BIKANER TECHNICAL UNIVERSITY, BIKANER
बीकानेर तकनीकी विश्वविद्यालय, बीकानेर

PROGRAMME SULLABUS

Agriculture Engineering- 2022

2ND YEAR – III SEMESTER

DC - AE-301 HEAT TRANSFER, REFRIGERATION AND AIR CONDITIONING

Contact Hour/ week	Credits
2 (Lecture)	2

Course Outcome: At the end of the course, the student will be able to:

CO1: Apply the principles of conservation of mass, first and second laws of thermodynamics to analyse closed steady state systems and processes involving heat and work interactions.

CO2: Show understanding of concepts of reversibility, entropy and Carnot cycle.

CO3: Demonstrate knowledge of properties of steam and ability to compute them from steam tables and Mollier chart.

CO4: Understand construction and working of steam boilers, steam engines and their specific applications.

CO5: Compute efficiency, power output, etc. of various vapour and gas cycles.

CO6: Demonstrate knowledge about construction and working of IC engines.

Unit I

Introductory concepts, modes of heat transfer, thermal conductivity of different materials, *Conduction:* General differential equation of conduction. One dimensional steady state conduction through plane & composite walls, tubes and spheres without heat generation, critical thickness of insulation. *Convection:* free and forced convection. Newton's law of cooling. Dimensional analysis of free and forced convection.

Unit II

Introduction of Radiation, Absorptivity, reflectivity and transmissivity, Black body and monochromatic radiation, Planck's law, Wien's law, Kirchoff's law, grey bodies and emissive power, solid angle, intensity of radiation. Radiation exchange between black surfaces, geometric configuration factor. *Heat Exchangers:* Types of heat exchangers, fouling factor, log mean temperature difference, heat exchanger effectiveness, NTU method (Only for parallel and counter flow).

Unit III

Second law of thermodynamics applied to refrigeration. Reversed Carnot cycle, coefficient of performance. Unit of refrigeration, vapour compression cycle and components, Compressors, expansion valves, evaporators and condensers Deviation of actual cycle from ideal cycle, Vapour absorption refrigeration system and components, Desirable properties of ideal refrigerant, Classification of refrigerants.

Unit IV

Psychrometry, Thermodynamic properties of moist air, Psychrometric chart and its use, Elementary Psychrometry processes, bypass and sensible heat factor, Air washer, Design of Air Conditioning system, sensible and latent cooling load calculation.

Texts/References

1. D.S. Kumar: Heat and Mass Transfer, SK Kataria& Sons, Delhi.
2. J. P. Holman: Heat Transfer, McGraw Hill.
3. Y. A. Cengel, Heat teransfer,McGraw-Hill
4. F. P. Incropera and D. P. Dewitt: *Fundamentals of Heat and Mass Transfer*, Wiley.
5. S. Domkundwar: A Course in Heat & Mass Transfer, Dhanpat Rai & Sons, Delhi.
6. C. P. Arora: Refrigeration and Air-conditioning, TMH.
7. W. Stoecker: Refrigeration and Air-conditioning, McGraw Hill.
8. J. L. Threlkeld: Thermal Environmental Engineering, Prentice Hall.
9. Khurmi & Gupta: Refrigeration and Air-conditioning, S. Chand Publishing, New Delhi.

DC - AE-302 STRENGTH OF MATERIALS

Contact Hour/ week	Credits
2 (Lecture)	2

Course Outcome: At the end of the course, the student will be able to:

CO1: Analyze behavior of materials under simple stress and strains

CO2: Analyze behavior of materials under compound stress and strains

CO3: Analysis of stress and strains by various methods, stresses in thin cylinder and special shells

CO4: Plot SFD and BMD of beams under various loading and determine shearing and bending stresses

CO5: Analyze various shafts under torque

CO6: Analyze and design columns using different formulae

Unit-I

Fundamentals: Stress and strain, engineering properties, Saint-Venant's Principle. Stress strain diagrams, mechanical properties of materials, elasticity and plasticity. Shear stress and strain, pure shear, complementary shear. Poison's ratio, volumetric strain, bulk modulus of elasticity. Elastic constants and relation between elastic modulie. Linear elasticity and Hooke's law. Temperature stresses and effects. Stress and strain in axially loaded members.

Unit-II

Analysis of Stress and Strain: Stress at a point, stress components. Stresses on inclined planes. Plane stress and strain. Mohr's circle representation of plain stress and strain. Principle stresses and strains, maximum shear stresses. Hooke's law for plain stress. Stresses in thin cylinder and special shells subjected to internal & external pressures.

