DR. A.P.J. ABDUL KALAM TECHNICAL UNIVERSITY, UTTAR PRADESH, LUCKNOW

EVALUATION SCHEME & SYLLABUS

FOR

B. TECH. FOURTH (IV) YEAR

AGRICULTURE ENGINEERING

AS PER

AICTE MODEL CURRICULUM

[Effective from the Session: 2021-22]

B.Tech. VII Semester
AGRICULTURE ENGINEERING

S. No.	Course Code	Course Title	Periods			Evaluation Scheme				End Semester		Total	Credits
			L	T	P	CT	TA	Total	PS	TE	PE		
1.	KHU701/KHU702	HSMC -1 #/HSMC-2 #	3	0	0	30	20	50		100		150	3
2.	KAG070-074	Department Elective –IV	3	0	0	30	20	50		100		150	3
3.	KAG075-079	Department Elective –V	3	0	0	30	20	50		100		150	3
4.		Open Elective-II	3	0	0	30	20	50		100		150	3
5.	KAG751	CAD LAB	0	0	2				25		25	50	1
6.	KAG752	Mini Project or Internship Assessment**	0	0	2				50			50	1
7.	KAG753	Project I	0	0	8				150			150	4
		MOOCs (Essential for Hons. Degree)											
		Total										**850**	**18**

Course Code **Course Title**

Department Elective-I

KAG070	Watershed Planning and Management
KAG071	Wasteland Development
KAG072	Waste & By-Product Utilization
KAG073	Crop process Engineering
KAG074	Tractor Design Principle

Department Elective-II

KAG075	Minor Irrigation and Command Area Development
KAG076	Food Packaging Technology
KAG077	Design of Agricultural Machinery
KAG078	Ground water, well & pumps
KAG079	Precision Agriculture and System Management

B.Tech. VIII Semester
AGRICULTURE ENGINEERING

S. No.	Course Code	Course Title	Periods			Evaluation Scheme				End Semeste		Total	Credits
			L	T	P	CT	TA	Total	PS	TE	PE		
1.	KHU701/KHU702	HSMC -1 #/HSMC-2 #	3	0	0	30	20	50		100		150	3
2.		Open Elective –III	3	0	0	30	20	50		100		150	3
3.		Open Elective –IV	3	0	0	30	20	50		100		150	3
4.	KAG851	Project II	0	0	18				100		300	400	9
		MOOCs (Essential for Hons.											
		Total										**850**	**18**

B.Tech VII Semester
Syllabus

Subject Code	KAG-070					
Category	Departmental Elective-IV					
Subject Name	**Watershed Planning and Management**					
Scheme and Credits	L-T-P	Theory Marks	Sessional		Total	Credit
			Test	Assig/Att.		
	3-0-0	100	30	20	150	3
Pre-requisites (if any)	Basic knowledge of watershed area and Hydrology.					

COURSE OUTCOMES

	Course Outcome (CO)	Bloom's Knowledge Level
At the end of this course, the student will be able to:		
CO 1	Understand the characteristics of watershed, watershed development problems, soil characteristics and land use practices and socio- economic factors.	K_2
CO 2	Understand the concept, objective, factor effecting in watershed planning and hydrological data also prioritization of watershed.	K_2
CO 3	Describes the rain water conservation technologies, and understand the integrated watershed management.	K_2
CO 4	Analyze the effect on watershed hydrology, and understand the watershed programme.	K_4 & K_2
CO 5	Remember and understand the Participatory watershed management, and formulation of project proposal for watershed management.	K_1 & K_2

K_1- Remember, K_2- Understand, K_3- Apply, K_4- Analyze, K_5-Evaulate, K_6- Create

DETAILED SYLLABUS

Module 1

Watershed - introduction and characteristics. Watershed development - problems and prospects, investigation, topographical survey, soil characteristics, vegetative cover, present land use practices and socio-economic factors.

Module 2

Watershed management - concept, objectives, factors affecting, watershed planning based on land capability classes, hydrologic data for watershed planning, watershed codification, delineation and prioritization of watersheds – sediment yield index. Water budgeting in a watershed.

