SunRise University

Approved by Govt. of Rajasthan vide Sunrise University Act, 2011
Recognized by UGC Act, 1956 u/s 2 (f)

SYLLABUS OF BACHELOR OF TECHNOLOGY

In the

DEPARTMENT OF AGRICULTURAL ENGINEERING &TECHNOLOGY

Semester-I

Code	Subject	Cr	Hrs./Week			Exam Hrs.	MaximumMarks				
			L	T	P		MS1	MS2	ENDTERM	IA	Total
Theory											
101	EngineeringMathematics-I	3	3	1	0	3	10	10	60	20	100
102	EngineeringPhysics	3	3	1	0	3	10	10	60	20	100
103	CommunicationSkills	3	3	1	0	3	10	10	60	20	100
104	ProgrammingForProblemSolving	3	4	1	0	3	10	10	60	20	100
105	Basic ElectricalEngineering	3	3	1	0	3	10	10	60	20	100
Practicals&Sessionals											
Code	Subject	Cr	Hrs./Week			Exam Hrs.	IA(60%)		EA(40%)		Total
			L	T	P		MP1 30%	MP2 30%			
106	EngineeringPhysicsLab	2	0	0	2	2	30	30	40		100
106	Language Lab	2	0	0	2	2	30	30	40		100
108	ComputerProgrammingLab	2	0	0	2	2	30	30	40		100
109	BasicElectricalLab	2	0	0	2	2	30	30	40		100
110	ComputerAidedEngg.Graphics	2	0	0	3	3	30	30	40		100
	GrandTotal	**26**	**18**	**6**	**11**						**1000**

Semester-II

Code	Subject	Cr	Hrs./Week			Exam Hrs.	MaximumMarks				
			L	T	P		MS1	MS2	ENDTERM	IA	Total
Theory											
201	EngineeringMathematics-II	3	3	1	0	3	10	10	60	20	100
202	EngineeringChemistry	3	3	1	0	3	10	10	60	20	100
203	HumanValues	3	4	1	0	3	10	10	60	20	100
204	BasicMechanical Engineering	3	3	1	0	3	10	10	60	20	100
205	BasicCivilEngineering	2	2	1	0	3	10	10	60	20	100
Practicals&Sessionals											
Code	Subject	Cr	Hrs./Week			Exam Hrs.	IA(60%)		EA(40%)		Total
			L	T	P		MP1 30 %	MP2 30 %			
206	Engineering ChemistryLab	2	0	0	2	2	30	30	40		100
206	HumanValuesActivities	2	0	0	2	2	30	30	40		100
208	ManufacturingPracticeWorkshop	2	0	0	2	2	30	30	40		100
209	BasicCivilEngineering Lab	2	0	0	3	3	30	30	40		100
210	ComputerAidedMachine Drawing	2	0	0	2	2	30	30	40		100
	GrandTotal	**26**	**18**	**06**	**11**						**1000**

Semester-III

Code	Subject	Credit	Hrs./Week			Exam Hrs.	MaximumMarks				
			L	T	P		MT1	MT2	EndTerm	TA	Total
Theory subjects											
3BTCH01	Mathematics -III	3	3	0	0	3	10	10	60	20	100
3BTCH02	Strength of Material	3	3	1	0	3	10	10	60	20	100
3BTCH03	Soil Mechanics	3	3	1	0	3	10	10	60	20	100

3BTCH04	Farm Power	3	3	1	0	3	10	10	60	20	100
3BTCH05	Surveying and Leveling	3	3	1	0	3	10	10	60	20	100
3BTCH06	Engineering properties of Biological Material &Food Quality	3	3	1	0	3	10	10	60	20	100
3BTCH07	Engineering Thermodynamics & Heat engines	3	3	1	0	3	10	10	60	20	100
Practicallaboratorycourses											

Code	**Subject**	**Credit**	**Hrs./Week**			**Exam Hrs.**	**MaximumMarks**				
			L	**T**	**P**		**MP1**	**MP2**	**EndTerm**	**Viva**	**Total**
3BTCH08	Soil Mechanics Lab	2	0	0	2	3	30	30	30	10	100
3BTCH09	Farm Power Lab	2	0	0	2	3	30	30	30	10	100
3BTCH010	Surveying and Leveling Lab	2	0	0	2	3	30	30	30	10	100
3BTCH11	Engineering properties of Biological Material& Food Quality Lab	2	0	0	2	3	30	30	30	10	100
	Grand Total	**29**	**21**	**4**	**8**						**1100**

Semester-IV

Code	Subject	Credit	Hrs./Week			Exam Hrs.	MaximumMarks				
			L	T	P		MT1	MT2	EndTerm	TA	Total
Theorysubjects											
4BTCH01	Heat & mass Transfer	3	3	0	0	3	10	10	60	20	100
4BTCH02	Theory of Machines	3	3	1	0	3	10	10	60	20	100
4BTCH03	Design of structures	3	3	0	0	3	10	10	60	20	100
4BTCH04	Watershed hydrology - I	3	3	1	0	3	10	10	60	20	100
4BTCH05	Fluid Mechanics	3	3	1	0	3	10	10	60	20	100
4BTCH06	Crop Process Engineering	3	3	1	0	3	10	10	60	20	100
4BTCH07	Agriculture for Engineers	3	3	1	0	3	10	10	60	20	100
Practicallaboratorycourses											
Code	**Subject**	**Credit**	**Hrs./Week**			**Exam Hrs.**	**MaximumMarks**				
			L	**T**	**P**		**MP1**	**MP2**	**EndTerm**	**Viva**	**Total**
4BTCH08	Watershed Hydrology -I Lab	2	0	0	2	3	30	30	30	10	100
4BTCH09	Crop Process Engineering Lab	2	0	0	2	3	30	30	30	10	100
	Grand Total	**25**	**21**	**4**	**8**						**900**

Semester-V

Code	Subject	Credit	Hrs./Week			Exam Hrs.	MaximumMarks				
			L	T	P		MT1	MT2	EndTerm	TA	Total
Theory subjects											
5BTCH01	Workshop Technology	3	3	1	0	3	10	10	60	20	100
5BTCH02	Machine Design	3	3	1	0	3	10	10	60	20	100
5BTCH03	Electrical Machine & Power utilization	3	3	1	0	3	10	10	60	20	100
5BTCH04	Farm Machinery & Equipment	3	3	0	0	3	10	10	60	20	100
5BTCH05	Ground Water, Wells & Pumps	3	3	1	0	3	10	10	60	20	100
5BTCH06	Drying & Storage Engineering	3	3	1	0	3	10	10	60	20	100
5BTCH07	Soil & water Conservation Engg.	3	3	1	0	3	10	10	60	20	100
Practicallaboratorycourses											
Code	**Subject**	**Credit**	**Hrs./Week**			**Exam Hrs.**	**MaximumMarks**				
			L	**T**	**P**		**MP1**	**MP2**	**EndTerm**	**Viva**	**Total**
5BTCH08	Farm Machinery & Equipment Lab	2	0	0	2	3	30	30	30	10	100
5BTCH09	Ground Water, Wells & Pumps Lab	2	0	0	2	3	30	30	30	10	100
5BTCH10	Drying & storage engineering Lab	2	0	0	2	3	30	30	30	10	100
5BTCH11	Soil & Water conservation Engineering Lab	2	0	0	2	3	30	30	30	10	100
	Grand Total	**29**	**21**	**4**	**8**						**1100**

Semester-VI

Code	Subject	Credit	Hrs./Week			Exam Hrs.	MaximumMarks				
			L	T	P		MT1	MT2	EndTerm	TA	Total
Theory subjects											
6BTCH01	Agricultural Structure & Environmental Control	3	3	1	0	3	10	10	60	20	100
6BTCH02	Refrigeration & Air conditioning	3	3	1	0	3	10	10	60	20	100
6BTCH03	Transfer Process in Food Engineering	3	3	1	0	3	10	10	60	20	100
6BTCH04	Tractor systems & controls	3	3	0	0	3	10	10	60	20	100
6BTCH05	Machine drawings & Computer graphics	3	3	1	0	3	10	10	60	20	100
6BTCH06	Irrigation and Drainage Engineering -I	3	3	1	0	3	10	10	60	20	100
6BTCH07	Elective-I	3	3	1	0	3	10	10	60	20	100
Practicallaboratorycourses											
Code	**Subject**	**Credit**	**Hrs./Week**			**Exam Hrs.**	**MaximumMarks**				
			L	**T**	**P**		**MP1**	**MP2**	**EndTerm**	**Viva**	**Total**
6BTCH08	Tractors systems & controls Lab	2	0	0	2	3	30	30	30	10	100
6BTCH09	Machine drawing & Computer graphics lab	2	0	0	2	3	30	30	30	10	100
6BTCH10	Irrigation and Drainage Engineering I Lab	2	0	0	2	3	30	30	30	10	100
	Grand Total	**27**	**21**	**4**	**8**						**1000**

Semester–VII

Code	Subject	Credit	Hrs./Week			Exam Hrs.	MaximumMarks				
			L	T	P		MT1	MT2	EndTerm	TA	Total
7BTCH01	Irrigation and Drainage Engineering -II	3	3	1	0	3	10	10	60	20	100
7BTCH02	System Engineering	3	3	1	0	3	10	10	60	20	100
7BTCH03	Mechanics of Tillage & Traction	3	3	1	0	3	10	10	60	20	100
7BTCH04	Unit Operation in Dairy and Food Engineering	3	3	0	0	3	10	10	60	20	100
7BTCH05	Watershed Hydrology - II	3	3	0	0	3	10	10	60	20	100
7BTCH06	Industrial Training	3	3	0	0	3	10	10	60	20	100
7BTCH07	Project	3	3	0	0	3	10	10	60	20	100
7BTCH08	Elective-II	3	3	0	0	3	10	10	60	20	100
Code	**Subject**	**Credit**	**Hrs./Week**			**Exam Hrs.**	**MaximumMarks**				
			L	**T**	**P**		**MP1**	**MP2**	**EndTerm**	**Viva**	**Total**
7BTCH09	Mechanics of Tillage & Traction Lab	2	0	0	2	3	30	30	30	10	100
7BTCH10	Unit Operation in Dairy and Food Engineering Lab	2	0	0	2	3	30	30	30	10	100
	Grand Total	**28**	**24**	**4**	**8**						**1000**

Semester-VIII

Code	Subject	Credit	Hrs./Week			ExamHrs.	MaximumMarks				
			L	T	P		MT1	MT2	EndTerm	TA	Total
Theory subjects											
8BTCH01	Tractor Design & Testing	3	3	1	0	3	10	10	60	20	100
8BTCH02	Food Process and Packaging Technology	3	3	1	0	3	10	10	60	20	100
8BTCH03	Watershed planning & Management	3	3	1	0	3	10	10	60	20	100

8BTCH04	Elective – III	3	3	1	0	3	10	10	60	20	100
8BTCH05	Project	3	3	1	0	3	10	10	60	20	100
8BTCH06	Renewable Energy Source	3	3	1	0	3	10	10	60	20	100
Practicallaboratorycourses											
Code	**Subject**	**Credit**	**Hrs./Week**			**Exa mHrs.**	**MaximumMarks**				
			L	**T**	**P**		**MP1**	**MP2**	**EndTerm**	**Viva**	**Total**
8BTCH07	Tractor design & testing Lab	4	0	0	2	3	60	60	60	20	100
8BTCH08	Food Process and packaging technology Lab	4	0	0	2	3	60	60	60	20	100
8BTCH09	Seminar	4	0	0	2	3	60	60	60	20	100
	Grand Total	**30**	**18**	**4**	**8**						**900**

DETAILED SYLLABUS

The detailed syllabus for the four year B.Tech programme in Agricultural Engineering course will comprised of papers

101EngineeringMathem atics-I

SN	CONTENTS
1	**Calculus:** Improperintegrals(BetaandGammafunctions)andtheirproperties;Applicationsofdefiniteintegralstoevaluatesurfa
2	**SequencesandSeries:** Convergenceofsequenceandseries,testsforconvergence; Power series, Taylor's series, series for exponential, trigonometric andlogarithmfunctions.
3	**FourierSeries:** Periodic functions, Fourier series, Euler's formula, Change ofintervals,Halfrangesineandcosineseries,Parseval'sth
4	**MultivariableCalculus(Differentiation):** Limit,continuityandpartialderivatives,directionalderivatives,totalderivative;Tangentplaneandnormalline;MaximLagran gemultipliers;Gradient,curland divergence.
5	**MultivariableCalculus(Integration):** Multiple Integration:Double integrals(Cartesian),change oforderof integration in doubleintegrals, Changeof variabland volumes,Centre ofmass and Gravity (constantand variabledensities); Triple integrals(Cartesian),Simple applicationsparallelepipeds;Scalarlineintegrals,vectorlineintegrals,scalarsurfaceintegrals, vectorsurfaceintegrals,TheoremsofGreen,GaussandStokes.

