College of Agricultural Engineering and Technology

College of Agricultural Engineering and Technology
Dean: Prof. M.K. Garg

B. Tech. (Agricultural Engineering)
Courses: Semester-wise

Course No.	Course Title	Credits
	Semester I	
CE 101	Surveying and Leveling	3 (1+2)
EE 101	Electrical Circuits	3 (2+1)
ME 101	Workshop Practice	2 (0+2)
ME 102	Engineering Drawing	3 (0+3)
MATH 104	Engineering Mathematics-I	3 (2+1)
PHY 101	Engineering Physics	3 (2+1)
CHEM 101	Engineering Chemistry	3 (2+1)
NCC/NSS	National Cadet Corps/National Service Scheme	2 (0+2)
TUT	Tutorial	1(1+0) NC
	Total Credits	**22 (9+13)**
	Semester II	
CE 102	Engineering Mechanics	3 (2+1)
EE 102	Computers Programming and Data Structures	3 (1+2)
EE 103	Introductory Database Management Systems	2 (0+2)
ME 103	Workshop Technology	3 (2+1)
ME 104	Thermodynamics and Heat Engines	3 (2+1)
FMPE 101	Field Operation and Maintenance of Tractors and Farm Machinery-I	2 (0+2)
MATH 105	Engineering Mathematics-II	3 (2+1)
AGRON 103	Agriculture for Engineers (To be taught jointly by Agronomy, Horticulture and Soil Science)	4 (3+1)
CCA	Co-curricular Activity	1 (0+1)
TUT	Tutorial	1 (1+0) NC
	Total Credits	**24 (12+12)**
	Semester III	
CE 201	Strength of Materials	3 (2+1)
ME 201	Theory of Machines	3 (2+1)
FMPE 201	Farm Machinery and Equipment-I	3 (2+1)
FMPE 202	Farm Power	3 (2+1)
PFE 201	Engineering Properties of Biological Materials and Food Quality	3 (2+1)
SWE 201	Watershed Hydrology	3 (2+1)
MATH 201	Engineering Mathematics-III	3 (2+1)
AG ECON 203	Agribusiness Management and Trade	3 (3+0)
NCC/NSS	National Cadet Corps/National Service Scheme	2 (0+2)
TUT	Tutorial	1(1+0)
	Total Credits	**26 (17+9)**

	Semester IV	
CE 202	Fluid Mechanics	3 (2+1)
ME 202	Heat and Mass Transfer	3 (2+1)
FMPE 203	Farm Machinery and Equipment-II	3 (2+1)
PFE 202	Crop Process Engineering	3 (2+1)
PFE 203	Renewable Energy Sources	3 (2+1)
SWE 202	Soil and Water Conservation Engineering	3 (2+1)
SWE 203	Irrigation Engineering	3 (2+1)
ENG 201	Technical Writing and Communication Skills	2 (1+1)
CCA	Co-curricular Activity	1 (0+1)
TUT	Tutorial	1(1+0) NC
	Total Credits	**24 (15+9)**
	Semester V	
CE 301	Soil Mechanics	3 (2+1)
EE 301	Electrical Machines	3 (2+1)
ME 301	Refrigeration and Air Conditioning	3 (2+1)
ME 302	Machine Design	3 (2+1)
FMPE 301	Tractor Systems and Controls	3 (2+1)
PFE 301	Dairy and Food Engineering	3 (2+1)
SWE 301	Groundwater Engineering and Pumping Systems	3 (2+1)
FMPE 390/ PFE 390/ SWE 390	Summer Training-I	3 (0+3)
CCA	Co-curricular Activity	1 (0+1)
TUT	Tutorial	1(1+0) NC
	Total Credits	**25 (14+11)**
	Semester VI	
CE 302	Design of Structures	3 (2+1)
EE 302	Applied Electronics and Instrumentation	3 (2+1)
FMPE 302	Field Operation and Maintenance of Tractors and Farm Machinery-II	3 (1+2)
PFE 302	Agricultural Structures and Environmental Control	3 (2+1)
PFE 303	Drying and Storage Engineering	3 (2+1)
SWE 302	Drainage Engineering	3 (2+1)
SWE 303	Soil and Water Conservation Structures	3 (2+1)
FOR 302	Environmental Science (To be taught jointly by Forestry, Entomology, Agricultural Economics, Agricultural Meteorology, Agronomy and Soil Science)	2(1+1) NC
FMPE 391/ PFE 391/ SWE 391	Undergraduate Seminar	1 (0+1)
CCA	Co-curricular Activity	1 (0+1)
TUT	Tutorial	1(1+0) NC
	Total Credits	**23 (13+10)**
	Semester VII	
EE 401	Web Designing and Applications	3 (1+2)
FMPE 401	Human Engineering and Safety	3 (2+1)

PFE 401	Food Processing Plant Design and Layout	3 (2+1)
SWE 401	Micro Irrigation System Design	3 (2+1)
FMPE 490/ PFE 490/ SWE 490	Summer Training-II	3 (0+3)
TUT	Tutorial	1(1+0) NC
Elective courses: Students are required to opt any one package of professional courses out of the following three packages		
	Package I. Farm Machinery and Power Engineering	
FMPE 402	Hydraulic Drive and Controls	3 (2+1)
FMPE 403	Farm Power and Machinery Management	3 (2+1)
FMPE 411	Project on Farm Machinery and Power Engineering-I	3 (0+3)
	Package II. Processing and Food Engineering	
PFE 402	Design and Maintenance of Green House	3 (2+1)
PFE 403	Food Packaging Technology	3 (2+1)
PFE 411	Project on Processing and Food Engineering -I	3 (0+3)
	Package III. Soil and Water Engineering	
SWE 402	Remote Sensing and GIS Applications	3 (2+1)
SWE 403	Watershed Planning and Management	3 (2+1)
SWE 411	Project on Soil and Water Engineering -I	3 (0+3)
	Total Credits	**24 (11+13)**
	Semester VIII	
EE 410	Hands on Training in Computer Applications	3 (0+3)
ME 410	Hands on Training in CAD/CAM	3 (0+3)
FMPE 410	Hands on Training in Manufacturing, Testing and Evaluation of Agricultural Machines	3 (0+3)
PFE 410	Hands on Training in Processing of Agricultural Produce	3 (0+3)
SWE 410	Hands on Training in Water Resources Planning, Development and Management	3 (0+3)
TUT	Tutorial	1(1+0) NC
	Package I. Farm Machinery and Power Engineering	
FMPE 412	Project on Farm Machinery and Power Engineering-II	3 (0+3)
	Package II. Processing and Food Engineering	
PFE 412	Project on Processing and Food Engineering -II	3 (0+3)
	Package III. Soil and Water Engineering	
SWE 412	Project on Soil and Water Engineering-II	3 (0+3)
	Total Credits	**18 (0+18)**

Core Courses of B. Tech. (Agricultural Engineering) Programme: Department-wise

Course No.	Course Title	Credits	Semester
Agricultural Engineering and Technology			
Farm Machinery and Power Engineering			
FMPE 101	Field Operation and Maintenance of Tractors and Farm Machinery-I	2 (0+2)	II
FMPE 201	Farm Machinery and Equipment-I	3 (2+1)	III
FMPE 202	Farm Power	3 (2+1)	III
FMPE 203	Farm Machinery and Equipment-II	3 (2+1)	IV
FMPE 301	Tractor Systems and Controls	3 (2+1)	V
FMPE 302	Field Operation and Maintenance of Tractors and Farm Machinery-II	3 (1+2)	VI
FMPE 390/ PFE 390/ SWE 390	Summer Training-I	3 (0+3)	V
FMPE 391/ PFE 391/ SWE 391	Undergraduate Seminar	1 (0+1)	VI
FMPE 401	Human Engineering and Safety	3 (2+1)	VII
FMPE 410	Hands on Training in Manufacturing, Testing and Evaluation of Agricultural Machines	3 (0+3)	VIII
FMPE 490/ PFE 490/ SWE 490	Summer Training-II	3 (0+3)	VII
	Total Credits	**30 (11+19)**	
Processing and Food Engineering			
PFE 201	Engineering Properties of Biological Materials and Food Quality	3 (2+1)	III
PFE 202	Crop Process Engineering	3 (2+1)	IV
PFE 203	Renewable Energy Sources	3 (2+1)	IV
PFE 301	Dairy and Food Engineering	3 (2+1)	V
PFE 302	Agricultural Structures and Environmental Control	3 (2+1)	VI
PFE 303	Drying and Storage Engineering	3 (2+1)	VI
PFE 390/ FMPE 390/ SWE 390	Summer Training-I	3 (0+3)	V
PFE 391/ FMPE 391/ SWE 391	Undergraduate Seminar	1 (0+1)	VI
PFE 401	Food Processing Plant Design and Layout	3 (2+1)	VII
PFE 410	Hands on Training in Processing of Agricultural Produce	3 (0+3)	VIII
PFE 490/ FMPE 490/ SWE 490	Summer Training-II	3 (0+3)	VII
	Total Credits	**31 (14+17)**	

Soil and Water Engineering			
SWE 201	Watershed Hydrology	3 (2+1)	III
SWE 202	Soil and Water Conservation Engineering	3 (2+1)	IV
SWE 203	Irrigation Engineering	3 (2+1)	IV
SWE 301	Groundwater Engineering and Pumping Systems	3 (2+1)	V
SWE 302	Drainage Engineering	3 (2+1)	VI
SWE 303	Soil and Water Conservation Structures	3 (2+1)	VI
SWE 390/ FMPE 390/ PFE 390	Summer Training-I	3 (0+3)	V
FMPE 391/ PFE 391/ SWE 391	Undergraduate Seminar	1 (0+1)	VI
SWE 401	Micro Irrigation System Design	3 (2+1)	VII
SWE 410	Hands on Training in Water Resources Planning, Development and Management.	3 (0+3)	VIII
SWE 490/ FMPE 490/ PFE 490	Summer Training-II	3 (0+3)	VII
	Total Credits	**31 (14+17)**	
Section of Basic Engineering			
Civil Engineering			
CE 101	Surveying and Leveling	3 (1+2)	I
CE 102	Engineering Mechanics	3 (2+1)	II
CE 201	Strength of Materials	3 (2+1)	III
CE 202	Fluid Mechanics	3 (2+1)	IV
CE 301	Soil Mechanics	3 (2+1)	V
CE 302	Design of Structures	3 (2+1)	VI
	Total Credits	**18 (11+7)**	
Electrical and Electronics Engineering			
EE 101	Electrical Circuits	3 (2+1)	I
EE 102	Computers Programming and Data Structures	3 (1+2)	II
EE 103	Introductory Database Management Systems	2 (0+2)	II
EE 301	Electrical Machines	3 (2+1)	V
EE 302	Applied Electronics and Instrumentation	3 (2+1)	VI
EE 401	Web Designing and Applications	3 (1+2)	VII
EE 410	Hands on Training in Computer Applications	3 (0+3)	VIII
	Total Credits	**20 (8+12)**	
Mechanical Engineering			
ME 101	Workshop Practice	2 (0+2)	I
ME 102	Engineering Drawing	3 (0+3)	I
ME 103	Workshop Technology	3 (2+1)	II
ME 104	Thermodynamics and Heat Engines	3 (2+1)	II
ME 201	Theory of Machines	3 (2+1)	III
ME 202	Heat and Mass Transfer	3 (2+1)	IV
ME 301	Refrigeration and Air Conditioning	3 (2+1)	V
ME 302	Machine Design	3 (2+1)	V

