

**UTTAR PRADESH TECHNICAL UNIVERSITY  
LUCKNOW**



**Syllabus  
for  
B. Tech. Agricultural engineering  
of  
Second Year**

**(Effective from the Session: 2014-15)**

**STUDY & EVALUATION SCHEME  
(B.TECH. AG. ENGG.)  
w.e.f-2014-15**

Year IIInd Semester IIIrd

S.No.	Course Code	SUBJECT	PERIODS			Evaluation Scheme				SUBJECT TOTAL	Credit
			L	T	P	SESSIONAL EXAM			ESE		
						CT	TA	Total			
<b>THEORY</b>											
1	NAS-301/ NOE-031-039	Mathematics III/ Science Based Open Elective	3	1	0	30	20	50	100	150	4
2	NAG-301	Basic Electronics and Instrumentation	3	1	0	30	20	50	100	150	4
3	NAG-302	Fluid Mechanics	3	1	0	30	20	50	100	150	4
4	NAG-303	Farm Machinery	3	1	0	30	20	50	100	150	4
5	NHU301/ NHU302	Industrial Psychology / Industrial Sociology	2	0	0	15	10	25	50	75	2
6	NAG-304	Strength of Material	2	1	0	15	10	25	50	75	3
7	AUC-001/ AUC-002	<i>Human Values &amp; Professional Ethics/ Cyber Security</i>	2	0	0	15	10	25	50	75*	
<b>PRACTICAL / TRAINING / PROJECT</b>											
8	NAG-351	Basic Electronics and Instrumentation Lab	0	0	3	10	10	20	30	50	1
9	NAG-352	Fluid Mechanics Lab	0	0	3	10	10	20	30	50	1
10	NAG-353	Farm Machinery Lab	0	0	2	10	10	20	30	50	1
11	NAG-354	SOM Lab	0	0	2	10	10	20	30	50	1
12	NGP-301	G.P.						50		50	
		<b>Total</b>	<b>18</b>	<b>5</b>	<b>10</b>					<b>1000</b>	<b>25</b>

**STUDY & EVALUATION SCHEME  
(B.TECH. AG. ENGG.)**

w.e.f-2014-15

Year II<sup>nd</sup> Semester IV<sup>th</sup>

S.No.	Course Code	SUBJECT	PERIODS			Evaluation Scheme				SUBJECT TOTAL	Credit
			L	T	P	SESSIONAL EXAM			ESE		
						CT	TA	Total			
<b>THEORY</b>											
1	NOE-041-049/ NAS-401	Science Based Open Elective/ Mathematics III	3	1	0	30	20	50	100	150	4
2	NBT-402	Heat & Mass Transfer	3	1	0	30	20	50	100	150	4
3	NAG-403	Soil Mechanics	3	1	0	30	20	50	100	150	4
4	NAG-404	Theory of Machinery	3	1	0	30	20	50	100	150	4
5	NHU401/ NHU402	Industrial Psychology /Industrial Sociology	2	0	0	15	10	25	50	75	2
6	NAG-405	Hydrology	2	1	0	15	10	25	50	75	3
7	AUC-002/ AUC-001	<i>Cyber Security/ Human Values &amp; Professional Ethics</i>	2	0	0	15	10	25	50	75*	
<b>PRACTICAL / TRAINING / PROJECT</b>											
8	NAG-453	Soil Mechanics Lab	0	0	2	10	10	20	30	50	1
9	NAG-454	TOM Lab	0	0	2	10	10	20	30	50	1
10	NAG-455	Hydrology Lab	0	0	3	10	10	20	30	50	1
11	NBT-452	Heat & Mass Transfer Lab	0	0	3	10	10	20	30	50	1
12	NGP-401	G.P.						50		50	
		<b>Total</b>	18	5	10					1000	25

**B. Tech. (Ag. Engg.) Semester –III (w.e.f. 2014-15)**

**NAG-301**

**Basic Electronics and Instrumentation 4(3+1)**

**Unit-1**

Semiconductors, p-n junction, V-I characteristics of p-n junction, diode as a circuit element, rectifier, clipper, clamper, capacitive filter,