Unit-III

Beam under Flexural Loads: Bending moment and shear force, relation between load, Shear force and bending moment. Bending moment and shear force diagrams for simply supported, Cantilever and overhang beams under static loading of different types viz. point loads, Uniformly distributed loads, linearly varying loads, Pure bending. Theory of simple bending of initially straight beams. Flexural stresses in beams. Built up and composite beams. Shear stresses in beams of Rectangular, Circular and I-section. Shear formula, effect of shear strain.

Unit-IV

Torsion: Torsion of solid and hollow circular shafts. Non-uniform torsion.

Columns: Buckling and stability, critical load. Euler's theory for initially straight column with different end conditions, equivalent length, Limitation of Eulor's formula. Rankine's formula. Column under eccentric loading. Secant, Perry's and Indian standard Formulae.

Text Books/References

1. Junarkar S.B. and Shah H.J., „Mechanics of Structures" Vol.-I Charoter Publishing, Anand.

2. PunmiaB.C., „Strength of Materials and Mechanics of Structures", Vol-I, Standard Publisher distributors, New Delhi.

3. Fedinard L., „Strength of Materials", Singer & Andrew Pytel".

4. Fenner, „Mechanics of Solids".

5. Davis H. E, Trophell, G.E. &Hanck, G.F.W., „The Testing of Engineering Materials", McGraw Hill.

6. Timoshenko, S.P. & Young, D.H., „Strength of Materials", East West Press Limited.

DC - AE-303 FLUID MECHANICS

Contact Hour/ week	Credits
2 (Lecture)	2

Course Outcome: At the end of the course, the student will be able to:

CO1: Demonstrate the knowledge of fluid properties.

CO2: Analyze forces and pressure variations on submerged bodies.

CO3: Analyze fluid flow pattern, characteristics and apply the same to solve general flow problems.

CO4: Apply energy equations to determine fluid flow parameters.

CO5: Apply the knowledge to solve problems relating to Open Channel flow.

Unit-I

Hydrostatics: Fluid Properties, Measurement of liquid pressure. Pascal's law fluid pressure on plane and curved stationery surface, Centre of pressure, Principal applications (preliminary) in simple gales and tanks.

Unit-II

Fluid motion: Type and patterns, velocity and acceleration of fluid, continuity equation, elementary concept of velocity potential. Stream function and flow nets. Euler; s equation of motion, integration of Euler's equation to give Bernoulli's equation for incompressible fluids. Applications of Bernoulli's equation.

Unit-III

Flow through pipes: Various types. Velocity distribution. Loss of head due to friction. Minor losses, hydraulic gradient, pipes in series and parallel. Discharge measurement in pipes Venturimeter, orificemeter.

Unit-IV

Open Channel Flow: Steady and uniform flow in open channel, Discharge formulae of Chezy, and Manning. Most economic section for rectangular, trapezoidal and circular channels. Specific energy of flow. Alternate depths. Critical depth in prismatic channels. Discharge measurement in open channels by notches and weirs

Text Books/References

1. Jadish Lal, Hydraulics. (1986). Metropolitan Book Co. Pvt. Ltd., Delhi.

2. P.N. Modi and S.M. Seth. (1995). Hydraulic and Fluid Mechanics, Standard Book House, Delhi-6.

3. R.K. Bansal. Fluid Mechanics & Machine.

DC - AE-304 FUNDAMENTALS OF AGRICULTURE

Contact Hour/ week	Credits
3 (Lecture)	3

Course Outcome: This course enable the Ag. Engg. Graduates to identify problematic soils and water and also basics of cereal and horticultural crop production.

Unit-I

Soils: Definition of soil, important soil physical properties and their importance, soil inorganic colloids, their composition, properties and origin of charge, ion exchange in soil and nutrient availability, soil organic matter, its composition and decomposition, effect on soil fertility, soil

reaction; acid, saline and sodic soils, quality of irrigation water, essential plant nutrients, their functions and deficiency symptoms in plants, important inorganic fertilizers and their mode of action in soils.

Unit-II

Agronomy: Definition and scope of agronomy, classification of crops, effects of different weather parameters on crop growth and development. Soil-water-plant relationship and water requirement of crops, weeds and their control, crop rotation, cropping systems, mono-cropping, double cropping, relay cropping and mixed cropping.

Unit-III

Study of following crops with reference to soil and climate requirements, seedbed preparation, improved varieties, seed rate, time and method of sowing, manuring, fertilisation, intercultural operations, weed control, irrigation, crop protection and their area, production and productivity in Rajasthan: Cereals-wheat, maize and bajra, Pulses- bengal gram, kharif pulses (green gram, black gram, and cowpea), Oil seeds- groundnut and mustard. Introduction to cash crops- cotton, sugarcane and potato and fodder crop- berseem.

