JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY KAKINADA
KAKINADA – 533 003, Andhra Pradesh, India

DEPARTMENT OF AGRICULTURAL ENGINEERING

COURSE STRUCTURE AND SYLLABUS

For UG – R20

B. TECH - AGRICUTLTURAL ENGINEERING

(Applicable for batches admitted from 2020-2021)

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY KAKINADA

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DEPARTMENT OF AGRICULTURAL ENGINEERING

II Year I Semester

S. No.	Subject	L	T	P	Credits
1	Mathematics – III (Vector Calculus, Transforms and PDE)	3	0	0	3
2	Surveying and Leveling	3	0	0	3
3	Fluid Mechanics and Open Channel Hydraulics	3	0	0	3
4	Properties and Strength of Materials	3	0	0	3
5	Farm Power and Tractor Systems	3	0	0	3
6	Surveying and Leveling Lab	0	0	3	1.5
7	Fluid Mechanics and Open Channel Hydraulics Lab	0	0	3	1.5
8	Field Operation and Maintenance of Tractors Lab	0	0	3	1.5
9	Agricultural Machinery Design using CAD/CAM Skill Oriented Course (Lab)	1	0	2	2
10	Constitution of India	2	0	0	0
	Total Credits				**21.5**

II Year II Semester

S. No.	Subject	L	T	P	Credits
1	Heat and Mass Transfer	3	0	0	3
2	Ground Water Hydrology, Well and Pumps	3	0	0	3
3	Theory of Structures	3	0	0	3
4	Soil Mechanics	3	0	0	3
5	Managerial Economics and Financial Analysis	3	0	0	3
6	Heat and Mass Transfer Lab	0	0	3	1.5
7	Theory of Structures Lab	0	0	3	1.5
8	Soil Mechanics Lab	0	0	3	1.5
9	Analysis/Simulation using MATLAB Skill Oriented Course (Lab)	1	0	2	2
	Total Credits				**21.5**

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II Year - I Semester		L	T	P	C
		3	0	0	3
	MATHEMATICS-III (Vector Calculus, Transforms and PDE)				

Course Objectives:
- To familiarize the techniques in partial differential equations
- To furnish the learners with basic concepts and techniques at plus two level to lead them into advanced level by handling various real-world applications.

Course Outcomes: At the end of the course, the student will be able to
- interpret the physical meaning of different operators such as gradient, curl and divergence (L5)
- estimate the work done against a field, circulation and flux using vector calculus (L5)
- apply the Laplace transform for solving differential equations (L3)
- find or compute the Fourier series of periodic signals (L3)
- know and be able to apply integral expressions for the forwards and inverse Fourier transform to a range of non-periodic waveforms (L3)
- identify solution methods for partial differential equations that model physical processes (L3)

UNIT –I: Vector calculus: (10 hrs)
Vector Differentiation: Gradient– Directional derivative – Divergence– Curl– Scalar Potential.
Vector Integration: Line integral – Work done – Area– Surface and volume integrals – Vector integral theorems: Greens, Stokes and Gauss Divergence theorems (without proof) and problems on above theorems.

UNIT –II: Laplace Transforms: (10 hrs)
Laplace transforms – Definition and Laplace transforms of some certain functions– Shifting theorems – Transforms of derivatives and integrals – Unit step function –Dirac's delta function Periodic function – Inverse Laplace transforms– Convolution theorem (without proof).
Applications: Solving ordinary differential equations (initial value problems) using Laplace transforms.

UNIT –III: Fourier series and Fourier Transforms: (10 hrs)
Fourier Series: Introduction– Periodic functions – Fourier series of periodic function – Dirichlet's conditions – Even and odd functions –Change of interval– Half-range sine and cosine series.
Fourier Transforms: Fourier integral theorem (without proof) – Fourier sine and cosine integrals – Sine and cosine transforms – Properties (article-22.5 in text book-1)– inverse transforms – Convolution theorem (without proof) – Finite Fourier transforms.

UNIT –IV: PDE of first order: (8 hrs)
Formation of partial differential equations by elimination of arbitrary constants and arbitrary functions – Solutions of first order linear (Lagrange) equation and nonlinear (standard types) equations.

UNIT – V: Second order PDE and Applications: (10 hrs)
Second order PDE: Solutions of linear partial differential equations with constant coefficients –Non-homogeneous term of the type $e^{ax+by}, \sin(ax+by), \cos(ax+by), x^m y^n$.
Applications of PDE: Method of separation of Variables– Solution of One-dimensional Wave, Heat and two-dimensional Laplace equation.

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Text Books:
1. **B. S. Grewal,** Higher Engineering Mathematics, 44th Edition, Khanna Publishers.
2. **B. V. Ramana,**Higher Engineering Mathematics, 2007 Edition, Tata Mc. Graw Hill Education.

Reference Books:
1. **Erwin Kreyszig,** Advanced Engineering Mathematics, 10th Edition, Wiley-India.
2. **Dean. G. Duffy,** Advanced Engineering Mathematics with MATLAB, 3rd Edition, CRC Press.
3. **Peter O' Neil,** Advanced Engineering Mathematics, Cengage.
4. **Srimantha Pal, S C Bhunia,** Engineering Mathematics, Oxford University Press.

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II Year - I Semester		**L**	**T**	**P**	**C**
		3	**0**	**0**	**3**
	SURVEYING AND LEVELING				

Course Objectives:
Surveying and leveling curriculum which is re-oriented to the needs of non-circuital branches of graduate engineering courses offered by JNT University: Kakinada that serves as a transit to understand the branch specific advanced topics. The course is designed to:

UNIT – I   (9 hrs)
INTRODUCTION: Overview of plane surveying (chain, compass and plane table), Objectives, Principles and classifications. Distance measurement conventions and methods; use of chain and tape, Electronic distance measurements, Meridians, Azimuths and Bearings, declination, computation of angle.

UNIT – II   (7 hrs)
LEVELING AND CONTOURING: Concept and Terminology, Temporary and permanent adjustments- method of leveling. Characteristics and Uses of contours- methods of conducting contour surveys and their plotting.

UNIT – III   (10 hrs)
COMPUTATION OF AREAS AND VOLUMES: Area from field notes, computation of areas along irregular boundaries and area consisting of regular boundaries. Embankments and cutting for a level section and two level sections with and without transverse slopes, determination of the capacity of reservoir, volume of barrow pits.

UNIT - IV   (8 hrs)
THEODOLITE: Theodolite, description, uses and adjustments – temporary and permanent, measurement of horizontal and vertical angles. Principles of Electronic Theodolite. Trigonometrical leveling, Traversing.

UNIT – V   (14 hrs)
TACHEOMETRIC SURVEYING:
Stadia and tangential methods of Tacheometry. Distance and Elevation formulae for Staff vertical position. Types of curves, design and setting out – simple and compound curves.
INDTRODUCTION TO ADVANCED SURVEYING : Introduction to geodetic surveying, Total Station and Global positioning system, Introduction to Geographic information system (GIS).