**Unit-2**

Bipolar junction transistor: operating point, classification (A, B & C) of amplifier, various biasing methods (fixed, self, potential divider),

h-parameter model of a transistor, analysis of small signal, CE amplifier,

**Unit-3**

Phase shift oscillator, analysis of differential amplifier using transistor, ideal OP-AMP characteristics, linear and non-linear applications of OP-AMP (adder, subtractor, integrator,

**Unit-4**

Half wave, full wave and bridge rectifier; comparator, differentiator, Zener diode voltage regulator, transistor series regulator, OP-AMP voltage regulators, LVDT

**Unit-5**

Basic theorem of Boolean algebra, Combinational logic circuits(basic gates, SOP rule and Kmap), D/A converter, successive approximation A/D converter, generalized instrumentation, measurement of displacement, temperature, velocity, force and pressure using potentiometer, resistance thermometer, thermocouples, bourden tube, LVDT, strain gauge and tacho-generator.

**NAG-351: Basic Electronics and Instrumentation Lab**

- 1 -To study V-I characteristics of p-n junction diode;
- 2 -To study half wave, full wave and bridge rectifier;
- 3- To study transistor characteristics in CE configurations;
- 4 -To design and study fixed and self bias transistor;
- 5 -To design and study potential divider bias transistor;
- 6 -To study a diode as clipper and clamper;
- 7 -To study a OP-AMP IC 741 as inverting and noninverting amplifier;
- 8 -To study a OP-AMP IC 741 as differentiator amplifier;
- 9 -To study a differential amplifier using two transistor;
- 10- To study a OP-AMP IC 741 as differential amplifier;

- 11 -To study a zener regulator circuit;
- 12 -To study a OP-AMP IC 741 as a active rectifier;
- 13 -To study a OP-AMP IC 741 as a comparator;
- 14 -To familiarize with various types of Transducers

### **NAG-302 : Fluid Mechanics 4 (3+1)**

#### **Unit-1**

Properties of fluids: Ideal and real fluid. Pressure and its measurement, Pascal's law, pressure forces on plane and curved surfaces, centre of pressure, buoyancy, metacentre and metacentric height, condition of floatation and stability of submerged and floating bodies;

#### **Unit-2**

Kinematics of fluid flow: continuity equation, path lines, streak lines and streamlines, stream tube, stream function, velocity potential function, and flow net. Types of fluid flow, translation, rotation, circulation and vorticity, Vortex motion; Dynamics of fluid flow, Bernoulli's theorem, venturimeter, orifice-meter, Introduction to orifice and notch.

#### **Unit-3**

Laminar flow: shear stress distribution and velocity distribution in circular pipes and two parallel plates; kinetic energy correction factor and momentum energy correction factor, average velocity, shear stress and pressure gradient; Turbulent flow in pipes, Darcy equation

#### **Unit-4**

Minor and major hydraulic losses through pipes and fittings, flow through network of pipes, hydraulic gradient and energy gradient, siphon; power transmission through pipe and nozzle; water hammer.

#### **Unit-5**

Dimensional analysis and similitude: Rayleigh's method and Buckingham's -theorem, types of similarities, dimensionless numbsers, model's law.

### **NAG-352 : Fluid Mechanics Lab**

- 1- Study of manometers and pressure gauges.
- 2- Determination of coefficient of discharge of venturimeter and orifice meter.
- 3- Determination of coefficient of friction in pipeline.
- 4- Determination of coefficient of discharge for rectangular and triangular notch.
- 5- Determination of coefficient of discharge, coefficient of velocity and coefficient of contraction for flow through orifice.
- 6- Determination of coefficient of discharge for mouthpiece.

7-Measurement of force exerted by water-jets on flat and hemispherical vanes.

8- Determination of metacentric height.

9-Determination of efficiency of hydraulic ram.

10- Study of current meter; Velocity distribution in open channels and determination of Manning's coefficient of roughness.

### **Text Book**

Text book of Fluid Mechanics by R.K.Bansal. Punmia; Laxmi Publication (P) Ltd. New Delhi

### **NAG-303: Farm Machinery 4 (3+1)**

#### **Unit-1**

Objectives of farm mechanization. Classification of farm machines. Materials of construction & heat treatment. Principles of operation and selection of machines used for production of crops. Field capacities & economics.

