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

EVALUATION SCHEME & SYLLABUS

FOR

B. TECH. SECOND YEAR
(Agriculture Engineering)

AS PER

AICTE MODEL CURRICULUM

[Effective from the Session: 2019-20]

SECOND YEAR EVALUATION SCHEME

(AGRICULTURAL ENGINEERING)

(Effective from the Session: 2019-20)

SEMESTER- III

Sl. No.	Subject Codes	Subject	Periods			Evaluation Scheme				End Semester		Total	Credit
			L	T	P	CT	TA	Total	PS	TE	PE		
1	KOE031-38/ KAS304	Engineering Science Course/ Maths V	3	0	0	30	20	50		100		150	4
2	KAS301/KVE301	Technical Communication/Universal Human Values	2 3	1 0	0 0	30	20	50		100		150	3
3	KAG301	Strength of Materials & Engineering Mechanics	3	1	0	30	20	50		100		150	4
4	KAG302	Elementary Agriculture & Surveying and Levelling	3	1	0	30	20	50		100		150	4
5	KAG303	Soil Mechanics	3	0	0	30	20	50		100		150	3
6	KAG351	Strength of Materials & Engineering Mechanics Lab	0	0	2				25		25	50	1
7	KAG352	Elementary Agriculture & Surveying and Levelling Lab	0	0	2				25		25	50	1
8	KAG353	Soil Mechanics and Engineering Mechanics Lab	0	0	2				25		25	50	1
9	KAG354	Mini Project or Internship Assessment*	0	0	2			50				50	1
10	KNC301/KNC302	Computer System Security/ Python Programming	2	0	0	15	10	25		50			0
		Total										**950**	**22**

*The Mini Project or internship (3-4 weeks) conducted during summer break after IInd semester and will be assessed during IIIrd semester.

SEMESTER- IV

Sl. No.	Subject Codes	Subject	Periods			Evaluation Scheme				End Semester		Total	Credit
			L	T	P	CT	TA	Total	PS	TE	PE		
1	KAS404/ KOE041-48	Maths V/Engineering Science Course	3	1	0	30	20	50		100		150	4
2	KVE401/KAS401	Universal Human Values/Technical Communication	3 2	0 1	0 0	30	20	50		100		150	3
3	KAG401	Theory of Machine and Machine Design	3	0	0	30	20	50		100		150	3
4	KAG402	Soil, Water conservation Engineering and Watershed Hydrology	3	1	0	30	20	50		100		150	4
5	KAG402	Fluid Mechanics & Open Channel Hydraulics	3	1	0	30	20	50		100		150	4
6	KAG451	Soil, Water conservation Engineering and Watershed Hydrology Lab	0	0	2				25		25	50	1
7	KAG452	Theory of Machine and Machine Design Lab	0	0	2				25		25	50	1
8	KAG453	Fluid Mechanics & Open Channel Hydraulics Lab	0	0	2				25		25	50	1
9	KNC402/KNC401	Python Programming/Computer System Security	2	0	0	15	10	25		50			0
10		MOOCs (Essential for Hons. Degree)											
		Total										**900**	**21**

Subject Code	KAG301					
Category	Engineering Course					
Subject Name	STRENGTH OF MATERIALS & ENGINEERING MECHANICS					
Scheme and Credits	L-T-P	Theory Marks	Sessional		Total	Credit
			Test	Assig/Att.		
	3-1-0	100	30	20	150	4
Pre-requisites (if any)	Basic knowledge of mathematics and physics of secondary level.					

COURSE OUTCOMES		
	Course Outcome (CO)	Bloom's Knowledge Level
At the end of this course, the student will be able to:		
CO 1	Analyze the stress and strain in beam.	K_2 & K_1
CO 2	Analysis of Mohar circle and principle stress in beam, Identify the failure of the coloumn and its safe limit.	K_2 & K_4
CO 3	Analyze the basic knowledge of forces, motions.	K_4
CO 4	Analyze friction and strength of beam.	K_4 & K_2
CO 5	Illustrate the application of parallel axis and perpendicular axis theorem and information of the behaviour of the materials.	K_5 & K_2

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

DETAILED SYLLABUS

Module 1

Simple stresses and strain Shear force and bending moment diagrams. Review of pure bending, Direct and shear stresses in beams due to transverse and axial loads. Analysis of statically intermediate beams. Fixed and continuous beams. Slope and deflection of beams using Mcauley techniques, moment area theorems and conjugate beam method.

