – rice polishers –types – constructional details – polishing –layout of modern rice mill - wheat milling – pulse milling methods – oil seed processing.	06
References	1. Chakraverty, A.2000.Third Edition, Post harvest technology for Cereals, Pulses and oilseeds. Oxford &IBH publication Pvt Ltd, New Delhi 2. Sahay, K.M., and Singh, K.K. 1994. Unit operations of Agricultural Processing. Vikas publishing house Pvt. Ltd., New Delhi.	

	3. Pande, P.H. 1994. Principles of Agriculture Processing. Kalyani Publishers, Ludhiana 2. Mohsenin, N.N.1970. physical properties of plant and animal materials Grodon and Breach publishers, Ludhiana.

Course code	AID -703

Category	**Discipline Specific Electives**				
Course title	Soil mechanics & Soil Physics				
Scheme and Credits	**Credit**	**L**	**T**	P	
	3	3	0	0	
Objectives	This course will help students to understand the basic concepts of soil mechanics, engineering, management, different parameters, quality and conservation.				
Outcomes	After the completion of this course, students will be able to learn: CO1: Basic elements of soil mechanics and its general classification.. CO2: Basic learning of stress conditions in soil and its determination and classification. CO3: Basic concepts of different types of soil compaction, methods and control. CO4: Factors affecting consolidation of soil, methods of determination and its control measures. CO5: Basic learning of Earth pressures, different theories and their stability analysis.				

Unit	**Content**	**Hours**
Unit I	Introduction of soil mechanics, field of soil mechanics, phase diagram physical and index properties of soil classification of soils, general classification based on particles size, textural classification and LS. soil	04
Unit II	Classification system stress condition in soils, effective and neutral stress, elementary concept of Bousinesque and Wester guards analysis, newmark influence chart. Shear strength mohr stress circle, theoretical relationship between principle stress circles, theoretical relationship between principal stress mohr-coulomb failure theory, effective stress principle. Determination of shear perameters by direct shear to be circle, theoretical test.	08
Unit III	Numerical exercise based on various types of tests. Compaction composition of soils standard and modified protector test, abbot compaction and Jodhpur mini compaction text field compaction method and control.	04
Unit IV	Consolidation of soil: Consolidation of soils, one dimensional consolidation spring analogy, Terzaghi's theory Laboratory consolidation text, calculation of void ratio and coefficient of volume change, Taylor's and. Casagrand's method, determination of coefficient of consolidation.	06
Unit-V	Earth pressure: Plastic equilibrium in soils, active and passive states, Rankine's theory of earth pressure. active and passive earth pressure for cohesive soils, simple numerical exercise. Stability of slopes: Introduction to stability analysis of and finite slopes friction circles method Taylor's stability number.	06
References	1. N. C. Brady and R. W. Ray. The Nature and Properties of Soils. Macmillan 2. T. D. Biswas and S. K. Mukherjee. Text book of Soil Science. McGraw Hill. 3. B. P. Ghildyal and R. P. Tripathi. Soil Physics. Wiley Eastern.	

	4. H. D. Foth. Fundamental of Soil Science. Wiley Eastern. 5. B. C. Punmia., Soil Mechanics and Foundations, Laxmi Publication Pvt. Ltd., New Delhi 6. S. G. Bowell. Soil Mechanics. Wiley Eastern. 7. Gopalrajan and A. S. R. Rao. Basic and Applied Soil Mechanics.

Course code	AID -704

Category	**Discipline Specific Electives**				
Course title	Natural Resources Management				
Scheme and Credits	**Credit**	**L**	**T**	P	
	3	3	0	0	
Objectives	This course will help students to understand the basic concepts of natural resource management, approaches and principles, problems and management of minerals, soil and water.				
Outcomes	After the completion of this course, students will be able to learn: CO1: Basic concepts of natural resource management, ecological, social and economic dimension of resource management. CO2: Basic learning of theories and approaches of natural resource conservation and management. CO3: Basic learning of theories and approaches of mineral resource conservation and management. CO4: Basic learning of theories and approaches of soil resource conservation and management CO5: Basic learning of theories and approaches of water resource conservation and management .				