#### **Unit-2**

Tillage; primary and secondary tillage equipment, Zero and conservation tillage equipment Forces acting on tillage tools, Hitching systems and controls, Measurement of forces of tillage tools, Draft measurement of tillage equipment Types of dynamometer; spring, hydraulic, and strain gauge types.

#### **Unit-3**

Earth moving equipment - their construction & working principles viz Bulldozer, Elevators, Scraper and Digger. Sowing, planting & transplanting equipment, various type Zero till ferti-drill Seed and planting metering devices, their calibration and adjustments. Furrow openers and covering devices. Fertilizer application equipment and their metering devices.

#### **Unit-4**

Weed control and Plant protection equipment - sprayers and dusters, their calibration, selection, constructional features of different components and adjustments.

#### **Unit-5**

Crop harvesting machinery, Principles & types of cutting mechanisms. Construction & adjustments of shear & impact-type cutting mechanisms. Brief description of mowers, windrowers, reapers, reaper binders and forage harvesters. Forage chopping & handling equipment. Description working principle of threshing machineries, grain and straw combine.

**NAG-353 : Farm Machinery Lab**

- 1- Introduction to various farm machines.
- 2- Visit to implements shed and research hall.
- 3- Field capacity and field efficiency measurement for at least two machines/implements;
- 4-Draft & fuel consumption measurement methods for different implements.
- 5- Construction details, field adjustments and working of M.B. plow, Disc Plough, Harrow, Cultivator and their remedies.
- 6- Introduction, construction and working of earth moving equipment.
- 7- .Construction and working of rotavators and other rotary tillers.
8. Working of seed-cum-fertilizer drills, planters and their calibration in level field.
- 9- Field operation of sowing and planting equipment and their adjustments.
- 10- Working of trans planters such as rice, maize etc.
- 11- Weeding equipments- their use and adjustment.
- 12- Measurement of nozzle discharge, field capacity of sprayer and duster.
- 13- Studies on methods of repair, maintenance and off season storage of farm equipments.

**Text Book**

Principle of Farm Machinery, R.A Kepner, Roy Bainer;; CBS Publication

Agricultural Engineering; Radhey Lal: Saroj Publication

**NAG – 304 : Strength of Materials 3(2+1)**

**Unit -1**

Compound stress and strains: Principal stress and strain. Mohr's stress circle, Three dimensional state of stress and strain, Theory of failure.

**Unit-2**

Stresses in thin cylinder and spherical shells, derivation of equations for circumferential and longitudinal stresses in shells and their applications.

**Unit-3**

Review of pure bending, Direct and shear stresses in beams due to transverse and axial loads, Deflection of beams, Equation of elastic curve, Macaulay's method, and Moment area method.

#### **Unit-4**

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.

#### **NAG -354 : Strength of Materials Lab**

- 1- To perform the tension test on metal specimen (M.S., C.I).
- 2- To observe the behaviour of materials under load, to calculate the value of E, ultimate stress, permissible stress, percentage elongation etc. and to study its fracture.
- 3- To perform the compression tension.
- 4- Concrete cylinders & cubes, C.I., M.S. & Wood specimens and to determine various physical and mechanical properties.
- 5- To perform the bending test on the specimens; M.S. Girder, Wooden beam, Plain concrete beams & R.C.C. beam, and to determine the various physical and mechanical properties.
- 6- To determine Young's modulus of elasticity of beam with the help of deflection produced at centre due to loads placed at centre & quarter points.
- 7- To study the behaviour of materials (G.I. pipes, M.S., C.I.) under torsion and to evaluate various elastic constants.
- 8- To study load deflection and other physical properties of closely coiled helical spring in tension and compression.
- 9- To perform the Rockwell, Vicker's and Brinell's Hardness tests on the given specimens.
- 10- To perform the Drop Hammer Test, Izod Test and Charpy's impact tests on the given specimens.
- 11- To determine compressive & tensile strength of cement after making cubes and briquettes.
- 12- To measure workability of concrete (slump test, compaction factor test).