TEXT BOOKS:
1. "Surveying (Vol – 1, 2 & 3), by B.C.Punmia, Ashok Kumar Jain and Arun Kumar Jain - Laxmi Publications (P) ltd., New Delhi
2. Duggal S K, "Surveying (Vol – 1 & 2), Tata Mc-Graw Hill Publishing Co. Ltd. New Delhi, 2004.
3. Text book of surveying by C. Venkataramaiah, University Press.

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REFERENCES:
1. Arthur R Benton and Philip J Taety, Elements of Plane Surveying, McGraw Hill – 2000
2. Arora K R "Surveying Vol 1, 2 & 3), Standard Book House, Delhi, 2004
3. Chandra A M, "Plane Surveying", New age International Pvt. Ltd., Publishers, New Delhi, 2002.
4. Chandra A M, "Higher Surveying", New age International Pvt. Ltd., Publishers, New Delhi, 2002.
5. Surveying and levelling by R. Subramanian, Oxford university press, New Delhi.

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II Year - I Semester		L	T	P	C
		3	0	0	3
	FLUID MECHANICS AND OPEN CHANNEL HYDRAULICS				

Objective: To enable the students to design efficient water conveyance systems like canals, channels and pipes from places of origin to delivery points by acquiring knowledge on the principles of mechanics of fluids, water measurement and regulation and open channel hydraulic principles.

Outcomes:

Acquaintance of skills on basic principles of fluid, their properties, flow patterns, classificationof flow regimes etc.,

Impart knowledge on boundary layer theory and their principals, alynamies of fluid flow andtheories of flow regimes – energy calculations.

Development of skills on Buoyancy principals, flow measuring devises, their flow dynamics. Skill development on flow through pipes & their concepts, dynamics of mix flow principles ofdimensional analysis and similitude, open channel flow dynamic.

Skill development on open channel flow dynamics, concepts & principles, their design procedures.

Unit – I:

Fluids-Definitions-classification-properties, dimensions. Fluid pressure–Introduction–measurement of fluid pressure, peizometer tube manometry, types of manometers. Mechanical gauges-Bourdon's tube pressure gauge, diaphragm pressure gauge, dead weight pressure gauge. Fluid static force on submerged surfaces, total force on horizontal, vertical and inclined surfaces. Center of pressure of an inclined immersed surface, center of pressure of a composite section. Pressure on a curved surface and its applications. Kinematics of fluid flow– Introduction, continuity of fluid flow, Types of flow lines.

Unit –II:

Boundary layer theory- Thickness of boundary layer, Thickness of boundary layer in a laminar flow, Thickness of boundary layer in a turbulent flow, Prandtl's experiment of boundary layer separation. Dynamics of fluid flow – Various forms of energy in fluid flow, frictional loss, general equation. Bernoulli's theorem, Euler's equation of motion. Practical applications of Bernoulli's theorem, verturimeter, pitot tube, orifice meter.

Unit – III:

Buoyancy of flotation – metacentric height. Flow through orifices (measurement of discharge)
– Types of orifices, jet of water, vena contracta, hydraulic coefficients, experimental method for hydraulic Coefficients, discharge through a rectangular orifice. Flow through orifices (measurement of time) – Time of emptying a square, rectangular or circular tank through an orifice at its bottom, time of emptying a hemispherical tank through an orifice at its bottom. Time of emptying a circular horizontal tank through an orifice at its bottom. Time of emptyinga tank of variable cross-section through an

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orifice. Flow through mouthpieces – Types of Mouthpieces; Loss of head of a liquid flowing in a pipe, discharge through a mouthpiece. Flow over notches- Types of notches, discharge over a rectangular notch, triangular notch, stepped notch. Time of emptying a tank over a rectangular notch, triangular notch. Flow over weirs – Types of weirs, discharge over a weir, Francis's formula for discharge over a rectangular weir (effect of end contractions), Bazin's formula for discharge over a rectangular weir, velocity of approach, determination of velocity of approach.

Unit – IV:

Flow through simple pipes – Loss of head in pipes, Darcy's formula for loss of head in pipes, Chezy's formula for loss of head in pipes. Transmission of power through pipes, Time of emptying a tank through a long pipe, Time of flow from one tank into another through a long pipe. Flow through compound pipes – Discharge through a compound pipe (pipes in series), discharge through pipes in parallel, equivalent size of a pipe, discharge through branded pipes from one reservoir to another. Dimensional analysis and similitude – Rayleigh's method and Buckingham's pi theorem. Types of similarities, dimensional analysis, dimensionless numbers, introduction to fluid machinery. Open channel hydraulics- classification of open channel and definitions. Chezy's formula for discharge through an open channel.

Unit – V:

Bazin's formula for discharge through open channel, numerical problems on design through open channel, Kutter's formula for discharge, problems on design. Manning's formula for discharge through an open channel. Channels of most economical cross sections – Conditions for maximum discharge through a channel of rectangular section, trapezoidal section, circular section. Specific energy concept - Specific energy of a following fluid, specific energy diagram, critical depth, type of flows, critical velocity. Velocity and pressure profiles in open channels. Hydraulic jump, types of hydraulic jumps, depth of hydraulic jump, loss of head due to hydraulic jump.

TEXT BOOKS:

1. Hydraulics and Fluid Mechanics, Modi P M and Seth S. M. 1973. Standard Book House,Delhi.
2. Open Channel Hydraulics, Chow V T, 1983, McGraw Hill Book Co., New Delhi.

REFERENCES:

1. A Text book of Hydraulics, Fluid Mechanics and Hydraulic Machines, Khurmi, R. S. 1970., S. Chand & Company Ltd., New Delhi.

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II Year - I Semester		L	T	P	C
		3	0	0	3
	PROPERTIES AND STRENGTH OF MATERIALS				

Objective: To enable the students to know about different materials used for engineering constructions like buildings, roads, farm structures and metals and other materials for manufacturing farm equipment, implements, dairy and food processing equipment.

Outcomes:

Skill development on basic properties of engineering materials and their uses, testing ofmaterials.

Knowledge development on properties and application of difference of concrete, varieties, distempers, glass, rubber and plywood, plastics, iron-based materials, alloys etc., Development of skill on stress – strain analysis of beams under different types of loadingpatterns.

Acquaintance of skill on Euler's theory and buckling load, analysis on columns & differenttypes of columns.

Skill development on different types of joints (Riveting), welding analysis cantilever, fixed,continuous beams, theory of moments and their analysis.