ME 410	Hands on Training in CAD/CAM	3 (0+3)	VIII
	Total Credits	**26 (12+14)**	
Agriculture			
Agricultural Economics			
AG ECON 203	Agribusiness Management and Trade	3 (3+0)	III
	Total Credits	**3 (3+0)**	
Agronomy			
AGRON 103	Agriculture for Engineers (To be taught jointly by Agronomy, Horticulture and Soil Science)	4 (3+1)	II
	Total Credits	**4 (3+1)**	
Forestry			
FOR 302	Environmental Science (To be taught jointly by Forestry, Entomology, Agricultural Economics, Agricultural Meteorology, Agronomy and Soil Science)	2(1+1) NC	VI
	Total Credits	**2 (1+1)**	
Basic Sciences and Humanities			
Chemistry and Physics			
Chemistry			
CHEM 101	Engineering Chemistry	3 (2+1)	I
	Total Credits	**3 (2+1)**	
Physics			
PHY 101	Engineering Physics	3 (2+1)	I
	Total Credits	**3 (2+1)**	
English (Languages and Haryanvi Culture)			
ENG 201	Technical Writing and Communication Skills	2 (1+1)	IV
	Total Credits	**2 (1+1)**	
Mathematics (Mathematics and Statistics)			
MATH 104	Engineering Mathematics-	3 (2+1)	I
MATH 105	Engineering Mathematics-I	3 (2+1)	II
MATH 201	Engineering Mathematics-II	3 (2+1)	III
	Total Credits	**9 (6+3)**	

Elective Courses: Package-wise (Package I to III)
All students are required to take any one package out of Packages I to III

Course No.	Course Title	Credits	Semester
Package I. Farm Machinery and Power Engineering			
FMPE 402	Hydraulic Drive and Controls	3 (2+1)	VII
FMPE 403	Farm Power and Machinery Management	3 (2+1)	VII
FMPE 411	Project on Farm Machinery and Power Engineering-	3 (0+3)	VII
FMPE 412	Project on Farm Machinery and Power Engineering-II	3 (0+3)	VIII
	Total Credits	**12 (4+8)**	

Package II. Processing and Food Engineering			
PFE 402	Design and Maintenance of Green House	3 (2+1)	VII
PFE 403	Food Packaging Technology	3 (2+1)	VII
PFE 411	Project on Processing and Food Engineering-I	3 (0+3)	VII
PFE 412	Project on Processing and Food Engineering-II	3 (0+3)	VIII
	Total Credits	**12 (4+8)**	
Package III. Soil and Water Engineering			
SWE 402	Remote Sensing and GIS Applications	3 (2+1)	VII
SWE 403	Watershed Planning and Management	3 (2+1)	VII
SWE 411	Project on Soil and Water Engineering-I	3 (0+3)	VII
SWE 412	Project on Soil and Water Engineering-II	3 (0+3)	VIII
	Total Credits	**12 (4+8)**	

Core Courses for B. Sc. (Hons.) Agriculture, 4-year programme/ 6-year programme: Department-wise

Farm Machinery and Power Engineering			
FMPE 303	Farm Power and Machinery	2 (1+1)	VI/X
	Total Credits	**2 (1+1)**	
Processing and Food Engineering			
PFE 304	Protected Cultivation and Post-harvest Technology	2 (1+1)	V/IX
PFE 305	Renewable Energy	2 (1+1)	VI/X
	Total Credits	**4 (2+2)**	
Soil and Water Engineering			
SWE 304	Fundamentals of Soil and Water Conservation Engineering	3 (2+1)	V/IX
	Total Credits	**3 (2+1)**	

COURSE CONTENTS: DEPARTMENT-WISE

FARM MACHINERY AND POWER ENGINEERING

Course No.	Course Title	Credits	Semester
Core Courses			
FMPE 101	Field Operation and Maintenance of Tractors and Farm Machinery - I	2 (0+2)	II
FMPE 201	Farm Machinery and Equipment - I	3 (2+1)	III
FMPE 202	Farm Power	3 (2+1)	III
FMPE 203	Farm Machinery and Equipment - II	3 (2+1)	IV
FMPE 301	Tractor Systems and Controls	3 (2+1)	V
FMPE 302	Field Operation and Maintenance of Tractors and Farm Machinery - II	3 (1+2)	VI
FMPE 303	Farm Power and Machinery **(For B.Sc. (Hons.) Agriculture)**	2 (1+1)	VI/X
FMPE 390/ PFE 390/ SWE 390	Summer Training - I	3 (0+3)	V
FMPE 391/ PFE 391/ SWE 391	Undergraduate Seminar	1 (0+1)	VI
FMPE 401	Human Engineering and Safety	3 (2+1)	VII
FMPE 410	Hands on Training in Manufacturing, Testing and Evaluation of Agricultural Machines	3 (0+3)	VIII
FMPE 490/ PFE 490/ SWE 490	Summer Training - II	3 (0+3)	VII
	Total Credits	**32 (12+20)**	
Elective Courses/Package			
FMPE 402	Hydraulic Drive and Controls	3 (2+1)	VII
FMPE 403	Farm Power and Machinery Management	3 (2+1)	VII
FMPE 411	Project on Farm Machinery and Power Engineering - I	3 (0+3)	VII
FMPE 412	Project on Farm Machinery and Power Engineering - II	3 (0+3)	VIII
	Total Credits	**12 (4+8)**	

FMPE 101 FIELD OPERATION AND MAINTENANCE OF TRACTORS AND FARM MACHINERY - I SEM II 2 (0+2)

Practical

Familiarization with tractor controls, learning procedure of tractor starting and stopping, driving in forward and reverse gears, driving safety rules and road signs; familiarization with different makes and models of 4-wheeled tractors; various systems of a tractor: fuel, lubrication, cooling, electrical, transmission, hydraulic and final drive; hitching, adjustments, settings and field operation of farm machinery; driving practice with 2-wheeled tractor trailer; practicing hitching and de-hitching of implements; study, operation and field adjustments of common primary and secondary tillage equipments and seed drills.

FMPE 201 FARM MACHINERY AND EQUIPMENT - I SEM III
3 (2+1)

Theory

Farm mechanization: objectives and advantages; classification of farm machines; materials of construction; heat treatment; principles of operation and selection of machines used for production of crops; field capacities and economics; primary and secondary tillage equipment; forces acting on tillage tools; hitching systems and controls; draft measurement of tillage equipment; earth moving equipment, their construction and working principles: bulldozer, trencher, elevators, laser land leveller etc; sowing, planting and transplanting equipment their calibration and adjustments; minimum tillage, no-tillage and straw management equipment; fertilizer application equipment; weed control and plant protection equipment viz sprayers, dusters and their calibration, selection, constructional features of different components and adjustments.

Practical

Identification of various farm machines; field capacity and field efficiency measurement for at least two machines/implements; draft and fuel consumption measurement under different soil conditions; construction details, adjustments and working of mould board plow, disc plow, disc harrow, other secondary tillage tools, earth moving equipment, rotavators, rotary tillers; measurement of speed and working width; working of seed-cum-fertilizer drills, planters and their calibration in field; working of transplanters and operation; weeding equipments and their use; sprayers, dusters and measurement of nozzle discharge, field capacity etc.

FMPE 202 FARM POWER SEM III
3 (2+1)

Theory

Sources of farm power; classification of tractors and internal combustion engines; review of thermodynamic principles of internal combustion (compression ignition and spark ignition) engines and deviation from ideal cycle; study of engine components, their construction, operating principles and functions; study of valves and valve mechanism, fuel and air supply, cooling, lubricating, ignition and electrical systems; study of constructional details, adjustments and operating principles of these systems; internal combustion engine fuels their properties and combustion of fuels, gasoline tests and their significance, diesel fuel tests and their significance, detonation and knocking in internal combustion engines, properties of coolants, anti freeze and anti-corrosion materials, lubricant types and their properties; engine governing systems.

Practical

Different systems of a compression ignition engine; engine parts, their functions, working principles etc; valve system their constructional features, operation and adjustments; determination of physical properties of fuel and lubricants; air cleaning system; fuel supply system of spark ignition engine, diesel injection system and timing; cooling systems: working of thermostat and radiator; part load efficiencies and governing; lubricating system and adjustments; electrical system; ignition system; tractor engine heat balance and engine performance curves; visit to engine manufacturer/ assembler/ spare parts agency.

FMPE 203 FARM MACHINERY AND EQUIPMENT - II SEM IV
3 (2+1)

Theory

Principles and types of cutting mechanisms; construction and adjustments of shear and impact-type cutting mechanisms; working and constructional details of mowers, windrowers, reapers, reaper binders, forage harvesters, forage chopping and handling equipment; threshing mechanism, various types of threshers and their use, straw combines, grain combines, maize harvesting and shelling equipment, root crop harvesting equipment i.e. potato, groundnut etc., cotton picking and sugarcane harvesting equipment; principles of fruit harvesting tools and machines; horticultural tools and gadgets; importance of testing of farm machinery, use of test codes and their procedure, interpretation of test results; selection and management of farm machines for optimum performance.

Practical

Principles, construction and operation of mowers, reaper, reaper binder, potato harvesters, groundnut harvesters, forage harvester, sugarcane harvester, maize sheller, threshers, cotton pickers, cotton strippers, combine harvesters, straw combines and fruit harvesting equipment.

FMPE 301 TRACTOR SYSTEMS AND CONTROLS SEM V
3 (2+1)

Theory

Transmission systems, clutch, gear box, differential and final drive mechanism; familiarization of brake mechanism; study of ackerman, hydraulic steering systems and hydraulic systems; tractor power outlets: power take off, belt pulley, drawbar etc.; tractor chassis mechanics and design for tractor stability; ergonomic considerations and operational safety.