Module 2

Compound stress and strains: Principal stress and strain. Mohr's stress circle, three dimensional states of stress and strain, Torsion of circular shaft and non-circular shaft. Columns and struts, derivation of buckling load equation for both end hinged, one end fixed and other end free, both end fixed & one end fixed and other end hinged, Empirical formula for columns.

Module 3:

Two dimensional force systems: Basic concepts, Laws of motion, Principle of Transmissibility of forces, Transfer of a force to parallel position, resultant of a force system simplest resultant of two dimensional concurrent force systems, Distributed force system, free body diagrams, equilibrium and equations of Equilibrium.

Module 4

Friction: Introduction, Laws of Coulomb Friction, Equilibrium of Bodies involving Dry friction, belt friction, application. Beam: Introduction, shear force and bending moment, Shear force and bending moment diagrams for statically determinate Beams. Trusses: Introduction, Simple truss and solution of simple truss, Method of joints.

Module 5: Centroid and Moment of Inertia : Centroid of plane, curve , area , volume and composite bodies , moment of inertia of plain area, parallel Axes theorem, Perpendicular axes theorems , Simple stress and Strain: Introduction, Normal and shear stresses, stress- strain Diagrams for ductile and brittle material, Elastic constants, One Dimensional Loading of members of varying cross-sections, Strain energy.

[KAG351] STRENGTH OF MATERIALS & ENGINEERING MECHANICS LAB

1. To perform the tension test on metal specimen (M.S., C.I.), to observe the behavior of materials under load, to calculate the value of E, ultimate stress, permissible stress, percentage elongation etc. and to study its fracture.
2. To perform the compression test on; Concrete cylinders & cubes, C.I., M.S. & Wood specimens and to determine various physical and mechanical properties.
3. To conduct torsion test on mild steel or cast iron specimen to find out the modulus of rigidity.
4. To perform the Rockwell, Vicker's and Brinell's Hardness tests on the given specimens.
5. To perform the Drop Hammer Test, Izod Test and Charpay's impact tests on the given specimens.
6. To verify the Parallelogram Law of Forces.
7. To Study the Mechanical properties of engineering materials.
8. To determine the Coefficient of Friction between two surfaces on a horizontal plane.
9. To determine the Coefficient of Friction between two surfaces on a inclined plane.

LAB OUTCOMES:

- Conduct experiments determine the strength and other mechanical properties of the specimen.
- Analyze the behavior of the material under different loading conditions.
- Experiment of torsion test enables us to determine the value of modulus of rigidity of a metallic specimen.
- Perform experiment analyze the hardness and impact strength of the specimen.
- Experiment demonstrates the impact of load on the materials.
- Experiment provides the information of behavior of the materials.
- Parallelogram law of forces enables us to determine the single force called resultant.
- Experiments analyze the average value of coefficient of friction between two surfaces on a horizontal as well as on an inclined plane.

Suggested Reading:

1. Ramamrutham, S, 2003. Strengths of Materials. Dhanpat Rai and Sons, Nai Sarak, NewDelhi.
2. Khurmi, RS, 2001. Strength of Materials S. Chand & Co., Ltd., New Delhi.
3. Sundarajan, V., 2002. Engineering Mechanics and Dynamics. Tata McGraw Hill Publishing Co. Ltd., New Delhi.
4. Junarkar, S.B., 2001. Mechanics of Structures, Vol. I, Charotar Publishing Home, Anand.
5. Khurmi, R.S., 2001. Strength of materials. S. Chand & Company Ltd., 7361, Ram Nagar, New Delhi – 110055.
6. Timoshenko, S and Young, DH, 2003. Engineering Mechanics. McGraw Hill Book Co., New Delhi.
7. Sundarajan, V, 2002. Engineering Mechanics and Dynamics. Tata McGraw Hill Pub. Co. Ltd., New Delhi.
8. Engineering Mechanics by Irving H.Shames, Prentice-Hall,2005

Subject Code	KAG302					
Category	Engineering Course					
Subject Name	ELEMENTARY AGRICULTURE & SURVEYING AND LEVELLING					
Scheme and Credits	**L-T-P**	**Theory Marks**	**Sessional**		**Total**	**Credit**
			Test	**Assig/Att.**		
	3-1-0	100	30	20	150	4
Pre-requisites (if any)	Basic knowledge of mathematics of higher secondary level.					