102:EngineeringPhysics

SN	CONTENTS	Hours
1	**WaveOptics:** Newton'sRings,Michelson's Interferometer,FraunhoferDiffraction fromaSingleSlit.Diffractiongrating:Construction,theoryandspectrum , Resolving power and Rayleigh criterionfor limit of resolution,Resolvingpowerofdiffractiongrating,X-RaydiffractionandBragg'sLaw.	9
2	**QuantumMechanics:** Introduction to quantum Mechanics, Wave-particle duality,Matterwaves,Wavefunctionandbasicpostulates,Timedependentandtime independentSchrodinger'sWaveEquation,Physicalinterpretationof wavefunctionanditsproperties,ApplicationsoftheSchrodinger's Equation:Particleinonedimensionalandthreedimensionalboxes.	6
3	**CoherenceandOpticalFibers:** Spatialandtemporalcoherence:Coherencelength;Coherencetimeand'Q'factorforlight,Visibilityasameasureof Coherenceandspectral purity, Optical fiber as optical waveguide, Numerical aperture;Maximumangleofacceptanceandapplicationsofoptical fiber.	4
4	**Laser:** Einstein'sTheoryoflaseraction;Einstein'scoefficients;PropertiesofLaser beam, Amplification of light by populationinversion,Components of laser, Construction and working ofHe-Ne andsemiconductorlasers,ApplicationsofLasersinScience,engineering andmedicine.	6
5	**MaterialScience&SemiconductorPhysics:** Bondinginsolids:covalentandmetallicbonding,Energybandsinsolids: Classification of solids as Insulators, SemiconductorsandConductors, Intrinsicand extrinsicsemiconductors,Fermidiracdistribution function and Fermi energy, Conductivity in semiconductors,HallEffect:Theory, HallCoefficientandapplications.	6
6	**IntroductiontoElectromagnetism:** Divergenceandcurlofelectrostaticfield,Laplace'sandPoisson's equationsforelectrostaticpotential,Bio-Savartlaw,Divergenceand curlofstaticmagneticfield,Faraday'slaw,Displacementcurrent and magneticfieldarisingfromtimedependentelectricfield,Maxwell's equations,FlowofenergyandPoyntingvector.	8
	TOTAL	**40**

03:CommunicationSkills

SN	CONTENTS	Hours
1	**Communication:** Meaning,ImportanceandCycleofCommunication.MediaandTypes ofCommunication. Verbal and Non-Verbal Communication.Barriers tocommunication. Formal and Informal Channels of Communication(Corporate Communication). DivisionsofHumanCommunication andMethods to improve Interpersonal Communication.Qualities of goodcommunication.	6
2	**Grammar:** PassiveVoice. ReportedSpeech. ConditionalSentences. ModalVerbs.LinkingWords(Conjunctions)	6
3	**Composition:** Job Application and Curriculum-Vitae Writing. Business Letter Writing.ParagraphWriting.ReportWriting.	6
4	**ShortStories:** "Luncheon" bySomersetMaugham."HowMuchLandDoesaManNeed?"byCountLeoTolstoy."TheNightTrainatDeoli"byRuskinBond.	6
5	**Poems:** "NoMenareForeign"byJamesKirkup."If"byRudyardKipling."WheretheMind iswithoutFear"byRabindranathTagore.	65
	TOTAL	35

104:ProgrammingforProblemSolving

SN	CONTENTS	Hours
1	**FundamentalsofComputer:** Storedprogramarchitectureofcomputers,Storagedevice-Primary memory,andSecondarystorage,Random,Direct,Sequentialaccess methods,Concepts ofHigh-level,AssemblyandLow-levellanguages,Representingalgorithmsthroughflowchartandpseudocode.	**12**
2	**Numbersystem:** Data representations,Conceptsofradixand representation ofnumbersinradixrwithspecialcasesofr=2,8,10and16with conversionfromradixr1tor2,r'sand(r-1)'scomplement,Binaryaddition,Binarysubtraction,Representationofalphabets.	**12**
3	**CProgramming:** Problemspecification, flowchart, datatypes, assignmentstatements,input outputstatements, developing simple C programs, Ifstatement,forloops,whileloops,do-whileloops,switchstatement, breakstatement,continuestatement,developmentofCprograms using above statements, Arrays, functions,parameter passing, recursion,ProgramminginCusingthesestatements,Structures,files,pointersand multifile handling.	**12**
	TOTAL	**36**

105:BasicElectricalEngineering

SN	CONTENTS	Hours
1	**DCCircuits:** Electricalcircuit elements(R,LandC),voltageandcurrent sources,Kirchhoffcurrentandvoltagelaws,Series-Parallelcircuits,Nodevoltagemethod,Meshcurrentmethod,Superpositio n,Thevenin's,Norton'sandMaximumpowertransfertheorems.	8
2	**ACCircuits:** Representationof sinusoidal waveforms, peak and r.m.s values,phasorrepresentation,realpower,reactivepower,apparentpower,p owerfactor.Analysisofsingle-phaseACcircuitsconsistingofR,L, C,RL,RCandRLCcombinations(seriesandparallel),resonance. Threephasebalancedcircuits,voltageandcurrentrelationsinstar and deltaconnections.	8
3	**Transformers:** Idealandpracticaltransformer,EMFequation,equivalentcircuit,lossesintransf ormers,regulationandefficiency.	6
4	**ElectricalMachines:** Generationofrotatingmagneticfields,Constructionandworkingof athree-phase induction motor, Significance of torque-slipcharacteristic. Starting and speed control of inductionmotor,single-phaseinduction motor. Construction, working, torque-speed characteristicandspeedcontrolofseparatelyexcitedDCmotor. Construction andworkingof synchronousgenerators.	6
5	**PowerConverters:** Semiconductor PN junction diode and transistor (BJT).CharacteristicsofSCR,powertransistorandIGBT .BasiccircuitsofsinglephaserectifierwithRload,SinglephaseInverter,DC-DCconverter.	6
6	**ElectricalInstallations:** LayoutofLTswitchgear:Switchfuseunit (SFU),MCB,ELCB,MCCB,Typeofearthing.Powermeasurement,elementarycal culationsfor energyconsumption.	6
	TOTAL	**40**

106:EngineeringPhysicsLab

1Todeterminethewavelengthofmonochromaticlightwiththehelpof Michelson'sinterferometer.
2. Todeterminethewavelengthofsodiumlightby Newton's Ring.
3. Todeterminethewavelengthofprominentlinesofmercurybyplanediffractiongrating withthehelpof spectrometer.
4. DeterminationofbandgapusingaP-Njunctiondiode.
5. Todeterminetheheightofgivenobjectwiththehelp ofsextant.
6. Todeterminethedispersive powerofmaterialofaprismwiththehelpofspectrometer.
6.Tostudythechargeanddischargeofacondenserandhencedeterminethesameconstant(bothcurrentandv oltagegraphsaretobeplotted.
8. Todeterminethecoherencelengthandcoherencetimeoflaserusing He–Nelaser.
9. Tomeasurethenumericalapertureofanopticalfibre.
10. TostudytheHallEffectanddeterminetheHallVoltageandHallcoefficients.

106:LanguageLab

1. PhoneticSymbols andTranscriptions.
2. Extempore.
3. GroupDiscussion.
4. DialogueWriting.
5. Listeningcomprehension.

108:ComputerProgrammingLab

1. To learn about the C Library, Preprocessor directive, Input-outputstatement.
2. Programstolearndatatype,variables,If-elsestatement
3 Programs tounderstandnestedif-elsestatementandswitchstatement
4. Programstolearniterativestatements likewhileanddo-whileloops
5. Programstounderstandforloopsforiterativestatements
6. Programstolearnabout arrayandstringoperations
6.Programstounderstandsortingandsearchingusingarray
8. Programstolearnfunctions andrecursivefunctions
9. ProgramstounderstandStructureand Union operation
10Programs tolearnPointeroperations
11.ProgramstounderstandFilehandlingoperations
12Programstoinput datathroughCommandlineargument

109:BasicElectricalEngineeringLab

1. Basicsafetyprecautions. Introductionanduseofmeasuringinstruments –voltmeter,ammeter,multi-meter,oscilloscope.Real-liferesistors,capacitorsandinductors.
2. Transformers: Observation of the no-load current waveform on anoscilloscope.Loadingofatransformer:measurementofprimaryandsecondaryvoltagesandcurrents,andpower.
3. Three-phase transformers: Star and Delta connections. Voltage and Current relationships(line-linevoltage,phase-to-neutralvoltage,lineandphase currents).Phase-shifts between the primary andsecondaryside.
4. Demonstrationofcut-outsectionsofmachines:dcmachine(commutator-brusharrangement),inductionmachine(squirrelcagerotor),synchronous machine(fieldwinging-slipringarrangement)andsingle-phaseinductionmachine.
5. TorqueSpeedCharacteristicofseparatelyexciteddcmotor.
6. Demonstrationof(a)dc-dcconverters(b)dc-acconverters–PWMwaveform (c)theuseofdc-acconverterforspeedcontrolofaninduction motorand(d)Components ofLTswitchgear.

110:ComputerAidedEngineeringGraphicsLab

Introduction: Principlesofdrawing,lines,typeoflines,usageof Drawing instruments,lettering,Conic sectionsincluding parabola, hyperbola, Rectangular Hyperbola (General method only); Scales-Plain,DiagonalandVernierScales.
ProjectionsofPoint&Lines: PositionofPoint,NotationSystem,SystematicApproachforprojectionsofpoints,frontview&Topviewofpoint,Positionof straight lines, line parallel to Both the RPs, Lineperpendicular to either of the RPs, LineinclinedtooneRPandparalleltotheother,LineinclinedtoBoththeRPs,Tracesofaline(Onedrawingsheet,oneassignmentinsketchbook).
ProjectionofPlanes: Positionsofplanes,Termsusedinprojectionsofplanes, planeparalleltoRP,planeinclinedtooneRPandperpendiculartotheotherRP,planeperpendiculartoBoththeRPs,planeInclinedtoBoththeRPs,Trueshapeoftheplane,Distanceof apointfromplane,Anglebetweentwoplanes.**ProjectionsofRegularSolids:**frustumandtruncatedsolids,thoseinclinedto both the Planes-AuxiliaryViews.
SectionofSolids: Theoryofsectioning,sectionofprismsandcubes,sectionof pyramidsandTetrahedronsectionofCylinders,sectionofcones,sectionofspheres (Onedrawingsheet,oneassignmentinsketchbook)
OverviewofComputerGraphics: CoveringtheoryofCADsoftware[suchas:Themenu System, Toolbars(standard, Object Properties, Draw, Modify andDimension),DrawingArea(Background,Crosshairs,CoordinateSystem),Dialogboxesandwindows,Shortcutmenus(ButtonBars), CommandLine(whereapplicable),TheStatusBar,Differentmethods ofzoomas usedinCAD,Selectanderaseobjects.:IsometricViewsoflines,Planes,SimpleandcompoundSolids.

201:EngineeringMathematics-II

SN	CONTENTS	Hours
1	**Matrices:** Rankofamatrix,rank-nullitytheorem;Systemoflinearequations; Symmetric,skew-symmetricandorthogonalmatrices; Eigenvaluesand eigenvectors; Diagonalizationof matrices; Cayley-HamiltonTheorem,andOrthogonaltransformation.	10
2	**Firstorderordinarydifferentialequations:** Linearand Bernoulli'sequations,Exact equations,Equationsnotof firstdegree:equationssolvablefor*p*,equationssolvablefor*y*, equations solvable for *x* andClairaut'stype.	6
3	**Ordinarydifferentialequationsofhigherorders:** Linear Differential Equations of Higher order with constant coefficients,SimultaneousLinear DifferentialEquations,Secondorderlineardifferentialequationswithvariablecoefficients: Homogenous andExactforms,onepartofCFisknown,Changeofdependentand independentvariables,methodofvariationofparameters,Cauchy-Eulerequation; PowerseriessolutionsincludingLegendredifferentialequationandBesseldifferentialequations.	12
4	**PartialDifferentialEquations–Firstorder:** OrderandDegree,Formation;LinearPartialdifferentialequationsof First order,Lagrange'sForm,NonLinearPartialDifferentialequationsoffirstorder,Charpit'smethod,Standardforms.	6
5	**PartialDifferentialEquations–Higherorder:** Classification of Second order partial differential equations,Separationofvariablesmethodtosimpleproblemsin Cartesian coordinates including twodimensionalLaplace,onedimensionalHeatandonedimensionalWaveequations.	6
	TOTAL	**40**

202:EngineeringChemistry

SN	CONTENTS	Hours
1	**Water:** Common impurities, hardness, determination of hardness bycomplexometric (EDTAmethod), Degree of hardness,Units of hardness Municipalwatersupply:Requisiteofdrinkingwater,Purificationof water; sedimentation, filtration, disinfection, breakpoint chlorination.Boiler troubles:ScaleandSludgeformation, Internaltreatmentmethods, Priming andFoaming, Boiler corrosion and CausticembrittlementWater softening; Lime-Sodaprocess, Zeolite (Permutit) process, Demineralization process.Numerical problems based onHardness,EDTA,Lime-SodaandZeolite process.	**10**
2	**OrganicFuels:** Solidfuels:Coal,ClassificationofCoal,ProximateandUltimate analysesofcoalanditssignificance,GrossandNetCalorificvalue, Determination of Calorific value of coal byBomb Calorimeter.Metallurgical coke, Carbonization processes; Otto-Hoffmann by-productovenmethod. Liquidfuels:Advantagesofliquidfuels,Mining, Refining and Composition ofpetroleum,Cracking,Syntheticpetrol,Reforming,Knocking, Octanenumber, Anti-knocking agents, Cetanenumber Gaseousfuels;Advantages,manufacturing,compositionandCalorificvalueofcoalgasandoilgas,Determinationofcalorific value of gaseous fuels by Junker'scalorimeter Numericalproblems basedondeterminationofcalorificvalue(bomb calorimeter/Junkerscalorimeter/Dulongs formula, proximate analysis& ultimateandcombustionoffuel.	**10**
3	**Corrosionanditscontrol:** Definitionandsignificanceofcorrosion,Mechanismofchemical(dry)andelectrochemical(wet)corrosion,galvaniccorrosion,concentrationcorrosionandpittingcorrosion. Protection from corrosion; protective coatings-galvanization andtinning,cathodicprotection,sacrificialanodeandmodificationsin design.	**3**
4	**EngineeringMaterials:** PortlandCement; Definition,ManufacturingbyRotarykiln.Chemistryofsettingandhardeningofcement.Role of Gypsum. Glass:Definition,Manufacturingbytankfurnace,significanceofannealing,Types andpropertiesofsoftglass,hardglass,borosilicateglass,glasswool,safetyglass Lubricants: Classification, Mechanism, Properties; Viscosity andviscosity index, flash and fire point, cloud and pour point.	**10**
5	**Organicreactionmechanismandintroductionofdrugs:** Organicreactionmechanism:Substitution; SN1,SN2,Elecrophilicaromatic substitution inbenzene, free radical halogenations of alkanes,Elimination;eliminationinalkylhalides,dehydrationofalcohols,Addition:electrophilicandfreeradicaladditioninalkenes,nucleophilicaddition in aldehyde and ketones, Rearrangement; Carbocation and free radicalrearrangements Drugs:Introduction,Synthesis,propertiesandusesofAspirin,Paracetamol	**6**
	TOTAL	**40**

203: HumanValues

SN	CONTENTS	Hours
1	**CourseIntroduction-Need,BasicGuidelines,ContentandProcessforValueEducation** Understandingtheneed,basicguidelines,SelfExploration-its content and process; 'Natural Acceptance' andExperiential Validation, ContinuousHappinessandProsperity-HumanAspirations,Right understanding,Relationship and Physical Facilities,Understanding HappinessandProsperitycorrectly-Acriticalappraisalofthecurrentscenario. Methodtofulfilltheabovehumanaspirations:understandingandlivinginharmonyatvariouslevels	5
2	**UnderstandingHarmonyintheHumanBeing-HarmonyinMyself**Understandinghumanbeingasaco-existenceofthesentient'I'andthe material'Body' Understanding the needs of Self ('I') and 'Body' - Sukh and Suvidha UnderstandingtheBodyasaninstrumentof'I',Understandingthe characteristicsandactivitiesof'I'andharmonyin'I'Understanding theharmonyofIwiththeBody:SanyamandSwasthya;correctappraisalof Physicalneeds,meaningofProsperityindetail,ProgramstoensureSanyamandSwasthya.	5
3	**UnderstandingHarmonyintheFamilyandSociety-HarmonyinHuman-HumanRelationship** Understanding harmony in the Family, Understanding values in human-humanrelationship;meaningofNyayaandprogramforitsfulfillment to ensure Ubhay-tripti; Trust (Vishwas) and Respect (Samman),meaningofVishwas;Differencebetweenintentionandcompetence,meaningofSamman,Difference between respect and differentiation; theothersalientvaluesinrelationship, harmonyinthesociety,Samadhan,Samridhi,Abhay,Sah-astitvaascomprehensiveHuman Goals,Visualizingauniversalharmonious orderinsociety- Undivided Society(AkhandSamaj),UniversalOrder(SarvabhaumVyawastha)- fromfamilytoworldfamily.	5
4	**UnderstandingHarmonyintheNatureandExistence-WholeexistenceasCoexistence** UnderstandingtheharmonyintheNature.Interconnectednessand mutualfulfillmentamongthefourordersofnature-recyclabilityandself-regulationinnature.UnderstandingExistenceasCo-existence	5
5	**ImplicationsoftheaboveHolisticUnderstandingofHarmonyonProfessionalEthics.Naturalacceptanceofhumanvalues**DefinitivenessofEthicalHumanConduct.BasisforHumanistic Education, Humanistic Constitution andHumanistic Universal Order. Competence in Professional Ethics: a) Ability to utilize the professional competence foraugmentinguniversalhumanorder, b)Abilitytoidentifythescopeandcharacteristicsofpeople-friendly andeco-friendlyproductionsystems,technologiesandmanagementmodels.Strategyfortransitionfromthepresentstatetouniversalhuman Order:Atthelevelof individual:associallyandecologicallyresponsibleengineers,technologistsandmanagers. Casestudies relatedtovalues inprofessionallifeandindividuallife.	5
	TOTAL	**25**