Unit	**Content**	**Hours**
Unit I	Introduction to Natural Resource Bases: Concept of resource, classification of natural resources. Factors influencing resource availability, distribution and uses. Interrelationships among different types of natural resources. Ecological, social and economic dimension of resource management Natural resources and development.	06
Unit II	Introduction Inter-relationship within Environmental system Natural Resource ecosystem, Urban ecosystem Principal of Natural Resource Conservation and Management Theory and Approach	04
Unit III	**Mineral** : Problems and management, Energy : Problems and management	04
Unit IV	**Soil** : Problems and management, Forestry & wildlife: Problems and management Air : Problems and management	04
Unit-V	**Water Resource :** Problems and management Marine Resource : Problems and management Coastal Resource: Problems and management.	06
References	4. Jha, Mrityunjay M., and R.B. Singh. 2008. Land Use, Reflection on Spatial Informatics, Agriculture and Development. Concept Publishing Company, New Delhi.318p. 5. Amit Hazra. Land Reforms, Myths and Realities. Concept Publishing Company, New Delhi. 6. Sundaram, K.V., M.Moni, and Mrityunjay M. Jha (ed.). Natural Resources Management and Livelihood Security. Concept Publishing Company, New Delhi.	

Course code	AID -705				
Category	**Discipline Specific Electives**				
Course title	Nanotechnology for agriculture				
Scheme and Credits	**Credit**	**L**	**T**	P	
	3	3	0	0	
Objectives	This course will help students to understand the basic concepts of nanotechnology and use of nanotechnology, nanomaterials, nanosensing and other nano techniques in agriculture.				
Outcomes	After the completion of this course, students will be able to learn: CO1: Basic concepts of nanotechnology, ecological, social and economic dimension of nanotechnology. CO2: Basic learning of theories and approaches of nanomaterials and their applications in agriculture. CO3: Basic learning of nanotechnological tools such as different microscopes. CO4: Basic learning of theories and approaches of nanosensing devices and their application in agriculture. CO5: Basic learning of theories and approaches of nanotechnology in plant disease management, post harvest monitoring and their role in sustainable agriculture.				

Unit	**Content**	**Hours**
Unit I	**NANOTECHNOLOGY:** Introduction, Definition, Length scales: top down and bottom up, Importance of Nanoscale and Technology, History of Nanotechnology, Nanotechnology Products &Applications: Nanotechnology in Computing and electronics, defence, Health and medicine, Textiles, Cosmetics, Agriculture, sports , automobiles.	08
Unit II	**NANOMATERIALS:** What are nanomaterials? One dimensional nanomaterials, two dimensional nanomaterials, three dimensional nanomaterials, Preparation of nanomaterials-Physical method-Ball Milling, Melt Mixing, Plasma arcing, Molecular Beam Epitaxy, Ion implantation, Sputter Deposition, Laser Ablation, Laser Pyrolysis, , Chemical methods: Sol- gels techniques, Langmuir Blogett method, Hybrid method: Chemical Vapor Deposition, Biological Method: Use of Microorganisms, Plants, Templates.	08
Unit III	**CHARACTERIZATION TOOLS:** Introduction, X-ray Diffraction (XRD), Scanning Electron Microscopy (SEM), Transmission Electron Microscopy (TEM), Scanning Probe Microscopy (SPM)-Scanning Tunneling Microscopy (STM), Atomic Force-Microscopy (AFM), Introduction to Lithography and its types.	08
Unit IV	**NANOSENSING:** Predicted applications,conducting polymer based sensors,existing nanosensors, nanosensor production methods, nano pressure sensor, physical sensor, biosensor, nano prostaglandin biosensor for selective detection & diagnostics.	04

Unit-V	**NANOTECHNOLOGY IN AGRICULTURE:** Crop improvement, Plant disease diagnostics, post harvest monitoring and food biotechnology, monitoring quality of agricultural products, nanofertilizers and their role in sustainable agriculture.	04
References	1. G. Cao, Nanostructures & Nanomaterials: Synthesis, Properties & Applications, Imperial College Press, 2004. 2. B. D.Cullity, "Elements of X-ray Diffraction", 4th Edition, Addison Wiley, 1978. 3. M. H.Loretto, "Electron Beam Analysis of Materials", Chapman and Hall, 1984. 4. R.M.Rose, L.A.Shepard and J.Wulff, "The Structure and Properties of Materials", Wiley Eastern Ltd.	