COURSE OUTCOMES		
	Course Outcome (CO)	**Bloom's Knowledge Level**
At the end of this course, the student will be able to		
CO 1	Remember and understand about soil, its classification, properties and nutrients that are essential for plant growth.	K_2 & K_1
CO 2	Understand the cropping patterns, scope of agronomy, horticulture and floriculture in present scenario of agriculture.	K_2
CO 3	Understand the basic concepts and principle of surveying & analyze chain surveying.	K_2 & K_3
CO 4	Analyze compass surveying and evaluate area of the surveyed land.	K_4 & K_5
CO 5	Understand the basic concepts of leveling and analyze theodolite surveying	K_2 & K_4

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

Module 1:

Introduction to soils, Nature and origin of soil, Soil forming rocks and minerals, their classification and composition, Classification of soils, Soil taxonomy orders, Important soil physical properties; and their importance, Soil particle distribution, Soil Organic Matter-Its composition and decomposition, effect on soil fertility, Essential plants nutrients. Functions and deficiency symptoms in plants, important inorganic fertilizers and their reactions in soils.

Module 2:

Definition and scope of agronomy ,Classification of crops, Principles of tillage, water requirement of crops, Crop rotation ,Cropping systems ,Relay cropping ,Mixed cropping, Organic farming-Sustainable agriculture. Soil water plant relationship, crop coefficients, critical stages for irrigation. Scope of horticultural and vegetable crops, Soil and climatic requirements for fruits, Soil and climatic requirements for Vegetables, Soil and climatic requirements for Floriculture crops, High-tech horticulture- Polyhouses for flowers and vegetables.

Module 3:

Principle and basic concepts of surveying. Plans and maps. Classification of surveying. Basic measurements. Units of measurement. Types of Scales, Principle of chain surveying. Types of Chains. Types of Ranging and Chaining. Chain and tape errors & corrections. Cross Staff, Optical Square, Prism Square. Obstacles in chaining and ranging.

Module 4:
Methods of traversing. Prismatic compass. Surveyors compass. Angle and bearing, Quadrantal system, Local attraction, Dip of angle. Magnetic declination, plotting a traverse survey, Errors In compass survey. Plane tabling instruments and accessories, Methods and principal, Two points problem, Three points problem, Errors in plane tabling, Computation of areas methods.

Module 5:
Definition, Basic principal of levelling, Benchmark, Types of levels optical, Levelling staff, Temporary adjustment, Permanent adjustment of levels, Field book entries, Types of levelling, Simple, differential levelling, reciprocal levelling, & profile levelling, Theodolite traversing, Theodolite Surveying, Ranging by theodolite. Temporary & Permanent adjustment of theodolite.

[KAG352] ELEMENTARY AGRICULTURE & SURVEYING AND LEVELLING LAB
1. Identification of rocks and minerals.
2. Examination of soil profile in the field.
3. Study of different garden tools.
4. Chain survey of an area and preparation of plan.
5. Compass survey of an area and plotting of compass survey.
6. Plane table surveying.
7. Contour survey of an area and preparation of contour map.
8. Introduction of software in drawing contour.
9. Theodolite surveying.
10. Ranging by Theodolite, height of object by using Theodolite.

LAB OUTCOMES:
- Conduct experiments delivers knowledge about rocks, minerals and soil profile.
- Perform experiment enables to make plan on sheet by chain surveying.
- Experiment enables to make plan on sheet by compass surveying.
- Application of software enables to draw contours.
- Experiment enables to calculate height of an object with the help of Theodolite.