Unit-IV

Horticulture: Scope of horticulture and vegetable crops, soil and climatic requirements for fruits, vegetable and floriculture crops, improved varieties, criteria for site selection, layout and planting methods, nursery raising and micro propagation methods, plant growing structures, pruning and training, fertilizer application, fertigation, irrigation methods, harvesting, grading and packaging, post harvest practices, management of orchards, extraction and storage of vegetable seeds. Introduction to hi-tech horticulture.

Text Books/references

1. D.K. Das. (2003). Introductory Soil Science, Kalyani Publishers, New Delhi.

2. M.M. Rai. (1995). Principles of Soil Science, S.G. Wasani for Mac Millan India Ltd., New Delhi.

3. K.S. Yawalkar, J.P. Agarwal and S. Bokde. (1992). Manures and Fertilizers. Mrs. Kumudini K. Yawalkar, Agri. Horti. Publishing House, 52, Bajaj Nagar-440 001.

4. ArunKatyayan. (2002). Fundamentals of Agriculture, Kushal Publications and Distributors, A. 3/4A, Trilochan Bazar, Varanasi- 221 001 (U.P.).

5. T.Y. Reddy and G.H.S. Reddi. (1992). Principles of Agronomy, Kalyani Publishers, New Delhi.

6. Chattopadhayay. (1999). Text book of Horticulture. Vol. II.

7. J.S. Bal. (1970). Fruit Production. Kalyani Publishers, New Delhi.

DC - AE-305 FUNDAMENTALS OF RENEWABLE ENERGY SOURCES

Contact Hour/ week	Credits
2 (Lecture)	2

Course Outcome: At the end of the course, the student is exposed to various wastes recycling and renewable energy based efficient technologies. Practical exposure to analyse basic parameters of waste and waste management techniques is also provided.

Unit I

Concept and limitation of Renewable Energy Sources (RES), Criteria for assessing the potential of RES, Classification of RES: Solar, Wind, Geothermal, Biomass, Ocean energy sources. Comparison of renewable energy sources with non renewable sources.

Unit II

Solar Energy: Energy available from Sun, Solar radiation data, Solar energy conversion into heat through: Flat plate and Concentrating collectors, different solar thermal devices, Principle of natural and forced convection drying system, Solar Photo voltaic: p-n junctions. Solar cells, PV systems, stand alone, Grid connected solar power station, Calculation of energy through photovoltaic power generation and cost economics.

Unit III

Wind Energy: Energy available from wind, Lift and drag forces. Basis of Wind energy conversion, Effect of density, Frequency variances, Angle of attack, Wind speed, Types of Windmill rotors, Determination of torque coefficient, Induction type generators, working principle of wind power plant.

Unit IV

Bio-energy: Pyrolysis of Biomass to produce solid, liquid and gaseous fuels. Biomass gasification, Types of gasifier, various types of biomass cook stoves for rural energy needs. Biogas: types of biogas plants, biogas generation, factors affecting biogas generation and usages; advantages and disadvantages of biogas spent slurry.

Suggested Readings

1. Rai, G.D. 2013. Non-Conventional Energy Sources, Khanna Publishers, Delhi.

2. Rai, G.D., Solar Energy Utilization, Khanna Publishers, Delhi.

3. Khandelwal, K.C. & S. S. Mahdi. 1990. Biogas Technology- A Practical Handbook.

4. Rathore N. S., Kurchania A. K., Panwar N. L. 2007. Non Conventional Energy Sources, Himanshu Publications.

5. Tiwari, G.N. and Ghoshal, M.K. 2005. Renewable Energy Resources: Basic Principles and Applications. Narosa Pub. House. Delhi.

6. Rathore N. S., Kurchania A. K., Panwar N. L. 2007. Renewable Energy, Theory and Practice, Himanshu Publications.

DC - AE-306 WATERSHED HYDROLOGY

Contact Hour/ week	Credits
1 (Lecture)	1

Course Outcome: At the end of the course, the student will be able to: To give an exposure to the students about the climatic parameters & their analysis to study direct & indirect effect on

agriculture scenario of particular area giving main focus on water availability, distribution of circulation.

Unit-I

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.

Unit-II

Hydrologic processes: Interception, infiltration. Runoff - Factors affecting, measurement, stage - discharge rating curve, estimation of peak runoff rate and volume, Rational method, Cook's method and SCS curve number method.

Unit-III

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.

Unit-IV

Stream gauging: Discharge rating curves, flood peak, design flood and computation of probable flood.

Suggested Readings

1. Chow, V.T., D.R. Maidment and L.W. Mays. 2010. Applied Hydrology, McGraw Hill Publishing Co., New York.

2. Jaya Rami Reddy, P. 2011. A Text Book of Hydrology. University Science Press, New Delhi.

3. Linsley, R.K., M.A. Kohler, and J.L.H. Paulhus. 1984. Hydrology for Engineers. McGraw-Hill Publishing Co., Japan.

4. Mutreja, K.N. 1990. Applied Hydrology. Tata McGraw-Hill Publishing Co., New Delhi.

5. Raghunath, H.M. 2006. Hydrology: Principles Analysis and Design. Revised 2nd Edition, New Age International (P) Limited Publishers, New Delhi.