204:BasicMechanicalEngineering

SN	CONTENTS	Hours
1	**Fundamentals:** Introductiontomechanicalengineering,conceptsofthermalengineering,mechanicalmachine design,industrial engineering andmanufacturingtechnology. Steam Boilersclassificationandtypesofsteam boilersandsteamturbines.IntroductionandClassificationofpowerplants.	6
2	**PumpsandICEngines:** Applicationsand working ofReciprocating and Centrifugalpumps.Introduction, Classification ofICEngines,Main ComponentsofICEngines,WorkingofICEnginesanditscomponents.	6
3	**RefrigerationandAirConditioning:** Introduction,classificationandtypesofrefrigerationsystemsand air-conditioning.Applications ofrefrigerationandAir-conditioning.	6
4	**TransmissionofPower:** IntroductionandtypesofBelt andRopeDrives,Gears.	6
5	**PrimaryManufacturingProcesses:** MetalCastingProcess:IntroductiontoCastingProcess,Patterns,Molding, Furnaces. Metal Forming Processes: Introduction toForging,Rolling, Extrusion, Drawing. Metal Joining Processes:IntroductiontovarioustypesofWelding,GasCutting,Brazing,andSoldering.	6
6	**EngineeringMaterialsandHeatTreatmentofSteel:** Introductiontovariousengineeringmaterialsandtheir properties.	5
TOTAL		**40**

205:BasicCivilEngineering

SN	CONTENTS	Hours
1	**Introductiontoobjective,scopeandoutcomethesubject**	
2	**Introduction:** ScopeandSpecializationofCivilEngineering,RoleofcivilEngineerinSociety,Impactofinfrastructuraldevelopmentoneconomyofcountry.	8
3	**Surveying:** Object,Principles&TypesofSurveying;SitePlans,Plans&Maps;Scales& UnitofdifferentMeasurements. LinearMeasurements:Instrumentsused.LinearMeasurementbyTape,RangingoutSurvey Lines and overcoming Obstructions; Measurements on sloping ground;Tape corrections,conventionalsymbols. AngularMeasurements:Instrumentsused;IntroductiontoCompass Surveying,BearingsandLongitude&Latitudeof aLine,Introductiontototalstation. Levelling:Instrumentused, Objectoflevelling,Methodsoflevellinginbrief, Contourmaps.	8
4	**Buildings:** SelectionofsiteforBuildings,LayoutofBuildingPlan,Typesofbuildings,Plintharea, carpet area, floor spaceindex, Introduction to buildingbyelaws,conceptofsunlightandventilation.Components ofBuildings&theirfunctions,BasicconceptofR.C.C.,Introductiontotypesof foundation.	8
5	**Transportation:** IntroductiontoTransportationEngineering;TrafficandRoadSafety: TypesandCharacteristicsofVariousModesofTransportation;VariousRoadTrafficSigns,CausesofAccidentsandRoadSafetyMeasures.	8
6	**EnvironmentalEngineering:** Environmental Pollution, Environmental Acts and Regulations,FunctionalConceptsofEcology,BasicsofSpecies,Biodiversity,Ecosystem,HydrologicalCycle;ChemicalCycles:Carbon,Nitrogen& Phosphorus; Energy Flow in Eco-systemsWaterPollution:Water Qualitystandards,IntroductiontoTreatment&DisposalofWasteWater.ReuseandSavingofWater,Rain Water Harvesting.SolidWasteManagement:ClassificationofSolidWaste,Collection, TransportationandDisposalofSolid.RecyclingofSolidWaste: Energy Recovery,Sanitary Land fill, On-SiteSanitation. Air&NoisePollution:PrimaryandSecondaryairpollutants,HarmfuleffectsofAirPollution,ControlofAirPollution..NoisePollution, HarmfulEffectsofnoisepollution,controlofnoisepollution,Global warming& Climate Change,Ozonedepletion,GreenHouse effect	8
	TOTAL	**40**

206:EngineeringChemistryLab

1. DeterminationthehardnessofwaterbyEDTA method
2. Determinationofresidualchlorineinwater
3. Determinationofdissolvedoxygeninwater
4. Determination ofthestrengthofFerrousAmmoniumsulphatesolution with the help ofK2Cr2O6solutionbyusingdiphenylamineindicator
5. Determinationofthe strengthofCuSO4solutioniodometricallybyusing hyposolution
6. Determination ofthestrengthofNaOHandNa2CO3inagivenalkalimixture

6. ProximateanalysisofCoal

8. Determination oftheflash&firepoint and cloud &pourpointoflubricatingoil
9. Determination ofthekinematicviscosityoflubricatingoilbyRedwood viscometer no. 1atdifferenttemperature
10. SynthesisofAspirin/ Paracetamol

206: Human ValuesActivitiesLab

PS1:
Introduceyourselfindetail.Whatarethegoalsinyourlife?Howdoyousetyour goalsinyourlife?Howdoyoudifferentiatebetweenrightandwrong?Whathave beenyoursalientachievementsandshortcomingsinyourlife?Observeandanalyze them.

PS2:
Now-a-days,thereisalotoftalkaboutmanytechnogenicmaladiessuchasenergy andmaterialresourcedepletion,environmentalpollution,globalwarming,ozone depletion,deforestation,soildegradation,etc.- all these seem to be manmade problems,threateningthesurvivaloflifeEarth-Whatistherootcauseofthese maladies & what is the way out inopinion?
On the otherhand, thereisrapidly growingdangerbecauseof nuclearproliferation, armsrace,terrorism,breakdownofrelationships,generationgap,depression & suicidal attemptsetc.- whatdoyouthink,istherootcauseofthesethreats to human happiness and peace - what couldbe thewayoutinyouropinion?

PS3:
1. Observethateachof ushas thefacultyof 'Natural Acceptance',basedon whichonecanverify whatisrightornot rightforhim.(Assuch weare not properly trained to listen to our'Natural Acceptance' andmay a timeit is also clouded by our strong per-conditioning and sensoryattractions).
Explorethefollowing:
(i) WhatisNaturallyAcceptable'toyouinrelationshipthefeelingofrespectordisrespectforyourself andforothers?
(ii) Whatis'naturallyAcceptable'toyou-tonurtureortoexploitothers?Is yourlivinginaccordance withyournaturalacceptance ordifferentfromit?
2. Outofthethreebasicrequirementsforfulfillmentofyouraspirations-rightunderstanding,relationship and physical facilities - observe how the problems inyourfamilyarerelatedtoeach.Alsoobservehowmuchtime&effortyoudevote foreach inyourdailyroutine.

PS4:

listdownallyourimportantdesires.Observewhetherthedesireisrelatedto Self (I) or theBody.
Ifitappearstoberelatedtoboth,visualizewhichpartofitisrelatedtoSelf(I) andwhichpartisrelatedtoBody.

PS5:

1. a.Observethatanyphysicalfacilityyouuse,followsthegivensequencewithtime:

Necessaryandtasteful-unnecessarybutstilltasteful-unnecessaryand tasteless-intolerable

b.Incontrast,observethatanyfeelinginyouiseithernaturallyacceptableornot acceptableatall.If notacceptable,youwantitcontinuously andif notacceptable, you do not want it anymoment!

2. Listdownallyour importantactivities.Observewhether theactivityisof'I'orof

PS6:

1.Chalkoutsomeprogramstowardsensuringyourharmonywiththebody-interms ofnurturing,protectionandrightutilizationof thebody.

2.Findouttheplantsandshrubsgrowinginandaroundyourcampus,whichcanbeusefulincuringcommondis eases.

PS6:

Formsmallgroups intheclassandmakethemcarryoutadialoguefocusing onthefollowing eightquestionsrelatedto'TRUST';

1a.DoIwanttomakemyselfhappy?2a.DoIwanttomaketheotherhappy?

3a.Doestheotherwant tomakehimself/herselfhappy?4a.Doestheotherwant tomakemehappy?

What istheanswer?

Intention(NaturalAcceptance)

1b.AmIabletoalwaysmakemyselfhappy?2b.AmIabletoalwaysmaketheotherhappy?

3b. Istheotherabletoalwaysmakehimself/herselfhappy?What istheanswer?

Leteachstudentanswerthequestions forhimselfandeveryoneelse.Discuss thedifferencebetweenintentionandcompetence.Observewhetheryouevaluateyourselfand othersonthebasis of intention/competence.

PS8:

1.Observe, on how many occasions, you are able to respect your related ones (by doingtherightevaluation)andonhowmanyoccasionsyouaredisrespecting by way of under-evaluation, over-evaluationorotherwise evaluation.

2.Also,observewhetheryourfeelingofrespectisbasedontreatingtheotherasyouwouldtreatyourselforondi fferentiationsbasedonbody,physicalfacilitiesorbelieds.

PS9:

1.Writeanarrationintheformofastory,poem,skitoressaytoclarifyasalient Human Valuetothechildren.

2.Recollectandnarrateanincidentinyourlifewhereyouwereabletoexhibitwillfuladherencetobaluesinadiff icultsituation.

PS10:

Listdownsomecommonunits(things)of Naturewhichyoucomeacrossinyourdailylifeandclassify theminthefourordersofNature.Analysisandexplaintheaspect ofmutualfulfillmentofeachunitwithotherorders.

PS11:

Makeacharttoshowthewholeexistenceasco-existence.Withthehelpofthischarttrytoidentifythe role and the scope of some of the courses of your study. Also indicatetheareaswhicharebeingeitherover-emphasizedorignoredinthepresentcontext.

PS12:

Identifyanytwoimportantproblemsbeingfacedbythesocietytodayandanalyze therootcauseoftheseproblems.Canthesebesolvedonthebasicofnaturalacceptance ofhumanvalues.Ifso, howshouldoneproceedinthisdirectionfrom

PS13:

1. Suggest ways in which you can use your knowledge ofScience/Technology/Managementetc.formovingtowardsauniversalhumanorder.
2. Proposeabroadoutlinefor humanisticConstitutionatthelevelofNation.

PS14:

Thecourseisgoingtobeover now.Itistimetoevaluatewhatdifferenceinyourthinkingithasmade.Summarizethecoremassageofthiscoursegraspedbyyou. How has this affectedyouinterms of;

a. Thought
b. Behavior
c. Workand
d. Relization

Whatpracticalstepsareyouabletovisualizeforthetransitionofthesocietyfromitspresentstate.Project: Everystudentrequiredtotake-upasocialprojecte.g.educatingchildrenin needy/weakersection,services inhospitals, NGO'sandothersuchworki.e. socialworkatvillagesadoptedbyrespectiveinstitute/college.

208:ManufacturingPracticesWorkshop

CarpentryShop

1. T–Lapjoint
2. Bridle jointFoundryShop
3. Mouldofanypattern
4. Casting ofanysimple patternWeldingShop
5. Lapjointbygaswelding
6. Buttjoint byarcwelding

6. Lapjointbyarcwelding

8. Demonstrationofbrazing, soldering&gascuttingMachine ShopPractice
9. JobonlathewithonestepturningandchamferingoperationsFittin gandSheetMetalShop
10. Finishingoftwosidesofasquarepieceby filing
11. Making mechanicaljointandsolderingofjointon sheetmetal
12. Tocutasquarenotchusinghacksawandtodrillaholeandtapping

209:BasicCivilEngineering Lab

1. LinearMeasurementbyTape:

a) RangingandFixingofSurveyStationalongstraightlineand acrossobstacles.

b) Layingperpendicularoffsetalongthesurveyline

2. CompassSurvey:Measurementofbearingoflinesusing Surveyor' sandPrismaticcompass

3. Levelling:UsingTilting/Dumpy/AutomaticLevel

a) Todeterminethereducedlevelsinclosedcircuit.

b) Tocarryoutprofilelevellingandplotlongitudinalandcrosssectionsfor roadbyHeightofInstrumentandRise&FallMethod.

4. Tostudyandtakemeasurementsusingvariouselectronicsurveyingin strumentslikeEDM,TotalStationetc.

5. To determinepH,hardnessand turbidityofthegivensampleofwater.

6. TostudyvariouswatersupplyFittings.

6. To determinethepHand totalsolidsofthegivensampleofsewage.

8. TostudyvariousSanitaryFittings.

210:ComputerAided MachineDrawingLab

Introduction:Principlesofdrawing,conventionalrepresentationofmachinecomponentsandmaterial s,lines,typesoflines,dimensioningtypes,rulesofdimensioning.

Conversionofpictorialviewsintoorthographicviews:(1drawingsheet)Introductiontoorthographicp rojection,concept of first angle and third angle projection,drawingofsimplemachineelementsinfirstangleprojection,missingviewproblemscoveri ngPrinciplesofOrthographic Projections.

Sectionalviewsofmechanicalcomponents: (1 drawing sheet) Introduction, cutting planeline,typeofsectionalviews-fullsection,halfsection,partialorbrokensection,revolvedsection,removedsection,offsetsection,sect ioningconventions-spokes,webrib,shaft,pipes,differenttypesofholes,conventionsofsectionlinesfordifferentmetalsand materials.

Fastenersandother mechanicalcomponents:(Freehandsketch)Temporaryand permanentfasteners, thread nomenclature and forms, thread foundationboltsetc.,keys,typesofkeys,cotterandknucklejoints.Rivetedjoints,rivetsandriveting,typeo frivets,typesofrivetedjointsetc.Bearing:Ball,roller,needle,footstepbearing.Coupling:Protectedtype, flange, andpintypeflexiblecoupling.Othercomponents:Weldedjoints,beltsandpulleys, pipesandpipejoints,valves etc.