Mandatory Courses

Course code	**MCC-301**				
Category	**Mandatory**				
Course title	Essence of Indian Traditional Knowledge				
Scheme and Credits	**Credit**	**L**	**T**	P	
	0	0	0	0	
Objectives	1. To facilitate the students with the concepts of Indian traditional knowledge and to make them understand the Importance of roots of knowledge system. 2. To make the students understand the traditional knowledge and analyse it and apply it to their day to day life				
Outcomes	1. Identify the concept of Traditional knowledge and its importance. 2. Explain the need and importance of protecting traditional knowledge. 3.IIllustrate the various enactments related to the protection of traditional knowledge. 4.Interpret the concepts of Intellectual property to protect the traditional knowledge. 5.Explain the importance of Traditional knowledge in Agriculture and Medicine.				

Unit	**Content**	**Hours**
Unit I	**Introduction to traditional knowledge**: Define traditional knowledge, nature and characteristics, scope and importance, kinds of traditional knowledge, the physical and social contexts in which traditional knowledge develop, the historical impact of social change on traditional knowledge systems. Indigenous Knowledge (IK), characteristics, traditional knowledge vis-à-vis indigenous knowledge, traditional knowledge Vs western knowledge traditional knowledge vis-à-vis formal	06

	knowledge	
Unit II	Protection of traditional knowledge: the need for protecting traditional knowledge Significance of TK Protection, value of TK in global economy, Role of Government to harness TK	06
Unit III	**Legal frame work and TK**:**A:** The Scheduled Tribes and Other Traditional Forest Dwellers (Recognition of Forest Rights) Act, 2006, Plant Varieties Protection and Farmer's Rights Act, 2001 (PPVFR Act); **B:** The Biological Diversity Act 2002 and Rules 2004, the protection of traditional Knowledge bill, 2016. Geographical indicators act 2003.	06
Unit IV	Traditional knowledge and intellectual property: Systems of traditional knowledge protection, Legal concepts for the protection of traditional knowledge, Certain non IPR mechanisms of traditional knowledge protection, Patents and traditional knowledge, Strategies to increase protection of traditional knowledge, global legal FORA for increasing protection of Indian Traditional Knowledge	06
Unit-V	Traditional knowledge in different sectors: Traditional knowledge and engineering,Traditional medicine system, TK and biotechnology, TK in agriculture, Traditional societies depend on it for their food and healthcare needs, Importance of conservation andsustainable development of environment, Management of biodiversity, Food security of the country and protection of TK	06
References	1. Traditional Knowledge System in India, by Amit Jha, 2009. 2. Traditional Knowledge System and Technology in India by Basanta Kumar Mohanta and Vipin Kumar Singh, PratibhaPrakashan 2012. 3. Traditional Knowledge System in India by Amit Jha Atlantic publishers, 2002 4. "Knowledge Traditions and Practices of India" Kapil Kapoor1, Michel Danino	

Course code	**MCC-708**				
Category	**Mandatory**				
Course title	Technical Report Writing				
Scheme and Credits	**Credit**	**L**	**T**	P	

Objectives	This course is designed to develop skills that will enable to produce clear and effective scientific and technical documents. While the emphasis will be on writing, oral communication of scientific and technical information will form an important component of the course, as well.				

Outcomes	1.Act ethically in their role in the communication situation. 2.Apply concepts of information design. These concepts include effective ways to design documents for print, web, and other electronic means of communication in order to construct documents meaningful to the audience. 3.Use visual items in effectively constructing meaning in communication situations. 4.Create clear, concise technical documents that effectively use style and grammar and information structure in ways that create meaning with the reader. 5.Collaborate effectively in various writing situations, including planning, creating, and managing, evaluating, editing and revising document production.