6. Subramanya, K. 2008. Engineering Hydrology. 3rd Edition, Tata McGraw-Hill Publishing Co., New Delhi.

7. Suresh, R. 2005. Watershed Hydrology. Standard Publishers Distributors, Delhi.

8. Varshney, R.S. 1986. Engineering Hydrology. Nem Chand and Brothers, Roorkee, U.P.

PRACTICAL

DC - AE-307 HEAT TRANSFER, REFRIGERATION AND AIR CONDITIONING LAB

Contact Hour/ week	Credits
2 (Practical)	1.5

1. Measure thermal conductivity of insulating powders.
2. Study temperature distribution along the length of fin in natural convection.
3. Study temperature distribution along the length of fin in forced convection.
4. Experiment on heat transfer in natural convection.
5. Determine emissivity of given surface.
6. Determine rate of heat transfer, LMTD and overall heat transfer coefficient for parallel flow heat exchanger.
7. Determine rate of heat transfer, LMTD and overall heat transfer coefficient for counter flow heat exchanger.
8. Determine COP of vapour compression refrigeration system.
9. Determine COP of heat pump.
10. Study Electrolux refrigerator.
11. Study of domestic refrigerator and
12. Study of one ton ice plant.
13. Study of water cooler.
14. Study of air conditioner.
15. Study of vapour absorption system.

DC - AE-308 STRENGTH OF MATERIALS LAB

Contact Hour/ week	Credits
2 (Practical)	1.5

1. Study of Universal Testing Machine, its part and functions.
2. Operation of U.T.M, fixing of specimen for different testing.
3. Tensile test on mild steel specimen to failure and computing, Stresses, % elongation, Contraction etc.
4. Compression test on timber.
5. Compression test on mild steel.
6. Compression test on concrete cube.
7. Determination of toughness test of mild steel, Brass and Aluminum by Charpy test.

8. Determination of toughness by Izod test for wood, Aluminum & Brass.
9. Study of torsion testing machine.
10. Performance of torsion test on circular shaft specimen.
11. Bending test on wooden beam and determination of modulus of rupture.
12. Deflection test on wooden beam.

DC - AE-309 FLUID MECHANICS LAB

Contact Hour/ week	Credits
2 (Practical)	1.5

1. Study and use of pressure gauge.
2. Study and use of manometer.
3. Determination of CC for orifices.
4. Determination of Cd for orifices.
5. Calibration of a Venturimeter.
6. Calibration of V notch.
7. Calibration of Rectangular notch.
8. Determination of friction for pipe.
9. Velocity distribution in channel cross section.
10. Field visit.
11. Revision.

DC - AE-310 FUNDAMENTALS OF AGRICULTURE LAB

Contact Hour/ week	Credits
2 (Practical)	1.5

Soils:
1. Determination of electrical conductivity and pH of soil.
2. Estimation of organic carbon of soil.
3. Determination of bulk density.
4. Determination of particle density and computation of soil porosity.

Agronomy:
1. Identification of crops.
2. Identification of seeds of different crops.

3. Identification of weeds.
4. Fertilizer application methods.
5. Different weed control methods.
6. Judging maturity time for harvesting of kharif crops.

Horticulture:
1. Identification and description of important fruit, flower and vegetable crops.
2. Study of different vegetable cultivation tools.
3. Practices of training and pruning in some important crops.
4. Vegetative propagation methods.

DC - AE-311 FUNDAMENTALS OF RENEWABLE ENERGY SOURCES LAB

Contact Hour/ week	Credits
2 (Practical)	1

1. Study of different types of solar cookers.
2. Study of Solar water heating system.
3. Study of Solar photovoltaic system.
4. Study of Natural convection solar dryer
5. Study of Forced convection solar dryer.
6. Study of Solar desalination unit.
7. Study of fixed dome biogas plants.
8. Study of floating drum biogas plants.
9. Study of biomass gasifiers.
10. Study of biomass improved cook-stoves.

DC - AE-312 WATERSHED HYDROLOGY LAB

Contact Hour/ week	Credits
2 (Practical)	1

1. Visit to meteorological observatory and study of different instruments.
2. Design of rain gauge network.
3. Exercise on intensity - frequency - duration curves.
4. Exercise on depth - area - duration and double mass curves.
5. Analysis of rainfall data and estimation of mean rainfall by different methods.

6. Exercise on frequency analysis of hydrologic data and estimation of missing data, test for consistency of rainfall records.