Module 3

Management measures - rainwater conservation technologies - in-situ and ex-situ storage, water harvesting and recycling. Dry farming techniques - inter-terrace and inter-bund land management. Integrated watershed management - concept, components, arable lands - agriculture and horticulture, non-arable lands - forestry, fishery and animal husbandry.

Module 4

Effect of cropping systems, land management and cultural practices on watershed hydrology. Watershed programme - execution, follow-up practices, maintenance, monitoring and evaluation.

Module 5

Participatory watershed management - role of watershed associations, user groups and self-help groups. Planning and formulation of project proposal for watershed management programme including cost-benefit analysis.

Suggested Reading:

1. Ghanshyam Das. 2008. Hydrology and Soil Conservation Engineering: Including Watershed Management. 2nd Edition, Prentice-Hall of India Learning Pvt. Ltd., New Delhi.
2. Katyal, J.C., R.P. Singh, Shriniwas Sharma, S.K. Das, M.V. Padmanabhan and P.K. Mishra. 1995. Field Manual on Watershed Management. CRIDA, Hyderabad.
3. Mahnot, S.C. 2014. Soil and Water Conservation and Watershed Management. International Books and Periodicals Supply Service. New Delhi.
4. Sharda, V.N., A.K. Sikka and G.P. Juyal. 2006. Participatory Integrated Watershed Management: A Field Manual. Central Soil and Water Conservation Research and Training Institute, Dehradun.
5. Singh, G.D. and T.C. Poonia. 2003. Fundamentals of Watershed Management Technology. Yash Publishing House, Bikaner.
6. Singh, P.K. 2000. Watershed Management: Design and Practices. E-media Publications, Udaipur.

Subject Code	KAG071					
Category	Departmental Elective-IV					
Subject Name	**Waste land Development**					
Scheme and Credits	L-T-P	Theory Marks	Sessional		Total	Credit
			Test	Assig/Att.		
	3-0-0	100	30	20	150	3
Pre-requisites (if any)	Basic knowledge of soil & water conservation engineering and engineering hydrology concepts.					

COURSE OUTCOMES		
	Course Outcome (CO)	Bloom's Knowledge Level
At the end of this course, the student will be able to:		
CO 1	Understand the concept, classification of Land degradation and able to remember wastelands causing factors and its classification.	K_2 & K_1
CO 2	Remember and understand the Planning of wastelands development, and conservation structures.	K_1 & K_2
CO 3	Summarize the water harvesting, recycling methods and understand the aforestation, shifting cultivation.	K_3 & K_2
CO 4	Elaborate wasteland development, Mine spoils- impact, land degradation, reclamation, rehabilitation and micro-irrigation for wastelands development.	K_2
CO 5	Understand Sustainable wasteland development, Government policies, Participatory approach, Preparation of proposal for wasteland development.	K_2

K_1- Remember, K_2- Understand, K_3- Apply, K_4- Analyze, K_5-Evaulate, K_6- Create

DETAILED SYLLABUS

Module 1

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.

Module 2

Planning of wastelands development - constraints, agro-climatic conditions, development options, contingency plans. Conservation structures - gully stabilization, ravine rehabilitation, sand dune stabilization.

Module 3

Water harvesting and recycling methods. Afforestation - agro-horti-forestry-silvipasture methods, forage and fuel crops - socioeconomic constraints. Shifting cultivation, optimal land use options.

Module 4

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. Micro-irrigation in wastelands development.

Module 5

Sustainable wasteland development - drought situations, socio-economic perspectives. Government policies. Participatory approach. Preparation of proposal for wasteland development and benefit-cost analysis.

Suggested Reading:

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.
3. Hridai Ram Yadav. 2013. Management of Wastelands. Concept Publishing Company. New Delhi.
4. Karthikeyan, C., K. Thangaraja, C. Cinthia Fernandez and K. Chandrakandon. 2009. Dryland Agriculture and Wasteland Management. Atlantic Publishers and Distributors Pvt. Ltd., New Delhi.