OverviewofComputerGraphics:(2drawingsheets)CoveringtheoryofCADsoftwaresuchas:Themenu System,Toolbars(Standard,ObjectProperties,Draw,Modify and Dimension),I Lines,Planes,SimpleandcompoundSolids

Third Semester

MAT3T1 – Mathematics – III	**(3 – 1 – 0 – 4)**
Unit - I	Fourier Series and Fourier Transforms : Euler's formulae, conditions for a Fourier expansion, change of interval, Fourier expansion of odd and even functions, Fourier expansion of square wave, rectangular wave, saw-toothed wave, half and full rectified wave, half range sine and consine series, complex form of Fourier series.
Unit - II	Fourier integral theorem – Fourier transform pair-Sine and Cosine transforms – Properties – Transform of elementary functions – Convolution theorem – Parseval's identity.

Unit - III	Partial differential Equations, Formation, solutions of first order equation, singular solutions, Lagrange's Linear equation, Integral surfaces passing through a given curve, solutions of linear equations of second order ant their classifiactions-parabolic, elliptic and hyperbolic
Unit - IV	Applications of Partial Differential Equations, Method of separation of Variables, Solutions of one dimensional wave equation and one dimensional heat equation, Steady state solution of two-dimensional heat equation
Unit - V	Z-transform – Elementary properties – Inverse Z-transform – Convolution theorem – Initial and Final value theorems – Formation of difference equation – Solution of difference equation using Z-transform
	Books: 1. Higher Engineering Mathematics: B. S. Grewal 2. Advanced Engineering Mathematics: E. Kreyszig 3. Advanced Engineering Mathematics: Jain and Iyenger 4. Advanced Engg. Mathematics: Michael D. Greenberg 5. Advanced Engineering Mathematics (7th Edition): Bali N., Goyal M.

AE3T01 – Strength of Materials(3 – 0 – 0 – 3)	
Unit - I	Introduction: Simple stresses and strains: Normal and shearing stresses in axially loaded members; Concept of factor of safety; Normal and shearing strains; stress strain relationship; Hook's law; Modulus of rigidity; complementary shear stress; Poisson's ratio; Bulk modulus; Relation between various elastic constants; Volumetric strain.
Unit - II	Mechanical properties of materials: Definition of elastic materials; plastic materials; Ductile materials; Brittle materials; Permanent set; Elastic limit, Fatigue limit; Ultimate strength; Modulus of resilence; Modulus of toughness; Modulus of rupture; Proof stress; Malleability; Toughness and hardness and their measurement.
Unit - III	Mechanics of rigid bodies: Types of supports; resultant and equilibrium of forces; Free body diagram; Resolution and composition of forces.
Unit - IV	Centroid and moment of inertia: Centroid and centre of gravity; Second moment of inertia; polar moment of inertia; Radius of gyration.
Unit - V	Bending moment and shear force: Definition and concept; SFD and BMD for cantilever; Simply supported and over hanging beams subjected to various combination of loadings; Point of inflection; Elastic curves; Relation between the load S.F. and B.M.
	Books: 1. Mechanics of Materials, J.M. Gera and S.P. Timoshenko, CBS Publishers & Distributors, 2nd Edition, New Delhi, 1980. 2. Strength of Materials & Mechanics of Structures, Vol.I&II, B.C Punmia, Standard publishers & Distributors, 1988. 3. Mechanics of Structures, Vol.I&II, 15th edition, S.B. Junnarkar, Charotar publishing house, Anand, 2000 4. Strength of materials, F.L. Singer & A. Pytel, Harper & Row Publisher, New York, 1980.

AE3T02 – Soil Mechanics(3 – 0 – 1 – 4)	
Unit - I	Introduction of soil mechanics, field of soil mechanics, phase diagram physical and index properties of soil classification of soils, general classification based on particles size, textural classification and I.S. soil classification system stress condition in soils, effective and neutral stress, elementary concept of Bousinesque and Wester guards analysis, new mark influence chart.
Unit - II	Shear strength Mohr stress circle, theoretical relationship between principle stress circle, theoretical relationship between principal stress Mohr-coulomb failure theory, effectives tress principle. Determination of shear parameters by direct shear to be circle, theoretical test. Numerical exercise based on various types of tests.
Unit - III	Compaction composition of soils standard and modified protector test, abbot compaction and Jodhpur mini compaction text field compaction method and control. Consolidation of soil: Consolidation of soils, one dimensional consolidation spring analogy, Terzaghi's theory Laboratory consolidation text, calculation of void ratio and coefficient of volume change, Taylor's and Casagrand's method, determination of coefficient of consolidation.
Unit - IV	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.
Unit - V	Stability of slopes: Introduction to stability analysis of infinite and finite slopes friction circles method Taylor's stability number.
	Books: 1. Soil mechanics & foundations, B.C Punmia, Ashok.K.Jain & Arun K. Jain, 13th edition, Laxmi pub. Pvt.Ltd., New Delhi, 1994. 2. Soil mechanics SI version, T.W. Lambe & R.V. Whitman, Wiley eastern Ltd., 1979. 3. Principles of Soil mechanics & foundation engineering, V.N.S Murthy, UBSPD, New Delhi, 2001. 4. Soil engineering in theory and practice, part-1 &2, A.Singh and G.R.Chowdhury, CBS Publishers and Distributors, New Delhi, 1994.

AE3L01 – Soil Mechanics Lab	
1.	Determination of water content of soil.
2.	Determination of specific gravity of soil.
3.	Determination of field density of soil by core cutter method.
4.	Determination of field density by sand replacement method.
5.	Grain size analysis by sieving (Dry sieve analysis).
6.	Grain size analysis by hydrometer method.
7.	Determination of liquid method by Casagrande's method.
8.	Determination of liquid limit by cone penetrometer and Plastic limit.
9.	Determination of permeability by constant and variable head method.
10.	Determination of compaction properties by standard proctor test.
11.	Determination of shear parameters by Direct shear test.
12.	Determination of unconfined compressive strength of soil.
13.	Determination of shear parameters by Triaxial test.

AE3T03 – Farm Power(3 – 0 – 0 – 3)	
Unit - I	Sources of farm power -conventional & non-conventional energy sources.Classification of tractors and IC engines. Review of thermodynamic principles of IC (CI &SI) engines and deviation from ideal cycle.
Unit - II	Study of engine components their construction, operating principles and functions. Engine system: valves & valve mechanism. Fuel & air supply, cooling, lubricating, ignition, starting and electrical systems. Study of constructional details, adjustments & operating principles of these systems.
Unit - III	IC engine fuels - their properties &combustion of fuels, gasoline tests and their significance, diesel fuel tests and their significance, detonation and knocking in IC engines.

Unit - IV	Study of properties of coolants, antifreeze and anti-corrosion materials, lubricant types & study of their properties.
Unit - V	Engine governing systems.
	Books: 1. Farm power, B.D.Mosses & K.R.Frost, 1952 edition, john Wiley & sons Pvt.Ltd, ew York, 1952. 2. Tractor & power units, John B. Liljedahly, W.M.Carleton, P.K.Turnquist & Makotohoki, 4th edition CBS pub. & Dist., New Delhi, 1977. 3. Off-road vehicle engineering principles, Goering, Caroll E, marvin L.Stone, Dvid W. Smith & Paul K.Turnquist, 2003 edition, ASAE, St.Joseph, Michigan. 4. Engine and Tractor power, Goering, Caroll E and Alan C.Hansen, 2004 edition, ASAE, St.Joseph, Michigan.

AE3L02 – Farm Power Lab(1)	
1.	Introduction of different systems of an IC engine.
2.	Engine parts and functions, working principle etc.
3.	Valve system- study, construction and adjustment.
4.	Oil & Fuel- determination of physical properties.
5.	Air cleaning system.
6.	Fuel supply system of SI engine.
7.	Diesel injection system and timing.
8.	Cooling system & fan performance, thermostat and radiator performance evaluation.
9.	Part load efficiencies & governing.
10.	Lubricating system & adjustment.
11.	Starting an electrical system.
12.	Ignition system.
13.	Tractor engine heat balance and engine performance curve.
14.	Visit to engine manufacturer/assembler/spare parts agency.

AE3T04 – Surveying and Leveling(2 – 0 – 0 – 2)	
Unit - I	Surveying: Definition, principles and basic concepts of surveying, classification, basic measurements, units of measurement, plans and map, types of scales, principle of chain surveying – definition, selection of survey station and lines, types of ranging and chaining, recording the measurements, offset measurements, cross staff, optical square, prism square, obstacles in chaining and ranging chain and tape correction.
Unit - II	Traversing: Method of traversing, prismatic and surveyor compass, angle and bearing, quadrantal systems, local attraction, magnetic, dip – traversing, plotting, Bowditch rule, transit rule, errors in compass survey, limits of accuracy.
Unit - III	Plane tabling: Instrument and accessories, methods, and principles, two point, three point problems, errors in plane tabling, minor instrument – hand level, abbey level, clinometers, sextant, planimeter, pentameter, computation of areas – methods
Unit - IV	Levelling: Definition, benchmarks types of levels, optical principles, lenses, telescope, sensitivity of bubble tubes, leveling staves, basic principles of leveling, temporary adjustments, field book entries, reduction of levels, missing entries, type of leveling, simple, differential and profile leveling, cross sectioning.
	Books: 1. R. E. Davis. Elementary Plane Surveying. McGraw Hill. 2. A. L. Higgins. Elementary Plane Surveying. McGraw Hill. 3. T.P. Kanetkar & S.V. Kulkarni. Surveying and Levelling (part I & II). Griha Prakashan.

AE3L03 – Surveying and Leveling Lab(1)	
1.	Handling of chain and chain accessories, offsetting with field work
2.	Ranging out survey line and plotting chain survey
3.	Triangulation of chain and offsetting for details for preparation of map of small area.
4.	Plotting of field book, reading for preparation of map – acquaintance with symbols of different
5.	objects used in map and scale of map.
6.	Setting up of prismatic compass and measurement of angles.
7.	Traversing of small area with chains and prismatic compass and offsetting for details.
8.	Plotting of the map with chain and prismatic survey
9.	Setting of a 20° accuracy transit theodolite and measurement of horizontal and vertical angles.
10.	Setting up plane table and offsetting by inter – section method
11.	Plane table traversing
12.	Setting up dumpy levels and exercise in fly leveling and reciprocal leveling.

AE3T05 – Engineering Properties of Biological Material & Food Quality (2 – 0 – 0 – 2)	
Unit - I	Importance of engineering properties of biological materials, Study of different physical and thermal characteristics of important biological materials like shape, size, volume, density, roundness, sphericity, surface area, specific heat, thermal conductivity, thermal diffusivity, etc. Rheological characteristics like stress, strain time effects, rheological models and their equations. Aerodynamic characteristics and frictional properties.
Unit - II	Measurement of colour, flavour, consistency, viscosity, texture and their relationship with food quality and composition.
Unit - III	Application of engineering properties in handling processing machines and storage structures.
Unit - IV	Concept, objectives and need of quality, quality control, methods of quality control, sampling; purpose, sampling techniques, requirements and sampling procedures for liquid, powdered and granular materials, sensory quality control, panel selection methods, interpretation of sensory results in statistical quality control, TQM and TQC, consumer preferences and acceptance.
Unit - V	Food Laws and Regulations in India. Food grades and standards BIS, AGMARK, PFA, FPO, CAC (Codex Alimantarious Commission),sanitation in food industry, GMP, HACCP (Hazard analysis and critical control point) and ISO 9000 Series.
	Books:
1.	Unit operations of Agricultural Processing, K.M. Sahay & K.K. Singh, Vikas publishing house, New Delhi, 2nd edition, 2001.
2.	Post Harvest Technology of cereals, pulses & Oil seeds, A Chakraborty, Oxford & IBH Pub. New delhi, 3rd edition, 2000
3.	Principles of Agricultural Engineering-I, A M Michael & T P Ojha, Jain Brothers Publ. New Delhi, 2006

AE3L04 – Engineering Properties of Biological Material & Food Quality Lab(1)	
1.	To find the shape and size of grain and fruits and vegetables.
2.	To determine the bulk density and angle of repose of grain.
3.	To determine the practical density/true density and porosity of soil grain.
4.	To find out the co-efficient of external and internal friction of different crops.
5.	To study the separating behavior of a grain sample in a vertical wind tunner (Aspirator column).
6.	To find the thermal conductivity of different grains.
7.	To determine specific heat of some food grains.
8.	To determine the cooking quality of rice.
9.	To determine impurities and invisible stress cracks in grains.
10.	Determination of hardness of food materials.
11.	Detection of adulteration in food product viz. milk, ghee, honey etc.

AE3T06 – Engineering Thermodynamics & Heat Engines (3 – 0 – 0 – 3)	
Unit - I	Thermodynamics properties, closed and open system, low and non-flow processes, gas laws, laws of thermodynamics, internal energy.
Unit - II	Application of first law in heating and expansion of gases in non-flow processes. Firs law applied to steady flow processes. Kelvin-Planck and Claussius statements. Reversible processes, Carnot cycle, Carnot theorem.
Unit - III	Entropy, physical concept of entropy, change of entropy of gases in thermodynamics processes. Difference between gas and vapour, change of phase during constant pressure process. Generation of steam, triple point and critical point. Internal energy and entropy of steam.Use of steam tables and Mollier chart, heating and expansion of vapour in non- flow processes, measurement of dryness fraction.
Unit - IV	Classification of steam boilers, Cochran, Lancashire, locomotive and Babcock-Wilcox boilers. Boiler mountings and accessories. Desirable properties of working fluid used for power plants. Rankine cycle. Expansive and non-expansive working. Saturation curve and missing quantity, governing.
Unit - V	Calculations of cylinder dimensions, Introduction to compound steam engines. Air Standard efficiency, other engine efficiencies and terms. Otto, diesel and dual cycles. Calculation of efficiency, mean effective pressure and their comparison. Measurement of IP, BP and heat balance calculations(not involving combustion). Engine efficiencies and performance.
	Books: 1. Engine Thermodynamics, P.K.Nag, 2nd editions, Tata McGraw Hill, New Delhi, 2001. 2. Heat and Thermodynamics, M.W. Zimmansky & R.H. Dittman, ISE 7th edition, McGraw Hill, New York, 1977. 3. Fundamentals of Internal Combustion Engine, P.W. Gill, J.H. Smith and E.J. Ziurys, 1st edition, Oxford and IBH Publishing Co. Pvt. Ltd., New Delhi, 1954. 4. A course in Internal Combustion Engines, M.L. Mathur and R. P. Sharma, 1994 edition, Dhanpat Rai and Sons, Delhi-110006.

