



SNS COLLEGE OF TECHNOLOGY

(An Autonomous Institution)



**Approved by AICTE, Recognized by UGC & Affiliated to Anna University
Accredited by NBA-AICTE, NAAC-UGC with 'A+' Grade**

Saravanampatti , Coimbatore -641035

**CURRICULA AND SYLLABI
REGULATION 2016
CHOICE BASED CREDIT SYSTEM**

**DEPARTMENT OF AGRICULTURE
ENGINEERING**

B.E. – AGRICULTURE ENGINEERING



SNS COLLEGE OF TECHNOLOGY, COIMBATORE – 641035

(AN AUTONOMOUS INSTITUTION)

REGULATION – 2016

CHOICE BASED CREDIT SYSTEM

SUGGESTED CURRICULUM AND SYLLABI

B. E. AGRICULTURE ENGINEERING

SEMESTER I

S.NO	COURSE CODE	COURSE TITLE	CAT	CONTACT PERIODS	L	T	P	C	PRE-REQUISITES
THEORY									
1.	16EN101	Technical English – I	HS	3	3	0	0	3	-
2.	16MA101	Engineering Mathematics – I	BS	4	3	1	0	4	-
3.	16PY101	Engineering Physics	BS	3	3	0	0	3	-
4.	16CH101	Engineering Chemistry	BS	3	3	0	0	3	-
5.	16CS101	Fundamentals of Computing and Programming	ES	3	3	0	0	3	-
6.	16ME101	Engineering Drawing	ES	5	3	0	2	4	-
7.	16GE111/ 16GE113	Career Development Program – I	EEC	3	1	0	2	2*	-
PRACTICAL									
8.	16CS102	Fundamentals of Computing and Programming Laboratory	ES	4	0	0	4	2	-
9.	16CH103	Chemistry Laboratory	BS	2	0	0	2	1	-
10.	16EN103	Communication Skills Laboratory	HS	4	0	0	4	2	-
TOTAL				34	20	0	14	25+2*	

SEMESTER II

S.NO.	COURSE CODE	COURSE TITLE	CAT	CONTACT PERIODS	L	T	P	C	PRE-REQUISITES
THEORY									
1.	16EN102	Technical English – II	HS	3	3	0	0	3	16EN101
2.	16MA102	Engineering Mathematics-II	BS	4	3	1	0	4	16MA101
3.	16PY102	Physics of Materials	BS	3	3	0	0	3	-
4.	16CH102	Environmental Science and Engineering	BS	3	3	0	0	3	-
5.	16EE101	Basic Electrical and Electronics Engineering	ES	3	3	0	0	3	-
6.	16ME102	Engineering Mechanics	ES	4	3	2	0	4	-
7.	16GE112/ 16AG112	Career Development Program –II/ Career Development Program – II(Agriculture Engineering Basics)	EEC	3	1	0	2	2*	-
PRACTICAL									
8.	16PY103	Physics Laboratory	BS	2	0	0	2	1	-
9.	16GE102	Engineering Practices Laboratory	ES	4	0	0	4	2	-
10.	16ME103	Computer Aided Drafting Laboratory	ES	2	0	0	2	1	-
TOTAL				31	21	0	10	24+2*	

SEMESTER III

S.N O.	COURSE CODE	COURSE TITLE	CAT	CONTACT PERIODS	L	T	P	C	PRE-REQUISITES
THEORY									
1.	16MA201	Transforms and Partial Differential Equations	BS	4	3	1	0	4	16MA101, 16MA102
2.	16AG201	Engineering Geology and Soil mechanics	PC	3	3	0	0	3	
3.	16ME201	Engineering Thermodynamics	ES	4	3	2	0	4	
4.	16ME202	Fluid Mechanics and Machinery	ES	3	3	0	0	3	
5.	16AG203	Surveying and Leveling	PC	3	3	0	0	3	-
6.	16GE211/ 16GE213	Career Development Program -III	EEC	3	1	0	2	2*	
PRACTICAL									
7.	16ME205	Fluid Mechanics and Machinery Lab	ES	4	0	0	4	2	-
8.	16AG204	Engineering Geology and Soil mechanics Lab	PC	2	0	0	2	1	-
9.	16AG205	Surveying and Leveling Lab	PC	2	0	0	2	1	-
THEORY CUM PRACTICAL									
10.	16AG202	Fundamentals of Soil Science	PC	4	2	0	2	3	-
TOTAL				32	19	1	12	24+2*	-

SEMESTER IV

S.NO	COURSE CODE	COURSE TITLE	CAT	CONTACT PERIODS	L	T	P	C	PRE-REQUISITES
THEORY									
1.	16MA205	Probability and Statistics	BS	4	3	1	0	4	16MA101, 16MA102
2.	16AG206	Unit Operations in Food Process Engineering	PC	3	3	0	0	3	16ME201, 16ME202
3.	16AG207	Biomass Conversion	PC	3	3	0	0	3	16ME201, 16ME202
4.	16AG209	Soil and water conservation Engineering	PC	3	3	0	0	3	16AG202
5.	16AG210	Heat Power Engineering	PC	3	3	0	0	3	16ME201
6.	16GE212/ 16GE214	Career Development Program - IV	EEC	3	1	0	2	2*	-
PRACTICAL									
7.	16AG211	Food Process Engineering Lab	PC	2	0	0	2	1	-
8.	16AG212	Biomass Conversion Lab	PC	2	0	0	2	1	-
9.	16AG213	Heat Power Engineering Lab	PC	2	0	0	2	1	-
THEORY CUM PRACTICAL									
10.	16AG208	Agronomy of Field Crops	PC	5	3	0	2	4	-
Total				30	20	0	10	23+2*	

SEMESTER V

S.NO	COURSE CODE	COURSE TITLE	CAT	CONTACT PERIODS	L	T	P	C	PRE-REQUISITES
THEORY									
1.	16MA302	Numerical Methods	BS	4	3	1	0	4	-
2.	16AG302	Solar and Wind Energy	PC	3	3	0	0	3	16ME201
3.	16AG303	Machine Design	PC	3	3	0	0	3	-

4.		Professional Elective-I	PE	3	3	0	0	3	-
5.		Open Elective –I	OE	3	3	0	0	3	-
6.	16AG304/ 16GE313	Career Development Program - V	EEC	3	1	0	2	2*	-
PRACTICAL									
7.	16AG305	Solar and Wind Energy Lab	PC	2	0	0	2	1	-
8.	16AG306	Machine Design & Computer Aided Drafting Laboratory	PC	2	0	0	2	1	16ME103
9.	16AG307	GIS Lab	PC	2	0	0	2	1	-
THEORY CUM PRACTICAL									
10.	16AG301	Farm Implements, Sowing and Plant Protection Equipment	PC	5	3	0	2	4	-
Total				30	20	0	10	23+2*	

SEMESTER VI

S. NO.	COURSE CODE	COURSE TITLE	CAT	CONTACT PERIODS	L	T	P	C	PRE-REQUISITES
THEORY									
1.	16GE301	Professional Ethics	HS	3	3	0	0	3	-
2.	16AG308	Farm Tractors	PC	3	3	0	0	3	16AG210
3.	16AG310	Post harvest Engineering	PC	3	3	0	0	3	16AG206
4.		Professional Elective -II	PE	3	3	0	0	3	-
5.		Professional Elective – III	PE	3	3	0	0	3	-
6.		Open Elective–II**	OE	3	3	0	0	3	-
7.	16GE312/ 16GE314	Career Development Program - VI	EEC	3	1	0	2	2*	-

PRACTICAL									
8.	16AG311	Farm Tractors Lab	PC	2	0	0	2	1	-
9.	16AG313	Post harvest Engineering Lab	PC	2	0	0	2	1	-
10.	16AG314	Mini project	ECC	2	0	0	2	1	-
Total				27	19	0	8	21+2*	

SEMESTER VII

S.NO	COURSE CODE	COURSE TITLE	CAT	CONTACT PERIODS	L	T	P	C	PRE-REQUISITES
THEORY									
1.	16AG401	Harvesting and Thrashing Machinery	PC	3	3	0	0	3	-
2.	16AG402	Dairy and Food Engineering	PC	3	3	0	0	3	16AG206
3.	16AG403	Irrigation and Drainage Engineering	PC	3	3	0	0	3	16ME202
4.		Professional Elective - IV	PE	3	3	0	0	3	-
5.		Professional Elective - V	PE	3	3	0	0	3	-
6.		Open Elective – III**	OE	3	3	0	0	3	-
PRACTICAL									
7.	16AG404	Management of Farm Machinery and Implements Lab	PC	2	0	0	2	1	-
8.	16AG405	Dairy and Food Engineering Lab	PC	2	0	0	2	1	-
9.	16AG406	Irrigation and Drainage Engineering Lab	PC	2	0	0	2	1	-
10.	16AG407	Project Work Phase – I	ECC	4	0	0	4	2	-
Total				28	18	0	10	23	-

SEMESTER VIII

S.NO.	COURSE CODE	COURSE TITLE	CAT	CONTACT PERIODS	L	T	P	C	PRE-REQUISITES
THEORY									
1.	16GE302	Engineering Economics and Cost Analysis	HS	3	3	0	0	3	-
2.		Professional Elective – VI	PE	3	3	0	0	3	-
3.		Professional Elective – VII	PE	3	3	0	0	3	-
PRACTICAL									
4.	16AG408	Project Work Phase - II	ECC	20	0	0	20	10	16AG407
Total				29	9	0	20	19	-

TOTAL NO. OF CREDITS: 182*

Not included in the calculation of CGPA

****Courses from the curriculum of other UG Programmes**

HUMANITIES AND SOCIAL SCIENCES (HS)

S.NO.	COURSE CODE	COURSE TITLE	CONTACT PERIODS	L	T	P	C	PRE-REQUISITES
1.	16EN101	Technical English - I	3	3	0	0	3	-
2.	16EN103	Communication Skills Laboratory	4	0	0	4	2	-
3.	16EN102	Technical English – II	3	3	0	0	3	16EN101
4.	16GE302	Engineering Economics and Cost Analysis	3	3	0	0	3	-
5.	16GE301	Professional Ethics	3	3	0	0	3	

BASIC SCIENCES (BS)

S.NO.	COURSE CODE	COURSE TITLE	CONTACT PERIODS	L	T	P	C	PRE-REQUISITES
1.	16MA101	Engineering Mathematics – I	4	3	1	0	4	-
2.	16PY101	Engineering Physics	3	3	0	0	3	-
3.	16CH101	Engineering Chemistry	3	3	0	0	3	-
4.	16CH103	Chemistry Laboratory	2	0	0	2	1	-
5.	16MA102	Engineering Mathematics – II	4	3	1	0	4	16MA101
6.	16PY102	Physics of Materials	3	3	0	0	3	-
7.	16CH102	Environmental Science and Engineering	3	3	0	0	3	-
8.	16PY103	Physics Laboratory	2	0	0	2	1	-
9.	16MA201	Transforms and Partial Differential Equations	4	3	1	0	4	16MA101, 16MA102
10.	16MA205	Probability and Statistics	4	3	1	0	4	16MA101, 16MA102
11.	16MA302	Numerical Methods	4	3	1	0	4	-

ENGINEERING SCIENCES (ES)

S.NO.	COURSE CODE	COURSE TITLE	CONTACT PERIODS	L	T	P	C	PRE-REQUISITES
1.	16CS101	Fundamentals of Computing and Programming	3	3	0	0	3	-
2.	16CS102	Fundamentals of Computing and Programming Laboratory	4	0	0	4	2	-
3.	16ME101	Engineering Drawing	5	3	0	2	4	-
4.	16EE101	Basic Electrical and Electronics Engineering	3	3	0	0	3	-

5.	16ME102	Engineering Mechanics	4	3	2	0	4	-
6.	16GE102	Engineering Practices Laboratory	4	0	0	4	2	-
7.	16ME103	Computer Aided Drafting Laboratory	2	0	0	2	1	-
8.	16ME201	Engineering Thermodynamics	4	3	2	0	4	-
9.	16ME202	Fluid Mechanics and Machinery	3	3	0	0	3	-
10.	16ME205	Fluid Mechanics and Machinery Lab	4	0	0	4	2	-

PROFESSIONAL CORE (PC)

S.NO.	COURSE CODE	COURSE TITLE	CONTACT PERIODS	L	T	P	C	PRE-REQUISITES
1.	16AG201	Engineering Geology and Soil mechanics	3	3	0	0	3	-
2.	16AG202	Fundamentals of Soil Science	4	2	0	2	3	-
3.	16AG203	Surveying and Leveling	3	3	0	0	3	-
4.	16AG204	Engineering Geology and Soil mechanics Lab	2	0	0	2	1	-
5.	16AG205	Surveying and Leveling Lab	2	0	0	2	1	-
6.	16AG206	Unit Operations in Food Process Engineering	3	3	0	0	3	-
7.	16AG207	Biomass Conversion	3	3	0	0	3	-
8.	16AG208	Agronomy of Field Crops	5	3	0	2	4	-
9.	16AG209	Soil and water conservation Engineering	3	3	0	0	3	-
10.	16AG210	Heat Power Engineering	3	3	0	0	3	-

11.	16AG211	Food Process Engineering Lab	2	0	0	2	1	-
12.	16AG212	Biomass Conversion Lab	2	0	0	2	1	-
13.	16AG213	Heat Power Engineering Lab	2	0	0	2	1	-
14.	16AG301	Farm Implements, Sowing and Plant Protection Equipment	5	3	0	2	4	-
15.	16AG302	Solar and Wind Energy	3	3	0	0	3	-
16.	16AG303	Machine Design	3	3	0	0	3	-
17.	16AG305	Solar and Wind Energy Lab	2	0	0	2	1	-
18.	16AG306	Machine Design & Computer Aided Drafting Laboratory	2	0	0	2	1	-
19.	16AG307	GIS Lab	2	0	0	2	1	-
20.	16AG308	Farm Tractors	3	3	0	0	3	-
21.	16AG310	Post harvest Engineering	3	3	0	0	3	-
22.	16AG311	Farm Tractors Lab	2	0	0	2	1	-
23.	16AG313	Post harvest Engineering Lab	2	0	0	2	1	-
24.	16AG314	Mini Project	2	0	0	2	1	-
25.	16AG401	Harvesting and Thrashing Machinery	3	3	0	0	3	-
26.	16AG402	Dairy and Food Engineering	3	3	0	0	3	-
27.	16AG403	Irrigation and Drainage Engineering	3	3	0	0	3	-
28.	16AG404	Management of Farm Machinery and Implements Lab	2	0	0	2	1	-
29.	16AG405	Dairy and Food Engineering Lab	2	0	0	2	1	-

30.	16AG406	Irrigation and Drainage Engineering Lab	2	0	0	2	1	-
31.	16AG407	Project Work Phase I	4	0	0	4	2	-
32.	16AG408	Project Work Phase II	20	0	0	20	10	-

PROFESSIONAL ELECTIVE (PE) I

S.NO.	COURSE CODE	COURSE TITLE	CONTACT PERIODS	L	T	P	C	PRE-REQUISITES
1.	16AG315	Building Materials, Estimation and Costing	3	3	0	0	3	
2.	16AG316	Strength of Materials	3	3	0	0	3	
3.	16AG317	Design of Farm Power & Machinery	3	3	0	0	3	
4.	16AG318	Co-Generation And Waste Heat Recovery Systems	3	3	0	0	3	
5.	16AG319	Technology Of Seed Processing	3	3	0	0	3	

PROFESSIONAL ELECTIVE (PE) II

S.NO.	COURSE CODE	COURSE TITLE	CONTACT PERIODS	L	T	P	C	PRE-REQUISITES
1.	16AG320	Theory of Machines	3	3	0	0	3	-
2.	16AG321	Watershed Planning and Management	3	3	0	0	3	-
3.	16AG322	Instrumentation and Testing Of Agricultural Machinery	3	3	0	0	3	-
4.	16AG323	Landscaping and Green house technology	3	2	0	2	3	-
5.	16AG324	Food Safety Regulations and Quality Control	3	3	0	0	3	-

PROFESSIONAL ELECTIVE (PE) III

S.NO.	COURSE CODE	COURSE TITLE	CONTACT PERIODS	L	T	P	C	PRE-REQUISITES
1.	16AG325	Groundwater hydrology and well hydraulics	3	3	0	0	3	-
2.	16AG326	Human Engg. & Safety in agriculture	3	3	0	0	3	-
3.	16AG327	Clean Development Mechanism (CDM) And Carbon Trading	3	3	0	0	3	-
4.	16AG328	Boiler And Steam Engineering	3	3	0	0	3	-
5.	16AG415	Fat And Oil Processing	3	3	0	0	3	-

PROFESSIONAL ELECTIVE (PE) IV

S.NO.	COURSE CODE	COURSE TITLE	CONTACT PERIODS	L	T	P	C	PRE-REQUISITES
1.	16AG330	Refrigeration and Air Conditioning	3	3	0	0	3	-
2.	16AG331	Minor Irrigation & Command Area Development	3	3	0	0	3	-
3.	16AG332	Agri Business Management	3	3	0	0	3	-
4.	16AG333	Agro-Energy Audit And Management	3	3	0	0	3	-
5.	16AG334	Production Technology Of Agricultural Machinery	3	3	0	0	3	-

PROFESSIONAL ELECTIVE (PE) V

S.NO.	COURSE CODE	COURSE TITLE	CONTACT PERIODS	L	T	P	C	PRE-REQUISITES
1.	16AG410	Heat and Mass Transfer	3	3	0	0	3	-
2.	16AG411	Mechanics of Tillage & Traction	3	3	0	0	3	-
3.	16AG412	Packaging Technology	3	3	0	0	3	-
4.	16AG413	Protected Cultivation	3	3	0	0	3	-
5.	16AG414	Climate Change And Adaptation	3	3	0	0	3	-

PROFESSIONAL ELECTIVE (PE) VI

S.NO.	COURSE CODE	COURSE TITLE	CONTACT PERIODS	L	T	P	C	PRE-REQUISITES
1.	16AG329	Food Plant Layout And Management	3	3	0	0	3	-
2.	16AG416	Disaster Management	3	3	0	0	3	-
3.	16AG417	Water And Wastewater Engineering	3	3	0	0	3	-
4.	16AG419	Design of irrigation systems	3	3	0	0	3	-
5.	16AG421	Extension Methodologies for Agriculture	3	3	0	0	3	-