Suggested Reading:
1. T.D. Biswas, S.K. Mukherjee 'Soil Science' –TMH Publication
2. T. Yellamanda Reddy, G.H Sankara Reddy 'Principle of Agronomy' - Kalyani Publication
3. Jitendra Singh 'Basic Horticulture'.Kalyani Publishers
4. Mehta. K. K. Reclamation of Alkali Soil in India, Oxford & IBH Publication
5. Maharaj Singh. Education for Sustainable Agriculture. Indian J. Agron
6. Surveying and Levelling Part-1 by T.P. Kanetkar & S.V.Kulkarni , Pune Vidyarthi Griha Prakashan
7. Surveying and Levelling By B C Punamia Vol-I & Vol-II, Laxmi Publications,2005
8. Surveying-III Higher Surveying, B.C Punamia, Laxmi Publications 2004

Subject Code	KAG303					
Category	Engineering Course					
Subject Name	SOIL MECHANICS					
Scheme and Credits	**L-T-P**	**Theory Marks**	**Sessional**		**Total**	**Credit**
			Test	**Assig/Att.**		
	3—0—0	100	30	20	150	4
Pre-requisites (if any)	Basic knowledge of mathematics and physics of secondary level.					

COURSE OUTCOMES		
	Course Outcome (CO)	**Bloom's Knowledge Level**
At the end of this course, the student will be able to		
CO 1	Familiar with basic information of the soil and soil properties.	K_1 & K_2
CO 2	Understand the concept of Permeability and vertical stress below applied load.	K_2
CO 3	Analyze the shear strength of the soil.	K_4
CO 4	Understand the concept of compaction and consolidation.	K_2
CO 5	Illustrate the earth pressure theory, and stability of slope.	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:
Nature and origin of soil; Soil forming rocks and minerals their classification and composition, important physical properties of soil. Introduction of soil mechanics, fields of soil mechanics, phase diagram, physical and index properties of soil, classification of soils.

Module 2:
Permeability, Darcy's Law, laboratory determination of hydraulic conductivity, equivalent hydraulic conductivity in stratified soil., effective and neutral stress, elementary concept of Boussinesq and Wester guards analysis, new mark influence chart.

Module 3:
Shear strength, Mohr stress circle, theoretical relationship between principle stress circle, theoretical relationship between principal stress, Mohr coulomb failure theory, effective stress principle. Determination of shear parameters by direct shear test, triaxial test & vane shear test. Numerical exercise based on various types of tests.

Module 4:
Compaction, composition of soils standard and modified protector test, abbot compaction and Jodhpur mini compaction test field compaction method and control. Consolidation of soil: Consolidation of soils, one dimensional consolidation spring analogy, Terzaghi’s theory, Laboratory consolidation test, calculation of void ratio and coefficient of volume change, Taylor’s and Casagrande’s method, determination of coefficient of consolidation.

Module 5:
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 exercises. Stability of slopes: introduction to stability analysis of infinite and finite slopes friction circle method, Taylor's stability number.

[KAG- 353] SOIL MECHANICS LAB

1. Determination of water content of soil.
2. Determination of specific gravity of soil.
3. Determination of field density of soil by core cutter method.
4. Determination of field density by sand replacement method.
5. Grain size analysis by sieving (Dry sieve analysis).
6. Grain size analysis by hydrometer method.
7. Determination of shrinkage limit.
8. Determination of permeability by constant head method.
9. Determination of permeability by variable head method.

LAB OUTCOMES:

- Conduct experiments determine the water content and specific gravity of the soil.
- Demonstrate the grain size distribution in soil.
- Perform experiment illustrating consistency of soil.
- Experiments enables to determine the permeability of the given soil specimen.

Suggested Reading:

1. Soil Mechanics, BC Punamia; Laxmi Publication (P) Ltd. New Delhi.
2. Punamia B.C. and Jain, A.K., 2005. Soil Mechanics and Foundations. Laxmi Pub. (P) Ltd. New Delhi.
3. Ranjan Gopal and Rao ASR, 1993. Basic and Applied Soil Mechanics. Welley Easters Ltd., New Delhi.
4. Indian Society of Soil Science.1998. Fundamental of Soil Science, IARI, New Delhi.

Subject Code	KAG401					
Category	Engineering Course					
Subject Name	THEORY OF MACHINE AND MACHINE DESIGN					
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 mathematics and physics of secondary level.					