Practical

Transmission systems and components; clutch functioning, parts and design problems; different types of gear box, calculation of speed ratios, design problems; differential and final drive; brake systems and design problems; steering geometry and adjustments; hydraulic systems in a tractor, hydraulic trailer and design problems; traction theory and performance of a tractor wheel; finding centre of gravity of a tractor by weighing and suspension/balancing techniques; finding moment of inertia of a tractor; appraisal of various controls in different tractors in relation to anthropometric measurements.

FMPE 302 FIELD OPERATION AND MAINTENANCE OF TRACTORS AND FARM MACHINERY - II SEM VI
3 (1+2)

Theory

Tractor maintenance procedure and trouble shooting; maintenance schedule after 10, 50,100, 250, 500 and 1000 hours of operation; safety hints; top end overhauling; fuel saving tips; preparing the tractor for storage; care and maintenance procedure of agricultural machinery during operation and off-season; workshop requirements/design layout for repair and maintenance of agricultural machinery.

Practical

Visit to tractor/engine repair workshop; familiarization with tools and equipment used for maintaining and servicing of tractors and farm machines; doing the 10-hours service jobs and maintenance after 50-hours of operation; conducting preventive maintenance of tractors and following service schedules; dismantling and assembling of major engine parts; injection pump, injector repair shop; doing minor repair of electric, mechanical and hydraulic systems; adjustment and maintenance of primary and secondary tillage equipment, seeding, planting and transplanting machines, plant protection equipment, reapers and threshers; adjustment and maintenance of combine harvesters, straw combines, balers etc.; visit to small scale farm machinery manufacturers, repair shops, seasonal maintenance of farm machinery.

FMPE 303 FARM POWER AND MACHINERY SEM VI/X
(For B.Sc. (Hons.) Agriculture) 2 (1+1)

Theory

Farm power in India: sources, I.C. engines, working principles, two stroke and four stroke engines, I.C. engine terminology and different systems of I.C. engine; tractors; types, selection of tractor and cost of tractor power; tillage implement: primary and secondary tillage implements, implements for intercultural operations, seed drill, paddy transplanters, plant protection equipment and harvesting equipment; equipment for land development and soil conservation.

Practical

Study of different components of I.C. engine; study of working of four stroke engine; study of working of two stroke engine; study of M.B. plough, measurement of plough size, different parts, horizontal and vertical suction, determination of line of pull etc.; study of disc plough; study of seed-cum-fertilizer drills-furrow opener, metering mechanism, and calibration; study of paddy transplanters; study, maintenance and operation of tractor; learning of tractor driving; study, maintenance and operation of power tiller; study of different parts, registration, alignment and operation of mower; study of different inter cultivation equipment in terms of efficiency, field capacity; repair, adjustments and operation of sprayers; repair, adjustments and operation of dusters.

FMPE 390/ SUMMER TRAINING - I SEM V
PFE 390/ 3 (0+3)
SWE 390

Exposure to industrial and institutional applications in selected fields of interest (Farm Machinery and Power, Food Processing, Soil and Water Engineering, Information Technology etc,); training report preparation and presentation (students will be required to undergo training of about 4 weeks during the summer break after 2nd year).

FMPE 391/ UNDERGRADUATE SEMINAR SEM VI
PFE 391/ 1 (0+1)
SWE 391

Topic selection, material collection, slide preparation, presentation and interaction.

FMPE 401 HUMAN ENGINEERING AND SAFETY SEM VII
3 (2+1)

Theory

Concept and development of systems in human factors; basic processes in system development, performance reliability, human performance, information input process, visual displays, major types and use of displays, auditory and factual displays; speech communications; biomechanics of motion, types of movements, range of movements, strength and endurance, speed and accuracy, human control of systems; human motor activities, controls, tools and related devices; anthropometry concept in arrangement and utilization of work space, atmospheric conditions, heat exchange process and performance, air pollution; dangerous machine (regulation) act, rehabilitation and compensation to accident victims; safety gadgets for spraying, threshing, chaff cutting, tractor and trailer operation etc.

Practical

Calibration of the subject in the laboratory using bi-cycle ergo-meter as loading device versus different physiological parameters; study and calibration of the subject in the laboratory using mechanical treadmill as loading device versus different physiological parameters; use of respiration gas meter from energy point of view; heart rate monitor and farm operation as a loading device; study of general fatigue of the subject using blink ratio method; use of electromyograph equipment; anthropometric measurements of a selected group of farm workers and its statistical analysis; optimum work space layout and locations of controls of different factors; familiarization with the noise and vibration equipment.

FMPE 402 HYDRAULIC DRIVES AND CONTROLS SEM VII
3 (2+1)

Theory

Study of Pascal's law, flow, energy, work, and power; hydraulic systems, color coding, reservoirs, strainers, filters, filtering material and elements; accumulators, pressure gauges and volume meters, hydraulic circuit, fittings and connectors; pumps, pump classifications, performance, displacement, designs, gear pumps, vane pumps, piston pumps, pump operation; construction, applications and maintenance of hydraulic actuators, cylinders, hydraulic motors; valves, pressure-control valves, directional-control valves, flow-control valves, installation, valve failures and remedies, assembly, troubleshooting valves, hydraulic circuit diagrams and troubleshooting; presentation of hydraulic systems with graphical symbols; tractor hydraulics, nudging system, automatic depth and draft control; pneumatics, air services, logic units; application of hydraulics and pneumatics drives in agricultural systems, programmable logic controls.

Practical

Hydraulic systems; study of hydraulic pumps, hydraulic actuators; study of hydraulic motors, hydraulic valves, hydraulic codes and circuits; building simple hydraulic circuits, hydraulics in tractors; applications of hydraulics and pneumatics.

FMPE 403 FARM MACHINERY AND POWER MANAGEMENT SEM VII 3 (2+1)

Theory

Role of mechanization and its relationship to productivity, employment, social and technological change; performance and power analysis; cost analysis of machinery; fixed cost and variable costs; effect of inflation on cost; selection of optimum machinery and replacement criteria; break-even analysis, reliability and cash flow problems; mechanization planning; case studies of agricultural mechanization in India.

Practical

Solving problems related to various field capacities, pattern efficiency, system limitation, power requirement and other operational parameters; problems related to cost analysis and inflation; problems related to selection of equipment, replacement, break-even analysis, time value of money etc.; presentation of seminar on topic assigned related to farm machinery management; design of farm mechanization plan for different farm size and cropping pattern.

FMPE 410 HANDS ON TRAINING IN MANUFACTURING, TESTING AND EVALUATION OF AGRICULTURAL MACHINES SEM VIII 3 (0+3)

Practical

Exposure to production technology; testing and evaluation of agricultural machinery as per standards, interpretation and preparation of test reports.

FMPE 411 PROJECT ON FARM MACHINERY AND POWER ENGINEERING –I SEM VII 3 (0+3)

Practical

Identification, planning and formulation of the problem, review of literature, initiation of work and presentation.

FMPE 412 PROJECT ON FARM MACHINERY AND POWER ENGINEERING –II SEM VIII 3 (0+3)

Practical

Field / lab studies, project report writing and presentation.

FMPE 490/ PFE 490/ SWE 490 SUMMER TRAINING - II SEM VII 3 (0+3)

Exposure to an environment in which students are expected to be associated in their future career, preparation of training report on technical aspects of the training and presentation (students will be required to undergo training of about 4 weeks during the summer break after 3rd year).

PROCESSING AND FOOD ENGINEERING

Course No.	Course Title	Credits	Semester
Core Courses			
PFE 201	Engineering Properties of Biological Materials and Food Quality	3 (2+1)	III
PFE 202	Crop Process Engineering	3 (2+1)	IV
PFE 203	Renewable Energy Sources	3 (2+1)	IV
PFE 301	Dairy and Food Engineering	3 (2+1)	V
PFE 302	Agricultural Structures and Environmental Control	3 (2+1)	VI
PFE 303	Drying and Storage Engineering	3 (2+1)	VI
PFE 304	Protected Cultivation and Post-harvest Technology **(For B.Sc. (Hons.) Agriculture)**	2 (1+1)	V/IX
PFE 305	Renewable Energy **(For B.Sc. (Hons.) Agriculture)**	2 (1+1)	VI/X
PFE 390/ FMPE 390/ SWE 390	Summer Training – I	3 (0+3)	V
PFE 391/ FMPE 391/ SWE 391	Undergraduate Seminar	1 (0+1)	VI
PFE 401	Food Processing Plant Design and Layout	3 (2+1)	VII
PFE 410	Hands on Training in Processing of Agricultural Produce	3 (0+3)	VIII
PFE 490/ FMPE 490/ SWE 490	Summer Training - II	3 (0+3)	VII
	Total Credits	**35 (16+19)**	
Elective Courses/Package			
PFE 402	Design and Maintenance of Green House	3 (2+1)	VII
PFE 403	Food Packaging Technology	3 (2+1)	VII
PFE 411	Project on Processing and Food Engineering - I	3 (0+3)	VII
PFE 412	Project on Processing and Food Engineering - II	3 (0+3)	VIII
	Total Credits	**12 (4+8)**	

PFE 201 ENGINEERING PROPERTIES OF BIOLOGICAL MATERIALS AND FOOD QUALITY SEM III 3 (2+1)

Theory

Importance of engineering properties of biological materials and their applications in processing equipments; study of different physical and thermal characteristics; shape, size, volume, density, roundness, sphericity, surface area, specific heat, thermal conductivity, thermal diffusivity, etc.; measurement of colour, flavour, consistency, viscosity, texture and their relationship with food quality and composition; rheological characteristics like stress, strain time effects, rheological models; aerodynamic and frictional properties; concept, and need of quality, quality control, sampling; sampling techniques for liquid, powdered and granular materials, sensory quality control, panel selection methods, interpretation of

sensory results in statistical quality control, food laws and regulations in India; food grades and standards- BIS, AGMARK, PFA, FPO, GMP, HACCP etc.

Practical

To find the shape, size, bulk density, particle density/ true density, porosity, angle of repose, co-efficient of external and internal friction, thermal conductivity, specific heat and thermal diffusivity of different crops; study of separation behavior of a grain in a vertical wind tunnel; to determine impurities and invisible stress cracks in grains; preparation of a ready reckoner of change in unit weight of food grains as affected by change in its moisture content (w.b); milling quality of paddy; determination of hardness of food material; cooking quality of rice; detection of adulteration in food products.