PROFESSIONAL ELECTIVE (PE) VII

S.NO.	COURSE CODE	COURSE TITLE	CONTACT PERIODS	L	T	P	C	PRE-REQUISITES
1.	16AG420	Public Health Engineering	3	3	0	0	3	-
2.	16AG418	Energy Conservation In Food Industry	3	3	0	0	3	-
3.	16AG422	Environmental Impact assessment	3	3	0	0	3	-
4.	16AG423	GIS and Natural resources management	3	3	0	0	3	-
5.	16AG424	Storage Technology	3	3	0	0	3	-

EMPLOYABILITY ENHANCEMENT COURSES (EEC)

S.NO.	COURSE CODE	COURSE TITLE	CONTACT PERIODS	L	T	P	C	PRE-REQUISITES
1.	16ME103	Computer Aided Drafting Laboratory	2	0	0	2	1	-
2.	16GE111/ 16GE113	Career Development Program I	3	1	0	2	2*	-
3.	16GE112/ 16AG112	Career Development Program –II/ Career Development Program – II(Agriculture Engineering Basics)	3	1	0	2	2*	-
4.	16GE211/ 16GE213	Career Development Program III	3	1	0	2	2*	-
5.	16GE212/ 16GE214	Career Development Program IV	3	1	0	2	2*	-
6.	16AG304/ 16GE313	Career Development Program V	3	1	0	2	2*	-
7.	16GE312/ 16GE314	Career Development Program VI	3	1	0	2	2*	-
8.	16AG306	Machine Design & Computer Aided Drafting Laboratory	2	0	0	2	1	-
9.	16AG307	GIS Lab	2	0	0	2	1	-
10.	16AG314	Mini project	2	0	0	2	1	-
11.	16AG407	Project Work Phase-I	4	0	0	4	2	--
12.	16AG408	Project Work Phase-II	20	0	0	20	10	--

OPEN ELECTIVE OFFERED TO OTHER UG PROGRAMMES

COURSE CODE	COURSE TITLE	L	T	P	C	Pre-requisites
16AGOE1	Quality Management in Food Industries	3	0	0	3	-
16AGOE2	Forest Resource Management	3	0	0	3	-
16AGOE3	Energy Management in Agriculture	3	0	0	3	-
16AGOE4	Farm Mechanization	3	0	0	3	-

ONE CREDIT COURSES

S.NO.	COURSE CODE	COURSE TITLE	CONTACT PERIODS	L	T	P	C	PRE-REQUISITES
1.	16AGOC1	Crop Disease Management	15	-	-	-	1	-
2.	16AGOC2	Recycling of waste	15	-	-	-	1	-
3.	16AGOC3	Manufacturing Technology of Agricultural Machinery	15	-	-	-	1	-

CREDITS PER SEMESTER

S.No.	SUBJECT AREA	Credits Per Semester								Total Credits
		I	II	III	IV	V	VI	VII	VIII	
1	HS	5	3				3		3	14
2	BS	11	11	4	4	4				34
3	ES	9	10	9						28
4	PC			11	19	13	8	12		63
5	PE					3	6	6	6	21
6	OE					3	3	3		9
7	EEC						1	2	10	13
	TOTAL	25	24	24	23	23	21	23	19	182
8.	Non-Credit / Mandatory	2*	2*	2*	2*	2*	2*			12*

SEMESTER I

16EN101	TECHNICAL ENGLISH I	L	T	P	C
	(Common to all B.E. / B. Tech. Courses)	3	0	0	3
UNIT I					9
General Vocabulary (Word-formation - prefixes & suffixes, root words) – Tenses – Adjectives forms – Adverb forms - Compound nouns - Abbreviations and Acronyms –Techniques of reading – Autobiographical writing.					
UNIT II					9
Active and Passive voice – Impersonal passive voice - Articles - Prepositions –Spelling and Punctuation –‘WH’ Question forms – Yes / No question form – Reading & note-making – Paragraph writing - comparison and contrast.					
UNIT III					9
Uses of Modal auxiliaries – Instructions– Definitions - Single line & Extended - Reading and understanding through Context –Transfer of information – bar chart, flowchart- Crafting advertisements.					
UNIT IV					9
Concord (subject & verb agreement) – Cause and effect expressions – One word substitution - Letter writing- letter to the editor & permission letter (for Industrial Visit & In-plant training) - Paragraph writing-descriptive.					
UNIT V					9
Empty verbs - ‘If’ conditionals – Gerund & Infinitive - Formal Letter writing – invitation, accepting & declining - Paragraph writing – analytical.					

L :45 T: 0 P: 0 Total: 45 PERIODS

TEXT BOOKS

- 1 Dhanavel.S.P. English and Communication Skills for Students of Science and Engineering, Orient Blackswan, Chennai, 2011.
2. Gunasekaran.S , ‘ Technical English I’ Third Edition, Vishnu Prints Media, Chennai, 2016.

REFERENCES

- 1 Raman, Meenakshi & Sangeetha Sharma. Technical Communication: Principles and Practice, Oxford University Press, New Delhi, 2011. .
- 2 Regional Institute of English. English for Engineers, Cambridge University Press, New Delhi, 2006.
- 3 Rizvi, Ashraf. M. Effective Technical Communication, Tata McGraw-Hill, New Delhi, 2005.
- 4 Department of English, Anna University, Mindscapes: English for Technologists and Engineers. Orient Blackswan, Chennai. 2012 .
- 5 Mitra K. Barun, “ Effective Technical Communication – A Guide for Scientists and Engineers”, Oxford University Press, New Delhi, 2006.

COURSE OUTCOMES

At the end of the course student should be able to:

- CO1** Employ their active and passive vocabulary and construct basic sentence structures.
- CO2** Become active readers who appreciate ambiguity and complexity, and who can articulate their own interpretations.
- CO3** Write effectively and flawlessly avoiding grammatical errors for a variety of professional and social settings.
- CO4** Demonstrate the usage of language effectively, creatively and successfully in both general and specific contexts.
- CO5** Exhibit letter writing skills for effective communication both in formal and informal situations.

16MA101	ENGINEERING MATHEMATICS- I (Common to All B.E. / B. Tech. Courses)	L	T	P	C
		3	1	0	4
UNIT I	MATRICES				9+3
Characteristic equation – Eigen values and Eigen vectors of a real matrix –Properties–Orthogonal transformation of a symmetric matrix to diagonal form – Quadratic form –Reduction of quadratic form to canonical form by orthogonal transformation – Cayley– Hamilton theorem (excluding proof).					
UNIT II	THREE DIMENSIONAL ANALYTICAL GEOMETRY				9+3
Equation of a sphere – Plane section of a sphere – Tangent Plane – Equation of a cone – Right circular cone – Equation of a cylinder – Right circular cylinder.					
UNIT III	DIFFERENTIAL CALCULUS				9+3
Curvature in Cartesian co-ordinates – Centre and radius of curvature – Circle of curvature – Evolutes – Envelopes.					
UNIT IV	FUNCTIONS OF SEVERAL VARIABLES				9+3
Partial derivatives – Euler’s theorem for homogenous functions – Total derivatives – Jacobians – Taylor’s expansion– Maxima and Minima – Method of Lagrangian multipliers.					
UNIT V	DIFFERENTIAL EQUATIONS OF HIGHER ORDER				9+3
Higher order linear differential equations with constant coefficients – Method of variation of parameters – Cauchy’s and Legendre’s linear differential equations.					

L :45 T:15 P: 0 Total: 60 PERIODS

TEXT BOOKS

- 1 Bali, N. P. and Manish Goyal, “Text book of Engineering Mathematics”, 4th Edition, University Science Press, 2014.
2. Grewal, B.S., “Higher Engineering Mathematics”, 43rd Edition, Khanna Publications, Delhi, 2014.

REFERENCES

- 1 Ramana, B.V., “Higher Engineering Mathematics”, Tata McGraw Hill Publishing Company, New Delhi, 2014.
- 2 Kandasamy, P., Thilagavathy, K. and Gunavathy, K., “Engineering Mathematics”, Volume I, S. Chand & Co., New Delhi, 2012.
- 3 Veerarajan, T., “Engineering Mathematics for First Year”, Tata McGraw Hill Pub. Co. Ltd., New Delhi, 2014.
- 4 Kreyszig, E., “Advanced Engineering Mathematics”, 8th Edition, John Wiley & Sons, Inc, Singapore, 2008.
- 5 Glyn James, “Advanced Modern Engineering Mathematics”, 3rd Edition, Pearson Education Ltd., 2013.

COURSE OUTCOMES

At the end of the course student should be able to:

- CO1** Know Eigen values and Eigen vectors and its role in the system of equations.
- CO2** Explore the knowledge to solving problems involving Sphere, Cone and Cylinder.
- CO3** Discover the radius, centre and circle of curvature of any curves.
- CO4** Identify the maximum and minimum values of surfaces.
- CO5** Solve the ordinary differential equations of certain types.

UNIT I CRYSTAL PHYSICS 9

Lattice – Unit cell – Bravais lattice – Lattice planes – Miller indices – d spacing in cubic lattice – Calculation of number of atoms per unit cell – Atomic radius – Coordination number – Packing factor for SC, BCC, FCC and HCP structures – Diamond and graphite structures (qualitative treatment)

UNIT II PROPERTIES OF MATTER AND THERMAL PHYSICS 9

Elasticity- Hooke's law - Relationship between three moduli of elasticity– stress -strain diagram – Poisson's ratio –Factors affecting elasticity –Bending moment – Depression of a cantilever Young's modulus by uniform bending- I-shaped girders Modes of heat transfer- thermal conductivity- Newton's law of cooling - Linear heat flow -Lee's disc method – Radial heat flow – Rubber tube method – conduction through compound media (series and parallel).

UNIT III QUANTUM PHYSICS 9

Black body radiation – Planck's theory (derivation) – Deduction of Wien's displacement law and Rayleigh – Jean's Law from Planck's theory – Compton effect. Theory and experimental verification – Properties of Matter waves – G.P Thomson experiment- Physical significance of wave function -Schrödinger's wave equation – Time independent and time dependent equations– Particle in a one dimensional box –Electron microscope- Scanning electron microscope

UNIT IV ACOUSTICS AND ULTRASONICS 9

Classification of Sound- decibel- Weber–Fechner law – Sabine's formula- derivation using growth and decay method – Absorption Coefficient and its determination –factors affecting acoustics of buildings and their remedies. Production of Ultrasonic's by magnetostriction and piezoelectric methods - acoustic grating - Non Destructive Testing – pulse echo system through transmission and reflection modes - A,B and C –scan displays, Medical applications – Sonogram.

UNIT V PHOTONICS AND FIBRE OPTICS 9

Spontaneous and stimulated emission- Population inversion -Einstein's A and B coefficients - derivation. Types of lasers – Nd:YAG, CO₂, Semiconductor lasers –applications. Principle and propagation of light in optical fibres – Numerical aperture and Acceptance angle - Types of optical fibres (material, refractive index, mode) – Losses in optical fibre- attenuation, dispersion, bending - Fibre Optical Communication system (Block diagram)

L :45 T: 0 P: 0 T: 45 PERIODS

TEXT BOOKS

- 1 Naresh Kumar. P and Balasubramanian. V, Engineering Physics I, Gems Publishers,2015
- 2 Avadhanalu.M.N and Kshirsagar.P.G, A textbook of Engineering Physics,S.Chand & ompany Ltd, 2013.

REFERENCES

- 1 Searls and Zemansky, University Physics, 2009.
- 2 Gaur R.K. And Gupta S.L, Engineering Physics, Dhanpat Rai publishers, 2009.
- 3 Palanisamy P.K, Engineering Physics, SCITECH Publications, 2011.
- 4 Rajendran.V, Engineering Physics,Tata Mcgraw-Hill Publishing Company Limited, New Delhi.2009.
- 5 Dr.G.Senthil kumar, Engineering Physics-I, VRB Publishers Pvt.Ltd.Chennai.(2013).

COURSE OUTCOMES :

At the end of the course student should be able to

- CO1** Understand the properties of the crystalline materials.
- CO2** Analyze the elastic and thermal properties of the materials.
- CO3** Understand the basics of quantum mechanics.
- CO4** Identify the applications of acoustics and ultrasonic waves.
- CO5** Understand the basics and applications of photonics and fibre optics technology.

16CH101**ENGINEERING CHEMISTRY**
(Common to All B.E. / B. Tech. Courses)**L T P C****3 0 0 3****UNIT I ELECTRO CHEMISTRY****9**

Electrochemical - EMF – Electrode potential – Nernst equation — problem – electrochemical series – significance– reference electrodes –Standard Hydrogen electrode - Calomel electrode – Ion selective electrode – glass electrode and measurement of pH and Fuel cells – hydrogen – oxygen fuel cell – batteries – Primary — Leclanche cell – secondary – Lead – acid battery – Lithium batteries (Li-TiS₂ and Li - S battery).

UNIT II CORROSION AND ITS CONTROL**9**

Chemical corrosion – oxidation corrosion – mechanism – Pilling – Bed worth rule – electrochemical corrosion – different types – galvanic corrosion – differential aeration corrosion – corrosion control – sacrificial anode and impressed cathodic current methods – corrosion inhibitors – protective coatings – paints – constituents and functions – metallic coatings – electroplating (Gold plating).

UNIT III SPECTROSCOPY**9**

Beer-Lambert's law – problem – UV-visible spectroscopy and IR spectroscopy (principle – instrumentation) (block diagram only) – estimation of iron by colorimetry – flame photometry – principle – instrumentation (block diagram only) – estimation of sodium by flame photometry – atomic absorption spectroscopy – principle – instrumentation (block diagram only) – estimation of nickel by atomic absorption spectroscopy

UNIT IV SURFACE CHEMISTRY & WATER TECHNOLOGY**9**

Adsorption – types – adsorption of gases on solids – adsorption isotherms – Frenlich and Langmuir isotherms — role of adsorbents in ion-exchange adsorption (Demineralization only). Water – hardness – problems –Domestic water treatment – disinfection methods (Chlorination, Ozonation, UV treatment) – break point chlorination – salinity – desalination by reverse osmosis

UNIT V ENGINEERING MATERIALS**9**

Refractories – classification – acidic, basic and neutral refractories – properties (refractoriness, refractoriness under load, dimensional stability, porosity, thermal spalling) Abrasives – natural and synthetic abrasives – quartz, corundum, emery, garnet, diamond, silicon carbide and boron carbide. Lubricants – mechanism of lubrication - properties – viscosity index, flash and fire points, cloud and pour points, oiliness) – solid lubricants – graphite and molybdenum sulphide.

L :45 T: 0 P: 0 T:45 PERIODS**TEXT BOOKS**

- 1 M.Manjuladevi, R.Anitha “Engineering Chemistry” Gem Pub. Coimbatore. 2013.
2. P.C.Jain and Monica Jain, “Engineering Chemistry” Dhanpat Rai Pub, Co., New Delhi 2008.

REFERENCES

- 1 B. Sivasankar “Engineering Chemistry” Tata McGraw-Hill Pub.Co.Ltd, New Delhi (2009).
- 2 R. Sivakumar and N Sivakumar, “Engineering Chemistry” Tata McGraw-Hill Pub.Co.Ltd. New Delhi.2009.
- 3 Dr.Gourkrishna and Dasmohapatra, “Engineering Chemistry” Vikas Pub. House Pvt.Ltd. 2011.
- 4 O.Gpalanna, “Engineering Chemistry” Tata McGraw-Hill Pub.Co.Ltd, New Delhi.2009.
- 5 B.R.Puri,L.R.Sharma&M.S.Pathania,“Principles of Physical Chemistry” Vishalpublishing Co. Jalandhar, Punjab. 2013.

COURSE OUTCOMES :

At the end of the course student should be able to:

- CO1** Assemble a battery and illustrate the phenomenon of production of electric current
- CO2** Know the technical information about corrosion, corrosion control by galvanization and electroplating
- CO3** Gain knowledge on the principles and instrumentation of spectroscopic techniques
- CO4** Apply the theory of adsorption in real life situations
- CO5** Acquire sound knowledge on different types of Engineering materials

16CS101	FUNDAMENTALS OF COMPUTING AND PROGRAMMING	L	T	P	C
	(Common to All B.E. / B. Tech.)	3	0	0	3
UNIT I	INTRODUCTION TO COMPUTERS				8
Introduction – Characteristics of Computers –Computer Generations – Classification of Computers – Basic Computer organization – Number Systems- Algorithm –Pseudo code –Flow Chart- Computer Software –Types of Software– Internet Terminology					
UNIT II	C PROGRAMMING BASICS				10
Introduction to ‘C’ programming –fundamental Rules–structure of a ‘C’ program –compilation and linking processes –Constants, Variables, keywords, Identifier, Delimiters –Declaring and Initializing variables–Data Types –Operators and Expressions–Managing Input and Output operations –Decision Making and Branching –Looping statements –solving simple scientific and statistical problems.					
UNIT III	ARRAYS AND STRINGS				10
Arrays – Characteristics, Initialization – Declaration – One dimensional and two dimensional arrays. String- String operations – String Arrays. Simple programs-sorting-searching –matrix operations (Addition, subtraction and Multiplication).					
UNIT IV	FUNCTIONS AND POINTERS				9
Function –definition of function – User-defined Functions - Declaration of function – Call by reference – Call by value –Recursion –Pointers -Definition –Initialization –Pointers arithmetic –Pointers and arrays-Example Problems.					
UNIT V	STRUCTURES AND UNIONS				8
Defining Structures and Unions–Structure declaration –need for structure data type - Structure within a structure- Union -Programs using structures and Unions- Pre-processor directives.					
		L : 45	T : 0	P : 0	Total: 45 PERIODS

TEXT BOOKS

- 1 E.Balagurusamy, “Fundamentals of Computing and Computer Programming”, Tata McGRaw-Hill Publishing Company Limited, (2011).
2. Ashok.N.Kamthane,“ Computer Programming”, Pearson Education (India) (2010).

REFERENCES

- 1 Byron Gottfried, “Programming with C”, 2nd Edition, (Indian Adapted Edition), TMH Publications, (2006).
- 2 Stephan G kochan, “Programming in C” Pearson Education (2010).
- 3 P.Sudharson, “Computer Programming”, RBA Publications (2008).
- 4 Anita Goel and Ajay Mittal, “Computer Fundamentals and Programming in C”, Dorling Kindersley (India) Pvt. Ltd., Pearson Education in South Asia, 2011.
- 5 Yashavant P. Kanetkar. “Let Us C”, BPB Publications, 2011.