Unit- I:

Properties of engineering materials, classifications of rocks, sources of stones and natural bed of stones, properties, varieties and uses of stones, properties, composition and uses of bricks, classification and tests of bricks, properties, varieties and uses of tiles, properties, varieties and uses of Lime, Properties, varieties and uses of Cement, Properties, varieties anduses of cement mortar, properties.

Unit - II

Varieties and uses of concrete, properties, varieties and uses of sand, properties, varieties and uses of paints, properties, varieties and uses of varnishes, properties, varieties and uses of distempers. Characteristics and uses of glass, rubber, plywood, plastics. Characteristics and uses of wrought iron, cast iron, steel, aluminium, copper, nickel; Alloys of Aluminium and its properties, Alloys of Copper and its properties, Alloys of Nickel and its properties; Definition and types of timber, seasoning of timber, industrial timber and uses of timber, Methods of heat treatment of steel.

Unit-III:

Introduction – Stresses, tensile, compressive and shear-strains, units-elastic curv- Elastic limit Poisons ratio, stresses in uniformity tapered circular sections, stresses in bars of composite, sections, thermal stresses and strains in simple bars and composite bars; Elastic constants- Young's modulus, bulk modulus and shear modulus - relation between them; Stresses on oblique planes, Mohr's circle method; Direct stresses in one plane, direct stresses in two planes- accompanied by shear stress. Deflection of beams, relation between slope, deflection and radios of curvature. Methods of finding out slopes and deflections of beams, double integration method. Slope and deflection equations of a simply supported beam with

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a central point load, simply supported beam with eccentric point load. Simply supported beam with a uniformly distributed load, Columns and struts.

Unit-IV:

Euler's column theory. Assumptions of Euler's column theory; Buckling load-derivations, types of end conditions of columns, both ends hinged, both ends fixed, one end fixed and other hinged; Expression for buckling load of a column with one end fixed other free, with one end fixed and other hinged, expression for buckling load of a column with both ends hinged, with both ends. Fixed types of end conditions of columns, both ends hinged, both ends fixed, one end fixed and other is hinged and one end fixed and other end is free. Types of end conditions of columns, both ends hinged, both ends fixed, one end fixed and other is hinged and one end fixed and other end is free. Limitations of Euler's formula Rankine's formula for columns.

Unit-V:

Riveted joints, types of joint strength of a rivet and riveted joint, efficiency of a riveted joint. Design of riveted joints, eccentric riveted connections, Welded joist, types of welded joints, strength of welded joints, technical terms. Design of welded joints, eccentric welded joints. Dams, forces acting, stressed at the base of dam. Stability of dams, design of base width of dams. Propped cantilever and beams – Deflection and slope equations; Fixed and continuous beams – Deflection and slope equations, Super position theorem – Claypeyron's theorem of three moments, application of Clayperon's theorem of three moments, Moment distribution methods. Analysis of statistically - indeterminate beams.

TEXT BOOKS:

1. Engineering Materials, Rangwala, S.C.1994. Charotar Publishing House, Anand.
2. Strength of Materials by Ramamrutham S. 2003. Dhanapathrai & Sons, Nai Sarak, NewDelhi.

REFERENCES:

1. Material of constructions Deshpande R S 1977. United Book Corporation, Poona.
2. Manufacturing Process. Hazra Choudhury 1985. Media Promoters and PublishersPrivate Limited, Bombay.
3. Workshop Technology (Part-I) Chapman W.A.J. 1994. Aronold Publishers, New Delhi.
4. Engineering Materials. Rangwala S.C. 1994. Charotar Publishing House, Anand.
5. Mechanics of Structures (Vol.I) Junnarkar S.B. 2001 - Charotar Publishing House,Anand.

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II Year - I Semester		L	T	P	C
		3	0	0	3
FARM POWER AND TRACTOR SYSTEMS					

Objective: To enable the students for acquiring the knowledge pertaining to systems like transmission system clutch, types of clutches, types of Gear, sliding, constant mesh type tractor power out lets like P. T.O, belt pulley, drawbar, traction theory rolling, resistance, rim pull, crawler tractor.

Outcomes:

Skill development on farm power sources classification I.C engine components & construction, operating systems.

Skill development on fuel supply ignition, cooling & lubrication electrical ignition, fuels & their properties, governing systems of IC engines, power transmission, clutches & its applications.

Acquaintance of knowledge on clutch types, concepts & principles, single & multiple plate clutches, working mechanism, gear theory and principles, differential unit of its functions, final drive & its applications.

Skill development on principles of fluid coupling &torque connector, brakes principles, classification & friction concepts of hydraulic system in factors.

Skill development on tractor powers outlets, P.T.O and its applications, Tractor testing and its main components, CG estimation, Tractor chassis its mechanics.

Unit-I:

Source of farm power – Conventional and non conventional energy sources, classification of tractor and I.C engines, study of I.C engine components and their construction, operating principles and functions, Engine systems and their construction details and adjustment.

Unit-II:

Valves and valve mechanism, fuel and air supply stems, cooling and lubricating systems, electrical and ignition systems, I.C engine fuels and their properties, detonation and knocking in IC engines, Study of properties of coolants, antifreeze and anti corrosion materials, Lubricant types & study of their properties – Engine governing systems. Introduction to transmission system – Power transmission system of tractor – Functions of a power transmission system. Clutch – Necessity of clutch in a tractor, essential features of good clutch, principal working of clutch, clutch repairs and maintenance.

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Unit-III:

Types of clutch – Friction clutch, dog clutch and fluid coupling, friction clutch – Single plate clutch or single disc clutch, multiple plate clutch or multiple disc clutch, cone clutch. Single plate clutch or single disc clutch – Constructional details and principle of working mechanism. Multiple plate clutch, splinted sleeve clutch type – Constructional details and principle of working mechanism ratchet and pawl arrangement mechanism – Constructional details and principle of working mechanism. Gears – Necessity for providing gear box, Selective sliding type, constant mesh type, Mechanical advantage in gears, torque ratio in gears, working of gear box. Differential unit and final drive – Differential, functions of crown wheel, differential lock, functions, final drive – functions of final drive.

Unit-IV:

Fluid coupling and torque connector, brake mechanism, requirements of good braking systems, classification of brakes, Mechanical brake and hydraulic brake – Working mechanism. Steering mechanism – Qualities of steering mechanism, main parts of steering mechanism types of steering boxes, working of hydraulic steering. Hydraulic control system – Working principals, basic components of hydraulic system – Types of hydraulic system, position control, draft control, mixed control, precautions for hydraulicsystem.

Unit-V:

Tractor power outlets – P.T.O., construction details; Belt pulley constructional details, tractor power out let, draw bar, construction details. Traction - Traction efficiency, method for improving traction, coefficient of traction, rolling resistance, wheel slip or track slip, Rimpul - crawler tractor. Tractor testing – Preparation for tests, types of tests, test at the main power take off, test at varying speeds at full load, test at varying load, belt or pulley shaft test, drawbar test, tractor engine performance. Determination of centre of gravity, Suspension method, balancing method, weighing method. Tractor chassis machines, functions of chassis frame. Tractor chassis – Mechanics of tractor chassis.