Unit	Content	Hours
Unit I	**Lab Work**: Foundation of Reading & Writing, Introduction to Technical Writing, Introduction to research papers, articles, technical notes, Document Development Life Cycle, Software Tools (Latex, etc.), concept of technical publication Students create a variety of projects, drawn from the genres listed below, and engage in numerous discussions and group activities to facilitate their ability to create effective documents.	8
Unit II	**Case Study**: Design Specification, User Manual / Guides, Hardware Manuals, Installation Manuals, Online Help, Web sites, Analytical/Feasibility Reports, Proposals (Business Development Perspective), Lab/Science Reports, Project proposal writing, Abstracts, Progress reports	8
References	1.Markel, Mike. Technical Communication. 7th ed. New York, NY: Bedford/St. Martin's, 2003. ISBN: 9780312403386. 2.Perelman, Leslie C., James Paradis, and Edward Barrett. The Mayfield Handbook of Technical and Scientific Writing. New York, NY: McGraw-Hill, 1997. ISBN: 9781559346474.	

Course code	**MCC- 401**				
Category	**Mandatory**				
Course title	**Environmental Sciences**				
Scheme and Credits	**Credit**	**L**	**T**	P	

Objectives	To give students an understanding of how science and the scientific method work to address environmental problems. The student will become familiar with the Earth's major systems (ecosystems and biogeochemical cycles), how they function and how they are affected by human activity (population growth, air, water and soil pollution, ozone depletion, global warming, solid waste disposal). Students will learn about the interaction of human society (urban sprawl, energy use/generation, resource consumption and economics) with the Earth's systems.				
Outcomes	1.Gain in-depth knowledge on natural processes that sustain life, and govern economy. 2. Predict the consequences of human actions on the web of life, global economy and quality of human life. 3.Develop critical thinking for shaping strategies (scientific, social, economic and legal) for environmental protection and conservation of biodiversity, social equity and sustainable development. 4.Acquire values and attitudes towards understanding complex environmental-economic social challenges, and participating actively in solving current environmental problems and preventing the future ones. 5. Adopt sustainability as a practice in life, society and ind				

Unit	Content	Hours
Unit I	**Natural Resources-** Renewable and Non-renewable Resources, Forests, water, minerals, Food and land (with example of one case study	2
Unit II	**Biodiversity and its conservation-**Biodiversity at global, national and local levels; India as a mega-diversity nation; Threats to biodiversity (biotic, abiotic stresses), and strategies for conservation.	3

Unit III	**Environmental Pollution-**Types of pollution- Air, water (including urban, rural, marine), soil, noise, thermal, nuclear; Pollution prevention.	3
Unit IV	**Environmental Biotechnology-** For environmental protection, biological indicators, biosensors, bioremediation, phytoremediation, biopesticides, biofertilizers.	5
UnitV	**Social Issues and Environment-** Climate change- Reasons, Greenhouse effect, Global warming. Legal issues- Environmental legislation (Acts and issues involved), Environmental ethics.	6
References	1. Gilbert M. Masters, (2004),Introduction to Environmental Engineering and Science, 2nd Ed., Pearson 2. Benny Joseph, (2006), Environmental Science and Engineering, Tata McGraw Hill, New Delhi 3. Rajagopalan.R., (2005), Environmental Studies – from crisis to cure, Oxford University Press 4. DarmendraS.Senger., (2007), Environmental Law, Prentice Hall of India (P) Ltd, New Delhi 5. Hans-JoachinJoerdening and Josef Winter., (20 05)), Environmental Biotechnology; Concepts and Applications, Willy-VCH Verlag	

Course code	MCC- 501				
Category	**Mandatory**				
Course title	Cyber Security				
Scheme and Credits	**Credit**	**L**	**T**	P	

Objectives	1.Exhibit knowledge to secure corrupted systems, protect personal data, and secure computer networks in an Organization. Practice with an expertise in academics to design and implement security solutions. 2. Understand key terms and concepts in Cryptography, Governance and Compliance. 3. Develop cyber security strategies and policies. 4.Understand principles of web security and to guarantee a secure network by monitoring and analyzing the nature of attacks through cyber/computer forensics software/tools.				
Outcomes	1.Analyze and evaluate the cyber security needs of an organization. 2.Determine and analyze software vulnerabilities and security solutions to reduce the risk of exploitation. 3. Measure the performance and troubleshoot cyber security systems. 4. Implement cyber security solutions and use of cyber security, information assurance, and cyber/computer forensics software/tools. 5. Comprehend and execute risk management processes, risk treatment methods, and key risk and performance indicators . 6. Design and develop asecurity architecture for an organization. 7. Design operational and strategic cyber security strategies and policies.				