COURSE OUTCOMES

At the end of the course student should be able to:

- CO1** Distinguish the differences among the various generation and classification of computers and solve problems in number system
- CO2** Understand the basic concepts of C programming and write programs using various control statements
- CO3** Implement programs using arrays and apply the concepts to solve basic problems
- CO4** Write C programs to solve problems using functions and pointers
- CO5** Understand the concepts structures and unions and apply them

16ME101**ENGINEERING DRAWING****L T P C**(Common to Aero, Agri, Auto, Civil, Civil & Planning, Mech,
MEA and MCT)**3 0 2 4****Concepts and conventions (Not for Examination)**

Importance of graphics in engineering applications - Use of drafting instruments -BIS Conventions and specifications -Size, layout and folding of drawing sheets –Lettering and dimensioning.

UNIT I PROJECTION OF POINTS, LINES AND PLANE SURFACES 12+8

Projection of points - Projection of straight lines located in the first quadrant -Determination of true lengths and true inclinations - Projection of polygonal surface and circular lamina inclined to both reference planes.

UNIT II PROJECTION OF SOLIDS 9+6

Projection of simple solids like prisms, pyramids, cylinder and cone when the axis is inclined to one reference plane by change of position method

UNIT III SECTION OF SOLIDS AND DEVELOPMENT OF SURFACES 9+6

Sectioning of above solids in simple vertical position by cutting planes inclined to one reference plane and perpendicular to the other -Obtaining true shape of section. Development of lateral surfaces of simple and truncated solids -Prisms, pyramids, cylinders and cones.

UNIT IV PICTORIAL PROJECTIONS AND FREE HAND SKETCHING 9+6

Principles of isometric projection -isometric scale -isometric projections of simple solids, truncated prisms, pyramids, cylinders and cones. Perspective projection of prisms, pyramids and cylinders by visual ray method.

Free hand sketching:

Representation of Three Dimensional objects -Need for importance of multiple views and their placement -First angle projection -layout views -Developing visualization skills through free hand sketching of multiple views from pictorial drawing.

UNIT V BUILDING DRAWING 6+4

Drawing of a plan, Elevation and sectioning of security room and residential building (Two bed rooms, kitchen, hall,etc.)

L: 45 T:0 P: 30 TOTAL : 75 PERIODS**TEXT BOOKS**

1. N.D. Bhatt and V.M. Panchal, “Engineering Drawing”, Charotar Publishing House, 53rd Edition, (2016).
2. K. R. Gopalakrishnan, “Engineering Drawing” (Vol.I & II), Subhas Publications (2014).

REFERENCES

1. K. V. Natarajan, “A text book of Engineering Graphics”, Dhanalakshmi Publishers, Chennai (2015).
2. M.S. Kumar, “Engineering Graphics”, D.D. Publications, (2011),
3. K. Venugopal & V. Prabhu Raja, “Engineering Graphics”, New Age International (P) Limited (2014).
4. M.B. Shah and B.C. Rana, “Engineering Drawing”, Pearson Education (2011),
5. K.L. Narayanan and P. Kannaiah, “Engineering Drawing” SciTech Publications, 2nd edition, (2012).

COURSE OUTCOMES**CO1** Sketch the projections of a points, straight lines and plane surfaces.**CO2** Illustrate top view and front view of the solids.**CO3** Sketch sectioned views and develop area required.**CO4** Demonstrate knowledge about isometric, perspective and orthographic projections.**CO5** Design simple buildings with detailed plan and sectional elevation.

16GE111	CAREER DEVELOPMENT PROGRAMME - I	L	T	P	C
	(Common to All B.E. / B. Tech. Courses)	1	0	2	2*
UNIT I	TRAINING FUNDAMENTALS				3+6
Goal Settings – Insights into pre-placement requisites – SWOT Analysis – LSRW Skills.					
UNIT II	LINGUISTIC SKILLS I				3+6
Parts of Speech – Noun, Verb, Participle, Articles, Pronoun, Preposition, Adverb, Conjunction – Logical sequence of words –Tense & Voice – Comparison – Comprehension – comprehend and understand a paragraph					
UNIT III	QUANTITATIVE ABILITY I				3+6
Number theory – Percentage – Profit, loss and discount – Simple and compound interest.					
UNIT IV	QUANTITATIVE ABILITY II				3+6
Ratio & Proportions – Partnership – Problems on Average & Ages – Clocks – Time sequence test.					
UNIT V	COMMUNICATION SKILLS				3+6
Impromptu Speech – Group Discussion – Questioning Technique.					
		L:15	T:0	P:30	Total: 45 PERIODS

TEXT BOOKS

- 1 John Eastwood, “Oxford Practice Grammar”, Oxford, 2006.
2. Rajesh Varma, “Fast Track Objective Arithmetic”, Arihant Publications, 2010.

REFERENCES

- 1 Barun K. Mithra, 2016, “Personality Development & Soft Skills”, Oxford.
- 2 R.V.Praveen, “Quantitative Aptitude and Reasoning” PHI Publication, 2012.
- 3 R.S.Agarwal, “Quantitative Aptitude for Competitive Examinations”, S.Chand & Company Pvt Limited, 2016.
- 4 Kreyszig, E., “Advanced Engineering Mathematics”, 8th Edition, John Wiley & Sons, Inc, Singapore, 2008.
- 5 Glyn James, “Advanced Modern Engineering Mathematics”, 3rd Edition, Pearson Education Ltd., 2013.

COURSE OUTCOMES

At the end of the course student should be able to:

- CO1** Set their career goals through SWOT analysis.
- CO2** Form sentences through logical sequence of words and understand passage through Comprehension
- CO3** Apply the shortcut methods in quantitative aptitude.
- CO4** Solve application orientated concepts in quantitative aptitude.
- CO5** Communicate well and familiarize with the questioning techniques.

16GE113	CAREER DEVELOPMENT PROGRAMME - I	L	T	P	C
	(Common to All B.E. / B. Tech. Courses)	1	0	2	2*
UNIT I	TRAINING FUNDAMENTALS				8
Goal Settings – Insights into pre-placement requisites – SWOT Analysis – LSRW Skills.					
UNIT II	LINGUISTIC SKILLS I				12
Parts of Speech – Error spotting, Logical sequence of words, Tense & Voice, Comparison, Paragraph completion.					
UNIT III	LINGUISTIC SKILLS II				8
Comprehend – comprehend and understand a paragraph , Sentences - Simple, Compound & Complex sentences, Jumbled sentence, Idioms & Phrases.					
UNIT IV	PERSONALITY DEVELOPMENT				9
Personality, Presentation Skills – stages, selection of topic, content & aids, Minutes of meeting, Public speaking.					
UNIT V	COMMUNICATION SKILLS				8
Impromptu Speech – Group Discussion – Questioning Technique.					
		L:15	T:0	P: 30	Total: 45 PERIODS

TEXT BOOKS

- 1 John Eastwood, “Oxford Practice Grammar”, Oxford.
2. Barun K. Mithra, “Personality Development & Soft Skills”, Oxford.

REFERENCES

- 1 Barun K. Mithra, 2016, “Personality Development & Soft Skills”, Oxford.
- 2 R.V.Praveen, “Quantitative Aptitude and Reasoning” PHI Publication, 2012.
- 3 R.S.Agarwal, “Quantitative Aptitude for Competitive Examinations”, S.Chand & Company Pvt Limited, 2016.
- 4 Kreyszig, E., “Advanced Engineering Mathematics”, 8th Edition, John Wiley & Sons, Inc, Singapore, 2008.
- 5 Glyn James, “Advanced Modern Engineering Mathematics”, 3rd Edition, Pearson Education Ltd., 2013.

COURSE OUTCOMES

At the end of the course student should be able to:

- CO1** Understand language structures and functioning of the language.
- CO2** Analyse the parts of speech.
- CO3** Demonstrate knowledge of personal beliefs and values.
- CO4** Understand language attitudes.
- CO5** Raise the basic language skills.

16CS102	FUNDAMENTALS OF COMPUTING AND PROGRAMMING LABORATORY	L	T	P	C
	(Common to All B.E. / B. Tech.)	0	0	4	2

LIST OF EXPERIMENTS

A) Word Processing

1. Document creation, Text manipulation with Scientific notations
2. Table creation, Table formatting and Conversion
3. Mail merge and Letter preparation
4. Drawing Flow Chart

B) Spread Sheet

1. Chart - Line, XY, Bar and Pie.
2. Formula - formula editor.
3. Spread sheet - inclusion of object, Picture and graphics, protecting the document and sheet.
4. Sorting and Import / Export features.

C) Simple C Programming

1. Data types, Expression Evaluation, Condition Statements.
2. Arrays , Looping Statement
3. Functions , Pointers
4. Structures and Unions

MAJOR EQUIPMENTS / SOFTWARE REQUIRED

Hardware

- LAN System with 33 nodes (OR) Standalone PCs – 33 Nos.
- Printers – 3 Nos.

Software

- OS – Windows / UNIX Clone
- Application Package – Office suite
- Compiler – C

L : 0 T : 0 P:60 Total:60 PERIODS

COURSE OUTCOMES

At the end of the course student should be able to:

- CO1** Create a document, insert formulas and pictures and prepare letters using MS office
- CO2** Create tables and charts, use formula in calculations and protect worksheets in MS Excel
- CO3** Write simple programs using basic C Concepts
- CO4** Write C programs using concepts in control statements
- CO5** Write C programs to solve problems using Arrays, Functions, Pointers, Unions, and Structures

16CH103

CHEMISTRY LABORATORY

L T P C

(Common to All B.E. / B. Tech. Courses)

0 0 2 1

LIST OF EXPERIMENTS

1. Estimation of hardness of Water by EDTA.
2. Determination of DO in water (Winkler's method)
3. Estimation of Chloride in Water sample (Argentometric).
4. Conductometric titration (Simple acid base).
5. Conductometric titration (Mixture of weak and strong acids vs strong base).
6. Potentiometric Titration (Fe^{2+} / KMnO_4 or $\text{K}_2\text{Cr}_2\text{O}_7$).
7. pH titration (acid & base).
8. Determination of inhibitor efficiency on the corrosion rate of steel in acid media by weight loss method.
9. Anodizing of aluminum and determination of thickness of anodic film.
10. Determination of cathode efficiency of nickel plating.

MAJOR EQUIPMENTS / SOFTWARE REQUIRED

- Electronic balance
- pH meter
- Potentiometer
- Conductivity bridge
- Spectro Photometer
- Colorimeter
- IC regulated power supply
- Hot air oven

L : 30 T: 0 P: 0 C: 1 Total:30 PERIODS

COURSE OUTCOMES

At the end of the course student should be able to:

- CO1** Gain the experimental knowledge of testing the water.
- CO2** Carry out titration using conductivity meter, potentiometer and pH meter.
- CO3** Estimate the metal ions in industrial effluents.
- CO4** Set up mini electroplating unit.
- CO5** Determine the inhibitor efficiency on the corrosion rate of steel.

16EN103	COMMUNICATION SKILLS LABORATORY	L	T	P	C
	(Common to all B.E. / B. Tech. Courses)	0	0	4	2
UNIT I	LISTENING				15
Listening and Responding -Listening to fill up information gaps-Listening to announcements at Railway stations, Airport, etc. - Listening to News on the radio/TV – listening to songs – writing lyrics.					
UNIT II	SPEAKING				15
Phonetics: Intonation - Correct Pronunciation- Tongue twisters/pronunciation drills - Introducing oneself -Creative thinking and speaking-Group Discussion-Conversation techniques – Negotiating others- Discussing as a group and making an oral report on the points discussed- Presentation of problems & solutions-Presentation skills-Interview techniques -Master of ceremony.					
UNIT III	READING				10
Reading for pleasure - Reading for specific information- Reading and reviewing books, articles, projects-Cloze exercises.					
UNIT IV	WRITING				15
Writing reviews on articles, stories - Letter Writing –Resume & cover letter, resume, Joining letter & Resignation letter - Picture Perception - Preparing projects.					
UNIT V	SOFT SKILLS				5
Emotional Intelligence- Inter & Intra personal skills-Teamwork -Time & Stress management- Leadership skills.					

L :0 T: 0 P:60 Total: 60 PERIODS

TEXT BOOKS

- 1 Anderson, P.V, Technical Communication, Thomson Wadsworth, Sixth Edition, New Delhi, 2007
2. John Seely, The Oxford Guide to Writing and Speaking, Oxford University Press, New Delhi, 2004.

REFERENCES

- 1 Prakash, P, Verbal and Non-Verbal Reasoning, Macmillan India Ltd., Second Edition, New Delhi, 2004
- 2 Anderson, Paul V. Technical Communication: A Reader-Centered Approach. Cengage. New Delhi. 2008
- 3 Department of English, Anna University. Mindscapes: English for Technologists and Engineers. Orient Blackswan, Chennai. 2012
- 4 Raman, Meenakshi & Sangeetha Sharma. Technical Communication: Principles and Practice.Oxford University Press, New Delhi. 2011
- 5 Viswamohan, Aysha. English for Technical Communication. Tata McGraw-Hill, New Delhi. 2008.

COURSE OUTCOMES

At the end of the course student should be able to:

- CO1** Face the challenges of the globalized world with confidence and with the best communicative skills.
- CO2** Make learners imbibe listening and speaking skills in both formal and informal contexts.
- CO3** Help them develop their reading skills by familiarizing them with different types of reading strategies.
- CO4** Make them acquire language skills at their own pace by using e-materials and language lab components.
- CO5** Enrich their creative and critical thinking and get through interviews successfully.

SEMESTER II

16EN102

TECHNICAL ENGLISH II
(Common to all B.E. / B. Tech. Courses)

L T P C
3 0 0 3

UNIT I

Technical Vocabulary – meanings in context – Sentence pattern - Process description - Sequencing words - Uses of Pronouns - Paragraph writing – narrative. **9**

UNIT II

Numerical adjective - Phrasal verbs - Phrases / Structures indicating use / purpose – Introduction to communication & Barriers to communication - Non-verbal communication – Different grammatical forms of the same word. **9**

UNIT III

Stress and Intonation – Word stress & Sentence stress – Formal Letter writing- quotations, clarification, placing orders, complaint letter – Writing – Using connectives (discourse makers) - Recommendations - Report writing – types of report, report format, recommendations/suggestions- (Fire Accident & Road Accident). **9**

UNIT IV

Direct & Indirect speech – Argumentative paragraphs – Letter of application – content, format (CV / Resume) – Checklist– E-mail communication – Blog writing. **9**

UNIT V

Auxiliary verbs - Preparing Agenda, Notices and Minutes – Proposal writing – project/business proposal- Technical essay – Conversational skills – four types of speeches – extempore, manuscript, impromptu, memorized. **9**

L :45 T: 0 P: 0 Total: 45 PERIODS

TEXT BOOKS

- 1 Gunasekaran.S , ‘ Technical English II’ Third Edition, Vishnu Prints Media, Chennai, 2016.
2. Dhanavel, S.P. English and Communication Skills for Students of Science and Engineering. Orient Blackswan, Chennai. 2011.

REFERENCES

- 1 Muralikrishna & Sunita Mishra. Communication Skills for Engineers. Pearson, New Delhi. 2011.
- 2 Smith-Worthington, Darlene & Sue Jefferson. Technical Writing for Success. Cengage, Mason USA. 2007.
- 3 Rizvi, Ashraf. M, Effective Technical Communication, Tata McGraw-Hill, New Delhi, 2005.
- 4 Mitra K. Barun, “ Effective Technical Communication – A Guide for Scientists and Engineers”, Oxford University Press, New Delhi, 2006.
- 5 Anderson, Paul V. Technical Communication: A Reader-Centered Approach. Cengage. New Delhi. 2008

COURSE OUTCOMES

At the end of the course student should be able to:

- CO1** Apply knowledge about the various principles of communication and its various stages.
- CO2** Imply the importance of verbal and non-verbal communication in the professional world along with its uses.
- CO3** Review the grammar – verbs and its different forms and application of the different forms of advanced grammar.
- CO4** Apply grammatical knowledge which enhances speaking and writing skills to prepare reports and resume in a professional manner.
- CO5** Speak clearly, confidently, comprehensively, and communicate with one or many listeners using appropriate communicative strategies.

16MA102	ENGINEERING MATHEMATICS II (Common to all B.E. / B. Tech. Courses)	L	T	P	C
		3	1	0	4
UNIT I	MULTIPLE INTEGRALS				9+3
Double integration in Cartesian co-ordinates – Change of order of integration – Triple Integrals – Simple problems – Area and volume by multiple integrals.					
UNIT II	VECTOR CALCULUS				9+3
Gradient Divergence and Curl – Directional derivative – Irrotational and solenoidal vector fields – Vector integration – Green’s theorem in a plane, Gauss divergence theorem and Stokes’ theorem (excluding proofs) – Simple problems involving cubes and rectangular parallelepipeds.					
UNIT III	COMPLEX DIFFERENTIATION				9+3
Functions of a complex variable – Analytic functions – Necessary conditions, Cauchy – Riemann equation and Sufficient conditions (excluding proofs) – Harmonic and orthogonal properties of analytic function – Harmonic conjugate – Construction of analytic functions using Milne Thomson’s method – Conformal mapping : $w = z + c$, cz , $1/z$, and bilinear transformation.					
UNIT IV	COMPLEX INTEGRATION				9+3
Complex integration – Statement and Problems of Cauchy’s integral theorem and Cauchy’s integral formula – Taylor’s and Laurent’s expansion – Singular points – Residues – Residue theorem – Problems only.					
UNIT V	LAPLACE TRANSFORMS				9+3
Laplace transform – Conditions for existence (statement only) – Transforms of standard functions – Properties (statement only) – Transforms of derivatives and integrals – Initial and Final value theorems (statement only) – Periodic functions - Inverse transforms – Convolution theorems (statement only) – Applications of Laplace transforms for solving the ordinary differential equations up to second order with constant co-efficient.					

L :45 T:15 P:0 Total: 60 PERIODS

TEXT BOOKS

- 1 Bali, N. P. and Manish Goyal, “Text book of Engineering Mathematics”, 4th Edition, University Science Press, 2014.
2. Grewal, B.S., “Higher Engineering Mathematics”, 43rd Edition, Khanna Publications, Delhi, 2014.