PFE 202 CROP PROCESS ENGINEERING SEM IV
3 (2+1)

Theory

Scope and importance of food processing, principles and methods of food processing. processing of farm crops: cereals, pulses, oil seeds, fruits and vegetables and their products for food and feed; processing of animal products; principle of size reduction, size reduction machineries, crushers, grinders, cutting machines etc. - operation, efficiency and power requirement – Rittinger's, Kick's and Bond's equation, fineness modulus, mixing, types of mixtures for dry and paste materials, rate of mixing and power requirement, mixing index; separation: types of separators, size of screens, sieve analysis, capacity and effectiveness of screens, pneumatic separation; filtration: different types of filters, rate of filtration, pressure drop during filtration; scope and importance of material handling devices, different types of material handling systems; belt, chain and screw conveyor, bucket elevator, pneumatic conveying, gravity conveyor- design consideration, capacity and power requirement.

Practical

Preparation of flow and layout charts of a food processing plant; determination of fineness modulus and uniformity index; study and performance evaluation of hammer mill; attrition mill, cleaning and grading equipment; separation behaviour in pneumatic separator; performance evaluation of indented cylinder and screen pre-cleaner; study of mixers; study of conveying equipments.

PFE 203 RENEWABLE ENERGY SOURCES SEM IV
3 (2+1)

Theory

Classification of energy sources; introduction to renewable energy sources, potential and scope of solar, wind, biomass, geothermal, ocean, small hydel and other new resources and their environmental aspects, solar energy : characteristics of sun, the solar constant, determination of solar time, solar energy measuring instruments, solar energy utilization and option, solar energy operated systems for heating, drying, cooling and photovoltaic application, thermal energy storage and solar pond; biomass : characterization of biomass, conversion of biomass into solid, liquid and gaseous fuel; combustion, pyrolysis and gasification, type of gasifiers ; anaerobic bio-conversions process, biogas production and properties, selection of different types of biogas plants, benefits of biogas; wind energy : types of wind mills, constructional details and application of wind mills; liquid bio-fuels, bio-diesel from agricultural produce and energy conservation in agriculture.

Practical

Study of solar radiation measuring instruments; testing of solar thermal appliances: solar cooker, solar still, solar dryer, solar water heater etc.; study of solar photovoltaic systems: solar water pumping system, solar street lighting, solar lantern etc.; study of different type of gasifiers; constructional details of different type of biogas plants field visit to biogas plants, wind mills and bio-diesel processing units.

PFE 301 DAIRY AND FOOD ENGINEERING SEM V
3 (2+1)

Theory

Dairy development in India; engineering, thermal and chemical properties of milk and milk products; unit operation of various dairy and food processing systems, process flow charts for product manufacture, working principles of equipment for receiving, pasteurization sterilization, homogenization, filling and packaging, butter manufacture, dairy plant design and layout, composition and proximate analysis of food products; deterioration in products and their controls; physical, chemical and biological methods of food preservation, changes undergone by the food components during processing, evaporation, drying, freezing, juice extraction, filtration, membrane separation, thermal processing, plant utilities requirement.

Practical

Study of a composite pilot milk processing plant and equipments; study of pasteurizers, sterilizers, homogenizers, separators, butter churners, evaporators, milk dryers and freezers; design of food processing plants and preparation of layout; determination of physical properties of food products; estimation of steam and refrigeration requirements in dairy and food plant; visit to food industry and multi-product dairy product.

PFE 302 AGRICULTURAL STRUCTURES AND ENVIRONMENTAL CONTROL SEM VI
3 (2+1)

Theory

Planning and layout of farmstead; farm roads, fencing and gates; functional requirements of farm buildings; design and layout of livestock buildings: dairy farm, poultry house, sheep / goat house etc.; BIS standards for farm structures, construction and cost estimation of farm structures; design and construction of rural grain storage system; scope, importance and need for environmental control; physiological reactions of livestock environmental factors; environmental control systems and their design, control of temperature, humidity and other air constituents by ventilation and other methods; sources and norms of water supply for human beings and animals; drinking water standards and water treatment suitable to rural community; sewage systems: design, cost and maintenance; site and orientation of building in regard to community sanitation system.

Practical

Design and layout of a dairy farm, poultry house, sheep / goat house, biogas plant, farm fencing system, feed fodder storage structure, familiarization with local storage structures, instruments for measuring environmental parameters; cooling load and moisture condensation in agricultural buildings; cost estimation of a farm buildings; visit to water treatment and community sanitation systems.

PFE 303 DRYING AND STORAGE ENGINEERING SEM VI
3 (2+1)

Theory

Importance of moisture content and EMC and methods of their determination, EMC curve and models, principle of drying, theory of diffusion, periods of drying, thin layer, deep bed and their analysis, critical moisture content, drying models, calculation of drying air temperature and air flow rate, air pressure within the grain bed, Shred's and Hukill's curve, different methods of drying; dryers: performance, energy utilization pattern and efficiency, types and causes of spoilage in storage, storage of perishable products, functional requirements of storage, control of temperature and relative humidity inside storage, calculation of refrigeration load; air movement inside the storage; storage of grains: destructive agents, respiration of grains, moisture and temperature changes in stored grains; natural ventilation inside storage, mechanical ventilation, artificial drying, traditional and modern grain storage structures; storage of seeds, hermetically sealed and air-cooled storages-refrigerated, controlled atmosphere, modified atmospheric and frozen storages; economic aspects of storage.

Practical

Study of mechanics of bulk solids affecting cleaning, drying and storage of grains; measurement of moisture content, relative humidity and air velocity during drying and aeration; drying characteristic and determination of drying constant; determination of EMC and ERH; study of various types of dryers; study the effect of relative humidity and temperature on grains stored in gunny bags; design and layout of commercial bag and bulk storage facilities; study of different domestic storage structures; visits to commercial handling and storage facilities for grains.

PFE 304 PROTECTED CULTIVATION AND POST-HARVEST TECHNOLOGY SEM V/IX
2 (1+1)
(For B.Sc. (Hons.) Agriculture)

Theory

Green house technology: introduction, types of green houses; plant response to green house environment, planning and design of greenhouses, design criteria of greenhouse for cooling and heating purposes; green house equipment, materials of construction for traditional and low cost green houses; irrigation systems used in greenhouses, typical applications, passive solar green house, hot air green house heating systems, greenhouse drying; cost estimation and economic analysis; choice of crops for cultivation under greenhouses, problems/constraints of greenhouse cultivation and future strategies; growing media, soil culture, type of soil required, drainage, flooding and leaching, soil pasteurization in peat moss and mixtures, rock wool and other inert media, nutrient film technique (NFT)/hydroponics; threshing, threshers for different crops, parts, terminology, care and maintenance; winnowing, manual and power operated winnowers, care and maintenance; groundnut decorticators, hand operated and power operated decorticators, principles of working, care and maintenance; maize shellers and castor shellers; drying, grain drying, types of drying, types of dryers; storage, grain storage, types of storage structures; fruits and vegetables cleaning, machinery for cleaning of fruits and vegetables, care and maintenance; grading, methods of grading, equipment for grading of fruits and vegetables, care and maintenance; size reduction, equipment for size reduction care and maintenance; evaporation, principle, types of evaporators, quality standards: FAQ, ASTA, FPO, FDA.

Practical

Study of different types of green houses based on shape, construction and cladding materials; calculation of air rate exchange in an active summer, winter cooling system; calculation of rate of air exchange in an active winter cooling system; estimation of drying rate of agricultural products inside green house; testing of soil and water to study its suitability for growing crops in greenhouses; the study of fertigation requirements for greenhouses crops and estimation of E.C. in the fertigation solution; the study of various growing media used in raising of greenhouse crops and their preparation and pasteurization/sterilization; visit to commercial green houses; study of threshers, their components, operation and adjustments; winnowers, their components, operation and adjustments; study of different components of groundnut decorticator; study of maize shellers; study of castor shellers; study of improved grain storage structure; study of dryers; study of cleaners and graders.

PFE 305 **RENEWABLE ENERGY** **SEM VI/X**
(For B.Sc. (Hons.) Agriculture) **2 (1+1)**

Theory

Energy sources: introduction, classification, energy from biomass, types of biogas plants, constructional details, biogas production and its utilization, agricultural wastes, principles of combustion, pyrolysis and gasification, types of gasifiers, producer gas and its utilization; briquettes: types of briquetting machines, uses of briquettes, shredders; solar energy: solar flat plate and focusing plate collectors, solar air heaters, solar space heating and cooling, solar energy applications/solar energy gadgets, solar cookers, solar water heating systems, solar grain dryers, solar refrigeration system, solar ponds, solar photo voltaic systems, solar lantern, solar street lights, solar fencing, solar pumping systems; wind energy: types of wind mills, constructional details and application of wind mills; liquid biofuels, bio diesel and ethanol from agricultural produce, its production and uses.

Practical

Constructional details of KVIC and Janta type biogas plants; constructional details of Deen Bandhu type biogas plants; field visit to biogas plants; constructional details of different types of gasifiers; testing of gasifiers; briquette preparation from biomass; study and efficiency of solar cooker; study and performance of a solar still; study and performance of a solar dryers; study and working of solar photovoltaic pumping system; study and performance evaluation of domestic solar water heater; study and performance evaluation of solar lantern; study and performance evaluation of solar street light; study and performance of different types of wind mills; field visit to wind mills; study of processing of bio-diesel production from jatropha.

PFE 390/ **SUMMER TRAINING-I** **SEM V**
FMPE 390/ **3 (0+3)**
SWE 390

Exposure to industrial and institutional applications in selected fields of interest (Farm Machinery and Power, Food Processing, Soil and Water Engineering, Information Technology etc,); training report preparation and presentation (students will be required to undergo training of about 4 weeks during the summer break after 2nd year).

PFE 391/ FMPE 391/ SWE 391 **UNDERGRADUATE SEMINAR** **SEM VI 1 (0+1)**

Topic selection, material collection, slide preparation, presentation and interaction.

PFE 401 **FOOD PROCESSING PLANT DESIGN AND LAYOUT** **SEM VII 3 (2+1)**

Theory

Meaning and definition of plant layout; objectives and principles of layout; types of layout; salient features of processing plants for cereals, pulses oilseeds, horticultural and vegetable crops, poultry, fish and meat products, milk and milk products; location selection criteria, selection of processes, plant capacity, project design, flow diagrams, selection of equipments, process and controls, handling equipments, plant layout, plant elevation, requirement of plant building and its components, labour requirement, plant installation, power and power transmission, sanitation; cost analysis, preparation of feasibility report; quantitative analysis for plant layout: engineering economy; common problems in plant layout and process scheduling; practical layout, common materials of construction of food plant, building; maintenance of food plant building, cleaning and sanitization.