Subject Code	KAG072					
Category	Departmental Elective-IV					
Subject Name	**Waste and By-Products Utilization**					
Scheme and Credits	**L-T-P**	**Theory Marks**	**Sessional**		**Total**	**Credit**
			Test	**Assig/Att.**		
	3-0-0	100	30	20	150	3
Pre-requisites (if any)	Basic knowledge of EPBM and Unit operation in process engineering concepts.					

COURSE OUTCOMES		
	Course Outcome (CO)	**Bloom's Knowledge Level**
At the end of this course, the student will be able to:		
CO 1	Understand the types and formation of by-products and waste, uses of different agricultural by-products.	K_2 & K_1
CO 2	Understand the concept, scope, maintenance of waste management and effluent treatment, Waste water contents and treatments and also familiar with microbiology of waste, ingredients like insecticide, pesticides & fungicides residues.	K_2
CO 3	Understand utilization of waste in various industries, biomass as fuel, charcoal briquette, and generation of electricity using surplus biomass and remember producer gas generation.	K_2 & K_1
CO 4	Understand the design consideration of waste treatment and disposal of community & family size biogas plants, vermin-composting and pre-treatment of waste.	K_4 & K_2
CO 5	Familiar with the secondary treatments for food plant wastes, tertiary treatments, effluent treatment plants and environmental performance of food industry.	K_2

K_1- Remember, K_2- Understand, K_3- Apply, K_4- Analyze, K_5-Evaulate, K_6- Create

DETAILED SYLLABUS

Module 1

Types and formation of by-products and waste; Magnitude of waste generation in different food processing industries; Uses of different agricultural by-products from rice mill, sugarcane industry, oil mill etc.

Module 2

Concept, scope and maintenance of waste management and effluent treatment, Temperature, pH, Oxygen demands (BOD, COD), fat, oil and grease content, metal content, forms of phosphorous and sulphur in waste waters, microbiology of waste, other ingredients like insecticide, pesticides and fungicides residues.

Module 3
Waste utilization in various industries, furnaces and boilers run on agricultural wastes and byproducts, briquetting of biomass as fuel, production of charcoal briquette, generation of electricity using surplus biomass, producer gas generation and utilization.

Module 4
Waste treatment and disposal, design, construction, operation and management of institutional community and family size biogas plants, concept of vermin-composting, Pre-treatment of waste: sedimentation, coagulation, flocculation and floatation.

Module 5
Secondary treatments: Biological and chemical oxygen demand for different food plant waste–trickling filters, oxidation ditches, activated sludge process, rotating biological contractors, lagoons, Tertiary treatments: Advanced waste water treatment process-sand, coal and activated carbon filters , phosphorous, sulphur, nitrogen and heavy metals removal, Assessment, treatment and disposal of solid waste; and biogas generation, Effluent treatment plants, Environmental performance of food industry to comply with ISO-14001 standards

Suggested Reading:

1. Markel, I.A. 1981. Managing Livestock Waste, AVI Publishing Co.
2. Pantastico, ECB. 1975. Post Harvest Physiology, Handling and utilization of Tropical and Subtropical fruits and vegetables, AVI Pub. Co.
3. Shewfelt, R.L. and Prussi, S.E. 1992. Post-Harvest Handling – A Systems approach, Academic Press Inc. USDA. 1992. Agricultural Waste Management Field Hand book. USDA, Washington DC.
4. Weichmann J. 1987. Post Harvest Physiology of vegetables, Marcel and Dekker Verlag. V.K. Joshi & S.K. Sharma. Food Processing Waste Management: Treatment & Utilization. New India Publishing Agency.
5. Vasso Oreopoulou and Winfried Russ (Edited). 2007. Utilization of By-products and Treatment
6. of waste in the Food Industry. Springer Science & Business media, LLC 233 New York.
7. Prashar, Anupama and Bansal, Pratibha. 2007-08. Industrial Safety and Environment. S.K. Kataria and sons, New Delhi
8. Garg, S K. 1998. Environmental Engineering (Vol. II) – Sewage Disposal and Air Pollution Engineering. Khanna Publishers, New Delhi
9. Bhatia, S.C.. 2001. Environmental Pollution and Control in Chemical Process Industries. Khanna
10. Publishers, New Delhi.