REFERENCES

- 1 Ramana, B.V., “Higher Engineering Mathematics”, Tata McGraw Hill Publishing Company, New Delhi, 2014.
- 2 Kandasamy, P., Thilagavathy, K. and Gunavathy, K., “Engineering Mathematics”, Volume I., S. Chand & Co., New Delhi, 2012.
- 3 Jain, R.K. and Iyengar S.R.K., “Advanced Engineering Mathematics”, 4th Edition, Narosa Publishing House Pvt. Ltd., 2015.
- 4 Kreyszig, E., “Advanced Engineering Mathematics”, 8th Edition, John Wiley & Sons, Inc, Singapore, 2008.
- 5 Glyn James, “Advanced Modern Engineering Mathematics”, 3rd Edition, Pearson Education Ltd., 2013.

COURSE OUTCOMES

At the end of the course student should be able to:

- CO1** Evaluate double integral and triple integral to compute area, volume for two dimensional and three dimensional solid structure.
- CO2** Know the gradient, divergence and curl, related theorems useful for engineering applications.
- CO3** Test the analyticity and to construct the analytic function and transform complex functions from one plane to another plane graphically.
- CO4** Evaluate real and complex integrals over suitable closed paths or contours.
- CO5** Know the Applications of Laplace transform and its properties & to solve certain linear differential equations using Laplace transform technique.

16PY102

PHYSICS OF MATERIALS

L T P C

(Common to All B.E. / B. Tech. Courses)

3 0 0 3

UNIT I CONDUCTING AND SUPERCONDUCTING MATERIALS 9

Classification of materials based on conductivity- Conductors –Quantum theory – Fermi distribution function – Effect of temperature on Fermi Function – Density of energy states – carrier concentration in metals.Superconductors – Type I and Type II superconductors – BCS theory of superconductivity (Qualitative) –High T_c superconductors – Application of superconductors –SQUID,Magnetic levitation.

UNIT II SEMICONDUCTING MATERIALS 9

Intrinsic semiconductor – carrier concentration derivation – Fermi level – Variation of Fermi level with temperature – electrical conductivity – band gap determination –direct and indirect band gap semiconductors- derivation of carrier concentration in n-type and p-type semiconductors – variation of Fermi level with temperature and impurity concentration — Hall effect –Determination of Hall coefficient – Applications.

UNIT III MAGNETIC MATERIALS 9

Basic concepts – magnetic moment, susceptibility, permeability. Origin of magnetic moment – Bohr magneton –Dia, Para and Ferro magnetism – Domain theory – Hysteresis – soft and hard magnetic materials – antiferromagnetic materials – Ferrites and its applications. Magnetic storage devices- magnetic hard disc, bubble memory.

UNIT IV DIELECTRIC MATERIALS 9

Electrical susceptibility – dielectric constant – electronic, ionic, orientational and space charge polarization – frequency and temperature dependence of polarisation – internal field – Clausius – Mosotti relation (derivation) – dielectric loss – dielectric breakdown – Applications of dielectric materials (capacitor and transformer) – ferroelectricity and applications.

UNIT V ADVANCED ENGINEERING MATERIALS 9

Metallic glasses: preparation, properties and applications. Shape memory alloys (SMA): Characteristics, properties of NiTi alloy, applications – Nanomaterials: Properties –Top-down process: Ball milling method- Bottom –up process: Chemical vapour deposition method- Carbon Nanotubes- Preparation by pulsed laser deposition method, properties and applications.

L :45 T: 0 P: 30 T: 45 PERIODS

TEXT BOOKS

- 1 Charles Kittel, Introduction to Solid State Physics, Wiley Publications, 2006.
- 2 Ragavan V, “Materials Science and Engineering:”, PHI Learning Private, 2012.

REFERENCES

- 1 Rajendran.V, Engineering Physics,Tata Mcgraw-Hill Publishing Company Limited,New Delhi.2009.
- 2 Neil W.Ashcroft, N.David Mermin, Solid state physics, Cengage Publication, 2011.
- 3 S.O.Pillai, Solid State Physics, New Age International, New Delhi, 2005.
- 4 William D.Callister, Material Science and Engineering, Wiley Publications, 2006.
- 5 Dr.G.Senthil kumar, Engineering Physics-II, VRB Publishers Pvt.Ltd.Chennai.(2013).

COURSE OUTCOMES :

At the end of the course student should be able to:

- CO1** Understand the properties and applications of conducting, super conducting materials
- CO2** Identify the electrical properties of semiconducting materials.
- CO3** Classify the magnetic materials based on the properties and employ it to act as an memory storage device.
- CO4** Understand the various types of polarisation and applications of dielectric materials.
- CO5** Comprehend the preparation and properties of advanced engineering materials for industrial applications.

16CH102 ENVIRONMENTAL SCIENCE AND ENGINEERING L T P C

(Common to All B.E. / B. Tech. Courses) **3 0 0 3**

UNIT I ENVIRONMENT & BIODIVERSITY 9

Definition, scope and introduction –planet earth (atmosphere, lithosphere & hydrosphere) of environment. Introduction to biodiversity definition: genetic, species and ecosystem diversity –Values of biodiversity: consumptive use, productive use, social, ethical, aesthetic and option values–threats to biodiversity: habitat loss, poaching of wildlife, man-wildlife conflicts – endangered and endemic species of India – conservation of biodiversity: In-situ and ex-situ conservation of biodiversity.

UNIT II AIR & NOISE POLLUTION 9

Air pollution - Atmospheric chemistry - Chemical composition of the atmosphere-Definition- causes, effects and control measures. Control of particulate and gaseous emission - Electrostatic precipitator – automobile emission - catalytic convertor - Acid rain- Green house effect - Global warming- -Air (Prevention & control of pollution act) - Noise pollution – Definition, effects & control of noise pollution.

UNIT III WATER & SOIL POLLUTION 9

Water and their environment significance-Water quality parameters-Physical, chemical and biological parameters-Dissolved Oxygen-Biological Oxygen demand – Chemical Oxygen Demand (Definition only) - Water pollution- causes, effect & control measures-Sewage water treatment – Water (prevention & control of pollution act) - Soil pollution-Definition, causes, effects of soil pollution

UNIT IV CONVENTIONAL & NON CONVENTIONAL ENERGY RESOURCES 9

Conventional – Coal – Gross net calorific value (Definition only) – Coke – Manufacture of coke – Otto Hoffmann method – Petroleum- Fractional distillation - Natural gas - LPG and CNG-Need for alternative energy resources –Nuclear energy- Fission and fusion reactions- Light water nuclear reactor for power generation (block diagram only) – Solar energy – Wind energy-H₂O₂ fuel cell. Role of an individual in conservation of energy resources

UNIT V GREEN CHEMISTRY & ENVIRONMENTAL MANAGEMENT 9

Green chemistry- Principles of green chemistry – Water conservation – Rain water harvesting - Solid waste management: causes, effects and control measures of municipal solid wastes. Disaster management – Floods, Earthquake – Population growth – Population explosion and its consequences - Role of information technology in environment and human health.

L : 45 T: 0 P: 0 T: 45 PERIODS

TEXT BOOKS

- 1 Dr.A.Ravikrishnan, “Environmental Science & Engineering” Sri Krishna Hitech Pub.Co.Pvt.Ltd.2013
- 2 Benny Joseph, “Environmental Science & Engineering” Tata McGraw-Hill Pub.Co.Ltd, New Delhi.2009.

REFERENCES

- 1 G.Tyler Miller, “Environmental Science” Cengage Learning India Pvt. Ltd.New Delhi.2011
- 2 Dr. Debang Solanki, “Principles of Environmental Chemistry” Prateeksha Pub.Jaipur.2011.
- 3 Gilbert M. Masters and Wendell. P.Ela, “Introduction to Environmental Engineering and Science” PHI Learning Pvt. Ltd. New Delhi.2010
- 4 Deeksha Dave and S.S. Katewa, “Environmental Science & Engineering” Learning India Pvt. Ltd.New Delhi.2011
- 5 Benny Joseph “Environmental Science & Engineering” Tata McGraw-Hill Pub.Co.Ltd, New Delhi. 2009 .

COURSE OUTCOMES :

At the end of the course student should be able to:

- CO1** Understand the importance of fossil fuels as energy sources, development of alternative sources of energy like solar, wind etc
- CO2** Aware on green house effect, various types of pollutions and global warming
- CO3** Know about the effects of automobile emission and its control measures
- CO4** Gain knowledge about the protection of environment
- CO5** Conscious on water conservation, rapid growth of population and advantages of green chemistry

16EE101	BASIC ELECTRICAL AND ELECTRONICS ENGINEERING	L	T	P	C
	(Common to all Non circuit branches)	3	0	0	3
UNIT I	ELECTRICAL CIRCUITS & MEASUREMENTS				9
	Ohm's Law – Kirchoff's Laws – Power and Power factor – Operating Principles of Moving Coil and Moving Iron Instruments (Ammeters and Voltmeters) and Energy meters.				
UNIT II	ELECTRICAL MACHINES				9
	Construction, Principle of Operation, Basic Equations and Applications of DC Generators, DC Motors, Single Phase Transformer, single phase induction Motor.				
UNIT III	SEMICONDUCTOR DEVICES AND APPLICATIONS				9
	Characteristics of PN Junction Diode – Zener Effect – Zener Diode and its Characteristics – Half wave and Full wave Rectifiers – Voltage Regulation. Bipolar Junction Transistor – CB, CE, CC Configurations and Characteristics – Elementary Treatment of Small Signal Amplifier.				
UNIT IV	DIGITAL ELECTRONICS				9
	Binary Number System – Logic Gates – Boolean Algebra – Half and Full Adders – Flip-Flops – A/D and D/A Conversion (single concepts)				
UNIT V	FUNDAMENTALS OF COMMUNICATION ENGINEERING				9
	Types of Signals: Analog and Digital Signals – Modulation and Demodulation: Principles of Amplitude and Frequency Modulations. Communication Systems: Radio, TV, Microwave, Satellite and Optical Fibre (Block Diagram Approach only).				
		L:45	T: 0	P:0	Total: 45 PERIODS

TEXT BOOKS

- 1 Muthusubramanian R, Salivahanan S, "Basic Electrical and Electronics Engineering", Tata McGraw Hill, New Delhi (2012)
2. Bhattacharya. S.K, "Basic Electrical and Electronics Engineering", Pearson Education , First Edition, (2011)

REFERENCES

- 1 N. Mittle "Basic Electrical Engineering", Second Edition, Tata McGraw Hill Edition, New Delhi, (2005)
- 2 Mehta V K, Mehta Rohit, "Principles of Electrical Engineering and Electronics", S.Chand & Company Ltd, (2010)
- 3 Mehta V K, Mehta Rohit, "Principles of Electronics", S.Chand & Company Ltd, (2005)
- 4 Anokh singh, Chhabra .A. K, "Principles of Communication Engineering", S.Chand & Company Ltd, (1999)
- 5 Vincent Deltoro, "Electrical Engineering Fundamentals", Second Edition, Pearson Education, (2015)

COURSE OUTCOMES

At the end of the course student should be able to:

- CO1** Apply the elementary concept of electric sources, elements and their properties in the circuits
- CO2** Familiarize in the concepts of measuring instruments
- CO3** Understand the construction and operation of electrical machines
- CO4** Gain knowledge on the theory and applications of analog and digital electronics
- CO5** Acquire the knowledge on basics of communication engineering

16ME102**ENGINEERING MECHANICS****L T P C**

(Common to Aero, Agri, Auto, Civil, CEP, MEA and MCT)

3 2 0 4**UNIT I BASICS & STATICS OF PARTICLES****9+6**

Introduction - Units and Dimensions - Vectorial representation of forces and moments – Coplanar Forces - Laws of Mechanics - Lamé's theorem, Parallelogram and triangular Law of forces -Resolution and Composition of forces -Equilibrium of a particle - Forces in space - Equilibrium of a particle in space - Equivalent systems of forces - Principle of transmissibility -Single equivalent force - Free body diagram

UNIT II EQUILIBRIUM OF RIGID BODIES**9+6**

Types of supports and their reactions -requirements of stable equilibrium -Moments and Couples - Moment of a force about a point and about an axis -Vectorial representation of moments and couples - Scalar components of a moment -Varignon's theorem - Equilibrium of Rigid bodies in two dimensions –Equilibrium of Rigid bodies in three dimensions -Examples

UNIT III PROPERTIES OF SURFACES AND SOLIDS**10+6**

Determination of Areas and Volumes -First moment of area and the centroid of sections - Rectangle, circle, triangle from integration -T section, I section, - Angle section, Hollow section by using standard formula -second and product moments of plane area -Rectangle, triangle, circle from integration -T section, I section, Angle section, Hollow section by using standard formula -Parallel axis theorem and perpendicular axis theorem -Polar moment of inertia -Principal moments of inertia of plane areas - Principal axes of inertia -Mass moment of inertia -Derivation of mass moment of inertia for rectangular section, prism, sphere from first principle -Relation to area moments of inertia.

UNIT IV DYNAMICS OF PARTICLES**8+6**

Displacements, Velocity and acceleration, their relationship - Relative motion -Curvilinear motion - Newton's law -Work Energy Equation of particles -Impulse and Momentum -Impact of elastic bodies.

UNIT V ELEMENTS OF RIGID BODY DYNAMICS**9+6**

Translation and Rotation of Rigid Bodies -Velocity and acceleration -General Plane motion. Analysis of structures -Plane Trusses -simple trusses -Analysis by Method of joints - Method of sections -Frames - Analysis of a structure containing multi -force members

L:45 T:30 P:0 TOTAL : 75 PERIODS**TEXT BOOKS**

1. Arthur P.Boresi and Richard J.Schmidt, "Engineering Mechanics:Statics and Dynamics", Thomson Asia Private Limited, Singapore, 2010.
2. Beer, F.P and Johnston Jr. E.R. "Vector Mechanics for Engineers", McGraw-Hill Education 10th Edition (India) Pvt Ltd. (2013).

REFERENCES

1. Vela Murali, "Engineering Mechanics", Oxford University Press (2010)
2. D.P.Sharma "Engineering Mechanics", Dorling Kindersley (India) Pvt. Ltd, New Delhi 2010.
3. Dr.I.S Gujral "Engineering Mechanical" second edition, 2011, Lakshmi Publication (P).Ltd.
4. J.L. Meriam & L.G. Karidge, Engineering Volume I) and engineering Mechanics: Dynamics, 7th edition, Wiley student edition, 2013.
5. Hibbeler, R.C., "Engineering Mechanics", 13th edition, Prentice hall (2013).

COURSE OUTCOMES**CO1** Recognize the basics of equilibrium of particles in 2D and 3D**CO2** Review the requirements of equilibrium of rigid bodies in 2D and 3D**CO3** Compute the center of mass and moment of inertia of surfaces and solids**CO4** Predict displacement, velocity and acceleration of dynamic particles**CO5** Solve for equilibrium and internal forces acting in a rigid body

16GE112	CAREER DEVELOPMENT PROGRAMME - II	L	T	P	C
	(Common to All B.E. / B. Tech. Courses)	1	0	2	2*
UNIT I	LINGUISTIC SKILLS II				15
	Goal Settings, Insights into pre-placement requisites, SWOT Analysis, LSRW Skills				
UNIT II	QUANTITATIVE ABILITY III				8
	Time, speed and distance -Train problems-Boats and streams, Time and work – Pipes and cisterns, Calendars, Venn diagram.				
UNIT III	QUANTITATIVE ABILITY IV				7
	Probability, Permutation & Combination, Mixtures & Allegation, Mensuration, Data Interpretation.				
UNIT IV	PERSONALITY DEVELOPMENT				8
	Personality, Presentation Skills – stages, selection of topic, content & aids, Minutes of meeting, Public speaking.				
UNIT V	COMMUNICATION SKILLS				7
	Power point presentation, Speak for three minutes, Online typing, Passage reading.				

L :15 T: 0 P: 30 T: 45 PERIODS

TEXT BOOKS

- 1 John Eastwood, "Oxford Practice Grammar", Oxford, 2006.
- 2 Rajesh Varma, "Fast Track Objective Arithmetic", Arihant Publications, 2010.
- 3 Barun K. Mithra, 2016, "Personality Development & Soft Skills", Oxford.

REFERENCES

- 1 R.V.Praveen, "Quantitative Aptitude and Reasoning" PHI Publication, 2012.
- 2 R.S.Agarwal, "Quantitative Aptitude for Competitive Examinations", S.Chand & Company Pvt Limited, 2016.

COURSE OUTCOMES

At the end of the course students should be able to

- CO1** Understand the field Linguistic techniques.
- CO2** Communicate at the basic level in public speaking and write reports.
- CO3** Solve time related problems.
- CO4** Get the critical concepts through the mixture & allegation & data interpretation sums.
- CO5** Write minutes of meeting and versatile presentations.

16AG112	CAREER DEVELOPMENT PROGRAMME II (AGRICULTURE ENGINEERING BASICS)	L	T	P	C
		3	0	0	3
UNIT I	AGRICULTURAL IMPLEMENTS AND MACHINE TESTING				9
Testing of Agricultural Implements-regulations for testing-Testing facilities in India-Agricultural machinery standards-calibration					
UNIT II	ENERGY AUDITING				9
Energy resources – Conservation of energy – energy audit - Need for energy audit – Types of energy audit – Benefits - Case studies.					
UNIT III	SOIL AND WATER QUALITY TESTING				9
Testing of Soil and Water samples-Types of water-Testing labs-Standards for testing-Benefits of testing					
UNIT IV	FOOD SAFETY STANDARDS				9
Food Safety-GMP-HACCP-BIS-National and International Standards-Scope of testing in Food industries					
UNIT V	ENTREPRENEURSHIP SKILLS				6
Entrepreneurship-Types of Industries-Schemes and loans-Project report preparation-Scope of Entrepreneurships-National and Global					

L : 15 T: 0 P: 45 Total: 45 PERIODS

TEXT BOOKS

- 1 Dr. Shukadev Mangaraj, Dr. R.T. Patil, “Agro Processing and Value Addition for Entrepreneurship Development”, Satish Serial Publishing, 2014
- 2 D.W. Smith, B.G. Sims, D.H. O'Neill , “Testing and evaluation of agricultural machinery and equipment”, FAO Publications, 1994

REFERENCES

- 1 Rai. G.D., "Non-Conventional Energy Sources", 4th Edition, Khanna Publishers, New Delhi, 2011. (Unit II).
- 2 Anil Kumar. A., “Small Business and Entrepreneurship”, I. K. International Pvt Ltd., New Delhi, 2008
- 3 Sonal Desai, “Handbook of Energy Audit”, McGraw-Hill Education (India) Limited, New Delhi, 2015

COURSE OUTCOMES

At the end of the course student should be able to:

- CO1** Test machines confidently and prepare reports.
- CO2** Perform Energy auditing in various Agro. Industries.
- CO3** Understand the concepts of soil and water testing
- CO4** Apply the principles of food safety standards.
- CO5** Gain knowledge and confidence to become an entrepreneur

16PY103

PHYSICS LABORATORY

L T P C

(Common to All B.E. / B. Tech. Courses)

0 0 2 1

LIST OF EXPERIMENTS

1. Determination of wavelength of mercury spectrum – Spectrometer grating
2. Determination of Young’s modulus of the material – uniform bending.
3. Determination of viscosity of liquid – Poiseuille’s method.
 - (a) Particle size determination using Diode Laser.
 - (b) Determination of Laser parameters – Wavelength.
4. Determination of velocity of sound and compressibility of liquid – Ultrasonic Interferometer.
5. Determination of thickness of a thin wire – Air wedge method.
6. Determination of dispersive power of a prism using spectrometer.
7. Determination of Young’s modulus of the material – non uniform bending.
8. Torsional Pendulum - determination of rigidity modulus of wire and moment of inertia of disc.
9. Determination of Band gap of semiconductor material.