Practical

Planning, visit and layout of flour milling plant, rice milling plant, milk plant, bakery plant, fruits and vegetable dehydration plant, beverages industry, edible of extraction plant, ice-cream plant, sugar mill plant, honey/turmeric/ chili processing plant.

PFE 402 **FOOD PACKAGING TECHNOLOGY** **SEM VII 3 (2+1)**

Theory

Factors affecting shelf life of food material during storage; spoilage mechanism during storage; definition, requirement, importance and scope of packaging of foods; types and classification of packaging system; advantage of modern packaging system; different types of packaging materials used; different forms of packaging, metal container, glass container, plastic container, flexible films, shrink packaging, vacuum and gas packaging; packaging requirement and their selection for the raw and processed foods; advantages and disadvantages of these packaging materials; effect of these materials on packed commodities; package testing, printing, labeling and lamination; economics of packaging; performance evaluation of different methods of packaging food products; their merits and demerits; scope for improvements; disposal and recycle of packaging waste.

Practical

Identification of different types of packaging materials; determination of tear, tensile strength, compressive and burst strength of given package; destructive and non-destructive tests for glass containers; vacuum packaging of agricultural produces; measurement of thickness of packaging materials; determination of water-vapour transmission rate; shrink wrapping of various horticultural produce; testing of grease and chemical resistance of packaging materials; determination of drop test of food package.

PFE 403 **DESIGN AND MAINTENANCE OF GREENHOUSE** **SEM VII 3 (2+1)**

Theory

History and types of greenhouse; importance, function and features of green house; scope and development of green house technology; location, planning and various component of greenhouse; design criteria and calculation; constructional material and methods of construction; covering materials and its characteristics, solar heat transfer, solar fraction for green house, steady state analysis of green house; greenhouse heating, cooling, and ventilation systems; instrumentation and computerized environmental control systems; applications of green house and its repair and maintenance; cost analysis of greenhouse production.

Practical

Study of a functional green house; planning and layout of green house and associated utilities; material selection for the construction of green house; measurement of temperature using thermometer, thermistor and thermocouples inside the green house; measurement of humidity and air velocity using various methods; measurement of solar radiations inside the green house; application of psychrometric charts; estimation of cooling requirements in a green house; estimation of ventilation requirements; thermal performance of green house; application of data loggers for simultaneous estimation and control of different parameters like temperature, RH, solar radiations etc.; calculations of environment indices inside a green house; structural analysis of green house; economic analysis of green house; visit to a commercial green house.

PFE 410 **HANDS ON TRAINING IN PROCESSING OF AGRICULTURAL PRODUCE** **SEM VIII 3 (0+3)**

Practical

Agro-processing, food product development, setting up of model plants for food processing and value addition, processing and packaging of selected grains, fruits and vegetables.

PFE 411 **PROJECT ON PROCESSING AND FOOD ENGINEERING - I** **SEM VII 3 (0+3)**

Practical

Identification, planning and formulation of the problem, review of literature, initiation of work and presentation.

PFE 412 **PROJECT ON PROCESSING AND FOOD ENGINEERING - II** **SEM VIII 3 (0+3)**

Practical

Field / lab studies, project report writing and presentation

PFE 490/ FMPE 490/ SWE 490 **SUMMER TRAINING - II** **SEM VII 3 (0+3)**

Exposure to an environment in which students are expected to be associated in their future career, preparation of training report on technical aspects of the training and presentation (students will be required to undergo training of about 4 weeks during the summer break after 3rd year).

SOIL AND WATER ENGINEERING

Course No.	Course Title	Credits	Semester
Core Courses			
SWE 201	Watershed Hydrology	3 (2+1)	III
SWE 202	Soil and Water Conservation Engineering	3 (2+1)	IV
SWE 203	Irrigation Engineering	3 (2+1)	IV
SWE 301	Groundwater Engineering and Pumping Systems	3 (2+1)	V
SWE 302	Drainage Engineering	3 (2+1)	VI
SWE 303	Soil and Water Conservation Structures	3 (2+1)	VI
SWE 304	Fundamentals of Soil and Water Conservation Engineering **(For B.Sc. (Hons.) Agriculture)**	3 (2+1)	V/IX
SWE 390/ FMPE 390/ PFE 390	Summer Training - I	3 (0+3)	V
SWE 391/ FMPE 391/ PFE 391	Undergraduate Seminar	1 (0+1)	VI
SWE 401	Micro Irrigation System Design	3 (2+1)	VII
SWE 410	Hands on Training in Water Resources Planning, Development and Management	3 (0+3)	VIII
SWE 490/ FMPE 490/ PFE 490	Summer Training-II	3 (0+3)	VII
	Total Credits	**34 (16+18)**	
Elective Courses/Package			
SWE 402	Remote Sensing and GIS Applications	3 (2+1)	VII
SWE 403	Watershed Planning and Management	3 (2+1)	VII
SWE 411	Project on Soil and Water Engineering - I	3 (0+3)	VII
SWE 412	Project on Soil and Water Engineering - II	3 (0+3)	VIII
	Total Credits	**12 (4+8)**	

SWE 201 **WATERSHED HYDROLOGY** **SEM III**
3 (2+1)

Theory

Hydrologic cycle; precipitation-forms, rainfall measurement, mass curve, hyetograph, mean rainfall depth, frequency analysis of point rainfall, plotting position, estimation of missing data, test for consistency of rainfall records; initial loss, interception, depression storage, infiltration, evaporation; surface runoff: estimation of peak runoff rate and volume, rational method, Cook's method, SCS curve number method; hydrograph, components, base flow separation; unit hydrograph theory, unit hydrograph of different durations, dimensionless unit hydrograph; distribution hydrograph, synthetic unit hydrograph, uses and limitations of unit hydrograph; head water flood control: methods, retards and their location; introduction to flood routing; hydrology of dry land areas, drought and its classification; introduction to watershed management and planning.

Practical

Visit to meteorological observatory; study of different types of rain gauges; exercise on analysis of rainfall data; double mass curve technique; determination of average depth of rainfall and frequency analysis; study of stage recorders and current meters; exercise on estimation of peak runoff rate, runoff volume, unit hydrograph and flood routing.

SWE 202 SOIL AND WATER CONSERVATION ENGINEERING SEM IV 3 (2+1)

Theory

Soil erosion: causes, types and agents of soil erosion; water erosion: forms of water erosion, mechanics of erosion; gullies and their classification, stages of gully development; soil loss estimation: universal soil loss equation and modified soil loss equation; erosion control measures, agronomical measures: contour farming, strip cropping, mulching; engineering measures, terraces: level and graded broad base terraces and their design, bench terraces and their design, layout procedure, terrace planning, bunds: contour bunds, graded bunds and their design; gully and ravine reclamation: principles of gully control, vegetative and temporary structures; wind erosion: factors affecting wind erosion, mechanics of wind erosion, soil loss estimation, wind erosion control measures: vegetative, mechanical measures, wind breaks and shelter belts, sand dunes stabilization; land use capability classification; grassed water ways and their design; introduction to water harvesting techniques.

Practical

Study of soil loss measurement techniques; study of details of Coshocton wheel and multi-slot runoff samplers; determination of sediment concentration through oven dry method; problem on universal soil loss equation; design of vegetative waterways; design of contour bunding system; design of graded bunding system; design of various types of bench terracing systems; design of shelter belts and wind breaks.

SWE 203 IRRIGATION ENGINEERING SEM IV 3 (2+1)

Theory

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; water conveyance: design of irrigation field channels; underground pipe conveyance system, irrigation structures, channel lining; land grading, land leveling design methods and estimation of earth work and cost; soil water plant relationship: soil water movement, infiltration, evapotranspiration, soil moisture constants, depth of irrigation, frequency of irrigation, irrigation efficiencies; surface irrigation methods of water application: border, check basin and furrow irrigation; sprinkler and drip irrigation method: merits, demerits, selection and design.

Practical

Measurement of soil moisture by different soil moisture measuring instruments; measurement of irrigation water; measurement of infiltration rate; computation of evapotranspiration; design of underground pipe line system; measurement of advance and recession in border irrigation and estimation of irrigation efficiency; measurement of advance and recession in furrow irrigation and estimation of irrigation efficiency;

measurement of uniformity coefficient of sprinkler irrigation method; measurement of emission uniformity of drip irrigation method.

SWE 301 GROUNDWATER ENGINEERING AND PUMPING SYSTEMS SEM V 3 (2+1)

Theory

Occurrence and movement of ground water, aquifer and its types, classification of wells, fully penetrating tubewells and open wells, familiarization of various types of bore wells, design of open well; groundwater exploration techniques; methods of drilling of wells: percussion, rotary, reverse rotary; design of tubewell and gravel pack, installation of well screen, completion and development of well; groundwater hydraulics-determination of aquifer parameters by different method such as Theis, Jacob and Chow's, Theis recovery method; well interference, multiple well systems, estimation of ground water potential, quality of ground water; artificial groundwater recharge planning; pumping systems: water lifting devices; different types of pumps, classification of pumps, component parts of centrifugal pumps, priming, pump selection, installation and trouble shooting, performance curves, effect of speed on capacity, head and power, effect of change of impeller dimensions on performance characteristics; hydraulic ram, propeller pumps, mixed flow pumps and their performance characteristics; deep well turbine pump and submersible pump.

Practical

Verification of Darcy's law; study of different drilling equipments; sieve analysis for gravel and well screens design; estimation of specific yield and specific retention; testing of well screen; measurement of water level and drawdown in pumped wells; estimation of aquifer parameters by Theis method, Coopers-Jacob method, Chow method, Theis recovery method; well design under confined and unconfined conditions; well losses and well efficiency; estimating ground water balance; study of artificial ground water recharge structures; study of radial flow and mixed flow centrifugal pumps, multistage centrifugal pumps, turbine, propeller and other pumps; installation of centrifugal pump; testing of centrifugal pump and study of cavitation problems.

SWE 302 DRAINAGE ENGINEERING SEM VI 3 (2+1)

Theory

Water logging: causes and impacts; drainage: objectives of drainage, familiarization with the drainage problems of the state, surface drainage coefficient, types of surface drainage; sub-surface drainage: purpose and benefits; investigations of design parameters: hydraulic conductivity, drainable porosity, water table; design of surface drains, interceptor and relief drains; derivation of Hooghoudt's and Ernst's drain spacing equations; design of subsurface drainage system; drainage materials: drainage pipes, drain envelope; layout, construction and installation of drains; drainage structures; vertical drainage; bio-drainage; mole drains; salt balance, reclamation of saline and alkaline soils, leaching requirements; conjunctive use of fresh and saline water.