TEXT BOOKS:

1. Farm Tractor Maintenance and Repair. Jain. S.C. and Roy C.R. 1984. TMH Publishing Co. Ltd., New Delhi.
2. Tractors and their power units. Lijedhal J.B. Carleton W.M. Turnquist P. K. andSmith D.W. 1984. AVI Publishing Co. Inc., Westport, Connecticut.

REFERENCES:

1. Farm Gas Engines and Tractors. Fred J.R. 1963. Allied Publisher Pvt. Ltd., Bombay.
2. Farm Machines and their Equipment. Nakra C.P., 1986. Dhanpet Rai and Sons. 1982Nai Sarak, New Delhi.

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II Year - I Semester		**L**	**T**	**P**	**C**
		0	0	3	1.5
	SURVEYING AND LEVLEING LAB				

(Any 10 of the following listed 15 experiments)

LIST OF EXPERIMENTS:

1. Survey of an area by chain survey (closed traverse) & Plotting.
2. Determination of distance between two inaccessible points with compass.
3. Surveying of a given area by prismatic compass (closed traverse) and plotting after adjustment.
4. Radiation method, intersection methods by plane Table survey.
5. Two point and three-point problems in plane table survey.
6. Fly leveling (differential leveling).
7. An exercise of L.S and C.S and plotting.
8. One exercise on contouring.
9. Study of theodolite in detail - practice for measurement of horizontal and vertical angles.
10. Measurement of horizontal angles by method of repetition and reiteration.
11. Trigonometric Leveling - Heights and distance problem (Two Exercises).
12. Heights and distance using Principles of tacheometric surveying (Two Exercises).
13. Area determination, traversing contouring using total station.
14. Determination of remote height and state out using total station.
15. Distance, gradient, Difference in height between two inaccessible points using total station.

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II Year - I Semester		L	T	P	C
		0	0	3	1.5
FLUID MECHANICS AND OPEN CHANNEL HYDRAULICS LAB					

Outcomes:

1. Imparting practical skills on determination of metacentric height and Bernouli's theorem.

2. Exposure to practical skills on measurement of discharge with venturimeter and pilot tubes.

3. Acquiring practical skills on determing discharge coefficient of rectangular, triangular and trapezoidal weir and orifices.

4. Imposing practical skills on flow measurement ……. Broad crested weirs and open channels.

5. Imposing practical skills on determination of head losses in pipes, roughness coefficient of open channels.

6. Practical exposes on determination of velocity and pressure in open channels, construction of flownet problems on flownets.

Practical

1. Determination of metacentric height
2. Verification of Bernouli's theorem
3. Measurement of discharge with a venturimeter
4. Measurement of velocity with a pilot tube
5. Determination of coefficient of discharge of rectangular weir
6. Determination of coefficient of discharge of triangular weir
7. Determination of coefficient of discharge of trapezoidal weir
8. Determination of hydraulic coefficient of orifices
9. Experiment on broad crested weir
10. Determination of head losses in pipes
11. Experiments on open channels
12. Determination of roughness coefficients of open channels
13. Measurement of velocity and pressure profiles in open channels
14. Construction of flownet
15. Problems on construction of flownet

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II Year - I Semester		L	T	P	C
		0	0	3	1.5
FIELD OPERATIONSAND MAINTENANCE OF TRACTORS LAB					

Objectives: To enable the students for acquiring the knowledge pertaining to maintenance of tractors like periodical maintenance (50 to 100 hours, 200 to 250 hours, 480 to 500 engine working hours, 960 to 1000 hours) and trouble shooting and remedial measures of all systems - fuel system, lubrication system, cooling system and ignition system.

Outcomes:

1. Improved practical skills on air kind fuel filtration systems, lubrication system and theirmaintenance in tractors.
2. Practical skills improvement on maintenance of transmission and radiators cooling systems in tractor.
3. Practical skills development on maintenance of tractor ignition and hydraulic systems.
4. Practical knowledge on periodical maintenance of tractors, emission of smoke, clutch andbrake system maintenance.
5. Practical skill development on maintenance of train machinery and implements.
6. Practical knowledge on tractor on-off practice of tractors.

1. Tractor Systems - maintenance of air fuel system – cleaning of air cleaners – frequent troubles and Remedies – process to remove air lock in the diesel engine – precautions in handling diesel fuels in diesel engine.
2. Maintenance of lubrication system – frequent troubles and remedies – troubles in lubricationsystem excessive oil consumption – care and maintenance of lubrication system.
3. Maintenance of transmission system – general maintenance – differential troubleshooting – Frequent troubles and Remedies.
4. Maintenance of cooling system and cleaning of radiators - frequent troubles and remedies – cooling system troubles – over heating – slow warm up of the engine – careand maintenance of cooling system.
5 Maintenance of ignition system – care and maintenance of batteries – Frequent troubles and remedies – causes of ignition failure in battery system.
6. Maintenance of hydraulic system – working principle – basic components of hydraulic system – types of hydraulic system – frequent troubles and remedies – repairs and maintenance of hydraulic system – precautions of hydraulic system.
7. Periodical maintenance of tractors – at 8 – 10 engine working hours – at 50 – 60 engine working hours and at 100-120 engine working hours
8 Periodical maintenance of tractors – at 200-250 engine working hours, at 480-500 engine working hours and at 960 – 1000 engine working hours.
9. Emission of smoke – over heating of engines - maintenance of clutch brakes hydraulic problems.
10. Maintenance of agricultural machinery before and after use like primary tillage implements,
    M.B. plough, disc plough and secondary tillage implements - harrows, seed drills, weeders,cultivators.

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11. Starting and stopping practice of the tractor and familiarization with instrumentationpanel and controls
12. Driving in forward and reverse gears, driving safety sales and study bean trepanned.

REFERENCES:

1.   Elements of Agricultural Engineering. Jasgishwara Sahay 1992. Agro Book Agency,Patna.
2.   Farm Tractor Maintenance and Repair. Jain S.C. and Roy C.R. 1984. Tata McGraw-Hill Publishing Co. Ltd., New Delhi.
3.   Tractors and their Power units. Liledahi J.B. Carleton W.M. Turnquist P.K. andSmith D.W. 1984. AVI Publishing Co., Inc., Westport, Connecticut.
4.   Farm Machines and their Equipment. Nakra C.P. 1986 Dhanpet Rai and Sons. NewDelhi.