MAJOR EQUIPMENTS / SOFTWARE REQUIRED

- Spectrometer
- Young’s modulus apparatus
- Poiseuille’s method apparatus
- Diode Laser
- Ultrasonic Interferrometer
- Air Wedge apparatus
- Torsional Pendulum Apparatus
- Bandgap determination kit

L : 45 T: 0 P: 0 C: 0 Total:30 PERIODS

COURSE OUTCOMES

At the end of the course student should be able to:

- CO1** Experiment the concept of stress, strain for the given material.
- CO2** Utilize the concept of interference and diffraction in optical measuring instruments.
- CO3** Experiment the concept of diffraction in determining the wavelength, velocity of ultrasonic waves.
- CO4** Grasp the knowledge of dependency of viscosity of a liquid on its density and velocity of liquid motion.
- CO5** Apply the concept of temperature dependence of resistance of a semiconducting

16GE102	ENGINEERING PRACTICES LABORATORY	L	T	P	C
		0	0	4	2

LIST OF EXPERIMENTS

GROUP A (CIVIL & MECHANICAL) (36)

CIVIL ENGINEERING (18)

1. Study of plumbing tools and Components
2. Preparation of threads in pipes
3. Preparation of single and multi tap connections for domestic
4. Study of carpentry tools and its applications
5. Preparation of Cross Lap and Dove Tail Joints.

MECHANICAL ENGINEERING (18)

1. Study of different types of Welding and its applications
2. Preparation of Butt, Lap and Tee joints
3. Study of sheet metal and its applications
4. Preparation of Rectangular, Square Trays and Funnel
5. Demonstration of Lathe and Drilling Operations
6. Demonstration of Smithy and Foundry tools.

GROUP B (ELECTRICAL AND ELECTRONICS) (30)

ELECTRICAL ENGINEERING PRACTICE (18)

1. Residential house wiring using switches, fuse, miniature circuit breaker, indicator, Lamp and energy meter.
2. Fluorescent lamp wiring.
3. Stair-case wiring.
4. Measurement of electrical quantities –voltage, current, power & power factor in RLC Circuit.
5. Measurement of energy using single phase energy meter.
6. Measurement of insulation resistance to earth of electrical equipment.
7. Measurement of single and three phase voltages.
8. Study of Iron Box, Emergency Lamp and Fan.

ELECTRONICS ENGINEERING PRACTICE (18)

1. Study of Electronic components and equipments –Resistor, colour coding, measurement of AC signal parameter (peak-peak, rms period, frequency) using CRO.
2. Verification of logic gates: AND, OR, Ex-OR and NOT.
3. Generation of Clock Signal.
4. Soldering practice –Components Devices and Circuits Using general purpose PCB.
5. Characteristics of a PN Junction diode

MAJOR EQUIPMENTS / SOFTWARE REQUIRED

- 1 CIVIL
- 2 Assorted components for plumbing consisting of metallic pipes, plastic pipes, flexible pipes, couplings, unions, elbows, plugs and other fittings.
- 3 Carpentry vice(fitted to workbench)

- 4 Standard wood working tools
- 5 Models of industrial trusses, door joints, furniture joints
- 6 Power Tools:
 - (a) Rotary Hammer
 - (b) Demolition Hammer
 - (c) Circular Saw
 - (d) Planer
 - (e) Hand Drilling Machine
 - (f) Jigsaw

MECHANICAL

- 1 Arc welding transformer with cables and holders
- 2 Welding booth with exhaust facility
- 3 Welding accessories like welding shield, chipping hammer, wire brush, etc.
- 4 Oxygen and acetylene gas cylinders, blow pipe and other welding outfit.
- 5 Centre lathe
- 6 Hearth furnace, anvil and smithy tools
- 7 Moulding table, foundry tools
- 8 Power Tool: Angle Grinder
- 9 Study-purpose items: centrifugal pump, air-conditioner

ELECTRICAL

- 1 Assorted electrical components for house wiring
- 2 Electrical measuring instruments
- 3 Study purpose items: Iron box, fan and regulator, emergency lamp
- 4 Megger (250V/500V)
- 5 Power Tools:
 - (a) Range Finder
 - (b) Digital Live-wire detector

ELECTRONICS

- 1 Soldering guns
- 2 Assorted electronic components for making circuits
- 3 Small PCBs
- 4 Multi Meters
- 5 Study purpose items: Telephone, FM radio, low-voltage power supply
- 6 Bread Board
- 7 CRO

L : 0 T : 0 P: 60 Total:60 PERIODS

COURSE OUTCOMES

At the end of the course student should be able to:

- CO1** Demonstrate plumbing system and Carpentry for the required applications.
- CO2** Relate the basic machining operations with engineering problems.
- CO3** Apply different types of Welding processes and Sheet metal processes for the Industrial applications
- CO4** Illustrate Residential House wiring and simple wiring circuits.
- CO5** Employ knowledge on measuring electrical quantities and usage of energy meters.

16ME103

COMPUTER AIDED DRAFTING LABORATORY

L T P C

(Common to Aero, Agri, Auto, Civil, CEP, Mech, MAE and
MCT)

0 0 2 1

LIST OF EXPERIMENTS

1. Study of capabilities of software for Drafting and Modeling -Coordinate systems (Absolute, relative, polar, etc.) -Creation of simple figures like polygon and general multi-line figures.
2. Drawing of a Title Block with necessary text and projection symbol.
3. Drawing of curves like ellipse, parabola, Hyperbola, Cycloid and Involutes.
4. Drawing of front view and top view of simple solids like prism, pyramid, cylinder cone, etc, and dimensioning.
5. Drawing front view, top view and side view of objects from the given pictorial views (eg. V-block, Base of a mixie, Simple stool, Objects with hole and curves).
6. Drawing of a plan of residential building (Two bed rooms, kitchen, hall, etc.)
7. Drawing of a simple steel truss.
8. Drawing sectional views of prism, pyramid, cylinder, cone, etc
9. Creation of 3-D models of simple objects by using Revolve and Extrude option and also Convert 3D to 2D
10. Creation of 3-D models of simple objects and obtaining 2-D multi-view drawings from 3-D model.

L:0 T:0 P:30 TOTAL: 30 PERIODS

LIST OF EQUIPMENTS REQUIRED

1. Pentium IV computer or better hardware, with suitable graphics facility -30 Nos.
2. Licensed software for Drafting and Modeling. -30 Licenses
3. Laser Printer or Plotter to print / plot drawings -1 Nos.

COURSE OUTCOMES

At the end of the course the student will be able to

- CO1** Use the concept of drafting and modeling with help of software.
- CO2** Display various views of engineering objects.
- CO3** Develop an idea in drawing truss like structures
- CO4** Create 3D drawings of simple models.
- CO5** Convert 3D to 2D views

SEMESTER III

16MA201	TRANSFORMS AND PARTIAL DIFFERENTIAL EQUATIONS	L	T	P	C
	(Common to all B.E. / B. Tech. Courses)	3	1	0	4

UNIT I FOURIER SERIES 9+3

Dirichlet's conditions – General Fourier series – Odd and even functions – Half range sine series – Half range cosine series – Parseval's identity – Harmonic Analysis.

UNIT II FOURIER TRANSFORMS 9+3

Fourier transform pair – Sine and Cosine transforms – Properties – Transforms of simple functions – Convolution theorem – Parseval's identity.

UNIT III PARTIAL DIFFERENTIAL EQUATIONS 9+3

Formation of partial differential equations – Lagrange's linear equation – Solution of standard types of first order partial differential equations – Linear partial differential equations of second order with constant coefficients (Homogeneous Problems).

UNIT IV APPLICATIONS OF PARTIAL DIFFERENTIAL EQUATIONS 9+3

Solutions of one dimensional wave equation – One dimensional equation of heat Conduction – Steady state solution of two-dimensional equation of heat conduction (Insulated edges excluded) – Fourier series solutions in Cartesian coordinates.

UNIT V Z -TRANSFORMS AND DIFFERENCE EQUATIONS 9+3

Z- Transforms – Elementary properties – Inverse Z - Transform – Convolution theorem – Formation of difference equation – Solution of difference equations using Z - Transform.

L:45 T:15 P: 0 Total: 60 PERIODS

TEXT BOOKS

- 1 Grewal, B.S., "Higher Engineering Mathematics", 43rd Edition, Khanna Publications, Delhi, 2014.
- 2 Ramana, B.V., "Higher Engineering Mathematics", Tata McGraw Hill Publishing Company, New Delhi, 2014.

REFERENCES

- 1 Bali, N.P. and Manish Goyal, "A Textbook of Engineering Mathematics", Fifth Edition, Laxmi Publications (P) Ltd., 2014.
- 2 Glyn James, "Advanced Modern Engineering Mathematics", Fourth Edition, Pearson Education, 2013.
- 3 Erwin Kreyszig, "Advanced Engineering Mathematics", Tenth Edition, Wiley India, 2015.
- 4 Ronald Bracewell, "The Fourier transforms & its Applications" 3rd Edition, 2012.
- 5 Zachmanoglou, E.C., "Introduction to partial differential Equations with Application", 2012.

COURSE OUTCOMES

At the end of the course student should be able to:

- CO1** Know how to find the Fourier Series and half range Fourier Series of a function given explicitly or to find Fourier Series of numerical data using harmonic analysis.
- CO2** Find the Fourier transform, sine and cosine transform of certain functions and use Parseval's identity to evaluate integrals.
- CO3** Form partial differential equations and solve certain types of partial differential equations.
- CO4** Solve one dimensional wave equation, one dimensional heat equation and two dimensional heat equation in steady state using Fourier Series.
- CO5** Use the effective mathematical tools for the solutions of partial differential equations by using Z transform techniques for discrete time systems.

16AG201

**ENGINEERING GEOLOGY AND SOIL
MECHANICS**

L T P C

3 0 0 3

UNIT I GEOLOGY AND APPLIED GEOLOGY

9

Introduction to Geology and Engineering Geology – importance - Earth's layers –Geological structures - Geomorphology – Concepts – Processes and Forms - Fluvial and Eolian Geomorphology-Drainage analysis-Watershed characteristics - Channel Geomorphology-Drainage pattern – Hydrogeology-Hydrological cycle – Water table-Aquifer - Groundwater flow - Well hydraulics – water quality

UNIT II SITE INVESTIGATION AND CONSTRUCTION

9

Hydrogeological Investigations - surface and sub surface – Approach – Content –Cost – Desk study – Field reconnaissance - Field investigations – Construction records – Reservoirs construction-Dams and Dam Sites – Parambikulam –Aliyar Project – Geology of Tamil Nadu - Remote Sensing and GIS applications in Water Resources Project Monitoring

UNIT III FLOW HYDRAULICS THROUGH SOIL

9

Permeability - Darcy's law-discharge velocity – validity of Darcy's law- seepage velocity - Factors affecting permeability - Hydraulics of laminar flow through soils-Seepage - Drainage – Properties of Flow net - Determination of specific gravity - soil consistency - Atterberg limits – liquid limit, plastic limit and shrinkage limit – relative density of cohesion less soil.

UNIT IV COMPACTION AND CONSOLIDATION

9

Compaction – objectives -relationship with water content- the Standard Proctor compaction test – factors affecting compaction-methods of compaction in field - Compressibility -coefficient of Compressibility - Consolidation of soils –stages of consolidation.

UNIT V STRENGTH OF SOILS

9

Shear strength –concept of shearing resistance and shearing strength - Coulomb's law - Mohr's circle of stresses - Earth pressure at rest - active pressure - passive pressure - Bearing capacity of soils– method of improving the bearing capacity of soils

L : 45 T: 0 P: 0

Total: 45 PERIODS

TEXT BOOKS

- 1 B.C.Punmia, *Soil Mechanics and Foundation*, Laxmi publishers, New Delhi,2004.
- 2 S.K. Garg, *Soil mechanics*, Khanna publishers, New Delhi, 2005.

REFERENCES

- 1 F.G.H Blyth and M.H Freitas, *A textbook of Geology for Engineers*, 7th Edition, Elsevier Publication, 2006.
- 2 F.G.Bell, *A text book of Engineering Geology*, Second Edition, Elsevier, 2007.
- 3 V.N.S. Murthy, *A textbook of Soil Mechanics and Foundation Engineering*, Sri Kripa Technical Consultants, Bangalore, 2008.
- 4 P.N. Modi, *Soil Mechanics and Foundation Engineering*, Rajsons publication, Standard book house, New Delhi, 2010.

COURSE OUTCOMES

At the end of the course student should be able to:

- CO1** Possess the concepts of geomorphology to understand water shed characteristics and hydrological cycle
- CO2** Can work on the constructional details of reservoirs and dams
- CO3** Able to utilize the knowledge on different aspects of flow hydraulics through soil
- CO4** Know about consolidation and compaction of soils
- CO5** Possess the knowledge on shear strength and bearing capacity of soils

16ME201

ENGINEERING THERMODYNAMICS

(Use of approved Steam tables is permitted)

(Common to Mech, Agri, Auto & MCT)

L T P C

3 2 0 4

UNIT I BASIC CONCEPTS AND FIRST LAW

9+6

Basic concepts - concept of continuum - comparison of microscopic and macroscopic approach - Path and point functions - Intensive and extensive - total and specific quantities - System and their types - Thermodynamic Equilibrium State - path and process - Quasi - static- reversible and irreversible processes - Heat and work transfer - definition and comparison - sign convention - Displacement work and other modes of work - P - V diagram - Zeroth law of thermodynamics -concept of temperature and thermal equilibrium-relationship between temperature scales -new temperature scales - First law of thermodynamics -application to closed and open systems -steady flow processes.

UNIT II PROPERTIES OF PURE SUBSTANCE

9+6

Formation of steam and its thermodynamic properties - P-V, P-T, T-V, T-s, h-s diagrams. P - V-T surface - Use of Steam Table and Mollier Chart - Determination of dryness fraction using Throttling, Separating and Throttling - Application of I law for pure substances.

UNIT III SECOND LAW

9+6

Second law of Thermodynamics - Statements of second law and its corollaries - Carnot cycle- Reversed Carnot cycle - Performance - Carnot theorem - Clausius equality - inequality- Concept of Entropy -T-s diagram -entropy change for pure substance - ideal gases - different processes - principle of increase in entropy - Applications of II Law.

UNIT IV STEAM POWER CYCLES

9+6

Ideal and actual Rankine cycles - Cycle Improvement Methods - Reheat and Regenerative cycles, Qualitative Treatment only: Economiser - preheater - Cogeneration Introduction - Binary and Combined cycles.

UNIT V IDEAL AND REAL GASES, GAS MIXTURE, THERMODYNAMIC RELATIONS

9+6

Mole and Mass fraction - Dalton's and Amagat's Law. Properties of gas mixture -Molar mass- gas constant - density - change in internal energy - enthalpy - entropy and Gibbs function. Properties of Ideal gas - Ideal and real gas comparison - Equations of state for ideal and real Gases - Reduced Properties - Compressibility Factor - Principle of Corresponding states - Generalized Compressibility Chart (Qualitative Treatment) and its use - Maxwell relations - Tds Equations - Difference and ratio of heat Capacities - Energy Equation - Joule -Thomson Coefficient - Clausius - Clapeyron equation.

L:45 T:30 P:0 TOTAL : 75 PERIODS

TEXT BOOKS

1. Nag.P.K., "Engineering Thermodynamics", 5th Edition, Tata McGraw - Hill, New Delhi, 2013.
2. Cengel. Y and M.Boles, "Thermodynamics - An Engineering Approach", 8th Edition, Tata McGraw Hill, 2014.

REFERENCES

1. Natarajan E., "Engineering Thermodynamics: Fundamentals and Applications", Anuragam Publications, 2012
2. Holman.J.P. "Thermodynamics", 3rd Edition, McGraw - Hill, 1995.
3. Rathakrishnan.E., "Fundamentals of Engineering Thermodynamics", 2nd Edition, Prentice -Hall of India Pvt. Ltd, 2006
4. Arora C.P, "Thermodynamics", Tata McGraw - Hill, New Delhi, 2007.
5. Kau - Fui Vincent Wong, "Thermodynamics for Engineers", CRC Press, 2010 Indian Reprint.

COURSE OUTCOMES

At the end of the course students should be able to

- CO1** Describe the laws of thermodynamics and their application to a wide range of systems.
- CO2** Determine dryness fraction of pure substances undergoing processes using Mollier chart
- CO3** Demonstrate Carnot, Clausius equality and Inequality theorems and apply the principles of entropy in real time applications
- CO4** Illustrate the principles of various steam power cycles and to solve problems related to steam undergoing various processes.
- CO5** Analyze the properties of ideal, real and its gas mixtures and apply the knowledge of mathematical relations in thermodynamic equations.