7. Exercise on computation of infiltration indices.

8. Computation of peak runoff and runoff volume by Cook‟s method and rational formula.

9. Computation of runoff volume by SCS curve number method.

10. Study of stream gauging instruments - current meter and stage level recorder.

11. Exercise on geomorphic parameters of watersheds.

12. Exercise on runoff hydrograph.

13. Exercise on unit hydrograph.

14. Exercise on synthetichydrograph.

15. Exercise on flood routing.

2ND YEAR – IV SEMESTER

DC - AE-401 SURVEYING AND LEVELING

Contact Hour/ week	Credits
1 (Lecture)	1

Course Outcome: At the end of the course, the student will be able to:

CO1: Use Theodolite, Tachometer & Gyroscope.

CO2: Use advanced instruments such as Total station & DGPS.

CO3: Draw & interpret contour maps.

CO4: Perform area volume calculations.

Unit-I
Description, construction and use of Theodolite, Temporary adjustments of Theodolite, Fixing, Centering, leveling and elimination of parallax. Various axes and their relationship. Measurement of Horizontal angle by Repetition and reiteration method. Measurement of vertical angle. Application of theodolite in field problem. Sources of error in the theodolite work.

Unit-II
Principles of Tacheometric survey and its field application. Constants of Tachometer. Staff held vertical and normal. Use of anallactic lens. Calculation of R.L. use of stadia wire. Application of laser in surveying. Electronic distance measuring equipments. Total Stations and measurements of angles and R.L. calculation. Introduction of DGPS.

Unit-III
Contours, contouring and their characteristics. Methods of contour surveying by Theodolite. Methods of contour surveying by Tachometer. Contour Drawing by different methods.

Unit-IV
Area calculation of regular boundaries by mathematical formulas. Use of Trapezoidal and Simpson's formula, their limitation. Planimeter: Its construction use and theory, Area calculations, Use of zero circle and solution of numerical Problems.

Computation of volumes, Earth work calculations. Level, Two level and Three level sections.

Text Books/References
1. T.P. Kanetker& S.V. Kulkarni. (1990). Surveying and Leveling Vol. I & II Pune VidyarthiGriha, Prakashan, Pune – 30.

2. B.C. Punmia. (1990). Surveying and Field work Vol. I & II Laxmi Publications, New Delhi.

DC - AE-402 IRRIGATION ENGINEERING AND SPRINKLER AND MICRO IRRIGATION SYSTEMS

Contact Hour/ week	Credits
3 (Lecture)	3

Course Outcome: At the end of the course, the student will be able to: To train the students and develop basic understanding of soil water plant relationship and select and design appropriate method of water application in varied situations and design of field specific Drip and Sprinkler Irrigation system, their proper operation and the maintenance.

Unit-I

Major and medium irrigation schemes of India, purpose of irrigation, source of irrigation water, present status of development and utilization of different water resources of the country; measurement of irrigation water: weir, flumes and orifices and other methods; open channel water conveyance system: design and lining of irrigation field channels, on farm structures for water conveyance, control & distribution; underground pipe conveyance system: components and design.

Unit-II

Soil water plant relationship: Soil properties influencing irrigation management, soil water movement, infiltration, soil water potential, soil moisture characteristics, soil moisture constants, measurement of soil moisture, moisture stress and plant response; water requirement of crops: concept of evapotranspiration (ET), measurement and estimation of ET.

Unit-III

Water and irrigation requirement of crops, depth of irrigation, frequency of irrigation, irrigation efficiencies; surface methods of water application: border, check basin and furrow irrigation-adaptability, specification and design considerations.

Unit-IV

Sprinkler irrigation: Adaptability, types of sprinkler irrigation systems; design of sprinkler irrigation system: layout selection, hydraulic design of lateral, sub-main and main pipe line, design steps; selection of pump and power unit for sprinkler irrigation system; performance evaluation of sprinkler irrigation system: uniformity coefficient and pattern efficiency;

Micro Irrigation Systems: Types-drip, spray, & bubbler systems, merits and demerits, different components; Design of drip irrigation system: hydraulics of drip irrigation system, maintenance of micro irrigation system: fertigation: advantages and limitations of fertigation.

Suggested Readings

1. Allen R. G., L. S. Pereira, D. Raes, M. Smith. 1998. Crop Evapotranspiration guidelines for computing crop water requirement. Irrigation and drainage Paper 56, FAO of United Nations, Rome.

2. Choudhary M.L and Kadam U.S 2006. Micro irrigation for cash crops Westville Publishing House.

3. Israelsen O W. and Hansen V. E and Stringham G. E. 1980. Irrigation Principles and Practice, John Wiley & Sons, Inc. USA.