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II Year - I Semester		L	T	P	C
		1	0	2	2

AGRICULTURAL MACHINERY DESIGN USING CAD/CAM

LIST OF EXPERIMENTS
1. Application of computers for designing and Overview of CAD window – explanation of various options on drawing screen.
2. Study of draw tool bar and practice on draw tool bar.
3. Study on dimension and dimensional editing tool bar and Practice on dimension toolbar.
4. Study of OSNAP, and application OSNAP.
5. Study on layer command and modifying drafting.
6. Practice on mirror, offset and array commands.
7. Practice on trim, extend, chamfer and fillet commands.
8. Practice on copy, move, and scale and rotate commands.
9. Practice on rotate and trim commands.
10. Drawing of 2 D- orthographic projections using draw tool bar.
11. Drawing of 2 D- orthographic projections and dimensioning using draw tool bar.
12. Drawing of isometric projections.
13. Practice on creating boundary, region, hatch and gradient commands.
14. Practice on Editing polyline-PEDIT and Explode commands.
15. 2D - Drawing of knuckle joint.
16. Drawing of hexagonal, nut and bolt.
17. Practice on 3-D commands- Extrusion and loft commands.
18. Practice on 3-D commands on sweep and press pull commands.
19. Practice on 3-D Commands- revolving and joining commands.
20. Demonstration on CNC machine and simple problems.

TEXT BOOK:
1. Rao P.N. 2002, "CAD/CAM Principles and Applications". McGraw-Hill Education Pvt.Ltd., New Delhi.

REFERENCE BOOK:
1. Sareen Kuldeep and Chandan Deep Grewal. 2010, "CAD/CAM Theory and Practice". S. Chand & Company Ltd., New Delhi.

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY: KAKINADA

KAKINADA – 533 003, Andhra Pradesh, India

DEPARTMENT OF AGRICULTURAL ENGINEERING

II Year - I Semester		L	T	P	C
		2	0	0	0
	CONSTITUTION OF INDIA				

Course Objectives:

- To Enable the student to understand the importance of constitution
- To understand the structure of executive, legislature and judiciary
- To understand philosophy of fundamental rights and duties
- To understand the autonomous nature of constitutional 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

Course Outcomes:

At the end of the course, the student will be able to have a clear knowledge on the following:

- Understand historical background of the constitution making and its importance for building a democratic India.
- Understand the functioning of three wings of the government ie., executive, legislative and judiciary.
- Understand the value of the fundamental rights and duties for becoming good citizen of India.
- Analyze the decentralization of power between central, state and local self-government.
- Apply the knowledge in strengthening of the constitutional institutions like CAG, Election Commission and UPSC for sustaining democracy.
    1. Know the sources, features and principles of Indian Constitution.
    2. Learn about Union Government, State government and its administration.
    3. Get acquainted with Local administration and Pachayati Raj.
    4. Be aware of basic concepts and developments of Human Rights.
    5. Gain knowledge on roles and functioning of Election Commission

UNIT I

Introduction to Indian Constitution: Constitution meaning of the term, Indian Constitution - Sources and constitutional history, Features - Citizenship, Preamble, Fundamental Rights and Duties, Directive Principles of State Policy.

Learning outcomes:After completion of this unit student will

- Understand the concept of Indian constitution
- Apply the knowledge on directive principle of state policy
- Analyze the History, features of Indian constitution
- Evaluate Preamble Fundamental Rights and Duties

UNIT II

Union Government and its Administration Structure of the Indian Union: Federalism, Centre- State relationship, President: Role, power and position, PM and Council of ministers, Cabinet and Central Secretariat, LokSabha, RajyaSabha, The Supreme Court and High Court: Powers and Functions;

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Learning outcomes: After completion of this unit student will

- Understand the structure of Indian government
- Differentiate between the state and central government
- Explain the role of President and Prime Minister
- Know the Structure of supreme court and High court

UNIT III

State Government and its Administration Governor - Role and Position - CM and Council of ministers, State Secretariat: Organisation, Structure and Functions

Learning outcomes: After completion of this unit student will

- Understand the structure of state government
- Analyze the role Governor and Chief Minister
- Explain the role of state Secretariat
- Differentiate between structure and functions of state secretariat

UNIT IV

A.Local Administration - District's Administration Head - Role and Importance, Municipalities - Mayor and role of Elected Representative - CEO of Municipal Corporation PachayatiRaj: Functions PRI: ZilaPanchayat, Elected officials and their roles, CEO ZilaPanchayat: Block level Organizational Hierarchy - (Different departments), Village level - Role of Elected and Appointed officials - Importance of grass root democracy

Learning outcomes:-After completion of this unit student will

- Understand the local Administration
- Compare and contrast district administration role and importance
- Analyze the role of Myer and elected representatives of Municipalities
- Evaluate Zillapanchayat block level organisation

UNIT V

Election Commission: Election Commission- Role of Chief Election Commissioner and Election Commissionerate State Election Commission:, Functions of Commissions for the welfare of SC/ST/OBC and women

Learning outcomes: After completion of this unit student will

- Know the role of Election Commission apply knowledge
- Contrast and compare the role of Chief Election commissioner and Commissiononerate
- Analyze role of state election commission
- Evaluate various commissions of viz SC/ST/OBC and women

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DEPARTMENT OF AGRICULTURAL ENGINEERING

References:

1) Durga Das Basu, Introduction to the Constitution of India, Prentice Hall of India Pvt. Ltd.
2) SubashKashyap, Indian Constitution, National Book Trust
3) J.A. Siwach, Dynamics of Indian Government & Politics
4) D.C. Gupta, Indian Government and Politics
5) H.M.Sreevai, Constitutional Law of India, 4th edition in 3 volumes (Universal Law Publication)
6) J.C. Johari, Indian Government andPolitics Hans
7) J. Raj IndianGovernment and Politics
8) M.V. Pylee, Indian Constitution Durga Das Basu, Human Rights in Constitutional Law, Prentice – Hall of India Pvt. Ltd.. New Delhi
9) Noorani, A.G., (South Asia Human Rights Documentation Centre), Challenges to Civil Right), Challenges to Civil Rights Guarantees in India, Oxford University Press 2012

e-Resources:

1) nptel.ac.in/courses/109104074/8
2) nptel.ac.in/courses/109104045/
3) nptel.ac.in/courses/101104065/
4) www.hss.iitb.ac.in/en/lecture-details
5) www.iitb.ac.in/en/event/2nd-lecture-institute-lecture-series-indian-constitution

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DEPARTMENT OF AGRICULTURAL ENGINEERING

II Year - II Semester		L	T	P	C
		3	0	0	3
	HEAT AND MASS TRANSFER				

Objective: To enable the students to know about the transport phenomenon in materials through heat and mass transfer for applications in unit operations of dairy and food engineering.

Outcomes:

Skill development on principles of heat and mass transfer, steady state heat transfer & its analysis, measurement of thermal conducting of pleasure & composite walls, tubes and spheres, multilayer tubes.

Skill development on conduction principles of different materials in parallel, combined convection and conduction, concept of insulation.