16ME202

FLUID MECHANICS AND MACHINERY

(Common to Mech, Agri, Auto)

L T P C

3 0 0 3

UNIT I FLUID PROPERTIES AND FLOW CHARACTERISTICS

9

Units and dimensions - Properties of fluids - mass density, specific weight, specific volume, specific gravity, viscosity, compressibility, vapour pressure, surface tension and capillarity. Flow characteristics -concept of control volume - application of control volume to continuity equation, energy equation and momentum equation

UNITII DIMENSIONAL ANALYSIS AND SIMILITUDE

9

Need for dimensional analysis –methods of dimensional analysis -Similitude –types of similitude - Dimensionless parameters - Reynold’s Number - Froude’s Number - Euler’s Number - Weber’s Number - Mach’s Number - application of dimensionless Parameters- Model analysis

UNIT III FLOW OVER FLAT PLATE AND FLOW THROUGH CIRCULAR CONDUITS

9

Hydraulic and energy gradient - Laminar flow through circular conduits and circular annuli - Boundary layer concepts -types of boundary layer thickness -Darcy Weisbach equation – friction factor - Moody diagram - commercial pipes - minor losses -Flow through pipes in series and parallel.

UNIT IV TURBINES

9

Classification of turbines -heads and efficiencies -velocity triangles. Axial, radial and mixed flow turbines. Pelton wheel, Francis turbine and Kaplan turbines - working principles - work done by water on the runner -draft tube. Specific speed - unit quantities.

UNIT V PUMPS

9

Impact of jets -Euler’s equation - Theory of roto - dynamic machines- various efficiencies- velocity components at entry and exit of the rotor - velocity triangles -Centrifugal pumps- working principle - work done by the impeller - Reciprocating pump - working principle.

L:45 T:0 P:0 TOTAL: 45 PERIODS

TEXT BOOKS

1. Yunus A. Çengel, John M. Cimbala., Fluid Mechanics: Fundamentals and Applications, McGraw - Hill Higher Education, 2010, 10thedition
2. Bansal, R.K., Fluid Mechanics and Hydraulics Machines,Laxmi Publications (P) Ltd.,New Delhi. 2011. 9th Editon

REFERENCES

1. Modi P.N. and Seth, S.M. "Hydraulics and Fluid Mechanics including Hydraulic Machines", Standard Book House, New Delhi 2013. 19thEditon
2. Robert W.Fox,alant.mcdonald,PhilipJ.Pritchard, “Fluid Mechanics and Machinery”, 2011.
3. Kumar. K.L.,Engineering Fluid Mechanics, Eurasia Publishing House (P) Ltd., NewDelhi, 2010. 8th Edison
4. Streeter. V. L., and Wylie, E.B., Fluid Mechanics, McGraw Hill, 2010. 9th Edition
5. Rajput. R. K, “A text book of Fluid Mechanics and Hydraulic Machines”,S. Chand & Company Ltd., New Delhi, Fourth edition, 2010

COURSE OUTCOMES

CO1 Paraphrase and apply the properties of fluids with mathematical knowledge

CO2 Apply the control volume approach to produce the continuity equation

CO3 Predict the behavior of the prototype/model by applying model laws

CO4 Examine the change of fluid properties during flow through circular conduits

CO5 Estimate the performance of the rotary machines and reciprocating pump.

UNIT I PRINCIPLES OF SURVEYING

Introduction - Principles and basic concepts and uses of surveying - classification and basic methods of surveying- Types of chains, Ranging rod, Ranging - Direct and Indirect methods –Method of Chaining on level and sloping ground - Obstacles in chaining.

UNIT II CHAIN SURVEYING

Introduction – Principles of chain surveying - selection of survey stations and lines - Offsets - types, Measurement - cross staff and optical square - Steps involved in Chain Survey - Reconnaissance, Index sketch, Reference sketch, Booking entries in field book - Plan and Map, Scale - Plain and Diagonal - Testing of Chain, Degree of accuracy in chaining, Errors and compensation - cumulative, mistakes - Determination of limiting length of offset and problems.

UNIT III COMPUTATION OF AREA AND VOLUME

Introduction – Formulae for calculation of cross sectional area – calculation of volume - Area computation, Mid-Ordinate rule, Average ordinate rule, Trapezoidal rules, Simpson rule and Coordinate method of finding area-Computation of volume.

UNIT IV COMPASS TRAVERSING

Basic terminologies of Compass traversing – Prismatic and Surveyors Compass - Checking the accuracy of traverse - Errors and mistakes in Compass survey - Plane tabling - instruments and accessories - Radiation, Traversing, Orientation - Intersection and Resection.

UNIT V LEVELLING AND CONTOURING

Levelling - definition - Benchmarks - different types of levels - Basic principles of leveling - Theory of simple, compound, cross sectional and reciprocal levelling -Contouring - definition - contour characteristics - direct and indirect methods -gradient contour - uses – Minor instruments, Hand level - Clinometer - Abney level– Theodolite types – adjustments – setting up – reading angles – measurements – Area and elevation determination.

L : 45 T : 0 P : 0**Total: 45 PERIODS****TEXT BOOKS**

- 1 Punmia. B.C “Surveying (Vol- I & Vol-II)” Laxmi publications, New Delhi. 1991.
- 2 Basak. V.N, “Surveying and Levelling”, Tata McGraw hill publications, New Delhi.

REFERENCES

- 1 Kanetkar, T.P. & Kulkarni, S.V., “Surveying & leveling”. Part –I, A.V.G. Prakashan,Poona. 1984.
- 2 A Text Book of Surveying and Levelling, R. Agor, 2013, Khanna Publs., New Delhi.
- 3 S.K. Roy, 2014,Fundamentals of Surveying, Khanna Publs., New Delhi
- 4 R. Subramanian,2014, Surveying and Levelling, Oxford University Press

COURSE OUTCOMES

At the end of the course student should be able to:

- CO1** The students will become acquainted with principle and basic concepts of surveying
- CO2** They will know about different aspects of chain surveying
- CO3** They can calculate area and volume of earth work needed in the construction of farm structures
- CO4** Know about compass traversing
- CO5** They can conduct leveling and contouring

16GE211 CAREER DEVELOPMENT PROGRAMME - III L T P C
(Common to All B.E. / B. Tech. Courses) 1 0 2 2*

UNIT I PERSONALITY DEVELOPMENT & SOFT SKILLS 8

Body Language – Introduction, Grooming, Postures and Gestures, Dressing Etiquettes, Hygiene & Cleanliness, Time Management. Resume Building – Introduction, difference between Resume and CV, Strategy of resume writing Body of the resume, Clarity and Crispness, Format and Content, Code of Conduct.

UNIT II LINGUISTIC SKILLS III 15

Synonyms & Antonyms, Error Spotting , Paragraph Writing , Word Substitution, Jumbled words, Spellings, Dialogue Writing, Presentation.

UNIT III VERBAL REASONING I 8

Analytical reasoning - Linear, Circular & Complex arrangement, Blood relation, Direction Problems.

UNIT IV VERBAL REASONING II 7

Logical reasoning – Number and Alpha series, Odd man out, Element series, Logical series, Coding and decoding, Syllogisms, Alphabets.

UNIT V PRACTICALS 7

Extempore speech, Online typing, Mock Interview, Case based interview, Passage writing.

L :15 T: 0 P: 30 T: 45 PERIODS

TEXT BOOKS

- 1 Barun K. Mithra, “Personality Development & Soft Skills”, Oxford, 2006.
- 2 S.P.Bakshi, “Objective English” Arihant Publications, 2014.
- 3 R.V.Praveen, “Quantitative Aptitude and Reasoning” PHI Publication, 2012.

REFERENCES

- 1 R.V.Praveen, “Quantitative Aptitude and Reasoning” PHI Publication, 2013.

COURSE OUTCOMES

At the end of the course students should be able to

- CO1** Improves their personality through non-verbal communication and write good resume.
- CO2** Write sentences and dialogues through paragraph & dialogue writing.
- CO3** Apply their analytical thinking.
- CO4** Think logically in critical situations.
- CO5** Face the interviews confidently through attending the mock interview sessions.

16GE213	CAREER DEVELOPMENT PROGRAMME - III	L T P C
	(Common to All B.E. / B. Tech. Courses)	1 0 2 2*
UNIT I	LINGUISTIC SKILLS I	8
	Parts of speech, Transformation of sentences-simple, complex, compound, Homonyms, Question tags.	
UNIT II	LINGUISTIC SKILLS II	15
	Synonyms, Antonyms, Cloze Test ,Voice, Idioms & Phrases. Verbal Analogies.	
UNIT III	VERBAL ABILITY I	8
	Logical sequence of words, Jumbled Words, Spellings, One word substitution.	
UNIT IV	VERBAL ABILITY II	7
	Comparison, Paragraph formation, Error spotting	
UNIT V	VERBAL ABILITY III	7
	Comprehension-comprehend and understand a passage, Dialogue Writing, Power point Presentation.	
	L :15 T: 0 P: 30 T: 45 PERIODS	

TEXT BOOKS

- 1 Dr. Aggarwal R.S and Monika Agarwal, "Objective General English", New Delhi, Sultan Chand and Company Ltd., 1999.
- 2 Arun Sharma & Meenakshi Upadhyay,"Verbal ability and Reading comprehension".Mc Graw Hill Education.

REFERENCES

- 1 "Aptimithra" , McGraw Hill Publications, 2012.
- 2 Ajaysingh," "Verbal ability and Reading comprehension", Arihant publication.

COURSE OUTCOMES

At the end of the course students should be able to

- CO1** Understand the importance & fundamentals of communication.
- CO2** Start speaking and writing in English without making any mistakes.
- CO3** Develop presentation skills.
- CO4** Think logically in critical situations.
- CO5** Prepare the questionnaire.

LIST OF EXPERIMENTS

1. Verification of Bernoulli's equation
2. Determination of the Coefficient of discharge of given Orifice meter/Venturimeter.
3. Calculation of the rate of flow using Rota meter.
4. Determination of friction factor for a given set of pipes.
5. Determination of major and minor losses in pipes
6. Performance studies on centrifugal pump / submergible pump
7. Performance studies on reciprocating pump.
8. Performance studies on Gear pump.
9. Performance studies on Pelton wheel.
10. Performance studies on Francis turbine.
11. Performance studies on of Kaplan turbine.

L:0 T:0 P:60 TOTAL: 60 PERIODS

SI.NO**LIST OF EQUIPMENTS REQUIRED**

(Each one No. For a batch of 36 students)

1. Bernoulli's equation verification setup
2. Orifice meter setup
3. Venturi meter setup
4. Rotameter setup
5. Major and minor losses measuring setup
6. Centrifugal pump/submergible pump setup
7. Reciprocating pump setup
8. Gear pump setup
9. Pelton wheel setup
10. Francis turbine setup
11. Kaplan turbine setup

COURSE OUTCOMES

At the end of the course the student will be able to

- CO1** Demonstrate the Bernoulli's equation in Bernoulli's apparatus.
- CO2** Measure the fluid flow through Orifice meter, venturimeter and Rotameter.
- CO3** Evaluate the friction factor for a given set of pipes.
- CO4** Predict the performance parameter of various rotary and reciprocating pumps.
- CO5** Estimate the performance parameter of various rotary turbines.

16AG204

**ENGINEERING GEOLOGY AND SOIL
MECHANICS LAB**

L	T	P	C
0	0	2	1

LIST OF EXPERIMENTS

1. Determination of field density by core cutter method and sand replacement method
2. Mechanical analysis of soil sieving
3. Hydrometer analysis for grain size distribution
4. Determination of Atterberg's limits of soil consistency.
5. Determination of hydraulic conductivity by constant permeameter and variable head permeameter
6. Proctor compaction test of soils
7. Consolidation test of soils
8. Direct shear test
9. Problems on Bearing Capacity, Permeability, Compaction and Compressibility
10. Field visit to Landslides areas and control measures.

L : 0 T: 0 P: 30 Total:30 PERIODS

COURSE OUTCOMES

At the end of the course student should be able to:

- CO1** Determine field density
- CO2** Can conduct sieve analysis of soils
- CO3** Determine Atterberg's limits of soil consistency
- CO4** Calculate the hydraulic conductivity of soils
- CO5** Can solve problems on Bearing Capacity, Permeability, Compaction and Compressibility

16AG205

SURVEYING AND LEVELING LAB

L	T	P	C
0	0	2	1

LIST OF EXPERIMENTS

1. Linear measurement and offset setting
2. Chain traversing of cropped area and error correction.
3. Computation of Area from field notes and plot plan.
4. Closed compass traversing, Plotting and correction of closing error
5. Open compass traversing-Problems on Compass traversing
6. Area computation by plane table survey - radiation method
7. Plane table survey – intersection
8. Plane table traversing resection methods
9. Use of Dumpy of level - limitation - handling – shifting- Simple levelling - temporary adjustments
10. Differential levelling in field- Profile leveling & Cross-sectioning - plotting
11. Contouring – Direct / Grid method-Plotting of contour - preparation of map - Computation of volume
12. Traversing with a Theodolite - Plotting theodolite survey
13. Area and elevation determination using Theodolite.
14. Study on Total station.

L : 0 T: 0 P: 45 Total:45 PERIODS

COURSE OUTCOMES

At the end of the course student should be able to:

- CO1** Calculate area using cross staff survey and plotting
- CO2** Conduct compass survey and plane table survey
- CO3** Conduct levelling and contouring and compute the volume of earth
- CO4** Conduct theodolite survey
- CO5** Compute Volume of earthwork by determining area and elevation

UNIT I CLASSIFICATION AND FORMATION OF SOILS**9**

Pedological and edaphological concepts- definition of soil, rocks and minerals-composition of earth- Weathering of rocks and minerals - physical, chemical and biological weathering – factors affecting soil formation processes.

UNIT II PHASE RELATIONSHIP OF SOIL**9**

Soil texture and textural classes - Soil structure and classification – absolute specific gravity - capillary and non-capillary porosity- Weight and Volume relationships- Gradation analysis- Soil consistency- classification of soil particles and their determination- Soil survey methods- Major soil types of India.

UNIT III PHYSICAL PROPERTIES OF SOIL**9**

Physical properties of soil and their significance – Bulk density, particle density and porosity - Soil colour – significance - causes and measurement- Soil temperature – Soil air – Soil water- Soil water potentials – Soil moisture constants – Movement of soil water – saturated and unsaturated flow – Infiltration, hydraulic conductivity, percolation, permeability and drainage.

UNIT IV SOIL COLLOIDS**9**

Soil colloids – Properties, types and significance – Layer silicate clays – their genesis and sources of charges – soil pH- Ion exchange – CEC, AEC and Base saturation – Factors influencing Ion exchange - significance. Soil reaction, Buffering capacity and EC.

UNIT V SOIL FERTILITY**9**

Soil organic matter – Composition – decomposition and mineralization, C : N ratio, Carbon cycle – Fractions of soil organic matter – Humus formation. Soil organisms - Beneficial and harmful effects- saline and alkali soils and their reclamations- significance of macro and micro nutrients, soil and water testing, soil fertility management- important fertilizers

PRACTICAL**30**

1. Soil sample collection
2. Visit to soils of different terrains and study of soil profiles
3. Determination of bulk density, particle density and porosity – cylinder, wax coating and core methods
4. Soil textural analysis – feel method, International pipette method
5. Determination of soil colour and temperature
6. Determination of soil moisture
7. Determination of Infiltration rate
8. Determination of hydraulic conductivity
9. Determination of soil pH and EC
10. Estimation of soil organic carbon

L : 45 T : 0 P : 30**Total: 75 PERIODS****TEXT BOOKS**

- 1 T.D. Biswas and S.K. Mukherjee, *Text Book of Soil Science*, 2nd Edition, Tata McGraw Hill Publishing Co. Ltd., New Delhi, 2001.
- 2 Dilip Kumar Das, *Introductory Soil Science*, 3rd Edition, Kalyani Publishers, Ludhiana, 2013.

REFERENCES

- 1 Indian Society of Soil Science, *Fundamentals of Soil Science*, ISSS Publication, IARI, New Delhi, 2012.
- 2 Brady, N.C., 2002 *The Nature and Properties of Soils* (13th Edition) McMillan Co., New York.
- 3 Indian Publisher – Eurasia Publishing House (P) Ltd., Ramnagar, New Delhi
- 4 Daji A.J., (1970) *A Text Book of Soil Science* - Asia Publishing House, Madras.
- 5 Jenny, H. 1941. *Factors of Soil Formation - A System of Quantitative Pedology*. McGraw-Hill Book Company INC. New York.

COURSE OUTCOMES

At the end of the course student should be able to:

- CO1** Know the various processes involved in soil formation
- CO2** Possess the knowledge on different methods and procedures to test the important properties of soil
- CO3** Get the knowledge about soil, water and plant relationship
- CO4** Know the properties of soil colloids
- CO5** Apply the knowledge on soil nutrients for the cultivation of crops

SEMESTER IV

16MA205	PROBABILITY AND STATISTICS (B.E. Agriculture Engineering)	L	T	P	C
UNIT I	RANDOM VARIABLES	3	1	0	4
Discrete and continuous random variables – Moments – Moment generating functions – Binomial, Poisson, Geometric, Uniform, Exponential, Gamma and Normal distributions.					
UNIT II	TWO - DIMENSIONAL RANDOM VARIABLES				9+3
Joint distributions – Marginal and conditional distributions – Covariance – Correlation and Linear regression – Transformation of random variables – Central limit theorem (for independent and identically distributed random variables).					
UNIT III	TESTING OF HYPOTHESIS				9+3
Sampling distributions - Estimation of parameters - Statistical hypothesis - Large sample test based on Normal distribution for single mean and difference of means -Tests based on t, Chi- square and F distributions for mean, variance and proportion - Contingency table (test for independent) - Goodness of fit.					
UNIT IV	DESIGN OF EXPERIMENTS				9+3
One way and Two way classifications - Completely randomized design – Randomized block design – Latin square design - 2^2 factorial design.					
UNIT V	STATISTICAL QUALITY CONTROL				9+3
Control charts for measurements (X and R charts) – Control charts for attributes (p, c and np charts) – Tolerance limits - Acceptance sampling.					

L:45 T:15 P: 0 Total: 60 PERIODS

TEXT BOOKS

- 1 Milton. J. S. and Arnold. J.C., "Introduction to Probability and Statistics", Tata McGraw Hill, 4th Edition, 2007.
- 2 Papoulis. A and Unnikrishnapillai, S., "Probability, Random Variables and Stochastic Processes" McGraw Hill Education India, 4th Edition, New Delhi, 2010.