4. Keller Jack and BliesnerRon D. 2001. Sprinkle and Trickle Irrigation. Springer Science+ business Media, New York.

5. Majumdar D. K. 2013. Irrigation Water Management Principles. PHI learning Private Limited New Delhi 2nd Edition.

6. Mane M.S and Ayare B.L. and MagarS.S.2006.Principles of Drip Irrigation systems, Jain Brothers, New Delhi.

7. Mane M.S. and Ayare B.L.2007. Principles of Sprinkler Irrigation systems, Jain Brothers, New Delhi.

8. Michael A.M. 2012. Irrigation: Theory and Practice. Vikas Publishing House New Delhi.

9. Michael AM, Shrimohan and KR Swaminathan. Design and evaluation of irrigation methods, (IARI Monograph No.1). Water Technology Centre, IARI New Delhi.

10. Murthy VVN. 2013. Land and Water Management Engineering. Kalyani Publishers, New Delhi.

DC - AE-403 SOIL MECHANICS

Contact Hour/ week	Credits
2 (Lecture)	2

Course Outcome: At the end of the course, the student will be able to:

CO1: Find out fundamental properties of soil and their relationship with determining index properties of soil.

CO2: Determine Shear strength of Soil Mass.

CO3: Understand the concept of compaction & consolidation.

CO4: Estimate earth pressure under simple conditions.

Unit-I
Introduction of Soil Mechanics, field of Soil Mechanics. Phase diagram, physical and index properties of soil.

Unit-II
Stress condition in soils, effective and neutral stress. Shear strength, Mohr-Colomb failure theory. Determination of shear parameters by direct shear, Triaxial and unconfined compression test.

Unit-III
Compaction: Compaction of Soil, standard, modified proctor test and Jodhpur mini compaction test. Field compaction method and control.
Consolidation of soil: One dimensional consolidation, spring analogy, laboratory consolidation test.

Unit-IV
Earth pressure: Plastic equilibrium in soils, active and passive state, Rankine's theory of earth pressure Active and passive earth pressure for cohesive soils, simple numerical exercises. **Bearing capacity:** Definition, elementary concept of Rankine's and Terzaghi's analysis. Effect of water table.

Text Books/References

1. Alam Singh. (1990). Soil Engg. Theory & Practice. Asia Publishing House (P) Ltd., New Delhi.

2. B.C. Punmia& A.K. Jain. (1996). Soil Mechanics & Foundations. Laxmi Publication Pvt. Ltd., Ansari road, Darya Ganj. New Delhi- 110002.

DC - AE-404 THEORY AND DESIGN OF MACHINES

Contact Hour/ week	Credits
3 (Lecture)	3

Course Outcome: At the end of the course, the student will be able to:

CO1: Explain the terminology of kinematics and inversions of common mechanisms.

CO2: Describe characteristics of different types of gears and compute velocity ratio of gear trains.

CO3: Perform calculations required for design of belt & chain drives, flywheel and friction drives.

CO4: Describe characteristics of different types of antifriction bearings.

CO5: Demonstrate knowledge of various considerations involved in the design of machines.
CO6: Determine factor of safety and select appropriate material in view of given conditions.

CO7: Design various mechanical components under static loading.

Unit I
Mechanisms: Elements, links, pairs, kinematic chain, and mechanisms. Classification of pairs and mechanisms. Lower and higher pairs. Four bar chain, slider crank chain and their inversions.
Gear: Types of gears. Law of gearing, Involute and cycloidal profile for gear teeth. Spur gear, nomenclature. Interference and undercutting. Introduction to helical, spiral, bevel and worm gear.
Gear Trains: Simple, compound, reverted, and epicyclic trains. Determining velocity ratio by tabular method.

Unit II
Power Transmission: 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.
Flywheel: Turning moment diagrams, co-efficient of fluctuation of speed and energy, weight of flywheel, flywheel applications.
Friction: Types of friction, laws of dry friction. Friction of pivots and collars. Single disc, multiple disc, and cone clutches. Rolling friction, antifriction bearings.

Unit III
Introduction: Meaning of design, Phases of design, design considerations. Common engineering materials and their mechanical properties. Types of loads and stresses, theories of failure, factor of safety, selection of allowable stress. Stress concentration.
Design of joints: Cotter joints, knuckle joint and pinned joints, turnbuckle. Design of threaded fasteners subjected to direct static loads, bolted joints loaded in shear (eccentric loading not included).

Unit IV

Design of shafts, keys and couplings: Design of shafts under torsion and combined bending and torsion. Design of keys. Design of muff or sleeve, and rigid flange couplings. Design of flat belt drives. Design of brackets, levers. Design of helical and leaf springs.

Text Books/References

1. Joseph E. Shigley and John J. Uicker, Jr.: Theory of Machines and Mechanisms (International Edition), McGraw Hill Inc.