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 basic mechanism and design principle of machines.	K_2 & K_3
CO 2	Understand the design criteria and mechanism of gears.	K_2 & K_3
CO 3	Analyze the failure criteria's of the system.	K_4
CO 4	Understand the concept of air conditioning systems.	K_1 & K_2
CO 5	Understand the types and control of transmission	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:
Introduction to machine and design Principle of design, Phases of design, design considerations. Elements, links, pairs, kinematics chain, and mechanisms. Classification of pairs and mechanisms. Lower and higher pairs. Four bar chain, slider crank chain and their inversions. Cam, Types of cam, Terminology used in cam-follower system, Cam profile.

Module 2:
Types of gears. Law of gearing, velocity of sliding between two teeth in mesh. Involute and cycloidal profile for gear teeth. Spur gear, nomenclature, interference and undercutting. Introduction to helical, spiral, bevel and worm gear, Design of spur and helical gears. Gear train, Determination of velocity ratio and train value by using tabular method.

Module 3:
Types of loads and stresses, theories of failure, factor of safety, selection of allowable Stress. Stress concentration. Elementary fatigue and creep aspects. Design of Cotter joints, knuckle joint and, Design of flange couplings.

Module 4:
Introduction to Belt drives, types of drives, belt materials, Length of belt, power transmitted, Velocity ratio, belt size for flat and V belts. Effect of centrifugal tension, Creep and Slip on power transmission, Bearing-Rolling friction, anti friction bearings. Types of governors. Constructional details and analysis of Watt, Porter, Proell governor.

[KAG451] THEORY OF MACHINE AND MACHINE DESIGN LAB

1. Analysis of 4-bar mechanism slides crank mechanism and their inversions.
2- Study of gear trains and motion analysis of some practical complex compound gear train.
3- To study the flywheel and governor action in laboratory.
4. To Study on Different Governors.

5. Design & drawing of Cotter joint.
6. Design & drawing of Knuckle joint
7. Design of eccentrically loaded riveted joint
8. Design of boiler riveted joint.
9. Design and drawing of flanged type rigid coupling.
10. Design and drawing of helical spring.

LAB OUTCOMES:

- Experiments reveals about the inversion of mechanism.
- Analysis of coupling.
- Study of motion analysis of gears.
- Applications of flywheel and governors.

Suggested Reading:

1. Khurmi R.S. and Gupta J.K. 1994. Theory of Machines. Eurasia Pub. House Pvt. Ltd., Ram Nagar, New Delhi.
2. Design of Machine Elements, V.B. Bhandari, Tata McGraw Hill Co.
3. Machine Design-Sharma and Agrawal, S.K. Kataria& Sons.
4. Design of Machine Elements, Sharma and Purohit, PHI.
5. Elements of Machine Component Design, Juvinal & Marshek, John Wiley & Sons.
6. Rattan S.B., 1993, Theory of Machines, Tata McGraw Hill Pub. Co. Ltd., 12/4 Asaf Ali Road, New Delhi.
7. Bhandari V.B. Machine Design Tata McGraw Hill Publishing Co. Ltd., 12/4 Asaf Ali, New Delhi.

Subject Code	KAG402					
Category	Engineering Course					
Subject Name	SOIL & WATER CONSERVATION ENGINEERING AND WATERSHED HYDROLOGY					
Scheme and Credits	**L-T-P**	**Theory Marks**	**Sessional**		**Total**	**Credit**
			Test	**Assig/Att.**		
	3-1-0	100	30	20	150	4
Pre-requisites (if any)	Basic knowledge of mathematics and science of higher secondary level.					

COURSE OUTCOMES		
	Course Outcome (CO)	**Bloom's Knowledge Level**
At the end of this course, the student will be able to		
CO 1	Understand hydrologic cycle, rainfall measurement, graphical relations, hydrologic process & runoff measurement.	K_2 & K_4
CO 2	Analyze the geomorphology of watershed, stream gauging, draught classification, causes and management strategy.	K_2 & K_1
CO 3	Understand soil erosion, its classification, mechanics of erosion, estimation of soil loss, rainfall erosivity and soil erodiability	K_4& K_5
CO 4	Familiarized with agronomical measures for water erosion, and analyze Engineering measures for soil erosion control.	K_2 & K_4
CO 5	Understand Gully and ravine reclamation, wind break, Land capability classification, sediment estimation.	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

Hydrologic cycle, precipitation and its forms, rainfall measurement and estimation of mean rainfall, frequency analysis of point rainfall. Mass curve, hyetograph, depth-area-duration curves and intensity-duration-frequency relationship. Hydrologic processes-Interception, infiltration, measurement and indices. Evaporation - Estimation and measurement. Runoff - Factors affecting, measurement, and stage - discharge rating curve, estimation of peak runoff rate and volume, rational method, Cook's method and SCS curve number method.