Unit		
Unit I	Introduction to information systems, Types of information Systems, Development of Information Systems, Introduction to information security, Need for Information security, Threats to Information Systems, Information Assurance, Cyber Security, and Security Risk Analysis.	4
Unit II	Application security (Database, E-mail and Internet), Data Security Considerations-Backups, Archival Storage and Disposal of Data, Security Technology-Firewall and VPNs, Intrusion Detection, Access Control. Security Threats -Viruses, Worms, Trojan Horse, Bombs, Trapdoors, Spoofs, E-mail viruses, Macro viruses, Malicious Software,	8

	Network and Denial of Services Attack, Security Threats to E-Commerce-Electronic Payment System, eCash,Credit/Debit Cards. Digital Signature, public Key Cryptography.	
Unit III	Developing Secure Information Systems, Application Development Security, Information Security Governance & Risk Management, Security Architecture & Design Security Issues in Hardware, Data Storage & Downloadable Devices, Physical Security of IT Assets, Access Control,CCTV and intrusion Detection Systems, Backup Security Measures.	8
Unit IV	Security Policies, Why Policies should be developed, WWW policies, Email Security policies, Policy Review Process-Corporate policies-Sample Security Policies, Publishing and Notification Requirement of the Policies. Information Security Standards-ISO, IT Act, Copyright Act, Patent Law, IPR. Cyber Laws in India; ITAct 2000 Provisions,Intellectual Property Law: Copy Right Law, Software License, Semiconductor Law and Patent Law.	8
References	1. Charles P. Pfleeger, Shari LawerancePfleeger, "Analysing Computer Security ", Pearson Education India. 2. V.K. Pachghare, "Cryptography and information Security", PHI Learning Private Limited, Delhi India. 3.Dr. Surya Prakash Tripathi, RitendraGoyal, Praveen kumar Shukla ,"Introduction to Information Security andCyber Law" Willey Dreamtech Press. 4. Schou, Shoemaker, " Information Assurance for the Enterprise", Tata McGraw Hill. 5. CHANDER, HARISH**,"** Cyber Laws And It Protection **"** , PHI Learning Private Limited ,Delhi ,India	
Course code	**MCC-601**	
Category	**Mandatory**	
Course title	**Indian Constitution**	
Scheme and Credits	**Credit** | **L** | **T** | P -----	
Objectives	To understand the autonomous nature of **c**onstitutiona**l** bodies like Supreme Court and high court, controller and auditor general of India and election commission of India. To understand the central and state relation, financial and administrative.	

Outcomes	1.Understand the meaning and importance of Constitution 2. Explain about making of Indian Constitution - contribution of Constituent assembly on it. 3.Describe the Salient (Outstanding) features of Indian Constitution. 4. Describe the importance of Preamble of the Indian Constitution and its significance.

Unit	Content	Hours
Unit I	Constitutional developments since 1858 to 1947, Making of the Indian Constitution, Nature and special features of the Constitution. Equality &Social Justice , Gender justice.	5
Unit II	Speech and expression, media, press and information, Freedom of Speech and contempt of court, Personal Liberty.	4
UnitIII	Fundamental Rights & Directive Principles - inter relationship - judicial balancing. Constitutional amendments -to strengthen Directive Principles. Reading Directive Principles into Fundamental Rights.	5
UnitIV	The need and status in constitutional set up, Interrelationship with fundamental rights and directive principles.	4
References	. G. Austin, History of Democratic Constitution: The Indian Expenditure (2000) Oxford 2. D. D. Basu, Shorter Constitution of India, (1996), Prentice Hall of India, Delhi 3. Constituent Assembly Debates Vol. 1 to 12 (1989) 4. H. M. Seervai, Constitution of India, Vol. 1-3 (1992), Tripathi, Bombay 4. S. C. Kashyap, Human Rights and Parliament (1978) Metropolitan, New Delhi	