#### **Text Book**

Strength of Materials, R. K. Bansal

Strength of Materials, R. K. Rajput

Semester –IV

**NBT-402: HEAT AND MASS TRANSFER**

<b>L</b>	<b>T</b>	<b>P</b>
<b>3</b>	<b>1</b>	<b>0</b>

**Unit I Conduction and Convection**

Introduction, Conduction: Basic concepts of conduction in solids, liquids and gases, One and two dimensional heat conduction. Critical and optimum insulation thickness. Introduction to unsteady state heat transfer. Principles of convection, Equations of forced and free convection, Heat flow due to conduction & convection

**Unit II Radiation**

Basic laws of heat transfer by radiation, black body and gray body concepts, solar radiations, combined heat transfer coefficients by convection and radiation. Heat Transfer Equipments: Double pipe, Shell & tube and Plate type heat exchanger, Evaporator, Condenser.

**Unit III Diffusion**

Molecular and turbulent diffusion, Diffusion coefficient, Fick's Law of diffusion, Dependence of diffusion coefficient on temperature, pressure and composition, Diffusion in multi-component gas mixtures. Diffusion in solids: Molecular, Knudsen & surface diffusion Inter-phase mass transfer, Mass transfer coefficients, Mass transfer in fluidized bed reactor, flow past solids and boundary layers, Simultaneous heat and mass transfer system.

**Unit IV Drying and Crystallization**

Solid-gas equilibria, Different modes of drying operation, Types of batch and continuous dryer Definitions of moisture contents, Rate of batch drying, Time of drying, Mechanism of batch drying, Continuous drying. Classification of crystallizers, Equilibrium yield of crystallization, Heat and mass transfer rates in crystallization, Theories of crystallization, Factors governing nucleation and crystal growth rates, controlled growth of crystal.

**Unit V Absorption and Adsorption**

Gas-Liquid equilibrium, Henry's Law, Selection of solvents, Absorption in tray column, Graphical and analytical methods, Absorption in packed column, Design equation for packed column, HTU, NTU and HTEP concepts, Description of adsorption process and their application, Types of adsorption nature of adsorbents, Adsorption equilibrium isotherm and its kinetics, Stage wise and continuous contact adsorption operation operations, Determination of number of stages, Equipments.

**Books Recommended**

1. Holman, J.P.: "Heat Transfer" 9 th ed. McGraw Hill (1989).
2. Treybal, R "Mass Transfer Operations", 3rd ed. New York: McGraw-Hill, (1980).

**Reference Books**

1. McCabe Smith: Unit Operations in Chemical Engineering, McGraw Hill
2. Foust A. S. et.al., "Principles of Unit Operations" John Wiley (1980).

**NBT-452: Heat and Mass Transfer Lab**

**L      T      P**  
**0      0      3**

**List of Experiments**

1. To find out the thermal conductivities of Metal rod.
2. To find the thermal conductivity of Composite cylinder.
3. To find out the thermal conductivity of Insulating powder.
4. To find the thermal conductivity of liquid / gases.
5. To determine the overall heat transfer coefficient in Parallel flow heat exchanger
6. To determine the overall heat transfer coefficient in Counter flow heat exchanger
7. To determine the overall heat transfer coefficient in Shell and Tube heat exchanger
8. To determine the overall heat transfer coefficient in Plate type heat exchanger
9. Any Experiment on natural convection
10. Any experiment on determination of emissivity
11. To visualize pool boiling apparatus to find out the heat transfer coefficient of boiling
12. To determine the drying characteristics of given sample

**NAG-403 : Soil Mechanics 4 (3+1)**

**Unit-1**

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 I.S. soil classification system stress condition in soils.

**Unit-2**

Effective and neutral stress, elementary concept of Bousinesque and Wester guards analysis, newmark influence chart. Shear strength mohr's stress circle, mohr-coulomb failure theory, effective stress principle. Numerical exercise based on various types of test.

### Unit-3

Compaction composition of soils standard and modified proctor test, abbot compaction and Jodhpur mini compaction test field compaction method and control.

### Unit-4

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 Casagrand's method, determination of coefficient of consolidation.

### Unit-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 exercise. Stability of slopes: Introduction to stability analysis of infinite and finite slope, friction circle method Taylor's stability number.