2. R. S. Khurmi and J. K. Gupta: Theory of Machines, S. Chand & Co. Ltd., New Delhi.

3. P. L. Ballaney: Theory of Machines, Khanna Publishers, Delhi.

4. Joseph Edward Shigely: Mechanical Engineering Design, McGraw Hill Book Company, Singapore.

5. P.C. Sharma and D.K. Aggarwal: Machine Design, SK Kataria& Sons, Delhi.

6. R. S. Khurmi and J. K. Gupta: A Text Book of Machine Design, S. Chand & Co. Ltd., New Delhi.

DC - AE-405 TRACTOR AND AUTOMOTIVE ENGINES

Contact Hour/ week	Credits
2 (Lecture)	2

Course Outcome: The students will be able to learn about different sources of farm power, construction and functioning of CI and SI engines, IC engine fuels, Coolants, anti freeze and anti corrosion materials.

Unit-I

Sources of farm power: Conventional and non-conventional energy sources. Classification of tractors and CI engines. Difference between CI and SI, Two stroke and four stroke engines. Status of tractor and power tiller industries in India. Review of thermodynamic principles of CI engines and deviation from ideal cycle. Simple numerical problems horse power calculation.

Unit-II

CI Engine systems: Study of engine components their construction, operating principles and functions.valves& valve mechanism. Fuel, intake and exhaust, ignition, starting and electrical systems.

Unit-III

IC engine fuels: Properties & combustion of fuels, gasoline tests and their significance, diesel fuel tests and their significance, detonation and knocking in IC engines, Simple numerical problems on fuel combustion.

Unit-IV

Study of properties of coolants, anti freeze and anti-corrosion materials, lubricant types and study of their properties. Engine cooling and lubricating systems. Engine governing systems: centrifugal and pneumatic. Familiarization with the basics of engine testing.

Text Books \ References

1. Liljedahl, B.J., Turnquist, P.K. Smith, W.D. and Hoki Vaketo1989. Tractor and their Power units. Jhon Wiley & Sons., New York.

2. Jones, F.R., - Farm Gas Engines & Tractors _ Mc.Grow Hill Book Company, New York.

3. Mosses & Frost – Farm Power, John Wiley & Sons, New York.

4. Rai & Jain – Farm Tractor Maintenance and repair, Tata McGraw Hill Publishing Co.Ltd., New-Delhi.

5. Mathur, M.L. and Sharma, R.P. Internal Combustion Engine, Dhanpat Rai & Sons, New Delhi.

6. Gupta, R.B. Automobile Engineering, Satya Prakashan, New Delhi.

DC - AE-406 WEB DESIGNING AND INTERNET APPLICATIONS

Contact Hour/ week	Credits
1 (Lecture)	1

Course Outcome: At the end of the course, the student will be able to:

CO1: Understand and implement the basics of Internet.

CO2: Understand and implement the basics of web programming for designing web applications using HTML.

CO3: Understand and implement the basics of web programming for designing web applications using Cascading Style Sheets.

CO4: Understand and implement internet programming and internet use using java script and other common internet applications.

Unit – I

Introduction to Internet: Evolution of Internet, Introduction to Internet Protocol -TCP/IP, UDP, HTTP, Secure Http(SHTTP), Internet Applications – Commerce on the Internet, Governance on the Internet, Impact of Internet on Society – Crime on/through the Internet. Internet Networks: LAN, MAN WAN, Services on Internet (Definition and Functions) E-mail, WWW, Telnet, FTP, IRC and Search Engine.

Unit – II

Mark-up language - HTML: Introduction, Basic Tags, Attributes, Heading, Formatting, Styles, Links, Images, Multimedia, Tables, Lists, Forms, Colors, Layout, Frames, Font, Head, Metatags, Overview of DHTML, Designing web pages using Dreamweaver.

Unit – III

Cascading Style Sheets: Introduction, Inline Styles, Embedded Style Sheets, Conflicting Styles, Linking External Style Sheets, Positioning Elements, Backgrounds, Elements Dimensions, Box Model and Text Flow, Media Types, Drop-Down, User Style Sheets, Document Object Model.

Unit – IV

Scripting and recent trends in Internet: Introduction to JavaScript, Decision Making, Control Statements, Functions, Objects, Arrays, Event Handling. Creating Web Banners. Learning to use FTP, Uploading of Site. Introduction to database connectivity, Flas h. Internet Phone, Internet Video, e-commerce, VoIP.

Text Books/References

1. Internet for Everyone, Alexis Leon and Mathews Leon, Vikas Publishing House Pvt. Ltd, New Delhi.

2. „O" Level Module M1.2 Internet & web page designing, VK. Jain, BPB Publication, New Delhi.