REFERENCES

- 1 Devore. J.L., "Probability and Statistics for Engineering and the Sciences", Cengage Learning, New Delhi, 8th Edition, 2012.
- 2 Walpole. R.E., Myers. R.H., Myers. S.L. and Ye. K., "Probability and Statistics for Engineers and Scientists", Pearson Education, Asia, 8th Edition, 2007.
- 3 Ross, S.M., "Introduction to Probability and Statistics for Engineers and Scientists", 3rd Edition, Elsevier, 2004.
- 4 Spiegel. M.R., Schiller. J. and Srinivasan. R.A., "Schaum's Outline of Theory and Problems of Probability and Statistics", Tata McGraw Hill Edition, 2004.
- 5 Johnson. R.A. and Gupta. C.B., "Miller and Freund's Probability and Statistics for Engineers", Pearson Education, Asia, 7th Edition, 2007.

COURSE OUTCOMES

At the end of the course student should be able to:

- CO1** Apply Utilize the skills in handling more than one random variable, standard distributions and functions of random variables.
- CO2** Discern the bivariate distributions and know how to calculate basic two - variable statistics (covariance, correlation).
- CO3** Acquire the notion of sampling distributions and statistical techniques used in engineering and management problems.
- CO4** Perform the ANOVA calculations which is needed for engineering research and project management.
- CO5** Judge the quality control through statistical modeling.

UNIT I EVAPORATION AND CONCENTRATION

6

Unit operations in food processing –conservation of mass and energy – overall view of an engineering process- dimensions and units – dimensional and unit consistency – dimensionless ratios-evaporation – definition – liquid characteristics – single and multiple effect evaporation- types of evaporators- performance of evaporators and boiling point elevation – capacity – economy and heat balance— evaporation of heat sensitive materials.

UNIT II MECHANICAL SEPARATION

8

Filtration – definition –filter media – types and requirements-constant rate filtration – constant pressure filtration – filter cake resistance-filtration equipment – rotary vacuum filter – filter press-sedimentation – gravitational sedimentation of particles in a fluid – Stoke’s law, sedimentation of particles in gas-cyclones – settling under sedimentation and gravitational sedimentation-centrifugal separations – rate of separations – liquid-liquid separation – centrifuge equipment.

UNIT III SIZE REDUCTION, MIXING AND BLENDING

9

Size reduction – grinding and cutting – principles of comminuting – characteristics of comminuted products – particle size distribution in comminuted products-energy and power requirements in comminuting – crushing efficiency – Rittinger’s, Bond’s and Kick’s laws for crushing-size reduction equipments – crushers – jaw crusher, gyratory crusher-crushing rolls – grinders – hammer mills – rolling compression mills - attrition, rod, ball and tube mills – construction and operation- Mixing- kneading-blending- emulsification-homogenization.

UNIT IV CONTACT EQUILIBRIUM SEPARATION

10

Contact equilibrium separation processes – concentrations – gas-liquid and solid-liquid equilibrium – equilibrium concentration relationships – operating conditions-calculation of separation in contact equilibrium processes-gas absorption – rate of gas absorption – stage – equilibrium gas absorption and equipment-properties of tower packing – types – construction – flow through packed towers-extraction – rate of extraction – stage equilibrium extraction-equipment for leaching coarse solids – intermediate solids – basket extractor-extraction of fine material – Dorr agitator – continuous leaching – decantation systems – extraction towers-washing – equipments.

UNIT V CRYSTALLIZATION, DISTILLATION AND MEMBRANE SEPARATION

12

Crystallization – equilibrium -solubility and equilibrium diagram – rate of crystal growth – equilibrium crystallization-crystallization equipment – classification – construction and operation-tank, agitated batch, Swenson-Walker vacuum crystallizers-distillation – binary mixtures – flash and differential distillation-steam distillation – theory – consumption – continuous distillation with rectification – vacuum distillation - batch distillation – operation and process – advantages and limitations-azeotropic distillation-distillation equipments – construction and operation – factors influencing the operation- membrane separation-osmosis –ultra filtration-reverse osmosis-rate of flow through membranes.

L : 45 T: 0 P: 0 Total: 45 PERIODS

TEXT BOOKS

- 1 R.L. Earle, Unit Operations in Food Processing, Pergamon Press, Oxford, U.K., 2003.
- 2 K. M. Sahay and K.K.Singh, Unit operations of Agricultural Processing, Vikas Publishing House Pvt. Ltd., New Delhi, 2004.

REFERENCES

- 1 J.M. Coulson and J.F. Richardson, Chemical Engineering, Volume I to V. The Pergamon Press, New York, 1999.
- 2 W.L. McCabe, J.C.Smith and P.Harriot, Unit Operations of Chemical Engineering, McGraw- Hill. Inc. Kosaido Printing Ltd. Tokyo, Japan, 2001.
- 3 C.J.Geankoplis, Transport Process and Unit Operations, Prentice-Hall of India Private Limited, New Delhi. 1999.

COURSE OUTCOMES

At the end of the course student should be able to:

- CO1** Become acquainted with different unit operations of processing industries such as evaporation, concentration and mechanical separation, size reduction equipments, distillation, membrane separation, etc
- CO2** Evaluate the performance of size reduction, mixing and blending equipments
- CO3** Apply the knowledge gained on crystallization in industrial processes
- CO4** Use the knowledge obtained on distillation and membrane separation
- CO5** Develop new food processes and modify the existing ones

UNIT I AVAILABILITY AND FUEL PROPERTIES OF BIOMASS 10

Biomass – types – fuels from biomass. Terms and units used in biomass production. Indian Energy scenario and renewable energy status- Biomass fuel characterization – physical, chemical and thermal – energy release. Supply chain – harvesting / collection-- transportation and processing. Briquetting – types – pelletizing.

UNIT II BIOCHEMICAL CONVERSION TECHNOLOGY 13

Biochemical degradation – factors affecting biogas production - types of biogas plants – construction details – operation and maintenance – utilization of biogas - slurry handling, utilization and enrichment – high rate biomethanation process – landfills – process – utilization-composting - methods – machinery.

UNIT III THERMO CHEMICAL CONVERSION BY COMBUSTION 6

Thermochemical degradation. stoichiometric air requirement - Combustion process – chemistry of combustion - combustion zones - emissions. Co firing of biomass. Incinerators - layout. Combustion of wastes and MSW. Wood burning stoves - types- operation.

UNIT IV THERMOCHEMICAL CONVERSION BY GASIFICATION AND PYROLYSIS 7

Biomass gasification – chemistry of gasification – types of gasifier – Gas cleaning & conditioning - utilization of producer gas - emissions – commercial gasifies plants. Pyrolysis – product recovery – types - biochar – bio oil – operation – recovery.

UNIT V PRODUCTION OF ETHANOL AND BIODIESEL AND COGENERATION 9

Bioethanol – feedstock - process – utilization. Biodiesel -feedstock - process and utilization- Cogeneration technologies – cycles – topping – bottoming – problems – applications – selection. Waste heat recovery - plate heat exchangers - waste heat boilers - heat pumps - thermic fluid heaters.

L : 45 T: 0 P: 0 Total: 45 PERIODS

TEXT BOOKS

- 1 Khandelwal K.C. and Mahdi, S.S. 1986. Biogas Technology. Tata Mc Graw Hill Pub. Co. Ltd., New Delhi
- 2 B. T. Nijaguna, Biogas Technology, New Age International, 2006
- 3 Godfrey Boyle, Renewable Energy: Power for a Sustainable Future, Second edition, Oxford University Press, UK, 2009, ISBN 0-19-926178-4, 13579108642.
- 4 A.V. Bridgwater, Advances in thermochemical biomass conversion, Blackie Academic & Professional, 01-Jan-1994, 1725 pages

REFERENCES

- 1 Ashok Pandey Thallada Bhaskar, Michael Stocker, Rajeev Sukumaran, Recent Advances in Thermo-Chemical Conversion of Biomass, Elsevier, February 2015.
- 2 A. Chakraverty, Biotechnology and other alternate technologies for utilisation of biomass, Oxford and IBH Publishing Co, New Delhi, 1993.
- 3 G. N. Tiwari, and M K. Ghosal, Fundamentals of Renewable Energy Sources, Alpha Science International Ltd, 2007, 666 pages, ISBN-10: 1842653970, ISBN-13: 978-1842653975
- 4 Ahmed F Zobaa and Ramesh C Bansal, Handbook of Renewable Energy Technology, 876 pages, 2011, ISBN: 978-981-4289-06-1
E-mail : sales@wspc.com.sg

COURSE OUTCOMES

At the end of the course student should be able to:

- CO1** Possess the knowledge on Indian power and renewable energy scenario, and the biomass characteristics
- CO2** Know about Biochemical conversion technologies of biomass for energy generation
- CO3** Possess the knowledge on the thermochemical conversion technologies for converting biomass into energy
- CO4** Know about combustion and incineration technology
- CO5** Know about fuel alcohol and biodiesel production processes

16AG209

**SOIL AND WATER CONSERVATION
ENGINEERING**

L T P C

**3 0 0 3
6**

UNIT I SOIL CONSERVATION PRACTICES

Types of erosion-Wind erosion- causes- types- factors - adverse effects and their control-Water erosion- types- factors - effects and their control-Methods of gully control- Estimation of soil loss.

UNIT II EROSION CONTROL

12

Soil Erosion control measures, Contour bunds and Graded bunds, Broad beds and furrows, wide based terraces and dykes, Random tie ridging, basin listing and mulching, Bench terraces, stone walls and contour trenches, - Contour cultivation, strip cropping, mixed cropping, mixed farming, crop rotation for erosion control, Afforestation - Diversion drains and vegetative water ways.

UNIT III ESTIMATION OF SOIL LOSS

9

Universal Soil Loss Equation(USLE) & soil loss tolerance, Rainfall Erosion Index, Soil erodibility Index, Slope, slope length and topographical factors, Crop management for soil erosion 'C' factor, Conservation practice factor 'P'- Wind erosion control - wind breaks and shelter belts.

UNIT IV WATER CONSERVATION AND HARVESTING

9

Types of storage structures- Water yield from catchments-Losses of stored water- water conservation methods-water harvesting methods and techniques.

UNIT V WATERSHED INTRODUCTION & ITS MANAGEMENT

9

Definition of watershed-Classification-Basic factors influencing watershed development-concept of priority watersheds-Land capability classification for watershed management.

L : 45 T: 0 P: 0 Total: 45 PERIODS

TEXT BOOKS

- 1 R. Suresh, Soil and Water Conservation Engineering, Standard Publishers & Distributors, New Delhi, 2000.
- 2 Glenn and O. Schwab, Soil and water Conservation Engineering, John Wiley and sons, New York, 1981.

REFERENCES

- 1 Ghanshyam Das, Hydrology and Soil Conservation Engineering Prentice-Hall of India Pvt Ltd., New Delhi, 2000.
- 2 B.C., Mal, Introduction to soil and water Conservation Engineering, Kalyani Publishers, New Delhi, 2002.
- 3 Gurmel Singh et al, Manual of soil and water conservation practices. Oxford & IBH Publishing Co, New Delhi, 1996.
- 4 V.V.N.Murthy, *Land and Water Management Principles and Practices*, Kalyani Publishers, New Delhi, 1998.

COURSE OUTCOMES

At the end of the course student should be able to:

- CO1** Apply conceptual knowledge to reduce soil erosion and thus retain the fertility of soil
- CO2** Design and construct soil conservation structures
- CO3** Determine water requirements of crops
- CO4** Determine the irrigation schedule for different crops
- CO5** Possess knowledge on water shed development and management

UNIT I FUELS AND COMBUSTION

Fuels – types and properties-higher and lower heating values, their determination. Combustion of fuels, stoichiometric air requirement – excess air-gravimetric analysis and volumetric analysis of products of combustion and their conversions-Fuels for IC engines- octane number requirement(ONR)-diesel fuels-cetane rating.

UNIT II CLASSIFICATION AND PRINCIPLES OF IC ENGINES

9

Classification-engine components-Four stroke cycle- principle-valve timing diagram-P-V diagram - two stroke cycle- principle-valve timing diagram-P-V diagram. Spark ignition engine-working principle and thermal efficiency- Compression ignition engine-working principle and thermal efficiency-fuel pump and injector. Gas engine –working principle-turbo charging.

UNIT III IC ENGINE SYSTEMS

7

Carburetion-Fuel injection-Ignition-engine friction and lubrication-engine cooling-scavenging in two stroke engines-super charging of SI engines-comparison between CI and SI engines.

UNIT IV IC ENGINES PERFORMANCE AND AIR COMPRESSORS

10

Engine Testing and performance-dynamometer types-performance parameters - indicated power, brake power, SFC, engine efficiencies-variables affecting performance characteristics- working principles of Stirling engines, Wankel rotary combustion engine, variable compression ratio engine test rig-emission standards. Air compressors-reciprocating, rotary and centrifugal types-work done and efficiency-slip factor.

UNIT V BOILERS

10

Boilers – classification – working principle of fire tube and water tube boilers – vertical and horizontal boilers - principles, construction and operation - Cochran, Lancashire, Cornish, Scotch, Velox, Locomotive, Babcock and Wilcox boilers –principles – boiler mountings and accessories – pressure regulators – blow off fittings - boiler performance- Boiler operation, inspection, safety and maintenance-ISI codes for boilers-Features of industrial boilers-economics of operation.

L : 45 T: 0 P: 0 Total: 45 PERIODS

TEXT BOOKS

- 1 M.C. Mathur and R.P. Sharma, *Internal combustion Engines*, Dhanpat Rai Publications, 2014.
- 2 Rayner Joel, *Basic engineering Thermodynamics*, Pearson publishers, 2009.

REFERENCES

- 1 P.K. Nag, *Engineering thermodynamics*, Tata-McGraw Hill Publishing Co, New Delhi, 1992.
- 2 V.P.Vasandani and D.S.Kumar, *Heat Engineering*, Metropolitan Book Co Pvt Ltd, 1972.
- 3 C.P.Kothandaraman., S.Domkundwar. and A.V.Domkundwar, *A course in Thermal Engineering*, Dhanpat Rai & Sons, Fifth edition, 2002.
- 4 J.P.Holman, *Thermodynamics*, McGraw-Hill, 1985.

COURSE OUTCOMES

At the end of the course student should be able to:

- CO1** Know about different types of fuels, their characteristics and combustion calculations
- CO2** Know about working principles of IC engines
- CO3** Know about IC engine systems
- CO4** Possess the knowledge on IC engines performance and air compressors
- CO5** Possess the knowledge on different types of boilers

16GE212	CAREER DEVELOPMENT PROGRAMME IV	L	T	P	C
	(Common to all B.E. / B. Tech. Courses)	1	0	2	2*
UNIT I	COMMUNICATION & SOFT SKILLS				7
Group Discussion – Types, guidelines, roles, Do’s and Don’ts during GD, Mock GD. Interview Etiquettes – Meaning, Purpose, Interview Process and Types, Checklist – Do’s and Don’ts, Preparation of Self Introduction.					
UNIT II	LINGUISTIC SKILLS IV				15
Cloze test, Direct & Indirect speech, Question Tags, Homonyms, HIGH LEVEL- Synonyms, Antonyms, Idioms and Phrases.					
UNIT III	VERBAL REASONING - III				7
Logical reasoning - Machine Input & Output, Coded Inequalities, Puzzles, Cubes, Data sufficiency, Analogy.					
UNIT IV	VERBAL &NON VERBAL REASONING - IV				8
Critical reasoning- Statement – Argument & Assumption, Courses of Action, Inferences. Non Verbal reasoning- Insert the missing character, Figure series, Odd man out, Cubes & Dices, Logical Venn diagram.					
UNIT V	PRACTICALS				8
Group Discussion, Online typing, Mock Interview, Company website references.					
		L:15	T:0	P:30	Total: 45 PERIODS

TEXT BOOKS

- 1 Barun K. Mithra, “Personality Development & Soft Skills”, Oxford, 2006.
- 2 S.P.Bakshi, “Objective English” Arihant Publications, 2014.
- 3 R.V.Praveen, “Quantitative Aptitude and Reasoning” PHI Publication, 2012.

REFERENCES

- 1 Dr. R.S.Agarwal, “A modern approach to Verbal & Non-verbal Reasoning”, S.Chand & Company Pvt Limited, 2013.

COURSE OUTCOMES

At the end of the course students should be able to

- CO1** Bring behavioral changes through interview etiquettes & communicate well.
- CO2** Improve their thinking ability.
- CO3** Solve the puzzles through their lateral thinking ability.
- CO4** Think critically and attain solutions for the problems.
- CO5** Speak better in GD and thorough with the company details.

16GE214	CAREER DEVELOPMENT PROGRAMME IV	L	T	P	C
	(Common to all B.E. / B. Tech. Courses)	1	0	2	2*
UNIT I	BODY LANGUAGE				9
Body Language – Introduction, Elements, Grooming, Body Language –Postures and Gestures, Dressing Etiquette, Hygiene and Cleanliness, Time Management, Body Language - Positive and Negative ,Importance of body language in Communication.					
UNIT II	INTERVIEW ETIQUETTE				9
Interview Etiquettes – Meaning, Purpose, Process, Types, Do’s and Dont’s, Dress Code, Self Introduction, Code of Conduct for Interviews, Mock Interview					
UNIT III	RESUME BUILDING				9
Resume Building –Introduction, difference between Resume and CV, Strategy of resume writing, Body of the resume, clarity and crispness, format and content, Resume Etiquettes – Do’s and Dont’s, model resume writing.					
UNIT IV	GROUP DISCUSSION				9
Group Discussion – Types, Key steps to succeed in GD, Skills required for GD, Importance of GD, Guidelines – Do’s and Dont’s during GD, the technique of Summing up, Mock GD.					
UNIT V	PRACTICALS				9
Extempore Speech, Company website References, Short speech.					

L:15 T:0 P:30 Total: 45 PERIODS

TEXT BOOKS

- 1 John Eastwood, “Oxford Practice Grammar”, Oxford.
- 2 Barun K. Mithra, “Personality Development & Soft Skills”, Oxford.
- 3 R.V.Praveen, “Quantitative Aptitude and Reasoning” PHI Publication, 2012.

REFERENCES

- 1 Sanjay Kumar “ Communication Skills”, Oxford University 2015.