Module 2

Geomorphology of watersheds – Linear, aerial and relief aspects of watersheds- stream order, drainage density and stream frequency. Hydrograph - Components, base flow separation, unit hydrograph theory, S-curve, synthetic hydrograph, applications and limitations. Stream gauging - discharge rating curves, flood peak, design flood and computation of probable flood. Flood routing – channel and reservoir routing. Drought – classification causes and impacts, drought management strategy.

Module 3

Soil erosion - Introduction, causes and types - geological and accelerated erosion, agents, factors affecting and effects of erosion. Water erosion - Mechanics and forms - splash, sheet, rill, gully, ravine and stream bank erosion. Gullies - Classification, stages of development. Soil loss estimation – Universal soil loss equation (USLE) and modified USLE. Rainfall erosivity - estimation by KE>25 and EI_{30} methods. Soil erodibility -

topography, crop management and conservation practice factors. Measurement of soil erosion - Runoff plots, soil samplers.

Module 4

Water erosion control measures - agronomical measures - contour farming, strip cropping, conservation tillage and mulching. Engineering measures– Bunds and terraces. Bunds - contour and graded bunds - design. Terraces - level and graded, broad base terraces, bench terraces - planning, design and layout procedure, contour stonewall and trenching.

Module 5

Gully and ravine reclamation - principles of gully control - vegetative measures, temporary structures and diversion drains. Grassed waterways and design. Wind erosion- Factors affecting, mechanics, soil loss estimation and control measures - vegetative, mechanical measures, wind breaks and shelter belts and stabilization of sand dunes. Land capability classification. Rate of sedimentation, silt monitoring and storage loss in tanks.

[KAG452] WATERSHED HYDROLOGY, SOIL & WATER CONSERVATION ENGG. LAB

1. Visit to meteorological observatory and study of different instruments.
2. Exercise on intensity-frequency-duration curves
3. Analysis of rainfall data and estimation of mean rainfall by different methods.
4. Exercise on frequency analysis of hydrologic data and estimation of missing data, test for consistency of rainfall records.
5. Exercise on computation of infiltration indices.
6. Study of different types and forms of water erosion.
7. Exercises on computation of rainfall erosivity index.
8. Computation of soil erodibility index in soil loss estimation.
9. Exercises on soil loss estimation/measuring techniques.
10. Study of rainfall simulator for erosion assessment.

LAB OUTCOMES:

- Performed experiment illustrates to convert the point rainfall values at various stations in to an average value over a catchment.
- Demonstrate the various meteorological instruments and their working operation.
- Perform experiment illustrate intensity-frequency-duration curves of rainfall.
- Experiment enables to compute the values of Φ-index and W-index.
- Experiment gives knowledge of different types and various forms of water erosion.

Suggested Reading:

1. Raghunath, H.M., 2006. Hydrology: Principles Analysis and Design. Revised 2nd Edition, New Age International (P) Limited Publishers, New Delhi.
2. Subramanya, K. 2008. Engineering Hydrology. 3rd Edition, Tata McGraw-Hill Publishing Co., New Delhi.
3. Chow, VT, D.R. Maidment and L.W. Mays. 2010. Applied Hydrology, McGraw Hill Publishing Co., New York.
4. Linsley, R.K., M.A. Kohler, and JLH Paulhus. 1984. Hydrology for Engineers. McGraw-Hill Publishing Co., Japan.
6. Mahnot, S.C., 2014. Soil and Water Conservation and Watershed Management. International Books and Periodicals Supply Service, New Delhi.
7. Mal, BC 2014. Introduction to Soil and Water Conservation Engineering. 2014. Kalyani Publishers.
8. Michael, A.M. and T.P. Ojha. 2003. Principles of Agricultural Engineering. Volume II. 4th Edition, Jain Brothers, New Delhi.