Skill development on conduction, convection and radiation analysis of heat and mass transfer, different laws on radiation theory.

Imparting skills on unsteady state analysis of heat transfer in fins, free & force convection, cooling theories and principles.

Skill development on theory and principles of heat exchanges, their analysis, frick's law of mass transfer coefficients, Reynolds analogy.

Unit – I:

Introductory concepts, application of heat and mass transfer, modes of heat transfer examples, Fourier's law of heat transport. Introduction to steady state heat transfer - One dimensional steady state heat conduction equation. Thermal conductivity of different materials – Measurement - insulation Materials, one dimensional steady state conduction through plane and composite walls, conduction through tubes and spheres with and without heat generation, conduction through multilayer tubes.

Unit – II:

Electrical analogy - Conduction through materials in parallel, combined convection and conduction and overall heat transfer coefficients, problem solving, Concept of critical thickness of insulation for a cylinder, problem solving,

Unit III:

Radiation heat transfer - Introduction, absorptivity, reflectivity and transmissivity. Black body and monochromatic radiation, Plank's law, Stefan-Boltzman law, Krichhoff's law, grey bodies and emissive power, solid angle intensity of radiation. Radiation exchange between black surfaces, geometric configuration factor. Heat transfer analysis involving conduction, convection and radiation by networks.

Unit IV:

Unsteady state heat transfer - Unsteady state system with negligible internal thermal resistance- equation for different geometries, Fins - Heat transfer from extended surfaces, types of fins, numerical, free and force & convection. Newton's law of cooling, heat transfer coefficient in convection. Dimensional analysis of free and forced

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convection. Useful non - dimensional numbers and empirical relationships for free and forced convection.

Unit V:

Equation of laminar boundary layer on flat plate and a tube, laminar forced convection on a flat plate and in a tube, combined free and forced convection, types of heat exchangers, fouling factor, log mean temperature difference, heat exchanger performance, transfer units, heat exchanger analysis restricted to parallel and counter flow heat exchangers. Steady state molecular diffusion in fluids at rest and in laminar flow - Fick's law mass transfer coefficients, Reynold's analogy.

REFERENCES:

1. Transport processes and Unit Operations, Geankoplis C.J. 1992. Allyn and Bacon Inc., Newton, Massachusetts.
2. Heat Transfer, Holman JP 1989. McGraw Hill Book Co., New Delhi.
3. Fundamentals of Heat and Mass Transfer, Incropera F P and De Witt D P 1980John Wiley and Sons. New York.
4. Engineering Heat Transfer, Gupta CP and Prakash R 1994. Nem Chand and Bros., Roorkee.
5. Heat transfer, Rajput S. Chand & Co, New Delhi.

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DEPARTMENT OF AGRICULTURAL ENGINEERING

II Year - II Semester		L	T	P	C
		3	0	0	3
	GROUND WATER HYDROLOGY, WELL AND PUMPS				

Objective: To enable the students to acquire knowledge on aquifers and estimation of their different properties like hydraulic conductivity, transmissibility, storage coefficient, specific yield, leakage factor, hydraulic resistance under steady and unsteady state conditions in wells dug under different aquifers, well drilling and development methods and equipment design of gravel pack in bore well. Further to make the students to acquire knowledge on various pumps available commercially, their selection, operation and maintenance with due importance to find out the cost of operation.

Outcomes:
Skill development on principles of ground water resources development, different acquaintance and their principles.
Imparting knowledge on theory of open well hydraulics and drilling methods.
Skill development on aquifers characteristics under steady and unsteady state conditions, multiples well systems for coastal areas.
Knowledge development to students on artificial ground water recharge classification of indigenous pumps, solar pumps, wind mill pumps etc.,
Skill development on principles of Centrifugal pumps, principles & characteristics, High lift pumps, mixed flow pumps and vertical turbine pump sets.

Unit – I: Water resources status of India-Occurrence and Movement of ground water and aquifers – Types of water bearing formations – Unconfined, confined, semi confined aquifers – Perched water table condition – diagramatic representation.

Unit – II: Classification of wells – Design of open wells – Ground water replenishment – Ground water exploration – Methods of drilling of wells – Common well drilling difficulties – Gravel packing – well screens – Development of well.

Unit – III: Aquifer characteristics - Influencing yield of wells - Determination of aquifer parameters – Steady state and unsteady state conditions – Well interference and multiple well point systems in coastal areas.

Unit – IV: Surface and subsurface exploitation and estimation of ground water potential – Artificial ground water recharge – Ground water project formulation – Classification of indigenous pumps – Wind powered water lifts – Solar powered and biogas operated water lifts – Reciprocating pumps.

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Unit – V: Centrifugal pumps – Terminology on horse power – Selection of pump installation and troubleshooting of pumps – Performance characteristic curves – Effect of change of impeller dimensions on performance characteristics. Hydraulic ram – Propeller pumps - Mixed flow pumps - Air lift pumps – Priming – Vertical turbine pumps – Submersible pumps – Cost economics

REFERENCES:

1. Ground water and tube wells - Garg S P 1985. Oxford and IBH publish in companylimited, New Delhi.
2. Water Well land Pump Engineering – Michael A M and Khepar S T 1989 Tata McGraw-Hill Publishing company limited, New Delhi.
3. Irrigation Theory and Practice – Michael A M 2008 Vikas Publishing House Pvt. Ltd,New Delhi.

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DEPARTMENT OF AGRICULTURAL ENGINEERING

II Year - II Semester		L	T	P	C
		3	0	0	3
	THEORY OF STRUCTURES				

Objective: The Students will have acquired knowledge on the design principles of beams, slabs,columns, foundations and RCC structures.

Outcomes:

Skill development on RCC theory and practice of principles, stress – Strain analysis.

Skill development on single, double reinforced sections, their theory & principles, shear stressanalysis.

Acquaintance of knowledge on design principles of shear reinforcement, anchorage of bars &analysis.

Skill development on theory and principles of design of one – way reinforced beams/slabs, twoway slabs and columns.

Skill development on principles of auxiliary loaded columns, foundations retaining walls, stability analysis.

Unit-I:

Introduction to loads and BIS codes – Analysis and designing of single reinforced sections – Properties of reinforced concrete, advantages, assumptions, modular ratio, equivalent area of R.C.C., stress and strain diagram, neutral axis, moment of resistance, design of rectangular section.

Unit-II:

Analysis of balanced over reinforced and under reinforced sections – Under reinforced sections, over reinforced sections, problems. Analysis and designing of double reinforced sections – Modular ratio for compression shell equivalent area of steel in compression, neutral axis, moment of resistance, steel beam theory, problems. Shear stresses in beams – Shear stress induced in homogeneous and R.C. beams, nominal shear stress, varying depth, effect of shear in R.C. beams, failures, shear resistance of concrete without shear reinforcement.