Fourth Semester

AE4T01 – Heat and Mass Transfer	**(3 – 0 – 0 – 3)**
Unit - I	Introductory concepts, modes of heat transfer, thermal conductivity of materials measurement. General differential equation of conduction. One dimensional steady state conduction through plane and composite walls, tubes and spheres with and without heat generation.
Unit - II	Electrical analogy. Insulation materials, critical thickness of insulation. Fins, Free and forced convection. Newton's law of cooling, heat transfer coefficient in convection. Dimensional analysis of free and forced convection. Useful non dimensional numbers and empirical relationships for free and forced convection.
Unit - III	Equation of laminar boundary layer on flat plate and in a tube. Laminar forced convection on a flat plate and in a tube. Combined free and forced convection.
Unit - IV	Absorptivity, reflectivity and transmissivity of radiation. Black body and monochromatic radiation, Planck's law, Stefan-Boltzman law, Kirchoff's law, grey bodies and emissive power, solid angle, intensity of radiation. Radiation exchange between black surfaces, geometric configuration factor.

Unit - V	Heat transfer analysis involving conduction, convection and radiation by networks. Types of heat exchangers, fouling factor, log mean temperature difference, heat exchanger performance, transfer units. Heat exchanger analysis restricted to parallel and counter flow heat exchangers. Steady state molecular diffusion in fluids at rest and in laminar flow, Flick's law, mass transfer coefficients.Reynold's analogy.
	Books: 1. Food Processing Technology Principles & Practice, P.J.Fellows, Woodhead Pub. New Delhi, 3rd edition, 2009 2. Food Engineering Operations, J.G.Brennan, J.R.Butters, N.D.Cowell & A.E.V.Lilly, Elsevier pub. 3rd edition. 3. Heat and mass transfer, Timoshenko 4. Transport processing and unit operation, C.J. Geankoplis, 3rd edition, prentice Hall India, 1993.

AE4T02 – Theory of machines	**(2 – 1 – 0 – 3)**
Unit - I	Elements, links, pairs, kinematics chain, and mechanisms. Classification of pairs and mechanisms. Lower and higher pairs. Four bar chain, slider crank chain and their inversions.
Unit - II	Determination of velocity and acceleration using graphical (relative velocity and acceleration) method. Instantaneous centers. Types of gears. Law of gearing, velocity of sliding between two teeth in mesh. Involute and cycloidal profile for gear teeth. Spur gear, nomenclature, interference and undercutting. Introduction to helical, spiral, bevel and worm gear. Simple, compound, reverted, and epicyclic trains. Determining velocity ratio by tabular method.
Unit - III	Turning moment diagrams, co-efficient of fluctuation of speed and energy, weight of flywheel, flywheel applications. Belt drives, types of drives, belt materials. Length of belt, power transmitted, velocity ratio, belt size for flat and V belts. Effect of centrifugal tension, creep and slip on power transmission, Chain drives.
Unit - IV	Types of friction, laws of dry friction. Friction of pivots and collars. Single disc, multiple disc, and cone clutches. Rolling friction, anti-friction bearings. Types of governors. constructional details and analysis of Watt, Porter, Proell governors. Effect of friction, controlling force curves. Sensitiveness,. stability, hunting, isochronism, power and effort of a governor. Static and dynamic balancing. Balancing of rotating masses in one and different planes. Partial primary balancing of reciprocating masses.
	Books: 1. Theory of Machines, R.S Khurmi 2. Theory of Machines & Mechanism – R.L. Norton, McGraw Hill. 3. Theory of Machines - Rattan, Tata McGraw Hill, New Delhi. 4. Theory of Machines – Abdulla and Sharif, Khanna Publishers.

AE4T03 – Design of Structures	**(2 – 1 – 0 – 3)**
Unit - I	Loads and use of BIS Codes.
Unit - II	Design of connections. Design of structural steel members intension, compression and bending. Design of steel roof truss.
Unit - III	Analysis and design of singly and doubly reinforced sections, Shear, Bond and Torsion.
Unit - IV	Design of Flanged Beams, Slabs, Columns, Foundations, Retaining walls and Silos.
	Books: 1. Vaidyanadhan, R and Perumal, P, Comprehensive Structural Analysis – Vol. I & Vol. II, Laxmi Publications, New Delhi, 2004. 2. Punmia B.C, Ashok Kumar Jain and Arunn Kumar Jain, Theory of Structures – II, Laxmi Publication Pvt. Ltd. 2004.

AE4T04 – Watershed Hydrology - I	**(3 – 0 –0 – 3)**
Unit - I	Introduction; hydrologic cycle; precipitation - forms, rainfall measurement, mass curve, hydrograph, mean rainfall depth, frequency analysis of point rainfall, plotting position, estimation of missing data, test for consistency of rainfall records; interception.
Unit - II	Infiltration; evaporation; evapo-transpiration - estimation and measurement; geomorphology of watersheds - stream number, stream length, stream area, stream slope and Horton's laws; runoff - factors affecting, measurement; stage and velocity, rating curve, extension of rating curve; estimation of peak runoff rate and volume; rational method, Cook's method, SCS method, Curve number method.
Unit - III	Hydrograph; components, base flow separation, unit hydrograph theory - unit hydrograph of different durations, dimensionless unit hydrograph, distribution hydrograph, synthetic unit hydrograph, uses and limitations of unit hydrograph.
Unit - IV	Head water flood control methods, Retards andtheir location; flood routing - graphical methods of reservoir flood routing: hydrology of dry land areas - drought and its classification; introduction to watershed management and planning.
	Books: 1. Elementary Hydrology, V.P. Singh, 1st edition, Prentice Hall of India, New Delhi, 1994. 2. Hydrology : Principles, Analysis and Design, H.M. Raghunath, 3rd edition., New Age International, New Delhi, 2001. 3. Watershed Management, V.V. Dh ruvanarayanan, ICAR, New Delhi, 1990. 4. Soil and Water Conservation Engineering, R. Suresh, 2nd edition, Standard Publisher and Distributors, New Delhi., 1997.

AE4L01 – Watershed Hydrology - I Lab(1)	
1.	Visit to meteorological observatory.
2.	Study of different types of rain gauge.
3.	Exercise on analysis of rainfall data.
4.	Double mass curve technique.
5.	Determination of average depth of rainfall and frequency analysis.
6.	Study of stage recorders and current meter.
7.	Exercise on estimation of peak runoff rate and runoff volume.
8.	Exercises on hydrograph and unit hydrograph.
9.	Exercise on design and location of retards for channel improvement.
10.	Exercise on flood routing problem.

AE4T05 – Fluid Mechanics (2 – 1 –0 – 3)	
Unit - I	Properties of fluids: Ideal and real fluid. Pressure and its measurement, Pascal's law, pressure forces on plane and curved surfaces, centre of pressure, buoyancy, metacentre and metacentric height, condition of floatation and submerged and floating bodies.
Unit - II	Kinematics of fluid flow: Lagrangian and aulerian description of fluid motion, continuity equation, path lines, streak lines and stream lines, stream function, velocity potential and flownet.
Unit - III	Types of fluid flow translation, rotation, circulation and vorticity, Vortex motion; Dynamics of fluid flow, Bernoulli's theorem, venturimeter, orifice-meter and nozzle, siphon.

Unit - IV	Laminar flow: Stress-strain relationships, flow between infinite parallel plates – both plate fixed, one plate moving, discharge, average velocity, shear stress and pressure gradient; Laminar and turbulent flow in pipes, general equation for head loss-darcy,Equation, Moody's diagram, Minor and major hydraulic losses through pipesand fittings, flow through network of pipes, hydraulic gradient and energy gradient, power transmission through pipe.
Unit - V	Dimensional analysis and Rayleigh's method and Buckingham's 'Pi' theorem, types of similarities, dimensional analysis, dimensionless numbers. Introduction to fluid.
	Books: 1. Fluid Mechanics, V.L. Streeter and E.B. Wylie, McGraw Hill Book Co. Singapore, 1983. 2. Hydraulics & fluid Mechanics of Structures, P.N. Modi & S.M.Seth, Standard Book House, Nai Sarak, Delhi, 1999. 3. Fluid Mechanics & Hydraulic Machines, R.K.Bansal, Laxmi Publication Pvt.ltd., New Delhi, 2000. 4. A text book of hydraulics, fluid mechanics & hydraulic machines, R.S.Khurmi, S.Chand & company, New Delhi, 2000.

AE4T06 – Crop Process Engineering (3 – 0 –0 – 3)	
Unit - I	Scope and importance of food processing, principles and methods of food processing. Theory of separation, size and un sized separation, types of Separators,size of screens, sieve analysis, capacity and effectiveness of screens, pneumatic separation.
Unit - II	Principle of size reduction, grain shape, size reduction machines; crushers, grinders, cutting machines etc.-operations, efficiency and power requirement- Rittinger's, Kick's and Bond's equation, fineness modulus.
Unit - III	Processing of farm crops; cereals, pulses, oil seeds, fruits and vegetables and their products for food and feed. Processing of animal products.
Unit - IV	Theory of mixing, types of mixtures for dry and paste materials, rate of mixing and power requirement, mixing index. Theory of filtration, study of different types of filters, rate of filtration, pressure drop during filtration.
Unit - V	Scope &importance of material handling devices, study of different types of material handling systems; belt, chainand screw conveyor, bucket elevator, pneumatic conveying, gravity conveyor- design consideration, capacity and power requirement.
Unit - VI	By-Products of Agricultural processing and their Utilization.
	Books: 1. Unit operations of Agricultural Processing, K.M. Sahay & K.K. Singh, Vikas publishing house, New Delhi, 2nd edition, 2001 2. Post Harvest Technology of cereals, pulses & Oil seeds, A Chakraborty, Oxford & IBH Pub. New delhi, 3rd edition, 2000 3. Food Engineering Operations, J.G.Brennan, J.R.Butters, N.D.Cowell & A.E.V.Lilly, Elsevier pub. 3rd edition. 4. Food Processing Technology Principles & Practice, P.J.Fellows, Woodhead Pub. New Delhi, 3rd edition, 2009

AE4L02 – Crop Process Engineering Lab	
1.	Preparation of flow and layout charts of a food processing plant.
2.	Determination of fitness modulus and uniformity intex.
3.	Performance evaluation of a hammer mill.
4.	Performance evaluation of attrition mill.
5.	Study of equipment
6.	Separation behavior in pneumatic separator.
7.	Study of grading equipment.
8.	Evaluation of performance of indented cylinder and screen pre-cleaner.
9.	Mixing index and study of mixers.
10.	Study of conveying equipments.
11.	Performance evaluation of bucket elevator.

AE4T07 – Agriculture for Engineers	**(3 – 0 –0 – 3)**
Unit - I	Soils: Nature and origin of soil; soil forming rocks and minerals, their classification and composition, soil forming processes, classification of soils, soil taxonomy orders; important soil physical properties; and their importance; soil particle distribution; soil inorganic colloids, their composition, properties and origin of charge; ion exchange in soil and nutrient availability;soil organic matter, its composition and decomposition, effect on soil fertility; soil reaction, acid, saline and sodic soils; quality or irrigation water; essential plants nutrients , their functions and deficiency symptoms in plants; important inorganic fertilizers and their reactions in soils.
Unit - II	Agronomy: Definition and scope of agronomy. Classification of crops, Effect of different weather parameters on crop growth and development. Principles of tillage, tilth and its characteristics. Soil water plant relationship and water requirement of crops, weeds and their control, crop rotation, cropping systems, Relay cropping and mixed cropping.
Unit - III	Horticulture: Scope of horticultural and vegetable crops. Soil and climatic requirements for fruits, vegetables and floriculture crops, improved varieties, Criteria for site selection, layout and planting methods, nursery raising, macro and micro propagation methods, plant growing structures, pruning and training, fertilizer application, fertigation, irrigation methods, harvesting, grading and packaging, post harvest practices, Garden tools, management of orchard, Extraction and storage of vegetables seeds.
	Books: 1. Handbook of Agriculture, ICAR 2. Agronomy, Shagufta, APH Publishing cooperation, 2001 3. Handbook of Horticulture, Jain Book Agency, 2004

Fifth Semester

AE5T01 – Workshop Technology (2 – 0 –0 – 2)	
Unit - I	Introduction to welding, types of welding, Oxyacetylene gas welding, types of flames, welding techniques and equipment. Principle of arc welding, equipment and tools.
Unit - II	Casting processes. Classification, constructional details of center hole. Main accessories and attachments. Main operations and tools used on center lathes. Types of shapers, Constructional details of standard shaper. Work holding devices, shaper tools and main operations.
Unit - III	Types of drilling machines. Constructional details of pillar types and radial drilling machines. Work holding and tool holding devices. Main operations. Twist drills, drill angles and sizes.
Unit - IV	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.
	Books: 1. Hajra Choudhury, Hajra Choudhury and Nirjhar Roy, Elements of Workshop Technology, 12th Ed, Vol. 1 & 2, Media Promoters & Publishers Pvt. Ltd. 2007. 2. W. A. J. Chapman, Workshop Technology, Part I, II & III, Viva Books Private Ltd, 2004.

AE5T02 – Machine Design(3 – 1 –0 – 4)	
Unit - I	Meaning of design, Phases of design, design considerations. Common engineering materials and their mechanical properties.
Unit - II	Types of loads and stresses, theories of failure, factor of safety, selection of allowable stress. Stress concentration. Elementary fatigue and creep aspects. Cotter joints, knuckle joint and pinned joints,' turnbuckle.
Unit - III	Design of welded subjected to static loads. Design of threaded fasteners subjected to direct static loads, bolted joints loaded in shear and bolted joints subjected to eccentric loading. Design of shafts under torsion and combined bending and torsion. Design of keys. Design of muff, sleeve, and rigid flange couplings. Design of helical and leaf springs.

Unit - IV	Design of flat belt and V-belt drives and pulleys. Design of gears. Design of brackets, levers, columns, thin cylindrical and spherical shells. Design of screw motion mechanisms like screw jack, lead screw, etc. Selection of antifriction bearings. Design of curved beams; Crane hooks, circular rings, etc.
	Books: 1. Mechanical Engineering Design, Shiegley and Mischke, McGraw Hill International, Auckland, 1998. 2. Design of Machine elements, MF Spott, Prentice Hall Of India, New Delhi, 1998. 3. Design of Machine elements, V.B. Bandari, Tata McGraw Hill, New Delhi, 1998. 4. Design of Machinery, R.L. Nortron, McGraw Hill International, Auckland, 1999.