Practical

In-situ measurement of hydraulic conductivity; determination of drainage coefficient; installation of piezometer and observation well; preparation of iso-bath and iso-bar maps; measurement of hydraulic conductivity and drainable porosity; design of surface drainage

systems; design of subsurface drainage systems; determination of chemical properties of soil and water; determination of gypsum requirement for land reclamation; monitoring of sub-surface drainage system.

SWE 303 SOIL AND WATER CONSERVATION STRUCTURES SEM VI 3 (2+1)

Theory

Classification of structures, functional requirements of soil erosion control structures; specific energy and critical depth; hydraulic jump: advantages of hydraulic jump, energy loss in hydraulic jump; drop spillway: general description, functional use, advantages and disadvantages, structural parts and functions, hydrologic and hydraulic design, free board and wave free board, aeration of weirs, concept of free and submerged flow; structural design of a drop spillway: loads on headwall, variables affecting equivalent fluid pressure, determination of saturation line for different flow conditions, seepage under the structure, creep line theory, uplift pressure estimation, safety against sliding, over turning, crushing and tension; chute spillway: general description and its components; energy dissipaters, design criteria of a SAF stilling basin and its limitations; drop inlet spillway: general description, functional use and design criteria.

Practical

Construction of specific energy and specific force diagram; hydraulic jump parameters; hydraulic design of a straight drop spillway; uplift force and construction of uplift pressure diagram; loads on headwall; stability analysis of a straight drop spillway; design of a SAF energy dissipater; design of drop inlet spillway.

SWE 304 FUNDAMENTALS OF SOIL AND WATER CONSERVATION ENGINEERING (For B.Sc. (Hons.) Agriculture) SEM V/IX 3 (2+1)

Theory

Surveying: survey equipment, chain survey, cross staff, plotting procedure, calculations of area of regular and irregular fields; leveling: leveling equipment, terminology, methods of calculation of reduced levels, types of leveling, contouring; irrigation: classification of projects, flow irrigation and lift irrigation; water lifting devices; pumps: capacity, power calculations; irrigation water measurement: weirs, flumes and orifices; water conveyance systems: open channel and underground pipeline; irrigation methods: border, basin, furrow, drip and sprinkler irrigation systems; soil and water conservation: soil erosion, types and introduction to agronomic and engineering control measures.

Practical

Acquaintance with chain survey equipment, ranging and measurement of offsets, chain triangulation, cross staff survey; plotting of chain triangulation; plotting of cross staff survey; leveling equipment, dumpy level, leveling staff, temporary adjustment and staff reading; differential leveling; profile leveling; contour survey grid method; plotting of contours; study of centrifugal pumping system and irrigation water measurement devices; study of different components of sprinkler irrigation systems; study of different components of drip irrigation systems; uniformity of water application in drip and sprinkler systems; study of soil and water conservation measures.

SWE 390/ FMPE 390/ PFE 390 **SUMMER TRAINING - I** **SEM V 3 (0+3)**

Exposure to industrial and institutional applications in selected fields of interest (Farm Machinery and Power, Food Processing, Soil and Water Engineering, Information Technology etc,); training report preparation and presentation (students will be required to undergo training of about 4 weeks during the summer break after 2nd year).

SWE 391/ FMPE 391/ PFE 391/ **UNDERGRADUATE SEMINAR** **SEM VI 1 (0+1)**

Topic selection, material collection, slide preparation, presentation and interaction.

SWE 401 **MICRO IRRIGATION SYSTEMS DESIGN** **SEM VII 3 (2+1)**

Theory

Past, present and future need of micro-irrigation systems: role of Govt. for the promotion of micro-irrigation in India; merits and demerits of micro-irrigation system; types and components of micro-irrigation system; micro-irrigation system-design, design synthesis, installation, and maintenance; sprinkler irrigation: types, planning factors, uniformity and efficiency, lateral, sub-mains and main line design, pump and power unit selection; drip irrigation: potential, crop suitability; fertigation: fertilizer application criteria, suitability of fertilizer compounds, fertilizer mixing, injection duration, rate and frequency, capacity of fertilizer tank; maintenance of micro-irrigation systems.

Practical

Study of different types of micro-irrigation systems and components; field visit of micro-irrigation system; study of water filtration unit; discharge measurement for different micro-irrigation systems; measurement of water distribution and estimation of uniformity coefficient; study of wetted front and moisture distribution under various types of micro-irrigation system; design of micro-irrigation system for an orchard; design of micro-irrigation system for row crops; design of spray type micro-irrigation system; design of micro-irrigation system for hilly terraced land; study of automation in micro-irrigation system; study of micro-climate inside a polyhouse; study of maintenance and cleaning of different components of various systems; design of sprinkler irrigation system; design of landscape irrigation system.

SWE 402 **REMOTE SENSING AND GIS APPLICATIONS** **SEM VII 3 (2+1)**

Theory

Basic component of remote sensing (RS), advantages and limitations of RS, possible use of RS techniques in assessment and monitoring of land and water resources; electromagnetic spectrum, energy interactions in the atmosphere and with the Earth's surface; major atmospheric windows; principal applications of different wavelength regions; typical spectral reflectance curve for vegetation, soil and water; spectral signatures; different types of sensors and platforms; contrast ratio and possible causes of low contrast; aerial

photography; types of aerial photographs, scale of aerial photographs, planning aerial photography: end lap and side lap; stereoscopic vision, requirements of stereoscopic photographs; airphoto interpretation: interpretation elements; photogrammetry: measurements on a single vertical aerial photograph, measurements on a stereopair: vertical measurements by the parallax method; ground control for aerial photography; satellite remote sensing, multispectral scanner: whiskbroom and pushbroom scanner; different types of resolutions; analysis of digital data- image restoration; image enhancement, information extraction, image classification, unsupervised classification, supervised classification, important consideration in the identification of training areas: vegetation indices; microwave remote sensing.

Practical

Familiarization with remote sensing and GIS hardware; use of software for image interpretation; interpretation of aerial photographs and satellite imagery; basic GIS operations such as image display; study of various features of GIS software package; scanning, digitization of maps and data editing; data base query and map algebra. GIS supported case studies in water resources management.

SWE 403 WATERSHED PLANNING AND MANAGEMENT SEM VII 3 (2+1)

Theory

Watershed management: problems and prospects; watershed based land use planning, watershed characteristics: physical and geomorphologic, factors affecting watershed management, hydrologic data for watershed planning; watershed delineation, delineation of priority watershed; water yield assessment and measurement from a watershed; hydrologic and hydraulic design of earthen embankments and diversion structure; sediment yield estimation and measurement from a watershed and sediment yield models; rainwater conservation technologies: in-situ and storage, design of water harvesting tanks and ponds; water budgeting in a watershed; effect of cropping system, land management and cultural practices on watershed hydrology; evaluation and monitoring of watershed programmes; peoples participation in watershed management programmes; planning and formulation of project proposals; cost benefits analysis of watershed programmes; case studies.

Practical

Study of watershed characteristic; analysis of hydrologic data for watershed management; delineation of watershed and measurement of area under different vegetative and topographic conditions; measurement of water and sediment yield from watershed; study of different watershed management structures; study of various water budget parameters; study of watershed management technologies; preparation of a techno-economically effective project proposal.

SWE 410 HANDS ON TRAINING IN WATER RESOURCES PLANNING, DEVELOPMENT AND MANAGEMENT SEM VIII 3 (0+3)

Practical

Farm planning and development of irrigation and drainage projects; watershed project formulation; design of water harvesting and recycling systems maintenance; operation of wells and pumps.

SWE 411	**PROJECT ON SOIL AND WATER ENGINEERING - I**	**SEM VII** **3 (0+3)**

Practical

Identification, planning and formulation of the problem, review of literature, initiation of work and presentation.

SWE 412	**PROJECT ON SOIL AND WATER ENGINEERING - II**	**SEM VIII** **3 (0+3)**

Practical

Field / lab studies, project report writing and presentation.

SWE 490/ FMPE 490/ PFE 490	**SUMMER TRAINING-II**	**SEM VIII** **3 (0+3)**

Exposure to an environment in which students are expected to be associated in their future career, preparation of training report on technical aspects of the training and presentation (students will be required to undergo training of about 4 weeks during the summer break after 3rd year).

CIVIL ENGINEERING (SECTION OF BASIC ENGINEERING)

Course No.	Course Title	Credits	Semester
CE 101	Surveying and Leveling	3 (1+2)	I
CE 102	Engineering Mechanics	3 (2+1)	II
CE 201	Strength of Materials	3 (2+1)	III
CE 202	Fluid Mechanics	3 (2+1)	IV
CE 301	Soil Mechanics	3 (2+1)	V
CE 302	Design of Structures	3 (2+1)	VI
	Total	**18 (11+7)**	

CE 101 SURVEYING AND LEVELING SEM I
3 (1+2)

Theory

Surveying: importance, classification of surveying, basic principles of surveying, linear measurements, chain surveying; compass surveying; errors in measurement, their elimination and corrections; plane table surveying; leveling, contouring; computation of area and volume; theodolite traversing: elements of simple circular curve and setting out of simple circular curves.

Practical

Chain survey of an area and preparation of map; compass survey of an area and plotting of compass survey; plane table surveying; leveling: L-section and X-sections and their plotting; contour survey of an area and preparation of contour map; computation of area; introduction of software in drawing contours; theodolite surveying; ranging, height of object; setting out curves by theodolite; use of minor instruments.

CE 102 ENGINEERING MECHANICS SEM II
3 (2+1)

Theory

Applications of engineering mechanics, basic concepts of force systems, free body diagram, equilibrium of forces; centroid, moment of inertia; frictional forces; analysis of simple trusses using methods of joints, methods of sections and graphical method; simple plane and complex stresses; shear force and bending moment diagrams; bending and shear stresses in beams; torsion in shafts.

Practical

Problems on composition and resolution of forces, moments of forces, couples, centroid of simple and composite areas; problems on moment of inertia; equilibrium of concurrent–coplanar and nonconcurrent–coplanar force systems; simple problems involving frictional forces; analysis of simple trusses by method of joints, method of sections and by graphical method; problems relating to simple stresses and strains; shear force and bending moment diagrams of beams; bending and shear stresses in simple beams; computation of torsional stresses in shafts; problems related to plane and complex stresses.

CE 201 **STRENGTH OF MATERIALS** **SEM III**
3 (2+1)

Theory

Slope and deflection of beams using integration techniques, moment area method and conjugate beam method; columns and struts; riveted and welded connections; stability of masonry dams; analysis of statically indeterminate beams: propped beams, fixed beams; analysis of continuous beams using three moment theorem and moment distribution method.