### **NAG-451: 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 liquid limit by Casagrande's method.
- 8 -Determination of liquid limit by cone penetrometer and plastic limit.
- 9 -Determination of shrinkage limit.
- 10- Determination of permeability by constant head method.
- 11 -Determination of permeability by variable head method.
- 12 -Determination of compaction properties by standard proctor test.
- 13 -Determination of shear parameters by Direct shear test.
- 14 -Determination of unconfined compressive strength of soil.
- 15 -Determination of shear parameters by Triaxial test.
- 16 -Determination of consolidation properties of soils.

#### **Text Books:**

Soil Mechanics, B. C. Punmia; Laxmi Publication (P) Ltd. New Delhi

**NAG-404 : Theory of Machines 4 (3+1)**

**UNIT-1**

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, Degree of freedom.

Determination of velocity and acceleration using graphical (relative velocity and acceleration) method. Instantaneous centers.

**UNIT-2**

Cam, Types of cam, Terminology used in cam-follower system, Cam profile, Gear train, Simple, compound, reverted, and epicyclical gear trains. Determination of velocity ratio and train value by tabular method.

**UNIT-3**

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, Chain drives.

Introduction to Clutches, Types of clutches (Single disc, multiple disc, and cone clutches).

**UNIT-4**

Introduction to Governor, Types of governors, Constructional details and Analysis of Watt, Porter, Proell governor, Sensitiveness, stability, hunting, isochronisms, power and effort of a governor.

Introduction to flywheel, Static and dynamic balancing. Balancing of rotating masses in one and different planes. Partial primary balancing of reciprocating masses.

**NAG-453: Theory of Machines Lab**

- 1- Analysis of 4-bar mechanism slider crank mechanism and their inversions.
- 2- Complete velocity and acceleration analysis (Graphical or Analytical) of few practical linkage mechanisms.
- 3- Study of gear trains and motion analysis of some practical complex compound gear train.
- 4- Motion analysis of Epicyclical gear trains using tabular and formula methods.
- 5- To study the flywheel and governor action in laboratory.
- 6- To graphically synthesize the cam profile for a desired standard follower motion.
- 7- To Study on the cam follower demonstration machine for follower displacement as a function of cam rotation angle and phenomenon of follower jump;
- 8- Demonstration of static and dynamic balancing in the laboratory.

9-Calculations on balancing a multi rotor unbalanced system by putting masses in two different planes.

10- To Study on Different Governors.

**Text Books:**

1. Theory of Machine by R.S.Khurmi. S.Chand Publication

**WATERSHED HYDROLOGY**

**NAG-405 3(2+1)**

**Unit I**

Introduction; hydrologic cycle; precipitation - forms, rainfall measurement, mass curve, hydrograph, mean rainfall depth, frequency analysis of point rainfall, plotting position, estimation of missing data, test for consistency of rainfall records; interception infiltration; evaporation; evapo-transpiration-estimation and measurement.

**Unit II**

Runoff - factors affecting, measurement; stage and velocity, rating curve, extension of rating curve; estimation of peak runoff rate and volume; rational method, Cook's method, SCS method, Curve number method.

**Unit III**

Hydrograph; components, base flow separation, unit hydrograph theory. unit hydrograph of different durations, dimensionless unit hydrograph, distribution hydrograph, synthetic unit hydrograph, uses and limitations of unit hydrograph.

**Unit IV**

Head water flood control - methods, retards and their location; flood routing – graphical methods of reservoir flood routing; hydrology of dry land areas - drought and its classification; introduction to watershed management and planning. Geomorphology of watersheds - stream number, stream length, stream area, stream slope and Horton's laws.

**NAG-452 WATERSHED HYDROLOGY LAB**

- 1-Visit to meteorological observatory.
- 2- Study of different types of rain gauges.
- 3-Exercise on analysis of rainfall data.
- 4- Double mass curve technique.
- 5- Determination of average depth of rainfall and frequency analysis.
- 6- Study of stage recorders and current meters.
- 7-Exercise on estimation of peak runoff rate and runoff volume.
- 8- Exercises on hydrograph and unit hydrograph.
- 9- Exercises on design and location of retards for channel improvement.
- 10-Exercises on flood routing problems.

**Text Books**

Engineering Hydrology by S. Subramanya

Water resource Engineering and Hydrology by S. K. Garg