AE5T03 – Electrical Machine and Power Utilization (3 – 0 –0 – 3)	
Unit - I	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.
Unit - II	Principles, operation and performance of, DCmachine (generator and motor). EMF and torque equations, armature reaction, commutation and characteristics of DC machines, starting methods of DC motors.
Unit - III	Induction & Synchronous machines- construction, operation, equivalent circuit, phasor diagram, torque equation, Starting methods of Induction and synchronous motors.
Unit - IV	Single phase induction motor, split phase and shaded pole motors, reluctance motor, Hysteresis motor. Double field revolving, theory, equivalent circuit, characteristics & application
	Books: 1. Electrical Machinery, P.S. Bhimra, Khanna Publications, Delhi. 2. Principles of Electrical machines, V.K. Mehta & Rohit Mehta

AE5T04 – Farm Machinery and Equipment	**(2 – 0 –1 – 3)**
Unit - I	Objectives of farm mechanization. Classification of farm machines. Materials of construction& heat treatment. Principles of operation and selection of machines used for production of crops. Field capacities & economics.
Unit - II	Tillage; primary and secondary tillage equipment. Design of farm machinery equipment. Forces acting on tillage tools. Hitching systems and controls. Draft measurement of tillage equipment.
Unit - III	Earth moving equipment - their construction & working principles viz Bulldozer, Trencher, Elevators etc.
Unit - IV	Sowing, planting & transplanting equipment - their calibration and adjustments.
Unit - V	Fertilizer application equipment. Weed control and Plant protection equipment- sprayers and dusters, their calibration, selection, constructional features of different components and adjustments.Crop harvesting machinery, Root crop harvesting equipment , Testing of farm machine.
	Books: 1. Principles of Farm Machinery, R.A. Kepner, Roy Bainer and E.L. Berger, 1st edition, CBS Publishers and Distributors, New Delhi, 1987. 2. Farm Machinery and Equipment, 6th edition H.P. Smith and L.H. Wilkis, Tata McGraw Hill Publishing co. Ltd. New Delhi, 1988. 3. Farm Machinery, C. Culpin, 11th edition, Crosby Publications, London, 1986. 4. Principles of Agricultural Engineering, Vol. 1, A.M. Michael and T.P. Ojha, 3rd edition, Jain brothers, New Delhi, 1978. 5. Moving of Earth, Work Book of Excavation, 3rd edition, Herbert L. Nicholas, North Castle Books, Connecticut, 1955.

AE5L01 – Farm Machinery and Equipment - I Lab	
1.	Introduction to various farm machineries, visit to implements shed and research hall.
2.	Field capacity and field efficiency measurement for atleast two rnochlness/implements.
3.	Draft and fuel consumption measurement for different implements under different soil condition.
4.	Construction details adjustments and working of M.B. plow, disc plow and disc harrow and secondary tillage tools.
5.	Introduction, construction and working of earth moving equipments.
6.	Construction and working of rotavators and other rotary tillers, measurement of speed and working width.
7.	Working of seed-cum-fertilizer drills, planters and their calibration in field.
8.	Working of transplanter and operation.
9.	Weeding equipments and their use.
10.	Study of sprayer, duster, measurement of nozzle discharge, field capacity etc.

AE5T05 – Ground Water Wells and Pumps(2 – 0 –0 – 2)	
Unit - I	Occurrence and movement of ground water, aquifer and its types, classification of wells, steady and transient flow into partially, fully and non-penetrating and open wells, familiarization of various types of bore wells common in the state, design of open well.
Unit - II	Groundwater exploration techniques, methods of drilling of wells, percussion, rotary, reverse rotary, design of assembly 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 etc. Theis recovery method, well interference, multiple well systems, surface and subsurface exploitation and estimation of groundwater potential, quality of ground water, artificial groundwater recharge planning, modeling, ground water project formulation.
Unit - III	Pumping Systems: Water lifting devices; different types of pumping machinery, classification of pumps, component parts of centrifugal pumps; pump selection, installation and troubleshooting; design of centrifugal pumps, performance curves, effect of speed on head capacity, power capacity and efficiency curves, effect of change of impeller dimensions on performance characteristics.
Unit - IV	Hydraulic ram, propeller pumps, mixed flow pumps and their performance characteristics; priming, self-priming devices, rotor dynamic pumps for special purposes such as deep well turbine pump and submersible pump
	Books:
1.	Water Well and Pump Engineering, A.M. Michael and S.D. Khepar, Tata McGraw Hill Publishing Co. Ltd. New Delhi, 1989.
2.	Ground Water Hydrology, D.K. Tood, John Wiley and Sons, New York, 2nd edition, 1995.
3.	Ground Water, H.M. Raghunath, Wiley Easten Ltd. New Delhi, 1982.

AE5T06 – Drying and Storage Engineering (3 – 0 –0 – 3)	
Unit - I	Concept of water activity of food. Moisture content and methods for determination, importance of EMC and methods of its determination, EMC curve and EMC model, principle of drying, theory of diffusion, mechanism of drying- falling rate, constant rate, thin layer, deep bed and their analysis, critical moisture content, drying models.
Unit - II	Psychrometry; Grain drying and drying equipment.
Unit - III	Types and functional requirements of storage structures. Grain pests and rodents control. Pressure theory in grain storage. Grain flow behaviour in storage structure. Aeration and fumigation in storage structure. Scheduling of aeration.
Unit - IV	Design features of various storage structures: controlled atmospheric storage, modified atmosphere storage, cold storage and frozen storage. Management of cold storage.

	Books:
1.	Unit operations of Agricultural Processing, K.M. Sahay& K.K. Singh, Vikas publishing house, New Delhi, 2nd edition, 2001
2.	Post Harvest Technology of cereals, pulses & Oil seeds, A Chakraborty, Oxford & IBH Pub. New delhi, 3rd edition, 2000
3.	Handbook of Post Harvest Technology, Cereals, Fruits, Vegetables, Tea and Spices, A Chakraverty, A S Mujumder, G S V Raghavan& H S Ramaswamy, star Educational book distributor, pvt. Ltd. New Delhi, 2010
4.	Principles of Agricultural Engineering-I, A M Michael & T P Ojha, Jain Brothers Publ. New Delhi, 2006
5.	Handling & Storage of Food Grains, Food and Agriculture organization of the U.N, Rome 3rd edition, oxford IBH Pub, New Delhi, 1980

AE5L03 – Drying and Storage Engineering Lab(1)	
1.	Study of mechanics of bulk solids affecting cleaning, drying and storage of grains.
2.	Measurement of moisture content during drying and aeration.
3.	Measurement of relative humidity during drying and aeration using different techniques.
4.	Measurement of air velocity during drying and aeration.
5.	Drying characteristics and determination of drying constant.
6.	Determination of EMC and ERH.
7.	Study of various types of dryers.
8.	To study the effect of relative humidity and temperature on grains stored in gunny bags.
9.	Design and layout of commercial bag storage facilities.
10.	Design and layout of commercial bulk storage facilities.
11.	Study of different domestic storage structure.
12.	Visits to commercial handling and storage facilities for grains.

AE5T07 – Soil and Water Conservation Engg.(3 – 0 –0 – 3)	
Unit - I	Introduction; 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.
Unit - II	Soil loss estimation - universal soil loss equation and modified soil loss equation, determination of their various parameters; erosion control measures - agronomical measures - contour cropping, strip cropping, mulching; mechanical measures - terraces - level and graded broad base terraces and their design, bench terraces & their design, layout procedure, terrace planning, bunds - contour bunds, graded bunds and their design.
Unit - III	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 &shelterbelts, sand dunes stabilization; sedimentation - sedimentation in reservoirs and streams, estimation and measurement, sediment delivery ratio, trap efficiency.
Unit - IV	Characteristics of contours and preparation of contour maps; land use capability classification; grassed waterways and their design; introduction to water harvesting; introduction to stream water quality and pollution.
Unit - V	

	Books:
1.	Soil and Water Conservation Engineering, G.O. Schwab, R.K. Frevert, T.W. Edminster and K.K. Barnes, 3rd edition, John Wiley and Sons, New York, 1981.
2.	Land and Water Management Engineering, V.V.N. Murthy, 2nd edition, Kalyani Publishers, Ludhiana, 1985.
3.	Introductory Soil and Water Conservation Engineering, B.C. Mal Kalyani Publishers, Ludhiana, 1995.
4.	Soil Conservation, Norman Hudson, B.T. Batsford, London, 1981.
5.	Soil and Water Conservation Engineering, R. Suresh, 2nd edition, Standard Publisher and Distributors, New Delhi., 1997.
6.	Hydrology and Soil Conservation Engineering, Ghanshyam Das, Prentice Hall of India Pvt. Ltd. New Delhi, 2000.

AE5L04 – Soil and Water Conservation Engg. Lab(1)	
1.	Study of soil loss measurement technique.
2.	Study of details of Coshocton wheel and multi- slot runoff sample.
3.	Determination of sediment concentration through oven dry method.
4.	Problems on Universal Soil Loss Equation.
5.	Preparation of contour map of an area and its analysis.
6.	Design of vegetative waterways.
7.	Design of contour bunding system.
8.	Design of grade bunding system.
9.	Design of various types of bench terracing system.
10.	Determination of rate of sedimentation and storage loss in reservoir.
11.	Design of shelter belt and windbreaks.

Sixth Semester

AE6T01 – Agricultural Structure & Environmental Control	**(2 – 1 –0 – 3)**
Unit - I	Planning and layout of farmstead. Physiological reactions of livestock to solar radiation and other environmental factors, livestock production facilities, BIS. Standards for dairy, piggery, poultry and other farm structures.
Unit - II	Design, construction and cost estimation of farm structures; animal shelters, compost pit, fodder silo, fencing and implement sheds, barn for cows, buffalo, poultry, etc. Design and construction of rural grain storage system Engineering for rural living and development, rural roads, their construction cost and repair and maintenance.
Unit - III	Sources of water supply, norms of water supply for human being and animals, drinking water standards and water treatment suitable to rural community. Site and orientation of building regard to sanitation, community sanitation system; sewage system its design, cost and maintenance, design of septic tank for small family. Estimation of power requirement for domestic and irrigation, source of power supply, use of alternate source of energy, electrification of rural housing.
Unit - IV	Scope, importance and need for environmental control, renewable and non-renewable resources and their equitable use, concept of ecosystem, biodiversity of its conservation, environmental pollution and their control, solid waste management system.
Unit - V	BOD and COD of food plant waste, primary and secondary treatment of food plant waste.
	Books:
1.	Principles of Agricultural Engineering-I, A M Michael & T P Ojha, Jain Brothers Publ. New Delhi, 2006
2.	Land and Water Management Engineering, V.V.N. Murthy, 2nd edition, Kalyani Publishers, Ludhiana, 1985.
3.	Water Conservation, use and Management for Semi-arid Region, R. Nagarajan.
4.	Goel, J. K. (2002). Energy and Environment of Buildings & Farms. Saroj Prakashan, Alahabad..

AE6T02 – Refrigeration & Air Conditioning	**(2 – 1 –0 – 3)**
Unit - I	Principles of refrigeration, second law of thermodynamics applied to refrigeration, carnot cycle, reversed Carnot cycle, coefficient of performance, unit of refrigeration.
Unit - II	Refrigeration in food industry, types of refrigeration system, mechanical vapour compression, vapour absorption system, components of mechanical refrigeration, refrigerant, desirable properties of ideal refrigerant, Centrifugal and steam jet refrigeration systems, thermoelectric refrigeration systems, vortex tube and other refrigeration systems, ultra-low temperature refrigeration, cold storages, insulation material, design of cold storages, defrosting.
Unit - III	Thermodynamic properties of moist air, perfect gas relationship for approximate calculation, adiabatic saturation process, wet bulb temperature and its measurement, psychometric chart and its use, elementary psychometric process.
Unit - IV	Air conditioning - principles- Type and functions of air conditioning, physiological principles in air conditioning, air distribution and duct design methods, fundamentals of design of complete air conditioning systems - humidifiers and dehumidifiers - cooling and calculations, types of air conditioners -applications.
	Books: 1. Refrigeration and Air Conditioning – C.P. Arora, TMGH. 2. Refrigeration and Air Conditioning – Manohar Prasad, New Age International. 3. Refrigeration and Air Conditioning – P.L. Ballaney, Khanna Publishers. 4. Principles of Refrigeration and Air Conditioning – Jordan and Prister, MGH.

AE6T03 – Transfer Process in Food Engineering	**(3 – 1 –0 – 4)**
Unit - I	Introduction to transfer process. Steady state conduction, convection and radiation heat transfer, equations for radiative, convective and overall heat transfer for various geometries.
Unit - II	Unsteady state heat transfer in objects simple geometry, Heat Exchangers: Heat Exchanger-types and constructional details, parallel, counter flow and cross flow H.E, LMTD, effectiveness, NTU, use of charts for LMTD and LTU calculations. Design of double pipe, shell and tube and plate heat exchangers.
Unit - III	Newtonian, and non-Newtonian fluids, laminar and turbulent flow through pipes and plates; Navier Stoke's equation; fanning's friction factor. Velocity profile of fluid flow. Turbulent flow.
Unit - IV	Introduction to mass transfer and their application in food engineering. Diffusive and convective mass transfer. Mass transfer through packaging materials. Simultaneous heat and mass transfer in agricultural processing operations.
	Books: 1. Transport Process and Unit Operations, C.J Geankopolis, 3rd edition, Prentice Hall of India, New Delhi, 1999. 2. Heat Transfer, J.P. Halman, 8th edition, McGraw Hill Book Co. New York, 1977. 3. Transport Phenomena, Bird, Steward and LightFoot, 8th edition, John Wiley and Sons, New York, 1977. 4. Heat transfer- A Basic Approach, M.N. Ozisik, McGraw Hill Book Co., New York, 1985.

AE6T04 – Tractor Systems & Control (2 – 0 –0 – 2)	
Unit - I	Study of transmission systems. Function, Principle of operation of clutch system, working of single plate system, detail of components, working of dual clutch plate system & clutch adjustment.
Unit - II	Gear Box: Introduction, principle of gearing & types of gear box.
Unit - III	Differential: Function, principle of operation, operational details and differential lock, Final Drive.
Unit - IV	Familiarization of brake mechanism, mechanical & hydraulic brake.

Unit - V	Ackerman and hydraulic steering and hydraulic systems. Tractor power outlets: P.T.O., belt pulley, drawbar, etc. Tractor chassis mechanics and design for tractor stability. Ergonomic considerations and operational safety.
	Books: 1. Elements of Agricultural Engineering by Dr. Jagdiswar Sahay (S). 2. Farm Tractor Maintenance and Repair, S.C. Jain & C.R. Rai (J). 3. Principles of Agricultural Engineering-I, A M Michael & T P Ojha, Jain Brothers Publ. New Delhi, 2006 4. Farm Machines & Equipments, CP Nakra, Dhankpat Rai & Sons (N)

AE6T05 – Machine Drawings & Computer Graphics(2 – 0 –0 – 2)	
Unit - I	First and third angle methods of projection. Preparation of working drawing from models and isometric views. Drawing of missing views. Different methods of dimensioning.
Unit - II	Concept of sectioning. Revolved and oblique section. Sectional drawing of simple machine parts. Types of rivet heads and riveted joints. Processes for producing leak proof joints. Symbols for different types of welded joints. Nomenclature, thread profiles, multi-start threads, left and right hand thread. Square headed and hexagonal nuts and bolts. Conventional representation of threads. Different types of lock nuts, studs, machine screws, cap screws and wood screws. Foundation bolts.
Unit - III	Design process, application of computers for design, definition of CAD, benefits of CAD, CAD system components. Computer hardware for CAD. Display, input and output devices.
Unit - IV	Graphic primitives, display file, frame buffer, display control, display processors, Line generation, graphics software. Points and lines, Polygons, filling of polygons. Text primitive. Other primitives. Windowing and clipping, view port. Homogeneous coordinates. Transformations. Planar and space curves design. Analytical and synthetic approaches. Parametric and implicit equations. B- spline and Beizer curves. Geometric modeling techniques. Wire frames.
Unit - V	Introduction to 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
	Books: 1. Engineering Drawing, N.D. Bhatt, Charotar Publishing House, 46th edition, 2003. 2. Gopalakrishnan K.R, Machine Drawing Jovast Publishers, Thrissur, 1993.