Practical

Mechanical behavior of engineering materials under loads: axial tensile, axial compressive, bending, torsion and impact; behavior of closely coiled helical spring in tension and compression; determination of hardness of given specimens; compressive strength of concrete and cement; tensile strength of cement; determination of fineness of cement, determination of fineness modulli of aggregates; measurement of workability of concrete; determination of fatigue strength of a given specimen.

CE 202 **FLUID MECHANICS** **SEM IV**
3 (2+1)

Theory

Fluids: properties, ideal and real fluid; pressure and its measurement, Pascal's law; pressure forces on plane and curved surfaces, centre of pressure; buoyancy, metacentre and metacentric height, stability of submerged and floating bodies; kinematics: Lagrangian and Eulerian methods, continuity equation, path lines, streak lines and stream lines, stream function, velocity potential and flow net, types of fluid flow, translation, rotation, circulation and vorticity, vortex motion; dynamics: Bernoulli's theorem, venturimeter, orifice-meter and nozzle, siphon, stress-strain relationships in laminar flow, flow between infinite parallel fixed and moving plates; laminar and turbulent flow in pipes; minor and major hydraulic losses; Moody's diagram, network of pipes; dimensional analysis and similitude- Rayleigh's method and Buckingham's π theorem, similarities, dimensional analysis, dimensionless numbers; introduction to fluid machinery and power transmission.

Practical

Study of manometers, pressure gauges and current meters; verification of Bernoulli's theorem; determination of coefficient of discharge of venturimeter, orifice meter, mouth piece and notches; determination of hydraulic coefficients for orifice; determination of coefficient of friction in pipeline; measurement of force exerted by water-jet on vanes; determination of metacentric height; efficiency of hydraulic ram; performance evaluation of Pelton and Francis turbines; velocity distribution in open channels and determination of Manning's roughness coefficient.

CE 301 **SOIL MECHANICS** **SEM V**
3 (2+1)

Theory

Soil's three phase diagram, engineering and index properties; classification of soils, general classification based on particle size, textural classification and I.S. soil classification system; stress condition in soils, effective and neutral stress, elementary concept of Bousinesque and Westerguards analysis, Newmark influence chart; effective stress principle; shear strength:

Mohr stress circle, relationship between principle stresses, Mohr, Coloumb, Mohr-Coloumb and effective Mohr-Coloumb failure theory,. determination of shear parameters by direct shear, triaxial test and various other tests, numerical exercise based on various types of tests; compaction: standard and modified Proctor compaction test, Abbot compaction and Jodhpur mini compaction test, field compaction method and control; consolidation of soil: Terzaghi's one dimensional consolidation and spring analogy theory, laboratory consolidation test: calculation of void ratio and coefficient of volume change, Taylor's and Casagrande's method, determination of coefficient of consolidation; earth pressure: plastic equilibrium in soils, active and passive states, Rankine's theory of earth pressure, active and passive earth pressure for cohesive soils, simple numerical exercise; stability of slopes: introduction to stability analysis of infinite and finite slopes, friction circle, Swedish circle method, Taylor's stability number.

Practical

Determination of water content of soil by oven drying method; specific gravity of soil by pycnometer method; field density of soil by core cutter method and sand replacement method; grain size analysis by sieving and by hydrometer method; determination of plastic limit and liquid limit; permeability of given soil by constant head method and variable head method; study of compaction properties by standard proctor test; determination of shear parameters of soil by direct shear test, unconfined compressive strength test and triaxial test; study of consolidation properties of soils.

CE 302 DESIGN OF STRUCTURES SEM VI
3 (2+1)

Theory

Basic design concepts; different types of loads and use of BIS Codes (IS800 and IS456); design of steel connections; design of structural steel members in tension, compression and bending; design of steel roof truss; analysis and design of singly and doubly reinforced concrete beams in flexure, shear, bond and torsion; design of flanged beams, slabs, columns, foundations, retaining walls and silos.

Practical

Design of tension members, compression members and steel beams; design and drawing of steel roof truss; design of singly and doubly reinforced concrete rectangular beams and T-beams; design of one way and two way slabs; design of columns, isolated and combined footings; design and drawing of a simple RCC building; design and drawing of cantilever retaining wall.

ELECTRICAL AND ELECTRONICS ENGINEERING
(SECTION OF BASIC ENGINEERING)

Course No.	Course Title	Credits	Semester
EE 101	Electrical Circuits	3 (2+1)	I
EE 102	Computers Programming and Data Structures	3 (1+2)	II
EE 103	Introductory Database Management Systems	2 (0+2)	II
EE 301	Electrical Machines	3 (2+1)	V
EE 302	Applied Electronics and Instrumentation	3 (2+1)	VI
EE 401	Web Designing and Applications	3 (1+2)	VII
EE 410	Hands on Training in Computer Applications	3 (0+3)	VIII
	Total Credits	**20 (8+12)**	

EE 101 ELECTRICAL CIRCUITS SEM I
3 (2+1)

Theory

Average and effective value of sinusoidal and linear periodic waveforms; independent and dependent sources: loop current and loop equations (mesh current method); node voltage and node equations (nodal voltage method); Network theorems; Thevenin's, Norton's, superposition, reciprocity and maximum power transfer: star- delta conversion; solution of DC circuit by network theorems; sinusoidal steady state response of circuits; instantaneous and average power: power factor, reactive and apparent power; concept and analysis of balanced polyphase circuits; Laplace transform method of finding step response of DC circuits; series and parallel resonance; classification of filters, constant-k filter, m-derived, terminating half network and composite filters.

Practical

Familiarization with the components and equipments used in laboratory; verification of Kirchhoff's current laws; Kirchhoff's voltage laws; Thevenin theorem; Norton's theorem; superposition theorem; reciprocity theorem. studying the sinusoidal response of RL series circuit; sinusoidal response of RC series circuit; step response of RL series circuit; step response of RC series circuit; study of the response of constant-K filters and m-derived filters; study of power consumed in a three-phase circuit.

EE 102 COMPUTER PROGRAMMING AND DATA STRUCTURES SEM II
3 (1+2)

Theory

Introduction to high level language 'c'; primary data types and user defined data types; variables; typecasting, operators, building and evaluating expressions; standard library functions; managing input and output; decision making; branching; looping; array; user defined functions; passing arguments and returning values; recursion; scope and visibility of a variable; string functions; structures and union; pointers; stacks, push/pop operations, queues, insertion and deletion operations; link lists.

Practical

Familiarizing with Turbo C; IDE; building an executable version of C program; debugging a C program; developing and executing simple programs; creating programs using decision making statements and looping statements; using nested control structures; familiarizing

with one and two dimensional arrays; using string functions; developing structures and union; creating user defined functions; passing ; using local, global and external variables; using pointers; implementing stacks; implementing push/pop functions; creating queues; developing linked lists in C language; insertion/deletion in data structures.

EE 103 INTRODUCTORY DATABASE MANAGEMENT SYSTEMS SEM II 2 (0+2)

Practical

Overview of database management system (DBMS); various views of data, data models; introduction to database languages; advantages of DBMS over file processing systems; responsibility of database administrator; introduction to client/server architecture; three levels architecture of database systems; E-R (entity relationship) diagram; mapping constraints; keys; reduction of E-R diagram into tables; SQL commands; DDL; DML; select command; joins and functions; group functions, set functions, working with forms.

EE 301 ELECTRICAL MACHINES SEM V 3 (2+1)

Theory

Electro motive force; reluctance; laws of magnetic circuits; determination of ampere-turns for series and parallel magnetic circuits; hysteresis and eddy current losses; transformer: principle of working, construction of single phase transformer, EMF equation, phasor diagram on load, leakage reactance, transformer on load, equivalent circuit, voltage regulation, power and energy efficiency, open circuit and short circuit tests; principles, operation and performance of DC machine (generator and motor); EMF and torque equations, armature reaction, commutation, excitation of DC generator and their characteristics, DC motor characteristics, starting of shunt and series motor; starters, speed control methods: field and armature control; polyphase induction motor: construction, operation, equivalent circuit, phasor diagram, effect of rotor resistance, torque equation, starting and speed control methods; single phase induction motor; double field revolving theory, equivalent circuit, characteristics, phase split, shaded pole motors; disadvantage of low power factor and power factor improvement; various methods of single and three phase power measurement; servo, stepper and universal motors.

Practical

Performing open circuit and short circuit tests on a single phase transformer; load characteristics of DC shunt/series /compound generator; characteristics of DC shunt/ series motors; no load test, blocked rotor test, load-test on 3-phase induction motor and plotting the torque v/s speed characteristics; no load and blocked –rotor test, load test on 1-phase induction motor; determining parameters of equivalent circuit drawn on basis of double revolving field theory; plotting torque –speed characteristics of single phase induction motor; visit to industry and power stations.

EE 302 APPLIED ELECTRONICS AND INSTRUMENTATION SEM VI 3 (2+1)

Theory

Semiconductors, p-n junction, V-I characteristics of p-n junction, diode as a circuit element, rectifier, clipper, clamper, voltage multiplier, capacitive filter, diode circuits for OR and AND (both positive and negative logics); bipolar junction transistor; operating point, various

biasing methods (fixed, self, potential divider), classification of (A,B and C) of amplifier, h-parameter model of a transistor, analysis of small signal, CE amplifier, phase shift oscillator; timer IC and its application; analysis of differential amplifiers using transistor, ideal OP-AMP characteristics, linear and non-linear applications of OP-AMP (adder, subtractor, integrator, active rectifier, comparator, differentiator, differential, instrumentation amplifier and oscillator), Zener diode voltage regulator; transistor series regulator, current limiting, OP-AMP voltage regulators; Basic theorem of Boolean algebra; combinational logic circuits(basic gates, SOP rule and K-map); binary ladder D/A converter, successive approximation A/D converter; generalized instrumentation, measurement of displacement, temperature, velocity, force and pressure using potentiometer, resistance thermometer, thermocouples, Bourden tube, LVDT, strain gauge and tacho-generator.

Practical

The p-n junction diode; and its application circuits, transistor characteristics; biasing and its application circuits; IC555 and its application circuits; IC741 and its application circuits; Zener diode regulator circuit; OPAMP voltage regulator and familiarization with various types of transducers.

EE 401 WEB DESIGNING AND APPLICATIONS SEM VII
3 (1+2)

Theory

Hypertext and hyper media; HTTP, HTML and URLs; the standards-HTML, XML, XHTML and the W3C; MIME types, plugins and helper applications; web design planning; website's purpose, specification, creating user profiles, creating website prototypes, quality testing; HTML; the anatomy of an HTML document; marking up for structure and style; basic page markup; absolute and relative links; ordered and unordered lists; embedding images and controlling appearance; table creation and use; frames; nesting and targeting; introduction to Cascading Style Sheets (CSS); website publishing and updating; methods of website popularization; web server performances; security issues; attacks by hackers and viruses, security polices and information backup; firewalls; introduction to XML.