Subject Code	KAG073					
Category	Departmental Elective-IV					
Subject Name	**Crop Process Engineering**					
Scheme and Credits	**L-T-P**	**Theory Marks**	**Sessional**		**Total**	**Credit**
			Test	**Assig/Att.**		
	3-0-0	100	30	20	150	3
Pre-requisites (if any)	Basic knowledge of unit operations and engineering properties of food materials.					

COURSE OUTCOMES		
	Course Outcome (CO)	**Bloom's Knowledge Level**
At the end of this course, the student will be able to:		
CO 1	Understand the principles and methods of food processing, Processing of farm crops, Processing of animal products.	K_2 & K_1
CO 2	Understand size reduction principle, efficiency, power requirement and size reduction law.	K_2 & K_4
CO 3	Summarize theory of mixing, types of mixture, theory of separation and types of separators.	K_2
CO 4	Understand filtration, types of filters and scope & importance of material handling.	K_2
CO 5	Understand material handling systems and analyze their design consideration, capacity and power requirement.	K_2 & K_4

K_1- Remember, K_2- Understand, K_3- Apply, K_4- Analyze, K_5-Evaulate, K_6- Create

DETAILED SYLLABUS

Module 1

Scope and importance of food processing, principles and methods of food processing. Processing of farm crops; cereals, pulses, oil seeds, fruits and vegetables and their products for food and feed. Processing of animal products for food and feed.

Module 2

Principle of size reduction, grain shape, Size reduction machines; crushers, grinders, cutting machines etc. - operation, efficiency and power requirement – Rittinger's, Kick's and Bond's equation, fineness modulus.

Module 3

Theory of mixing, types of mixtures for dry and paste, materials, rate of mixing and power requirement, mixing index. Theory of separation, size and upsized separation, Types of separators, size of screens, sieve analysis, capacity and effectiveness of screens, pneumatic separation.

Module 4

Theory of filtration, study of different types of filters, rate of filtration, pressure drop during filtration. Scope & importance of material handling devices,

Module 5

Study of different types of material handling systems; belt, chain and screw conveyor, bucket elevator, pneumatic conveying, gravity conveyor- design consideration, capacity and power requirement.

Suggested Reading:

1. Food Science and Technology, *by* Avantika Sharma. International Book Distributing Co., Lucknow (ISBN: 81-8189-097-3).
2. Dhamsaniya, N. K. (2009). Guide to Post Harvest Unit Operations. Kalyani Publishers.
3. Fellows, P. (2000). Food Processing Technology, Principles and Practice (Second Edition ed.). Cambridge , England: Woodhead Publishing Limited.
4. Sahay, K. M. and Singh, K. K. (2009). Unit Operations of Agricultural Processing (Second ed.). India : Vikas Publishing House Pvt Limited.
5. Srivastava, R. P. and Kumar, S. (2002). Fruits and Vegetables Preservation: Principles and Practices. Lucknow, India: International Book Distributing Co.

Subject Code	KAG074					
Category	Departmental Elective-IV					
Subject Name	**Tractor Design Principles**					
Scheme and Credits	L-T-P	Theory Marks	Sessional		Total	Credit
			Test	Assig/Att.		
	3-0-0	100	30	20	150	3
Pre-requisites (if any)	Basic knowledge of Engg. Mechanics, advanced mathematics and farm power concepts.					

COURSE OUTCOMES

	Course Outcome (CO)	Bloom's Knowledge Level
At the end of this course, the student will be able to:		
CO 1	Understand agricultural tractor design and development procedure, parameters of stability by weight distribution.	K_2 & K_1
CO 2	Analyze the design of hydraulic lift system, hitch system and mechanical power transmission of a tractor.	K_4 & K_2
CO 3	Analyze the design parameters of Ackerman Steering, hydraulic systems, seat and controls of tractor and understand Testing of a tractor.	K_4
CO 4	Understand design features selection of tractor engines.	K_2
CO 5	Analyze the design consideration of standard power transmission components and understand the safety precautions in power transmission.	K_4 & K_1

K_1- Remember, K_2- Understand, K_3- Apply, K_4- Analyze, K_5-Evaulate, K_6- Create

DETAILED SYLLABUS

Module 1

Procedure for design and development of agricultural tractor, study of parameters for balanced design of tractor for stability weight distribution.