Subject Code	KAG403					
Category	Engineering Course					
Subject Name	FLUID MECHANICS & OPEN CHANNEL HYDRAULICS					
Scheme and Credits	**L-T-P**	**Theory Marks**	**Sessional**		**Total**	**Credit**
			Test	**Assig/Att.**		
	3-1-0	100	30	20	150	4
Pre-requisites (if any)	Basic knowledge of mathematics and physics of secondary level.					

COURSE OUTCOMES		
	Course Outcome (CO)	**Bloom's Knowledge Level**
At the end of this course, the student will be able to		
CO 1	Understand property of fluid, measurement of pressure and conditions of floating and submerged bodies.	K_2 & K_3
CO 2	Analyze the fluid flow, continuity equation, fluid motion, Bernoulli's theorm with its applications.	K_2, K_3 & K_4
CO 3	Analyze the laminar and turbulant flow, flow through pipes, major and minor losses in pipe.	K_2 & K_4
CO 4	Illustrate the Dimensional analysis, dimensionless numbers, similitude: Rayleigh's method and Buckingham's `Pi' theorem	K_2 & K_3
CO 5	Understand the fluid machinery, centrifugal and reciprocating pump.	K_4 & K_5

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

DETAILED SYLLABUS

Module - 1:
Properties of fluids: Ideal and real fluid. Newtonian and non Newtonian fluid, Pressure and its measurement, Pascal's law, pressure forces on plane and curved surfaces, centre of pressure, buoyancy, Meta centre and Meta centric height, condition of floatation and stability of submerged and floating bodies.

Module - 2: Kinematics of fluid flow: Lagrangian and Eulerian description of fluid motion, continuity equation, path lines, streak lines and stream lines, stream function, velocity potential and flow net. Types of fluid flow, translation, rotation, circulation and vorticity, Vortex motion; Dynamics of fluid flow, Bernoulli's theorem, venturimeter, orifice meter and nozzle, siphon.

Module - 3 :
Laminar flow: Stress strain relationships, flow between infinite parallel plates both plates fixed, , average velocity; Laminar and turbulent flow in pipes, general equation for head loss Darcy, Equation, Minor and major hydraulic losses through pipes and fittings, flow through network of pipes, hydraulic gradient and energy gradient; Chezy's formula for loss of head in pipes, Flow through simple and compound pipes.

Module - 4:
Dimensional analysis and similitude: Rayleigh's method and Buckingham's `Pi' theorem, types of similarities, dimensionless numbers.

Module -5:
Introduction to fluid machinery, Centrifugal pump – construction work done, heads and its efficiencies, NPSH, priming. Reciprocating pump and its working, slip and classification.

[KAG453] FLUID MECHANICS & OPEN CHANNEL HYDRAULICS LAB

1. Study of manometers and pressure gauges
2. Verification of Bernoulli's theorem
3. Determination of coefficient of discharge of venture-meter and orifice meter
4. Determination of coefficient in pipeline
5. Determination of coefficient of discharge for rectangular and triangular notch
6. Determination of coefficient of discharge for mouth piece
7. Measurement of force exerted by water jets on flat and hemispherical vanes
8. Determination of meta-centric height
9. Determination of efficiency of hydraulic ram
10. Determination of surface tension of a given liquid.

LAB OUTCOMES:

- Conduct experiments find the pressure in fluid in different conditions
- Examine the friction and energy losses in pipe.
- Perform experiment discharge through different cross-sections.
- Able to calculate the surface tension.

Suggested Reading:

1.Khurmi, R.S. 1970. A Text Book of Hydraulics, Fluid Mechanics and Hydraulic Machines S. Chand & Company Limited, New Delhi.
2. Modi, PM and Seth, SM 1973. Hydraulics and Fluid Mechanics. Standard Book House, Delhi.
3. Chow, VT, 1983. Open Channel Hydraulics. McGraw Hill Book Co., New Delhi.
4. Lal Jagadish, 1985. Fluid Mechanics and Hydraulics. Metropolitan Book Co. Pvt. Ltd., New Delhi.