AE6L01 – Machine Drawings & Computer Graphics Lab	
1.	Preparation of manual drawings with dimensions for models and isometric drawings og objects and machine components.
2.	Preparation of sectional drawings of simple machine parts.
3.	Drawing of riveted joints and thread fasteners.
4.	Demonstration on computer graphics and computer aided drafting use of standard software.
5.	Practice in the use of basics and drawing commands on auto cad.
6.	Generating simple 2-D drawings with dimensioning using auto cad. Practice in the use of modify and rebelling commands.
7.	Practice in graphics mathematics, curve fitting and transformations.
8.	Demonstration on CNC machine.

AE6T06 – Irrigation and Drainage Engineering - I	**(2 – 0 –1 – 3)**
Unit - I	Irrigation,impact of irrigation on Human Environment, some major and medium irrigation schemes of India, purpose of irrigation, sources of irrigation water, Present status of development and utilization of different water resources of the country; Measurement of irrigation water, weir, notches, flumes and orifices andOther methods; water conveyance, design of irrigation field channels, underground pipe conveyance system, irrigation structures, channel lining; land grading,different design methods and estimation of earth work and cost.
Unit - II	Soil Water plant relationship, soil water movement, infiltration, evapo-transpiration, soil moisture constant, depth of irrigation, frequency of irrigation, irrigation efficiencies.
Unit - IV	Drainage, objectives of drainage, familiarization with the drainage problems of the state, Surface drainage, drainage coefficient, types of surface drainage, design of open channel, sub-surface drainage purpose and benefits.
	Books: 1. Irrigation theory and practice, A.M.Michael, 2nd revised and enlarged edition, vikas pub. House, New Delhi, 2008. 2. Fundamentals of irrigation engineering, Bharat Singh, 8th edition, New chand and brothers, Roorkee, 1997.. 3. Irrigation engineering, G.S.Birdie and R.C.Das, 2nd edition, Dhanpat Rai & sons, New Delhi, 1996. 4. Irrigation engineering, N.N.Basak, tata McGraw hill pub., co., Ltd., New Delhi, 2001. 5. Irrigation engineering and hydraulic structures, S.K.Garg, Khanna Pub., New Delhi., 1999. 6. Drainage Engineering, J. N. Luthin, John Wiley and Sons, New York, 1970.

AE6L02– Irrigation and Drainage Engineering Lab	
1.	Field and Laboratory demonstration of hydro-met observatory, lysimeter, flow measurement
2.	Determination of crop water requirement and irrigation scheduling.
3.	In-situ measurement of hydraulic conductivity.
4.	Determination of drainage coefficient.
5.	Installation of piezometer and observation well.
6.	Preparation of iso- bath and iso- bar maps.
7.	Measurement of hydraulic conductivity and drainable porosity.
8.	Design of surface drainage system.
9.	Design of sub surface drainage system.
10.	Determination of chemical properties of soil and water.
11.	Fabrication of drainage tiles.
12.	Testing of drainage tiles.

Elective – I (AE6EL__)

AE6EL01 – Agribusiness Management and Trade(3 – 0 –0 – 3)	
Unit - I	Basics of agri-business management; planning, Organising, Controlling, Leading.
Unit - II	Forecasting for agri-business; location and Layout of facilities, Workforce management.
Unit - III	Quality management, Maintenance management.
Unit – IV	Financial analysis of agri-business.
Unit - V	Process Strategy; inventory management.
	Books: 1. Agri-business and Entrepreneurship_ Rajgopal, Indian Book & Periodicals, new Delhi, 1990. 2. Agribusiness and rural Development_ R.S. Jalal, Indian Book & Periodicals, New delhi, 1991. 3. Fundamentals of Farm Business Management_ S.S. Johl & R.R. kapur, kalyani Publishers, Ludhiana, 1997.

AE6EL02 – Entrepreneurship Development and Communication Skills	**(3 – 0 –0 – 3)**
Unit - I	Entrepreneurship Development: Assessing overall business environment in the Indian economy. overview of Indian social, political and economic systems and their implications for decision making by individual entrepreneurs. Globalization and the emerging business/entrepreneurial environment. Concept of entrepreneurship; entrepreneurial and managerial characteristics; managing on enterprise; motivation and entrepreneurship development; importance of planning, monitoring, evaluation and follow up; managing competition; entrepreneurship development programs; SWOT analysis, Generation, incubation and commercialization of ideas and innovations.
Unit - II	Government schemes and incentives for promotion of entrepreneurship. Government policy on Small and Medium Enterprises (SMEs)/SSIs. Export and Import Policies relevant to horticulture sector. Venture capital. Contract farming and joint ventures, public-private partnerships. Characteristics of Indian farm machinery industry. Social Responsibility of Business.
Unit - III	Communication Skills: Structural and functional grammar; meaning and process of communication, verbal and non-verbal communication; listening and note taking, writing skills, oral presentation skills field diary and lab record; indexing, footnote and bibliographic procedures. reading and comprehension of general and technical articles, précis writing, summarizing, abstracting; individual and group presentations, impromptu presentation, public speaking; Group discussion. Organizing seminars and conferences.
	Books: 1. Agri-business and Entrepreneurship, Rajgopal, Indian Book & Periodicals, New Delhi, 1990. 2. Industrial Entrepreneurship & small Scale Industries_ R.S. Jalal, Indian book & Periodicals, New Delhi, 1991. 3. Entrepreneurship development_ B.S. Rathore & J.S. Saini, wiley eastern Ltd. New delhi, 1991.

AE6EL03 – Design and Maintenance of Greenhouse	**(3 – 0 –0 – 3)**
Unit - I	History and types of greenhouse; importance, function and features of green house; scope and development of greenhouse technology.
Unit - II	Location, Planning and various components 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.
Unit - III	Steady state analysis of green house, Greenhouse heating, cooling, shedding and ventilation systems; Carbon Dioxide generation and monitoring and lighting systems, instrumentation & computerized environmental Control Systems. Watering, fertilization, root substrate and its pasteurization, containers and benches, plant nutrition.
Unit - IV	Alternative cropping systems; plant tissue culture, chemical growth regulation; disease control; integrated pest management; postproduction quality and handling Cost analysis of greenhouse production; Applications of green house & its repair & maintenance
	Books: 1. Rick Fisher, Bill Yanda, The Food and Heat Producing Solar Greenhouse, Design, Construction, Operation, John Muir Publisher, 1980. 2. Integrated Greenhouse Systems for Mild Climates, Christian von Zabeltitz, 2011.

Seventh Semester

AE7T01 – Irrigation and Drainage Engineering - II(2 – 0 –0 – 2)	
Unit - I	Surface irrigation methods of water application, border, check basin; furrow and counter irrigation; sprinkler and drip irrigation method, merits, demerits, selection and design; Participatory irrigation management. Economics of water resources utilization.
Unit - II	Investigations of design parameters, hydraulic conductivity, drainable porosity, water table etc., types and use of subsurface drainage system, Design of surface drains, interceptor and relief drains. Derivation of ellipse (Hooghoudt's) and Ernst's drain spacing equations. Design of subsurface drainage system.

Unit - III	Drainage materials, drainage pipes, drain envelope. Layout, construction and Installation of drains. Drainage structures. Vertical drainage. Bio-drainage. Tile drains. Drainage of irrigated and humid areas. Salt balance, reclamation of saline and alkaline soils. Leaching requirements, conjunctive use of fresh and saline waters. Economic aspects of drainage.
	Books: 1. Irrigation theory and practice, A.M.Michael, 2nd revised and enlarged edition, vikas pub. House, New Delhi, 2008. 2. Fundamentals of irrigation engineering, Bharat Singh, 8th edition, New chand and brothers, Roorkee, 1997.. 3. Irrigation engineering, G.S.Birdie and R.C.Das, 2nd edition, Dhanpat Rai & sons, New Delhi, 1996. 4. Irrigation engineering, N.N.Basak, tata McGraw hill pub., co., Ltd., New Delhi, 2001. 5. Irrigation engineering and hydraulic structures, S.K.Garg, Khanna Pub., New Delhi., 1999. 6. Drainage Engineering, J. N. Luthin, John Wiley and Sons, New York, 1970.

AE7T02 – System Engineering	**(2 – 1 –0 – 3)**
Unit - I	System concepts. Requirements for a Linear programming problems. Mathematical formulation of Linear Programming problems and its Graphical solution.
Unit - II	Artificial variable techniques, Big M method and two phase methods. Mathematical models physical systems. Modeling of Agricultural Systems and operations.
Unit - III	Cost analysis. Transportation problems. Assignment problems. Waiting line problems. Project management by PERT /CPM. Resource scheduling.
Unit - IV	Numerical solution of algebraic and transcendental equations by bisection method, Regula-Falsi method,Newton-Raphson's method, Solution of linear simultaneous equations- Gauss elimination and Gauss-Seidel iterative method
Unit - V	Finite differences-Forward, backward and central differences,Newton's forward and backward interpolation formulae, Lagrange interpolation, Newton's divided difference formula, Numerical differentiation at the tabulated points with forward backward and central differences. Numerical Integration with Trapezoidal rule, Simpson's 1/3 rule, Simpson's 3/8 rule.
	Books: 1. Veerarajan T. Numerical Methods, with Programs in C, Tata McGraw Hill, New Delhi, 2006. 2. M.K. Venkataraman, Numerical Methods, National Publishing Company, 2000.

AE7T03 – Mechanics of Tillage and Traction(2 – 0 –0– 2)	
Unit - I	Introduction to mechanics of tillage tools, engineering properties of soil, principles and concepts, stress strain relationship.
Unit - II	Response of systems. Computer as a tool in system analysis. Simplex method. Degeneracy and Duality in linear programming.
Unit - III	Introduction to traction and mechanics, off road traction and mobility, traction model, traction improvement, traction prediction, tyre size, tyre lug geometry and their effects, tyre testing, soil compaction and plant growth.
Unit - IV	Variability and geo statistic, application of GIS in soil dynamics
	Books: 1. Soil Dynamics in Tillage and Traction, W.R. Gill And G.E. Vandenberg, ARS, USDA, 1968. 2. Theory of Land Locomotion, M.G. Bekker, & Ann Arbor, The University of Michigan Press, U.S.A. 1956. 3. Soil Cutting and Tillage, E. McKeyes Elsevier, Tokyo, 1985. 4. Theory of Ground Vehicles, J.Y. Wong, John Wiley and Sons Inc. New York, 1993.

AE7T04 – Unit Operation in Dairy and Food Engineering(3 – 0 –3 – 3)	
Unit - I	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, drying filling &packaging, butter manufacture, dairy plant design and layout.
Unit - II	Material and energy balances involving solids, liquids and gases in dairy & food processing systems.
Unit - III	Contact equilibrium separation process: Concept of mass transfer in unit operations. Theory of equilibrium. Distillation, solid liquid extraction, gas absorption, adsorption, crystallization, humidification and dehumidification. Membrane separation.
Unit - IV	Simultaneous heat & mass transfer: Drying, different drying methods: conduction, convection & radiation drying. Microwave drying, Irradiation. Evaporation: method & design concept, steam economy. Material handling: Methods & design concept.
	Books: 1. Food Engineering and Dairy Technology, H.G. Kessler, V.A. Kessler, Freising, Germany 1981. 2. Fundamentals of Food Process Engineering, R.T. Toled, 2nd edition, CBS Publishers and Distributors, New Delhi, 1997. 3. Transport Processes and Unit Operations, C.J. Geankopolis, 3rd edition, Prentice Hall of India, New India, 1999. 4. Food Engineering Operations, Brennan, Butters Cowell and Lilley, 3rd edition, Elsevier Applied Science, Amsterdam, 1900.

AE7L01– Unit Operation in Dairy and Food Engineering Lab	
1.	Study of composite pilot milk processing plant & equipments.
2.	Study of pasteurizers &sterilizers.
3.	Study of homogenizers.
4.	Study of separators.
5.	Study of butter churners.
6.	Study of evaporators.
7.	Study of milk dryers.
8.	Study of freezers.
9.	Visit to multiproduct dairy product.
10.	Visit to food industry.

AE7T05 – Watershed Hydrology - II **(2 – 1 –0 – 3)**	
Unit - I	Introduction; floods - causes of occurrence, flood classification - probable maximum flood, standard project flood, design flood, flood estimation - methods of estimation; estimation of flood peak - Rational method, empirical methods.
Unit - II	Probability: Sample space, conditional probability, independent variables and independent experiments, Baye's theorem, Random variables (continuous and discrete), probability density function, cumulative distribution function, moment generating function. Probability distributions-Binomial, Poisson, Normal. Sampling, Sampling distribution, standard error, Student's t-distribution, Chi-square test as a test of goodness of fit.
	Unit hydrograph method; Statistics in hydrology, flood frequency methods - Log normal, Gumbel's extreme value, Log-Pearsontype-1, 1 distribution; depth-area-duration analysis.

Unit - III	Flood forecasting, flood routing - channel routing, Muskingum method, reservoir routing, modified Paul's method; flood control - history of flood control, structural and non-structural methods of flood control measures, storage and detention reservoirs, levees, channel improvement.
	Books: 1. Dhruvanarayana, V. V. (1993). Soil and Water Conservation Research in India. ICAR, New Delhi. 2. Goldman, S. J, Jackson K. and Bursztynsky, T. A. (1986). Erosion and Sediment Control Handbook. McGraw- Hill Book Company. 3. Murthy, V.V.N. (1998). Land and Water Management. Kalyani Publishing, New Delhi.

Elective – II (AE7EL__)

AE7EL01 – Remote Sensing and GIS Application	**(3 – 0 –0 – 3)**
Unit - I	Remote sensing: definition, stage in remote sensing, modern remote sensing technology versus conventional aerial photography: visual image interpretation, image interpretation, basic principles of image interpretation.
Unit - II	Factors governing the quality of the image: factors governing interpretability, visibility of objects, elements of image interpretation, techniques of image interpretation, digital image processing, digital image : remote sensing in agricultural progress and prospects, microwave radiometry for monitoring agricultural crops and hydrologic forecasting: aerial photo interpretation for water resources development and soil conservation survey.
Unit - III	GIS: history of development of GIS. definition, basic components, and standard GIS packages: data – Entry, storage and maintenance: Data types- spatial- non- spatial (attribute data), data structure, data format- point line vector- raster- polygon object structural model- files- files organization- data base management systems (DBMS), entering data in computer digitizer- scanner- data compression.
	Books: 1. Introduction to Environmental Remote Sensing, E.C. Barret and L.F. Curtis, Chapman and Hall, London 3rd Edition, 1992. 2. Remote Sensing and Geographical Information System: Manggi Reddy, B.S. Publication, 2nd Edition, 2002. 3. Remote Sensing and Image Interpretation, I.M. Lillesand and R.W. Keifer, John Willey and Sons Inc., New York, 2000 4. Fundamentals of Geographical Information System, Micheal N. DeMers. John willey & Sons, 2nd Edition, 1999.