Module 2

Hydraulic lift and hitch system design. Design of mechanical power transmission in agricultural tractors.

Module 3

Design of Ackerman Steering and tractor hydraulic systems. Design of seat and controls of an agricultural tractor. Tractor Testing.

Module 4

Study of special design features of tractor engines and their selection.

Module 5

Design of Standard power transmission components use in agriculture mechanics Mechanical & hydraulic units. Introduction of safety in power transmission.

Suggested Reading:

1. Tractors and their Power Units,John B. Lijiedahal, Paul K. Turnquist :CBS Publication
2. Karl Theodor Renius, Fundamentals of Tractor Design
3. J.B. Liljedahl, Paul k. turnquist, David W. Smith, Makoto Hoki, Tractors and Their Power Units, 4e Fourth Edition

4. Michael AM. and Ojha TP. 2014. Principles of Agricultural Engineering Vol-I 12th Edition. Jain Brothers Publication, New Delhi
5. Er. Sanjay Kumar, A text book of tractor at a glance, international book distribution company
6. Lal Radhey and AC Datta. Agricultural Engineering Principles of Farm Machinery.
7. Tractors and their Power Units,John B. Lijiedahal, Paul K. Turnquist :CBS Publication
8. Barger, E.L.; Lijedehl, J.B; Carleton, W.B. and Mc Kibben, E.G. Tractors and their Power Units.
9. Renius, K., Fundamentals of Tractor Design.

Subject Code	KAG075					
Category	Departmental Elective-IV					
Subject Name	**Minor Irrigation and Command Area Development**					
Scheme and Credits	L-T-P	Theory Marks	Sessional		Total	Credit
			Test	Assig/Att.		
	3-0-0	100	30	20	150	3
Pre-requisites (if any)	Basic knowledge of Engg. Hydrology, and Irrigation engineering concepts.					

COURSE OUTCOMES		
	Course Outcome (CO)	Bloom's Knowledge Level
At the end of this course, the student will be able to:		
CO 1	Understand minor irrigation systems, Factors affecting performance of irrigation projects.	K_2 & K_1
CO 2	Understand lift irrigation and tank irrigation systems.	K_2
CO 3	Familiar with CAD programme components, need, scope, historical perspective and CAD authority's functions.	K_2
CO 4	Familiar with On farm development works, Reclamation works and understand remote sensing techniques for CAD works.	K_2 & K_1
CO 5	Understand the water productivity and farmers' participation in CAD.	K_2 & K_3

K_1- Remember, K_2- Understand, K_3- Apply, K_4- Analyze, K_5-Evaulate, K_6- Create

DETAILED SYLLABUS

Module 1
Factors affecting performance of irrigation projects; types of minor irrigation systems in India.

Module 2
Lift irrigation systems: feasibility, type of pumping stations and their site selection. tank Irrigation: grouping of tanks, storage capacity, supply works and sluices.

Module 3
Command area development (CAD) programme- components, need, scope, and development approaches, historical perspective, command area development authorities functions and responsibilities.

Module 4
On farm development works, Reclamation works, use of remote sensing techniques for CAD works.

Module 5
Water productivity: concepts and measures for enhancing water productivity; Farmers' participation in command area development.

Suggested Reading:

1. Arora, K.R. 2001. Irrigation, Water Power and Water Resources Engineering. Standard Publishers Distributors, Delhi.
2. Garg S. K. 2014. Irrigation Engineering and Hydraulic Structures, Khanna Publishers New Delhi.
3. Michael A.M. 2012. Irrigation: Theory and Practice. Vikas Publishing Vikas Publ.House New Delhi.
4. Sahasrabudhe SR. 2011. Irrigation Engineering and Hydraulic structures. SK Kataria & Sons Reprint 2015

Subject Code	KAG076					
Category	Departmental Elective-IV					
Subject Name	**Food Packaging Technology**					
Scheme and Credits	L-T-P	Theory Marks	Sessional		Total	Credit
			Test	Assig/Att.		
	3-0-0	100	30	20	150	3
Pre-requisites (if any)	Basic knowledge of material science and unit operations in process engineering concepts.					