3. Web Design The complete Reference, Thomas Powell, Tata Mc Graw Hill.

4. HTML and CSS The complete Reference, Thomas Powell, Tata Mc Graw Hill.

5. Java Script 2.0 : The Complete Reference, Second Edition by Thomas Powell and Fritz Schneider.

PRACTICAL

DC - AE-407 AUTO CAD APPLICATION

Contact Hour/ week	Credits
3 (Practical)	1.5

1. Introduction to CAD LAB-1.

2. Line type, Dimensions and Drafting setting.

3. Use of Draw toolbar.

4. Use of Drawing status bar.

5. Use of Modify toolbar.

6. Uses of Geometric constraints and Dimensional constraints.

7. Practice set using- trim, extend, fillet and chamfer commands.

8. Practice set using- Geometric constraints.

9. Practice set using- Dimensional constraints.

10. Practice set using- explode, boundary.

11. Practice set using- copy, mirror, and move commands.

12. Practice set using- polar array and rectangular array.

13. Practice set using- extrusion and loft.

14. Practice set using- revolving and joining.

DC - AE-407 SURVEYING AND LEVELING LAB

Contact Hour/ week	Credits
3 (Practical)	1.5

1. Conducting contour survey in different area their compilation.

2. Study of theodolite, fixing on stand and temporary adjustment, Permanent adjustment of theodolite and their checking.

3. Horizontal and vertical angle measurements by theodolite.

4. Problems of height and distance.

5. Use of tacheometer with inclined sight and staff held inclined.

6. Contouring by grid method.

7. Contouring by radial line method.

8. Contouring by spot level method.

9. Practice of contour plotting by various methods.

10. Use of planimeter, finding constants and calculation of areas of irregular boundaries.

11. Introduction of total station. 12. Gyroscope and its use

DC - AE-408 IRRIGATION ENGINEERING AND SPRINKLER AND MICRO IRRIGATION SYSTEMS

Contact Hour/ week	Credits
2 (Practical)	1.5

1. Measurement of soil moisture by different soil moisture measuring instruments;

2. Measurement of irrigation water;

3. Measurement of infiltration characteristics; determination of bulk density, field capacity and wilting point;

4. Estimation of evapotranspiration;

5. Design of underground pipeline system;

6. Estimation of irrigation efficiency;

7. Study of advance, recession and computation of infiltration opportunity time; infiltration by inflow-outflow method;

8. Evaluation of border irrigation method;

9. Evaluation of furrow irrigation method;

10. Evaluation of check basin irrigation method.

11. Study of different components of sprinkler irrigation system;

12. Design and installation of sprinkler irrigation system; cost economics of sprinkler irrigation system;

13. Study of different components of drip irrigation;

14. design and installation of drip irrigation system;

15. Field visit to micro irrigation system and evaluation of drip system; cost economics of drip irrigation system.

DC - AE-409 SOIL MECHANICS LAB

Contact Hour/ week	Credits
2 (Practical)	1.5

1. Sieve analysis of soils.

2. Hydrometer analysis for grain size distribution in soils.

3. Field density determination by sand replacement methods.

4. Field density determination by core cutter methods.

5. Determination of maximum dry density and optimum moisture content by :
(a) Standard. (b) Mini compaction.

6. Determination of atterberg‟s limits of soils.

7. Unconfined compression test.

8. Shear box test.

9. Triaxial test.

10. Consolidation test.

11. Study and use of sampling equipments.

12-15 Field Visit.

DC - AE-410 TRACTOR AND AUTOMOTIVE ENGINES LAB

Contact Hour/ week	Credits
2 (Practical)	1.5

1. Introduction to different systems of a CI engine; Engine parts and functions.
2. Valve system – study and adjustments.
3. Oil & Fuel - determination of physical properties.
4. Study of Air cleaning system.
5. Study of Fuel supply system of CI engine.
6. Study of Cooling system: thermostat and radiator.
7. Study of Lubricating system.
8. Study of Starting and electrical system of tractor.
9. Study of engine performance curves.
10. Visit to engine manufacturer/ assembler/ spare parts agency.

DC - AE-406 WEB DESIGNING AND INTERNET APPLICATIONS LAB

Contact Hour/ week	Credits
2 (Practical)	1.5

1. Write a program to add all basic HTML tags.
2. Write a program to set background image in a frame.
3. Write a program to implement nested lists.
4. Write a program to implement table tag and its various attributes.
5. Write a program to create forms in HTML.
6. Write a program to implement various features of CSS.
7. Write a program to create popup boxes in JavaScript.
8. Write a program to perform arithmetic operations using JavaScript.
9. Write a program to implement in-built string functions in JavaScript.
10. Develop static website using various HTML features including validation of various user details using JavaScript.