Unit- III:

Design of shear reinforcement, problems. Vertical stirrups and inclined bars – Development of length, development of stress in R.C.C. anchorage for reinforced bars Anchorage for reinforced bars, anchorage bars in tension, anchorage bars in compression. Curtailment of bars – Decision on the curtailment of bars, design considerations for bond, general concept of bond. Design of flanges beams (CT and I beams).

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Unit- IV:

Design of one - way slabs – Loading on slabs, arrangement of reinforcement, Problems on design of one - way slabs. Design of reinforced brick slabs, Design of one - way slabs – Rankine theory, Grashoff theory, shear force on the edges, design, problems, Merco's method. Design of two way slabs – Torsion reinforcement, load and bending moment, problems, slabs with edges fixed. Design of two - way slabs – Provision of torsion reinforcement, Marcor's method, problems. Axially loaded columns – Types of columns, effective length of columns, long and short columns, composite columns.

Unit- V:

Axially loaded columns – Basic rules for design of columns, arrangement of transverse reinforcement, problems. Foundations – Types of foundations, design criteria. Foundations – Problems on design criteria. Retaining walls – Earth pressure on a retaining wall, active earth pressure, passive earth pressure. Stability of walls – Conditions for stability of retaining walls, problems.

TEXT BOOKS:

1. Mechanics of Structures Vol. I, Junarkar,S.B. 2001 – Charotar Publishing Home, Anand.
2. Mechanics of Materials, Dr. B.C. Punmia, Laxmi Publications.

REFERENCES:

1. Strength of materials, R.S. Khumi 2001 – S. Chand & Company Ltd., 7361, Ram Nagar, NewDelhi – 110055.
2. Treasure of R.C.C. Design, Sushil Kumar 2003 – R.K.Jain – 1705-A, Nai Sarak, Delhi.

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DEPARTMENT OF AGRICULTURAL ENGINEERING

II Year - II Semester		L	T	P	C
		3	0	0	3
	SOIL MECHANICS				

Objective: Students will be trained on concepts and analysis of soil properties, stress conditions of loaded soil, consolidation and soil failure theories. The knowledge imparted will be used in higher level design considerations for construction of soil and water conservation structures, irrigation and drainage structures.

Outcomes:

Skill development on principles of soil mechanics soil classification, stresses insoils.
Skill development on Bousinesq's analysis for vertical pressure applications &
westerguard's analysis for point load applications.
Acquaintance of knowledge on shear stress analysis, mohr's stress circle, measurement of shear strength.
Skill development on soil consolidations theory and principles.
Skill development on earth pressure and its effects on soil stability of slopes.

Unit–I:

Introduction of soil mechanics – Field of soil mechanics. Soil on three phase systems – Physical and index properties of soil. Classification of soils - General, particle size classification. Classification of soils - Textural classification, I.S. classification. Stress condition in soils – Effective and neutral stress.

Unit-II:

Concept on Bousinesq's analysis – Vertical pressure distribution on vertical line, vertical pressure under a uniformly loaded circular area, vertical pressure due to a line load. Concept on Bousinesq's analysis – Vertical pressure under strip load, vertical pressure under a uniformly loaded rectangular area, equivalent point load method. Concept on Westerguard's analysis – Point load pressure distribution, uniformly loaded circular area. Westerguard's analysis – Uniformly loaded rectangular area, comparisons between Bousinesq's and Westerguard's solutions. Newmark's influence chart – Preparation, problems.

Unit-III:

Shear strength – Introduction, Mohr's stress circle, stress systems with principal planes parallel to the coordinate axes. Shear strength – Introduction, Mohr's stress circle, stress systems with principal planes parallel to the coordinate axes. Shear strength – Mohr – Coulomb failure theory, effective stress principle. Measurement of shear strength – Introduction, direct shear test, tri-axial compression test, stress conditions in soil specimen during tri-axial testing. Measurement of shear strength – Advantages of tri-axial test, graphical solutions, unconfined compression test, vane shear test. Problems on shear strength. Compaction of soils – Standard test and modified Proctor test. Abbot compaction test. Jodhpur mini compaction test. Field compaction method and control.

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Unit – IV:

Consolidation of soil – One - dimensional analysis spring analogy – Terzaghi's theory. Laboratory consolidation test. Calculation of coefficient of volume change – Coefficient of consolidation.

Unit-V:

Earth pressure – Plastic equilibrium in soils. Active and passive states of earth pressure. Rankine's theory of earth pressure. Earth pressure for cohesive soils. Simple numerical exercises on earth pressure. Stability of slopes – infinite and finite slopes. Friction circle method. Taylor's stability number.

TEXT BOOK:

1. Soil Mechanics and Foundations, Punmia B C, Jain A K and Jain A K, 2005. Laxmi Publications (p) LTD. New Delhi

REFERENCES:

1. Basic and Applied Soil Mechanics, Gopal Ranjan and Rao A S R 1993.Willey Eastern Ltd., New Delhi.
2. Soil Engineering Vol.1, Alam Singh 1994. CBS Publishers, and Distributions, Delhi.

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DEPARTMENT OF AGRICULTURAL ENGINEERING

II Year - II Semester		L	T	P	C
		3	0	0	3
	MANAGERIAL ECONOMICS AND FINANCIAL ANALYSIS				

Course Objectives:
- The Learning objectives of this paper are to understand the concept and nature of Managerial Economics and its relationship with other disciplines and also to understand the Concept of Demand and Demand forecasting.
- To familiarize about the Production function, Input Output relationship, Cost-Output relationship and Cost-Volume-Profit Analysis.
- To understand the nature of markets, Methods of Pricing in the different market structures and to know the different forms of Business organization and the concept of Business Cycles.
- To learn different Accounting Systems, preparation of Financial Statement and uses of different tools for performance evaluation.
- Finally, it is also to understand the concept of Capital, Capital Budgeting and the techniques used to evaluate Capital Budgeting proposals.

Unit-I
Introduction to Managerial Economics and demand Analysis:
Definition of Managerial Economics –Scope of Managerial Economics and its relationship with other subjects – Concept of Demand, Types of Demand, Determinants of Demand- Demand schedule, Demand curve, Law of Demand and its limitations- Elasticity of Demand, Types of Elasticity of Demand and Measurement- Demand forecasting and Methods of forecasting, Concept of Supply and Law of Supply.

Unit – II:
Theories of Production and Cost Analyses:
Theories of Production function- Law of Variable proportions-Isoquants and Isocosts and choice of least cost factor combination-Concepts of Returns to scale and Economies of scale-Different cost concepts: opportunity costs, explicit and implicit costs-Fixed costs, Variable Costs and Total costs –Cost –Volume-Profit analysis-Determination of Breakeven point(problems)-Managerial significance and limitations of Breakeven point.