COURSE OUTCOMES		
	Course Outcome (CO)	Bloom's Knowledge Level
At the end of this course, the student will be able to:		
CO 1	Understand the development of safe food packaging material and role of packaging in extending shelf life of food.	K_2 & K_1
CO 2	Understand about Packaging requirement of food product and different types of food packaging systems.	K_2
CO 3	Understand about the use of paper, plastic, aluminum & Tin as the packaging material.	K_2
CO 4	Familiar with package accessories and advances in packaging technology.	K_2
CO 5	Understand the packaging technology and equipments/machinery used in packaging.	K_2

K_1- Remember, K_2- Understand, K_3- Apply, K_4- Analyze, K_5-Evaulate, K_6- Create

DETAILED SYLLABUS

Module 1

Introduction of Food packaging, Need of food packaging Role of packaging in extending shelf life of foods. Introduction of packaging materials, Types of packaging materials their characteristics and uses. Designing of package materials. Testing of package materials. Testing of package performance. Principles in the development of safe and protective packing, Safety assessment of food packaging materials.

Module 2

Introduction of food packaging system, product characteristics and package requirements. Different forms of packaging. Rigid, semi-rigid, flexible forms of packaging. Different packaging system for-Dehydrated foods, Frozen foods, Dairy products, Fresh fruits, Vegetables, Meat, Poultry, Sea foods.

Module 3

Paper as a packaging material-Pulping Fibrillation, Beating, Types of papers ,Testing methods. Use of glass as a packaging material-Composition, Properties, Methods of bottle making. Use of metals as a packaging material- Tinplate containers, Tinning process, Components of tinplate, Tin free steel (TFS), Types of cans, Aluminum containers, Lacquers. Use of plastics as a packaging material-Types of plastics, Plastic films, laminated plastic materials, Co-extrusion.

Module 4

Package accessories and advances in Packaging technology-Introduction, Active packaging, Modified atmosphere packaging, Aseptic packaging, Packages for microwave ovens, Biodegradable plastics, Edible gums, Coatings.

Module 5

Packaging equipment and machinery- Vacuum packaging machine, CA & MA packaging machine, Gas packaging machine, Seal and shrink packaging machine. Form & fill sealing machine, Aseptic packaging systems, Retort pouches, Bottling machines, Carton making machines, Package printing machines.

Suggested Reading:

1. Gordon L. Robertson, Food Packaging: Principles and Practice, Third Edition,2013.
2. Gordon L. Robertson, Food Packaging and Shelf Life: A Practical Guide,2010.
3. Ruben Hernandez, Susan E. MSelke, John Culter, John D. Culter, Plastics Packaging: Properties, Processing, Applications, and Regulations,2000.
4. Walter Soroka, Fundamentals of Packaging Technology-Fourth Edition,

Subject Code	KAG077					
Category	Departmental Elective-IV					
Subject Name	**Design of Agricultural Machinery**					
Scheme and Credits	L-T-P	Theory Marks	Sessional		Total	Credit
			Test	Assig/Att.		
	3-0-0	100	30	20	150	3
Pre-requisites (if any)	Basic knowledge of engineering mechanics, soil mechanics and farm machinery & equipment concepts.					

	Course Outcome (CO)	Bloom's Knowledge Level
At the end of this course, the student will be able to:		
CO 1	Remember the material, their composition and properties which are used in construction of agricultural farm machinery and tractor.	K_1 & K_2
CO 2	Analyze the design parameter of tillage implements and force analysis of primary tillage tool.	K_4 & K_5
CO 3	Analyze the design concepts of sowing equipment, furrow openers and rotavater.	K_4
CO 4	Analyze the design parameter of planters.	K_4 & K_5
CO 5	Analyze the design consideration of threshing machines and combines.	K_4 & K_2

K_1- Remember, K_2- Understand, K_3- Apply, K_4- Analyze, K_5-Evaulate, K_6- Create

DETAILED SYLLABUS

Module 1
Materials of construction of agricultural farm machinery and tractor - their composition and properties.