Practical

Creating various types of webpages using HTML with graphical and multimedia contents; projects to create specific websites with desired content.

EE 410 HANDS ON TRAINING IN COMPUTER APPLICATIONS SEM VIII
3 (0+3)

Practical

Use of standard mathematical and statistical packages; use of neural network techniques for practical problems; use of GIS software.

MECHANICAL ENGINEERING
(SECTION OF BASIC ENGINEERING)

Course No.	Course Title	Credits	Semester
ME 101	Workshop Practice	2 (0+2)	I
ME 102	Engineering Drawing	3 (0+3)	I
ME 103	Workshop Technology	3 (2+1)	II
ME 104	Thermodynamics and Heat Engines	3 (2+1)	II
ME 201	Theory of Machines	3 (2+1)	III
ME 202	Heat and Mass Transfer	3 (2+1)	IV
ME 301	Refrigeration and Air Conditioning	3 (2+1)	V
ME 302	Machine Design	3 (2+1)	V
ME 410	Hands on Training in CAD/CAM	3 (0+3)	VIII
	Total Credits	**26 (12+14)**	

ME 101 WORKSHOP PRACTICE SEM I
2 (0+2)

Practical

Plant and shop layout; carpentry tools, materials, woods and their characteristics, operations in wood working; preparation of cross halving; lap joint, T-halving joint, mortise and tenor joint; introduction to smithy tools and operations; bending and shaping; jobs on drawing, punching, riveting; introduction to tools and measuring instruments for fitting; jobs on sawing, filing and right angle fitting of MS flat, complex fitting job; operations of drilling, reaming, and threading with tap and dies; introduction to tools and operations in sheet metal work; making different types of sheet metal joints.

ME 102 ENGINEERING DRAWING SEM I
3 (0+3)

Practical

Introduction of drawing scales; principles of orthographic projections; references planes; points and lines in space and traces of lines and planes; auxiliary planes and true shapes of oblique plain surface; true length and inclination of lines; projections of solids; section of solids and interpenetration of solid surfaces; development of surfaces of geometrical solids; isometric projection of geometrical solids; forms of screw threads: bsw, square, metric, representation of threads, bolts, headed counter sunk-stud screws and set screws; butt-hexagonal and square; keys: types, tapers, sunk tapper, hollow saddle, flat saddle round gib head feather and woodruff keys.

ME 103 WORKSHOP TECHNOLOGY SEM II
3 (2+1)

Theory

Welding: types of gas welding- oxy acetylene, oxy hydrogen welding, types of flames, welding techniques and equipment; arc welding: TIG, MIG, plasma arc welding, equipment and tools; casting processes; classification, gravity die, slush and centrifugal casting, casting defects; constructional details of center lathe, accessories, lathe operations and tools used; shapers: constructional details of shaper, classification of shaper, shaper tools and main

operations; types of drilling machines, constructional details of pillar types and radial drilling machines, work holding and tool holding devices, drilling operations, safety measures, drill speed, drill angles and sizes; milling machine: types and classification, constructional details and principles of operation of column and knee type universal milling machines, plain milling cutter, main operations on milling machine, safety measures.

Practical

Introduction to welding equipment, processes tools, their use and precautions; arc welding: lap, butt, tee and corner joints; gas welding: lap, butt and tee Joints; introduction to metal casting equipment, tools and their use; mould making using one-piece pattern, two pieces, sweep and match plate patterns; introduction to machine tools; cutting tools, measuring instruments; jobs on simple turning, face turning step turning, taper turning, drilling and threading; operations on shaper; demonstration of operations on a milling machine, industrial visit.

ME 104 THERMODYNAMICS AND HEAT ENGINES SEM II
3 (2+1)

Theory

Thermodynamics properties: closed and open system, flow and non-flow processes; gas laws: zeroth law of thermodynamics and temperature measurement; first law of thermodynamics: internal energy, work and heat, application in non-flow and steady flow processes; second law: Kelvin-Planck and Claussius statements, reversible process, Carnot cycle, Carnot theorem; entropy: change of entropy in thermodynamics process; pv diagram for a pure substance, triple point and critical point; steam: generation of steam, internal energy and entropy of steam, steam tables and mollier chart, measurement of dryness fraction; classification of boilers, cochran, lancashire, locomotive and Babcock-Wilcox boilers, mountings and accessories; Rankine cycle, desirable properties of working fluid used for power plants; steam engine, saturation curve and missing quantity, governing of simple steam engine; introduction to compound steam engines: otto, diesel and dual cycles, air standard efficiency, mean effective pressure and their comparison; classification of IC engine; measurement of IP, BP and heat balance sheet(not involving combustion)

Practical

Study of boilers and their mountings and accessories; study and test on steam engine; measurement of dryness fraction of steam; study of IC engines including valve timing diagrams of 2 and 4-stroke engines; performance test on 2- cylinder diesel engines; performance test and heat balance test on a diesel engine; to conduct Morse test on multi-cylinder petrol engine; comparison of different temperature measuring methods.

ME 201 THEORY OF MACHINES SEM III
3 (2+1)

Theory

Elements, pairs, kinematics chain, degree of freedom, mechanism, their classification; inversion of mechanisms only four bar chain; velocity, acceleration-graphical method; gears, types, nomenclature, law of gearing, teeth profile, interference/undercutting; simple, compound, reverted, and epicyclic gear trains, analysis by tabular method; flywheel, turning moment diagrams; belts: flat and v-belts, materials, power transmitted, size, centrifugal tension, creep and slip; chain drives- friction, types, laws, pivots and collars; single disc, multiple disc, and cone clutches; governors, watt, porter, proell governors, effect of friction,

terms relating to governor-sensitiveness, stability, hunting, isochronisms; static and dynamic balancing. balancing of rotating masses in one plane. balancing of reciprocating masses; cam-construction of cam profile for radial cam, classification of followers.

Practical

Study of mechanisms; analysis of 4-bar mechanism, slider crank mechanism and their inversions; velocity and acceleration analysis of practical mechanisms; study of gears, gear trains and analysis-tabular method; synthesis of gear trains for a desired speed ratio; study of flywheel and governor action; study of cam profile for a desired follower motion; study on the cam follower demonstration machine for follower displacement as a function of cam rotation angle and phenomenon of follower jump; demonstration of static and dynamic balancing.

ME 202 HEAT AND MASS TRANSFER SEM IV
3 (2+1)

Theory

Modes and basic laws of heat transfer, Fourier equation, thermal resistance; conduction: thermal conductivity of materials, general differential equation of conduction for cartesian co-ordinates only; one dimensional steady state conduction through plane and composite walls, insulation materials, critical thickness of insulation; fins: effectiveness, efficiency; free and forced convection: Newton's law of cooling, heat transfer coefficient in convection, Nusselt number, Newton-Rikhman law; dimensional analysis, useful non dimensional numbers and empirical relationships for free and forced convection: Reynold's number, Prandtl number, Nusselt number, Stantan number; radiation: introduction, absorptive, reflectivity and transmissivity, black body and monochromatic radiation, Planck's law, Stefan-boltzmann law, Kirchhoff's law, grey bodies and emissive power, intensity of radiation; heat exchangers: types, fouling factor, log mean temperature difference, heat exchanger performance, number of transfer units, heat exchanger analysis restricted to parallel and counter flow heat exchangers; diffusion mass transfer, Fick's law, mass transfer coefficients.

Practical

Study of parallel flow and counter flow of heat; study of heat transfer through plane and composite wall for natural convection; study of heat transfer through plane and composite wall for forced convection; emissivity measurement.

ME 301 REFRIGERATION AND AIR CONDITIONING SEM V
3 (2+1)

Theory

Principles of refrigeration, carnot cycle, reversed carnot cycle, coefficient of performance; vapour compression system, advantages, dry saturated vapour after compression, wet vapour after compression; vapour absorption system, advantages, COP, domestic electrolux refrigerator; refrigerant: desirable properties of ideal refrigerant, classification; steam jet refrigeration-working, efficiencies; cold storages, insulation material, defrosting-manual, pressure control, temperature control, water and reverse cycle defrosting method; refrigeration in food industry; thermodynamic properties of moist air, wet bulb temperature and its measurement; psychometric chart: elementary psychometric processes, humidifiers and dehumidifiers; air conditioning: principles, classification and functions of air

conditioning, comfort, industrial, winter, summer, central air conditioning system, physiological principles in air conditioning, air distribution and duct, air conditioning systems, applications of air conditioning.

Practical

Study of vapour compression refrigeration systems; study of vapour absorption (electrolux) refrigeration systems; determination of the coefficient of performance of the refrigeration system; experiment on humidifier for the determination of humidifying efficiency; experiment on dehumidifier for the determination of dehumidifying efficiency; experiment on the COP of a domestic refrigerator; study of a cold storage plant; study of air conditioning unit; determination of the coefficient of performance of air conditioning system; estimation of refrigeration load; estimation of cooling load for air conditioner; estimation of humidification and dehumidification load; design of complete cold storage system.

ME 302 MACHINE DESIGN SEM V
3 (2+1)

Theory

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, stress concentration, fatigue and creep; fits and tolerance; design of threaded fasteners subjected to direct static loads, bolted joints subjected to eccentric loading; design of shafts under torsion and combined bending and torsion; design of keys, muff/sleeve flange couplings; helical and leaf springs; flat belt and V-belt; spur gears, hand levers; selection of antifriction bearings.

Practical

Problems based on load/stress analysis of machine components; problems based on practical application of theories of failure and fatigue and determination of factor of safety, problems on design of shafts, keys and coupling; problems in selection/ design of belts; selection of roller bearings - use of catalogue; problems on design of helical and leaf spring; problems on design of spur gears.

ME 410 HANDS ON TRAINING IN CAD/CAM SEM VIII
3 (0+3)

Practical

CAD-application and utilities, CAD system components, computer hardware for CAD; line generation. points and lines, polygons, filling of polygons, text primitive, other primitives, windowing and clipping, view port, homogeneous transformations, planar and space curves design; analytical and synthetic approaches, parametric and implicit equations, B-spline and Beizer curves, geometric modeling techniques; wire frames, solid modeling; introduction to numerical control, basic components of NC system, NC coordinates and motion control systems; computer numerical control, direct numerical control, combined CNC/DNC, NC machine tools and control units, tooling for NC machines, part programming, punched tape, tape coding and format, manual and computer assisted part programming; industrial visit.