AE7EL02 – Environmental Engineering (3 – 0 –0 – 3)	
Unit - I	Importance of safe water supply system. Domestic water requirements for urban and rural areas. sources of water supply. intake and transportation of water. Drinking water quality. Indian standard of drinking water.
Unit - II	Introduction to water treatment. Importance of sanitation. domestic waste water: quantity, characteristics, disposal and urban and rural areas. Sewer: types, design discharge and hydraulic design. Introduction to domestic waste water treatment. Design of septic tank. Solid waste : quantity, characteristics and disposal of urban and rural areas.
Unit - III	Introduction to air pollution. types of pollutants properties and their effects on living beings. ISI standards for pollutants in air and their abetments.
	Books: 1. Environmental Engineering, G.N.Pandey, G.C.Carney, Tata MacGraw Hill Co. New Delhi, 1994. 2. Environmental Engineering, Gepard Kiely, MacGraw Hill international, New York, 1998. 3. Environmental Pollution Control Engineering, C.S.Rao, New Age International, New Delhi, 2001.

AE7EL03 – Development of Processed Product & Equipment	**(3 – 0 –0 – 3)**
Unit - I	Application of unit operations to food industry, analytical processing concepts with regard to mass and energy balances, equipment involved in the commercially important food processing methods and unit operation: valve addition to cereals like rice , wheat etc. parboiling of rice, quality of processed products of rice and wheat. Processing of pulses, spices and condiments: Extruded food product, fermented food product, frozen and dried product, technology of meat, fish and poultry product, technology of milk and milk products.
Unit - II	Technology of oil seeds and fat product, snack foods, fruits and vegetables product: candy, nutraceuticals, food product development trends, food additive and labeling.
Unit - III	Process equipment for thermal processing- evaporation, dehydration, drying, blenching, pasteurization distillation: mechanical separation- filtration, sieving, centrifugation, sedimentation: mechanical handling- conveying and elevation: size reduction and classification- mixing : kneading, blending.
	Books: 1. Food Engineering and Dairy Technology, H.G. Kessler, V.A. Kessler, Freising, Germany 1981. 2. Fundamentals of Food Process Engineering, R.T. Toled, 2nd edition, CBS Publishers and Distributors, New Delhi, 1997. 3. Unit operations of Agricultural Processing, K.M. Sahay& K.K. Singh, Vikas publishing house, New Delhi, 2nd edition, 2001 4. Post-Harvest Technology of cereals, pulses & Oil seeds, A Chakraborty, Oxford & IBH Pub. New delhi, 3rd edition, 2000

AE7EL04 – Waste and By-product Utilization	**(3 – 0 –0 – 3)**
Unit - I	Types and formation of byproducts and waste; magnitude of waste generation in different food processing industries; concept scope and maintenance of waste management and effluent treatment, Temperature, pH, Oxygen demands (BOD, COD,), fat, oil and grease content, metal content, forms of phosphorous and sulphur in waste waters, microbiology of waste, other ingredients like insecticide, pesticides and fungicides residues.
Unit - II	Waste utilization in various industries, furnaces and boilers run on agricultural wastes and byproducts, briquetting of biomass as fuel, "production of charcoal briquette, generation of electricity using surplus biomass, producer gas generation and utilization.
Unit - III	Waste treatment and disposal, design, construction, operation and management of institutional community and family size biogas plants, concept of vermi-composting, Pre-treatment of waste: sedimentation, coagulation, flocculation and floatation.
Unit - IV	Secondary treatments: Biological and chemical oxygen demand for different food plant waste-trickling filters, oxidation ditches, activated sludge process, rotating biological contractors, lagoons.
Unit - V	Tertiary treatments: Advanced waste water treatment process-sand, coal and activated carbon filters, phosphorous, sulphur, nitrogen and heavy metals removal, Assessment, treatment and disposal of solid waste; and biogas generation.
	Books: 1. Food from waste, Warvan. 2. Food protein sources, Pirie. 3. Technology of fish utilization, Ed. Kreuyer.

AE7EL05 – Food Processing Plant Design & Layout	**(3 – 0 –0 – 3)**
Unit - I	Meaning and definition of plant layout. Objectives and principles of layout. Types of layout.
Unit - II	Salient features of processing plants for cereals, pulses oilseeds, horticultural and vegetable crops, poultry, fish and meat products, milk and milk products.
Unit - III	Location selection criteria, selection of processes, plant capacity, project design, flow diagrams, selection of equipments, process and controls, handling equipments, plant layout.

Unit - IV	Plant elevation, requirement of plant building and its components, labor requirement, plant installation, power and power transmission, sanitation. Cost analysis, preparation of feasibility report.
	Books: 1. Agricultural process engineering, R.N.Reddy, Daya Pub. House, 2010 2. Fundamentals of Food engineering, D.G.Rao, Phi Learning Pub. 2010 3. Introduction to Food Engineering, Singh R, 3rd Edition, Academic Press, 2001

Eight Semester

AE8T01 – Tractor Design and Testing	**(3 – 0 –1 – 4)**
Unit - I	Importance of testing. Types of test-confidential, commercial and batch. Testing facilities in India and abroad. O.E.C.D., Nabraska and I.S.I. test code for engine test, P.T.O. test, belt and pulley test, draw bar test, Hydraulic power and lifting capacity test.
Unit - II	Turing ability, visibility from driver's seat. Brake test, air cleaner, oil pull over test, noise measurement, vibration measurement, assessment of power drop and wear.
Unit - III	Testing of various farm machineries and their main components for functional performance, wear, strength, force and power requirement.
	Books: 1. Barger, E.L., Liledahl, J.B., Carleton, W.M.and Mckibben, E.G. (1978). Tractor and their power units. Wiley Eastern pvt. Ltd, New York. 2. Kanafoshi, C.Z. and Karwawshi, T. (1976). Agricultural Machines, Theory and Construction (Vol. 1 and 2). USDA, Poland. 3. Pandya, N.C. and Shah, C.S. (1981). Elements of Machine Design. Charotar Publishing House, Anand.

AE8T02 – Food Process and Packaging Technology(3 – 0 –0 – 3)	
Unit - I	Thermal processing of foods: Kinetics of microbial death, process calculations for caning, pasteurization and sterilization of foods. Concept of minimal food processing.
Unit - II	Chemical preservatives. Food preservation by fermentation, curing, pickling, smoking etc; use of enzymes in food processing. F&V technology: Concept of fruits & vegetables preservation, dryig technology. Technology of beverages.
Unit - III	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.
Unit - IV	Food packaging materials, Food packaging methods. Effects of processing on quality of foods. Indian food laws. HACCP & GMP concept.
Unit - V	Packaging requirement & their selection for the raw & processed foods. Advantages & disadvantages of these packaging materials; effect of these materials on packed commodities, Package testing, Printing, labeling and lamination. Disposal and recycle of packaging waste.
	Books: 1. Novel Food Packaging Techniques, R Ahvenainen, Woodhead pub. Ltd., New York, 2000 2. Handbook of Post-Harvest Technology, Cereals, Fruits, Vegetables, Tea and Spices, A Chakraverty, A S Mujumder, G S V Raghavan& H S Ramaswamy, star Educational book distributor, pvt. Ltd. New Delhi, 2010 3. Advances in Preservation & Processing Technologies of Fruits & Vegetables, S Rajarathnam& R S Ramteke, New India Pub Agency, New Delhi, 2011 4. Food Process Engg.& Technology, Z Berk, 1st edition, Elsevier, New York, 2009

AE8T04 – Watershed Planning and Management	**(2 – 0 –0 – 2)**
Unit - I	Watershed management - problems and prospects; watershed based land use planning, watershed characteristics - physical and geomorphologic, factors affecting watershed management.
Unit - II	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 structures; sediment yield estimation and measurement from a watershed and sediment yield models.
Unit - III	Rainwater conservation technologies - in-situ and storage, design of water harvesting tanks and ponds; water budgeting in a watershed; effect of cropping system.
Unit - IV	Land management and cultural practices on watershed hydrology; evaluation and monitoring of watershed programmes; people's participation in watershed management programmes; planning and formulation of project proposal; cost benefits analysis of watershed programmes; optimal land use models; case studies.
	Books: 1. Watershed Management by JVS Murthy-New age International Publishers. 2. Water Resource Engineering by R. Awurbs and WP James – Prentice Hall Publisher. 3. Integrated Watershed Management, Principles and Practice by I.W. Heathcote, John Wiley & Sons, Inc., New York, 1988. 4. Integrated Watershed Management in the Global Ecosystem by R. Lal – CRC Press, Boca Raton, FL, 2000.

Elective – III (AE8EL__)

AE8EL01 – Human Engineering and Safety	**(3 – 0 –0 – 3)**
Unit - I	Human factors in system development - concept of systems; basic processes in system development, performance reliability, human performance.
Unit - II	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.
Unit - III	Human motor activities, controls, tools and related devices. Anthropometry: arrangement and utilization of work space, atmospheric conditions, heat exchange process and performance, air pollution.
Unit - IV	Dangerous machine (Regulation) act, Rehabilitation and compensation to accident victims, Safety gadgets for spraying, threshing, Chaff cutting and tractor &trailer operation etc.
	Books: 1. Grandjean, E, 1988, Fitting the Task to the Man, Taylor and Francis, London. 2. Sanders, M.S. and McCormick, E.J. 1978, Human Factors in Engineering and Design, McGraw Hill Inc, Singapore. 3. Griffin, M.J. 1996, Hand Book of Human Vibration, Academic Press.

AE8EL02 – Biomass Management for Fodder and Energy(3 – 0 –0 – 3)	
Unit - I	Introduction to biomass management, biomass resource assessment management techniques/supply chains.
Unit - II	Processing of paddy straw, densification-Extrusion process, pellets, mills and cubers, Bailing-classification, uses; residue management for surface mulch and soil incorporation, Paddy Straw choppers and spreaders as an attachment to combine harvester, Mulch seeder, Paddy straw Chopper-cum-loader, Balar for collection of straw.

Unit - III	Processing of straw/fodder for animal use; Agricultural and horticultural use, Cushioning material for fruits and vegetables, mulching and Composting, Paper and cardboard manufacturing Straw as a fuel.
	Books: 1. Unit operations of Agricultural Processing, K.M. Sahay& K.K. Singh, Vikas publishing house, New Delhi, 2nd edition, 2001 2. Post Harvest Technology of cereals, pulses & Oil seeds, A Chakraborty, Oxford & IBH Pub. New delhi, 3rd edition, 2000 3. Food from waste, Warvan.

AE8EL03 – Production Technology of Agricultural Machines	**(3 – 0 –0 – 3)**
Unit - I	Critical appraisal in production of Agricultural machinery; Modelling and stress analysis of Machinery parts by using standard software; Advances in material used for tractor & Agril. Machinery. Cutting tools including CNC tools and finishing tools.
Unit - II	Advanced manufacturing techniques like powder metallurgy, EDM (Electro-Discharge Machining), Heat treatment of steels including pack carburizing, shot pining process, chemical vapor deposition (CVD) etc. Limits, Fits 7 Tolerances, Jigs & Fixtures, Microstructure Analysis. Industrial lay-out planning, Quality management, Economics of process selection. Techno-economic feasibility of Project Report. Selection of Standard/critical components.
Unit - III	Case studies of manufacturing of Agril. Machinery. Servo motors, drives 7 controllers, CNC controllers for machine tools. CNC programming. Assembly and plant automation. Storage and transportation.
	Books: 1. Theory of Ground Vehicles, J.Y. Wong, John Wiley & Sons Inc. New York, 1993 2. Rnam Test Codes and Procedures for Farm Machinery, 2nd Edition, UNIDO, 1995

AE8T05 – Renewable Energy Source	**(2 – 1 –0 – 3)**
Unit - I	Classification of energy sources; Introduction to renewable energy sources.
Unit - II	Characterization of biomass; types, construction, working principle, uses and safety/environmental aspects of different renewable energy devices like gasifiers, biogas plants, solar passive heating devices, photovoltaic cells and arrays;
Unit - III	Brief introduction to wind energy, hydroelectric energy, ocean energy, briquetting and baling of biomass, biomass combustion, biodiesel preparation and energy conservation in agriculture.
	Books: 1. Non-Conventional Sources of Energy, G.D. Rai, 4th edition, Khanna Publishers, Delhi 1996. 2. Non-Conventional Sources of Energy, O.P. Singhal, 1st edition, Saroj Prakashan, Allahabad, 1996. 3. Solar Energy, S.P. Sukhatme, 2nd edition, Tata McGraw Hill Publishing Co. Ltd. New Delhi, 1996. 4. Biotechnology, other Alternative Technologies for Utilization of Biomass/Agril. Wastes, A. Chakraborty, 1st edition, Oxford and IBH Publishing Co. Pvt. Ltd, New Delhi, 1989.

Minutes of the 1st Board of Undergrsduate Studies (BUGS) meeting for the department of Agricultural Engineering and Technology, School of Engineering, Nagaland University

27th March 2015

The First Board of Undergraduate studied (BUGS) meeting for the Department of Agricultural Engineering and Technology was held on 27th march 2015 at DEAN's chamber, Academic block, School of Engineering and Technology, Nagaland University, Dimapur.

The meeting was presided by Prof. D.P Chaturvedi, Chairmain , BUGS committee and Dean of SET & SMS. Department of Agricultural Engineering and Technology presented the revised course structure and syllabi for B.Tech programme in Agricultural Engineering and Technology to the members of the Commiittee for approval and rectifications.

After Long discussion on each and every items presented in the house , it was concluded with appropriate course structure and syllabi to be followed for B.Tech programm in Agricultural Engineering and Technology as annexed.

Following discussion were also discussed.

1. Removal of mathematics IV from fourth semester as the syllabus content can be in cooperated with watershed hydrology II and System engineering.
2. Addition of course on Agriculture for Engineers course in fourth semester with code AE4T08 with credit 3 credit.
3. Removal of Reservoir and farm pond (AE7T01) and added a course on Irrigation and Drainage Engineering II with 2 credit.
4. Removal of Course on Hydraullic drive and control (AE8T03, 3 credit) and part of important content in the syllabus has been added to Tractor design and Testing AE8T01.
5. And other course structure proposed by the department were approved for implementation.

The meeting was concluded by giving a vote thanks from I/C department of Agricultural Engineering and Technology.

27/3/15 (R.C Nayaa)

27/3/15 (A.K Verma)

27/3/15 (P.K. DAS)

27/3/15

Chitrasen Lairenjam
27/03/2015