Module 2
Force analysis of primary tillage tools and their hitching systems, design of tillage implements- M B plough, disk plough, disk harrow, rotavator.

Module 3
Design of seed-drill, happy seed-drill, seed metering device, power transmission and furrow opener such as double disc, Inverted T type and roto type(rotavater).

Module 4
Design of planter such as maize, cotton, sugar cane planter, vegetable planter.

Module 5
Design considerations of threshing machines, combines.

Suggested Reading:

1. D.N. Sharma & S. Mukesh, Farm Machinery design Principles & Problems, Jain Brothers, New Delhi
2. R.A. Kepner, Roy Bainer, E.L. Berger, Principles of Farm Machinery
3. K Mahadevan and Balaveera Reddy- Design Data Hand Book- CBS Publication,3rd Edition, 2010
4. R. S. Khurmi & J. K. Gupta - Machine DesignEurasia publishing house New Delhi,14th Edition, 2008
5. S.S Rattan-Theory of Machine,Tata - McGraw Hill Publishing Company New Delhi,2nd Edition,2006
6. Smith HP and LH Wilkey. Farm Machinery and Equipment.
7. Michael AM. and Ojha TP. 2014. Principles of Agricultural Engineering Vol-I 12th Edition. Jain Brothers Publication, New Delhi.

Subject Code	KAG078					
Category	Departmental Elective-IV					
Subject Name	**Ground water well & Pumps**					
Scheme and Credits	L-T-P	Theory Marks	Sessional		Total	Credit
			Test	Assig/Att.		
	3-0-0	100	30	20	150	3
Pre-requisites (if any)	Basic knowledge of fluid mechanics concepts.					

COURSE OUTCOMES		
	Course Outcome (CO)	Bloom's Knowledge Level
At the end of this course, the student will be able to:		
CO 1	Understand ground water occurrence and movement, well classification, groundwater exploration techniques.	K_2 & K_1
CO 2	Understand the drilling methods of a well, development of well and analyze the design criteria of tube well, gravel pack.	K_2 & K_4
CO 3	Analyze the aquifer parameters by Theis, Jacob and Chow's, Theis recovery method. And also understand the well interference, multiple well systems, Estimation of ground water potential, quality of ground water; artificial groundwater recharge techniques.	K_4
CO 4	Familiar with the pumps, its classification, components and their performance characteristics curves.	K_2
CO 5	Understand about hydraulic ram, propeller pumps, mixed flow pumps and their performance characteristics; deep well turbine pump and submersible pump.	K_2

K_1- Remember, K_2- Understand, K_3- Apply, K_4- Analyze, K_5-Evaulate, K_6- Create

DETAILED SYLLABUS

Module 1
Occurrence and movement of ground water; aquifer and its types; classification of wells, fully penetrating tube wells and open wells, familiarization of various types of bore wells; groundwater exploration techniques.

Module 2
Methods of drilling of wells: percussion, rotary, reverse rotary; design of tube well and gravel pack, installation of well screen, completion and development of well;

Module 3
groundwater hydraulics-determination of aquifer parameters by different method such as Theis, Jacob and Chow's Theis recovery method; well interference, multiple well systems, Estimation of ground water potential, quality of ground water; artificial groundwater recharge techniques.

Module 4
Pumping systems: water lifting devices; different types of pumps, classification of pumps, component parts of centrifugal pumps, priming, pump selection, installation and trouble shooting, performance curves, effect of speed on capacity. performance characteristics curves.

Module 5
hydraulic ram, propeller pumps, mixed flow pumps and their performance characteristics; deep well turbine pump and submersible pump.

Suggested Reading:

1. Michael AM, Khepar SD. and SK Sondhi. 2008. Water Well and Pumps, 2nd Edition, Tata Mc- Graw Hill.
2. Todd David Keith and Larry W. Mays. 2004. Groundwater Hydrology, 3rd Edition, John Wiley & Sons, New York (International Book Distributing Company Lucknow).
3. Michael AM. and Ojha TP. 2014. Principles of Agricultural Engineering Vol-II, 5th Edition. Jain
4. Brothers Publication, New Delhi.