Unit – III:
Introduction to Markets, Theories of the Firm & Pricing Policies:
Market Structures: Perfect Competition, Monopoly, Monopolistic competition and Oligopoly – Features – Price and Output Determination – Managerial Theories of firm: Marris and Williamson's models – other Methods of Pricing: Average cost pricing, Limit Pricing, Market Skimming Pricing, Internet Pricing: (Flat Rate Pricing, Usage sensitive pricing) and Priority Pricing, Business Cycles : Meaning and Features – Phases of a Business Cycle. Features and Evaluation of Sole Trader, Partnership, Joint Stock Company – State/Public Enterprises and their forms.

Unit – IV:
Introduction to Accounting & Financing Analysis:
Introduction to Double Entry System, Journal, Ledger, Trail Balance and Preparation of Final Accounts with adjustments – Preparation of Financial Statements-Analysis and Interpretation of Financial Statements-Ratio Analysis – Preparation of Funds flow and cash flow analysis (Problems)

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Unit – V:

Capital and Capital Budgeting: Capital Budgeting: Meaning of Capital-Capitalization-Meaning of Capital Budgeting-Time value of money- Methods of appraising Project profitability: Traditional Methods(pay back period, accounting rate of return) and modern methods(Discounted cash flow method, Net Present Value method, Internal Rate of Return Method and Profitability Index)

Course Outcomes:

- The Learner is equipped with the knowledge of estimating the Demand and demand elasticities for a product.
- The knowledge of understanding of the Input-Output-Cost relationships and estimation of the least cost combination of inputs.
- The pupil is also ready to understand the nature of different markets and Price Output determination under various market conditions and also to have the knowledge of different Business Units.
- The Learner is able to prepare Financial Statements and the usage of various Accounting tools for Analysis.
- The Learner can able to evaluate various investment project proposals with the help of capital budgeting techniques for decision making.

TEXT BOOKS:

A R Aryasri, Managerial Economics and Financial Analysis, The McGraw – Hill companies.

REFERENCES:
1. Varshney R.L, K.L Maheswari, Managerial Economics, S. Chand & Company Ltd,
2. JL Pappas and EF Brigham, Managerial Economics, Holt, R & W; New edition edition
3. N.P Srinivasn and M. SakthivelMurugan, Accounting for Management, S. Chand & Company Ltd,
4. MaheswariS.N,AnIntroduction to Accountancy, Vikas Publishing House Pvt Ltd
5. I.M Pandey, Financial Management , Vikas Publishing House Pvt Ltd
6. V. Maheswari, Managerial Economics, S. Chand & Company Ltd,

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DEPARTMENT OF AGRICULTURAL ENGINEERING

II Year - II Semester		**L**	**T**	**P**	**C**
		0	**0**	**3**	**1.5**
	HEAT AND MASS TRANSFER LAB				

1. COP of VCR System with Capillary and thermal expansion valve.
2. Determination of overall heat transfer co-efficient of a composite slab
3. Determination of heat transfer rate through a lagged pipe.
4. Determination of heat transfer rate through a concentric sphere
5. Determination of thermal conductivity of a metal rod.
6. Determination of efficiency of a pin-fin
7. Determination of heat transfer coefficient in natural and forced convection
8. Determination of effectiveness of parallel and counter flow heat exchangers.
9. Determination of emissivity of a given surface.
10. Determination of Stefan Boltzman constant.
11. Determination of heat transfer rate in drop and film wise condensation.
12. Determination of critical heat flux.
13. Determination of Thermal conductivity of liquids and gases.
14. Investigation of Lambert's cosine law.

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II Year - II Semester		L	T	P	C
		0	0	3	1.5
	THEORY OF STRUCTURES LAB				

1. Verify moment area theorem regarding the slope and deflection of the beam.
2. Verify strain in an externally loaded beam with the help of a strain gauge indicator and to verify theoretically
3. Study behavior of different types of columns and find Euler's buckling load for each case.
4. Study two hinged arch for the horizontal displacement of the roller end for a given system of loading and to compare the same with those obtained analytically.
5. Study the behavior of a portal frame under different end conditions.
6. Find the value of flexural rigidity (EI) for a given beam and compare it with theoretical value.
7. Determine the deflection of a pin connected truss analytically & graphically and verify the same experimentally.
8. Verify the Muller Breslau theorem by using Begg's deformator set.
9. Verify clerk Maxwell's reciprocal theorem
10. Determine material fringe value by using diffused light research polariscope.
11. Verify the moment area theorem regarding the slopes and deflections of the beam.
12. Determine the moment required to produce a given rotation (rotational stiffness) at one end of the beam when the other end is pinned.

TEXT BOOKS:

1. Mechanics of Structures Vol. I, Junarkar,S.B. 2001 – Charotar Publishing Home, Anand.
2. Mechanics of Materials, Dr. B.C. Punmia, Laxmi Publications.

REFERENCES:

1. Strength of materials, R.S. Khumi 2001 – S. Chand & Company Ltd., 7361, Ram Nagar, NewDelhi – 110055.
2. Treasure of R.C.C. Design, Sushil Kumar 2003 – R.K.Jain – 1705-A, Nai Sarak, Delhi.

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II Year - II Semester		L	T	P	C
		0	0	3	1.5
	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 Tri-axial test.
16. Determination of consolidation properties of soils.

TEXT BOOKS:
1. B. C. Punmia and A. K. Jain,2005, Soil Mechanics and Foundations, 16th edition, LaxmiPublishing,New Delhi.
2. N. C. Brady,2008, The Nature and Properties of Soil, 10th edition, Macmillan Publishing Company, New York.
REFERENCES BOOKS:
1. B. M. Das and G. V. Ramana, 2010,Principles of Soil Dynamics, 2nd edition, Cengage Learning.
2. V. N. S. Murthy,2008, Soil Mechanics and Foundation Engineering, 1st edition, CBS Publishers,New Delhi.
3. B. Singh and S. Prakash,2010, A Text Book of Soil Mechanics, New Chand and Bros., Roorkee.

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DEPARTMENT OF AGRICULTURAL ENGINEERING

		L	T	P	C
II Year - II Semester		**1**	**0**	**2**	**2**
	ANALYSIS/SIMULATION USING MATLAB				

1. Development of soil monitoring systems
2. Analysis of harvesting equipment design parameters and performance
3. Assessment of disease management
4. development and optimisation of smarter irrigation system
5. Analysis of safety storage of harvested crops
6. Analysis of effective usage of water resources
7. Tractor position tracking using MatLab
8. Air and water quality monitoring system for healthy crop environment.
9. Development of real–time monitoring system of agricultural fields
10. Using wireless sensor network in an agricultural field also to develop a smart farming environment.
11. Monitoring the critical factor as water quality to enhance the growth of crops is develop using sensors
12. Stock management system at agricultural storages.