Subject Code	KAG079					
Category	Departmental Elective-IV					
Subject Name	**Precision Agricultural and System Management**					
Scheme and Credits	L-T-P	Theory Marks	Sessional		Total	Credit
			Test	Assig/Att.		
	3-0-0	100	30	20	150	3
Pre-requisites (if any)	Basic knowledge of farm machinery concepts.					

COURSE OUTCOMES		
	Course Outcome (CO)	Bloom's Knowledge Level
At the end of this course, the student will be able to:		
CO 1	Understand Precision Agriculture, Familiarization with equipment for precision agriculture.	K_2 & K_1
CO 2	Familiar with farm machines and equipment and GIS based precision agriculture.	K_2 & K_1
CO 3	Understand Database management, System concept and approach in farm machinery management.	K_2 & K_4
CO 4	Understand Application to PERT and CPM for machinery system management.	K_3 & K_2
CO 5	Understand green house History, origin, development, National and International Scenario, types of green houses.	K_2 & K_1

K_1- Remember, K_2- Understand, K_3- Apply, K_4- Analyze, K_5-Evaulate, K_6- Create

DETAILED SYLLABUS

Module 1

Precision Agriculture – need and functional requirements. Familiarization with issues relating to natural resources. Familiarization with equipment for precision agriculture including sowing and planting machines.

Module 2

power sprayers, land clearing machines, laser guided land levellers, straw-chopper, straw-balers, grain combines, etc. Introduction to GIS based precision agriculture and its applications.

Module 3

Introduction to sensors and application of sensors for data generation. Database management. System concept. System approach in farm machinery management, problems on machinery selection, maintenance and scheduling of operations.

Module 4

Application to PERT and CPM for machinery system management. Protected cultivation.

Module 5

Introduction, History, origin, development, National and International Scenario, components of green house, perspective, Types of green houses, polyhouses /shed nets.

Suggested Reading:

1. Kuhar J E. The Precision Farming Guide for Agriculturist.
2. Dutta SK. Soil Conservation and land management.
3. Sigma and Jagmohan. Earth Moving Machinery.
4. Wood and Stuart. Earth Moving Machinery.
5. DeMess MN. Fundamentals of Geographic Information System.
6. Hunt Donnell. Farm Power and Machinery Management.
7. Sharma DN and S Mukesh. Farm Power and Machinery Management Vol I.

[KAG-751] CAD Lab

1. An Introduction to Engineering Drawings and Auto Cad
2. Introduction to the Draw tools and commands
3. Introduction to the Modify tools
4. Unit setting and coordinate System
5. Drafting of Basic Geometry Shapes in Auto cad
6. Introduction of 3D drafting and rendering tools
7. Line Drawing or Circle Drawing experiment: Writing and validation of computer program.
8. Design of machine component or other system experiment: Writing and validation of computer program.
9. Understanding and use of any 3-D Modeling Software commands.
10. Solid modeling of a machine component

LAB OUTCOMES: At the end of this course, the student will be able to:

- Attain the basic knowledge of CAD.
- Gain practical experience in handling 2D drafting and 3D modeling software systems
- Examine and handle design problems in a systematic manner.

Suggested Reading:

1. CAD/CAM Lab Manual (Prepared by Staff)
2. Bathe K.J, (2007), Finite Element Procedures, Prentice-Hall of India Pvt. Ltd., third edition ISBN: 978-0- 979-00490-2
3. Zienkiewicz O.C.(1979), The Finite Element Method, McGraw-Hill, ISBN- 978-0-750-66431-8 4. ANSYS Help manual Hyper mesh Help manual
4. Yorem Koren (1983), Computer Integrated Manufacturing Systems, McGraw Hill, ISBN- 978-0-891-16874- 4
5. Ranky, Paul G.(1986), Computer Integrated Manufacturing, Prentice Hall International, ISBN- 978-0-131- 656550
6. R.W. Yeomamas, A. Choudry and P.J.W. Ten Hagen (1985.), Design rules for a CIM system, North Holland Amsterdam, ISBN- 978-0-444-87812-0