COURSE OUTCOMES

At the end of the course students should be able to

- CO1** Exhibit appropriate body language and interview skills.
- CO2** Speak effectively in group discussion and acquire interpersonal skills.
- CO3** Acquire the professional skills of Group discussion and Resume writing.
- CO4** Improve thinking, listening and speaking skills.
- CO5** Demonstrate an understanding of the principles of active listening.

16AG211

FOOD PROCESS ENGINEERING LAB

L T P C

0 0 2 1

LIST OF EXPERIMENTS

1. Problems on single effect and multiple effect evaporators
2. Determination of separation efficiency of centrifugal separator
3. Determination of efficiency of liquid-solid separation by filtration
4. Performance evaluation of a sieve and determination of particle size of granular foods by sieve analysis
5. Performance evaluation of pin mill
6. Performance evaluation of hammer mill
7. Performance evaluation of ball mill
8. Determination of thermal efficiency and economy of single effect evaporator
9. Determination of economy and thermal efficiency of rotary flash evaporator for concentration of juice
10. Performance evaluation of a steam distillation process
11. Visit to a solvent extraction industry
12. Visit to a sugar industry

L : 0 T: 0 P: 30 Total:30PERIODS

COURSE OUTCOMES

At the end of the course student should be able to:

- CO1** Evaluate the performance of evaporator
- CO2** About separation equipment and filtration processes
- CO3** Conduct sieve analysis of food products
- CO4** Evaluate the performance of different size reduction equipments
- CO5** Evaluate the performance of distillation equipment

16AG212

BIOMASS CONVERSION LAB

L	T	P	C
0	0	2	1

LIST OF EXPERIMENTS

- 1 .Solving problems on Energy units and Conversions
- 2 .Design of KVIC model biogas plant
3. Design of Deenabandhu model biogas plant
4. Evaluation of thermal efficiency of biogas stove
5. Performance evaluation of biogas run dual fuel diesel engine.
6. Determination of BOD of a liquid effluent
7. Determination of COD of a liquid effluent
8. Study on briquetting of biomass
9. Determination of thermal efficiency of wood burning stoves
10. Performance evaluation of agro residue gasifier
11. Visit to biomass based power plant
12. Visit to a biogas plant in a farm/dairy

L : 0 T: 0 P: 30 Total:30 PERIODS

Course outcomes

At the end of the course student should be able to:

- CO1** Assess the different physical and chemical properties of biomass
- CO2** Design and evaluate the different designs of Biogas plants
- CO3** Conduct engine performance study of biogas run dual fuel engines
- CO4** Design and evaluate the performance of UASB reactors
- CO5** Evaluate the performance of a gasifier

16AG213

HEAT POWER ENGINEERING LAB

L T P C

0 0 2 1

LIST OF EXPERIMENTS

1. Experiments on Engine Performance using Hydraulic, Mechanical & Electrical dynamometers
2. Morse Test for Engine Performance analysis
3. Assessment of Heat balance in Diesel Engine
4. Performance of Air Compressor
5. Determination of Viscosity of Liquid Fuels using viscometer
6. Dismantling & Assembling of IC engines (Petrol / Diesel)
7. Experiment with two stroke engine for drawing Port timing Diagram
8. Experiment with Four stroke engine for drawing Valve Timing Diagram
9. Determination of Flash Point & Fire point of liquid fuels
10. Performance of Heat Exchangers- Parallel Flow, Counter flow and plate heat exchangers
11. Determination of thermal conductivity, convective heat transfer coefficient and radiation Heat transfer coefficients of heat transfer surfaces

L : 0 T: 0 P: 30 Total:30 PERIODS

Course outcomes

At the end of the course student should be able to:

- CO1** Assess the engine performance using dynamometers
- CO2** Assess the heat balance in diesel engine
- CO3** Determine the different properties of fuels
- CO4** Can assemble and dismantle IC engines
- CO5** Assess the performance of heat exchangers

UNIT I PRINCIPLES OF AGRONOMY

Definition of agriculture and agronomy – Factors affecting crop growth – climate and weather parameters – Soil fertility and productivity – tillage and tith - objective and principles – different kinds of tillage. Precision farming-objectives-present status-methods.

UNIT II AGRONOMIC INPUTS, WEED MANAGEMENT AND CROPPING SYSTEMS 10

Seeds and seed treatment – sowing and planting – different methods – crop geometry – manures and fertilizers – source, nutrient contents and methods of application – bio fertilizers – irrigation techniques for different soils and crops. Weeds – classification of weeds- principles and methods of weed management – cropping systems – monoculture and multiple cropping – inter, mixed, relay, strip and multitier cropping.

UNIT III AGRONOMY OF FIELD CROPS 9

Package of practices for important field crops – rice, wheat, maize, pulses, oilseeds. Package of practices of cotton, Sugarcane, biofuel crops such as Jatropha, sweet sorghum and sugar beet.

UNIT IV FUNDAMENTALS OF HORTICULTURE AND PROPAGATION TECHNIQUES 10

Horticulture - Definition – scope and importance – nutritive value and global scenario of horticultural crops - Division and classification of horticultural crops –Horticultural zones in India. Propagation – definition – propagation methods – seed propagation-vegetative propagation -cutting, layering, grafting and budding methods – specialized plant parts for propagation – micro propagation.

UNIT V SYSTEMS OF PRODUCTION AND CROP MANAGEMENT PRACTICES 10

Planting systems including HDP and UHDP – Cropping systems - Protected cultivation principles and structures used – shade net houses, poly houses - Special structures used for propagation –mist chambers, hot beds.

Weed management -Canopy management and crop regulation. Maturity indices — harvesting methods, pre cooling – packaging, packing methods – storage of horticultural crops.

PRACTICAL 30

1. Field inspection at Kottaipalayam
2. Identification of different crops, seeds, manures and fertilizers
3. Preparation of plot for cultivation of tomato
4. Sowing of seedlings
5. Irrigation
6. Weeding
7. Visit to wet land to learn important cropping systems
8. Horticultural tools and implements used for various operations.
9. Study on irrigation, fertilizer application and weed management practices in horticultural crops
10. Visit private orchards to identify different features of orchard.
11. Harvesting

L : 45 T : 0 P:30**Total: 75 PERIODS****TEXT BOOKS**

- 1 Palaniappan, and S. Sivaraman, *Cropping systems in the tropics- Principles and Management*, New Age international publishers, New Delhi, (2nd edition), 1998.
- 2 T.Yellamanda Reddy and G.H. Sankara Reddi, *Principles of Agronomy*, Kalyani publishers, Ludhiana, 2005
- 3 Kumar, N.2010. Introduction to Horticulture, Oxford and IBH Publication, New Delhi

REFERENCES

- 1 S.Sankaran and V.T Subbaiah Mudaliar, *Principles of Agronomy*, The Bangalore Printing and Pubg Co, Bangalore, 1993.
- 2 P.Balasubramain and SP. Palniappan, *Principles and Practices of Agronomy*, Agrobios publishers, Ludhiana, 2001.

- 3 B.Chandrasekaran, B. , K. Annadurai and E. Somasundaram, *A Text book of Agronomy*, Scientific publishers, Jodhpur, 2007.
- 4 George Acquaah, *Horticulture-principles and practices*, Prentice-Hall of India Pvt. Ltd., New Delhi, 2002.

COURSE OUTCOMES

At the end of the course student should be able to:

- CO1** Possess the knowledge on the agronomic practices for raising different crops and intensive cultivation through use of improved varieties and the liberal use of irrigation and fertilizers to increase the food production.
- CO2** Utilize the knowledge on rainfed and dry land agriculture and precision farming
- CO3** Possess the knowledge on the commercial production of high-value horticultural crops such as fruits, vegetables, cut flowers, potted plants, bedding plants, and bulbs and floral design
- CO4** Possess the knowledge on harvesting methods, pre cooling, packaging and storage of horticultural crops
- CO5** Possess the knowledge on Cropping systems and Protected cultivation

SEMESTER V

16MA302	NUMERICAL METHODS (B.E. Agriculture Engineering)	L	T	P	C
UNIT I	SOLUTIONS OF EQUATIONS AND EIGEN VALUE PROBLEMS	3	1	0	4
	Solution of equation - Fixed point iteration: $x=g(x)$ method – Newton’s method – Gauss Elimination method – Pivoting Gauss Jordan methods – Iterative methods of Gauss – Jacobi and Gauss – Seidal – Matrix Inversion by Gauss – Jordan method – Eigen values of a matrix by power method.				9+3
UNIT II	INTERPOLATION AND APPROXIMATION				9+3
	Lagrange’s polynomials - Divided differences – Interpolating with a cubic spline – Newton’s forward and backward difference formulae.				
UNIT III	NUMERICAL DIFFERENTIATION AND NUMERICAL INTEGRATION				9+3
	Differentiation using interpolation formulae – Numerical integration by Trapezoidal and Simpson’s $1/3^{\text{rd}}$ and $3/8^{\text{th}}$ rules – Romberg’s method – Two and three point Gaussian quadrature formulae – Double integrals using Trapezoidal and Simpson’s rules.				
UNIT IV	INITIAL VALUE PROBLEMS FOR ORDINARY DIFFERENTIAL EQUATIONS				9+3
	Single Step methods - Taylor’s series method - Euler’s method – Modified Euler’s Method – Fourth order Runge - Kutta method for solving first order equations – Multi step methods - Milne’s and Adams – Bash fourth predictor corrector methods for solving first order equations.				
UNIT V	BOUNDARY VALUE PROBLEMS IN ORDINARY AND PARTIAL DIFFERENTIAL EQUATIONS				9+3
	Finite difference methods for solving two-point linear boundary value problems - Finite difference techniques for the solution of two dimensional Laplace’s and Poisson’s equations on rectangular domain - One dimensional heat flow equation by explicit and implicit (Crank Nicholson) methods - One dimensional wave equation by explicit method.				

L:45 T:15 P: 0 Total: 60 PERIODS

TEXT BOOKS

- 1 Veerarjan, T. and Ramachandran.T., "Numerical Methods with programming in 'C'", Second Edition Tata McGraw Hill Pub.Co.Ltd, First reprint 2007.
2. Sankar Rao K., "Numerical Methods For Scientists And Engineers", 3rd Edition Princtice Hall of India Private, New Delhi, 2007.

REFERENCES

- 1 Kandasamy, P., Thilagavathy. K and Gunavathy, K., "Numerical Methods", 3rd Edition, S.Chand & Company Pvt. Ltd, 2013.
- 2 Gerald C.F. and Wheate, P.O. ,"Applied Numerical Analysis", 2nd Edition, Pearson Education Asia, New Delhi, 2014.
- 3 Chapra, S.C and Canale, R.P. “Numerical Methods for Engineers”, 6th Edition, Tata McGraw Hill Edition, 2014.
- 4 Grewal, B.S and Grewal, J.S, “Numerical methods in Engineering and Science”, 9th Edition, Khanna Publishers, New Delhi, 2012.
- 5 Kreyszig,E.,“Advanced Engineering Mathematics”,8th Edition,John Wiley & Sons, Inc,Singapore, 2008.

COURSE OUTCOMES

At the end of the course student should be able to:

- CO1** Solve a set of algebraic equations representing steady state models formed in engineering problems.
- CO2** Use the interpolation methods to discrete data tables.
- CO3** Find the trend information from discrete data set through numerical differentiation and summary information through numerical integration.
- CO4** Predict the system dynamic behaviour through solution of ODEs modeling the system.
- CO5** Solve PDE models representing spatial and temporal variations in physical systems through numerical methods.

UNIT I SOLAR ENERGY RADIATION AND SOLAR THERMAL COLLECTORS 10

Solar radiation availability - radiation measurement – transmittance - absorptance - flat plate collectors - heat transfer correlations - collector efficiency - heat balance – absorber plate – types - selective surfaces. Solar driers – types – heat transfer - performance of solar driers – agro industrial applications - liquid flat plate collectors - their performance.

UNIT II SOLAR CONCENTRATING COLLECTORS AND PV TECHNOLOGY 9

Optically concentrating collectors – types – reflectors - solar thermal power stations – principle and applications - solar stills - types - solar pond - performance – characteristics – applications – solar refrigeration. Photovoltaics - types – characteristics – load estimation - batteries – invertors – operation - system controls. PV system installations – standalone systems - PV powered water pumping – system sizing and optimization - hybrid system - solar technologies in green buildings.

UNIT III WIND MAPPING ANALYSIS AND CHARACTERISTICS OF WIND 8

Nature of wind – wind structure and measurement - wind power laws - velocity and power duration curves - aero foil - tip speed ratio - torque and power characteristics - power coefficients – Betz coefficient.

UNIT IV WIND POWER GENERATOR AND WIND ENERGY STORAGE 6

Wind mill – classification– power curve. An upwind and downwind system - transmission rotors –pumps - generators - standalone system - grid system – batteries. Wind energy storage - wind farms - wheeling and banking - testing and certification procedures.

UNIT V ALTERNATE ENERGY SOURCES 12

Ocean energy- off shore and on shore ocean energy conversion technologies- OTEC principles-open and closed cycles. Tidal energy – high and low tides – tidal power- tidal energy conversion schemes. Geothermal energy – resources – classification and types of geothermal power plants. Nuclear energy –reactions – fusion fission hybrid. Fuel cell – principle and operation – classification and types. Energy storage – pumped hydro and underground pumped hydro – compressed air - battery - flywheel – thermal.

L : 45 T: 0 P: 0 Total: 45 PERIODS

TEXT BOOKS

- 1 H. P. Garg, Treatise on Solar Energy, Vol.1: Fundamentals of solar energy, John Wiley & sons Ltd, 1982.
- 2 Solanki Chetan Singh, Solar Photovoltaics: Fundamentals, Technologies and Applications, Prentice-Hall Of India Pvt. Limited, 2009.
- 3 J.F.Manwell, J.G. McGswan and A.L.Rogers, Wind Energy Explained – Theory, Design and Application, John Wiley and Sons Ltd, 2004.

REFERENCES

- 1 A.John. Duffie and William A. Beckmann, Solar Engineering of Thermal Processes, 4th Edition ISBN: 978-0-470-87366-3, John Wiley and Sons Ltd, 2013.
- 2 H.P. Garg, Advances in Solar Energy Technology Volume 2, Industrial Applications of Solar Energy, ISBN: 978-94-010-8188-7 (Print), Springer Publications., 1987.
- 3 Jui Sheng Hsieh, Solar Energy Engineering, Prentice Hall, London, 1986.

COURSE OUTCOMES

At the end of the course student should be able to:

- CO1** Possess the knowledge on the basics of solar radiation
- CO2** Know about the kinetics of solar thermal collectors and applications
- CO3** Know about the solar photo voltaic and its applications
- CO4** Know about wind power generators and wind energy storage
- CO5** Possess the knowledge on the working principle of alternate energy sources

UNIT I FUNDAMENTALS OF MACHINE DESIGN**10**

General consideration in machine design-strength properties of engineering materials. Limits and tolerances- types of fits-simple stresses in machine elements-tension-compression-shear and bearing stresses. Torsional and bending stresses in machine parts- torsional stresses in shafts, bending stresses in beams. Theories of failure-Rankine's theory, Guest theory, Saint Venants theory and Von Mises theory.

UNIT II DESIGN OF FASTENERS**9**

Design of permanent joints-welded joints-types of welded joints-transverse and parallel strength of fillet welds-design of butt joints-design of threaded fasteners-stresses in screwed fastening due to static loading.

UNIT III DESIGN OF MACHINE ELEMENTS**8**

Keys and couplings-strength of sunk keys- shaft couplings-design of sleeve coupling and flange coupling. Design of cotter and knuckle joints-design of shafts-shafts subjected to torsion, bending and combined stresses.

UNIT IV FUNDAMENTALS OF THEORY OF MACHINES**6**

Linkages-basic definitions-different types of mechanisms and their applications-instantaneous center of rotation for four bar mechanisms-determination of velocities in 4 bars and slider crank mechanism-acceleration in mechanisms. Flywheel –fluctuation of speed and energy- energy stored in flywheel.

UNIT V DESIGN OF TRANSMISSION SYSTEM COMPONENTS**12**

Gears-classification-gear terminology-law of gearing-design of spur and bevel gear based on Lewis and Buckingham equation. Springs-types of springs-design of helical springs. Belt drives-flat belts-Euler's formula-V-belt design-power calculation and selection-chain drive-components-design.

L : 45 T : 0 P : 0 Total: 45 PERIODS**TEXT BOOKS**

- 1 Kannaiah,P.2003. Machine Design Scitech Publishers (India) Pvt. Ltd. Chennai.
- 2 Khurmi, R.S. and Gupta, J.S.2001, A textbook of machine design. Eurasia Publi. House, Delhi.

REFERENCES

- 1 Gill, P.S. 1992. A textbook of machine drawing. S.K. Kataria and sons, New Delhi.
- 2 Siddeswar, N, P.Kannaiah and V.V.S Sastry. 1993.Machine drawing. Tata McGraw- Hill pub.
- 3 Narayana, K.L. and P.Kannaiah. 1992. Engineering graphics. Tata McGraw-Hill pub.

COURSE OUTCOMES

At the end of the course student should be able to:

- CO1** Know about the basics of machine design
- CO2** Know the design of fastenings
- CO3** Know the design of machine elements
- CO4** Know about the fundamentals of theory of machines
- CO5** Know about the design of transmission system components

16AG304	CAREER DEVELOPMENT PROGRAMME V	L	T	P	C
		3	0	0	3
UNIT I	AGRICULTURAL IMPLEMENTS AND MACHINE TESTING				9
Testing of Agricultural Implements-regulations for testing-Testing facilities in India-Agricultural machinery standards-calibration					
UNIT II	ENERGY AUDITING				9
Energy resources – Conservation of energy – energy audit - Need for energy audit – Types of energy audit – Benefits - Case studies.					
UNIT III	SOIL AND WATER QUALITY TESTING				9
Testing of Soil and Water samples-Types of water-Testing labs-Standards for testing-Benefits of testing					
UNIT IV	FOOD SAFETY STANDARDS				9
Food Safety-GMP-HACCP-BIS-National and International Standards-Scope of testing in Food industries					
UNIT V	ENTREPRENEURSHIP SKILLS				6
Entrepreneurship-Types of Industries-Schemes and loans-Project report preparation-Scope of Entrepreneurships-National and Global					

L : 15 T: 0 P: 45 Total: 45 PERIODS

TEXT BOOKS

- 1 Dr. Shukadev Mangaraj, Dr. R.T. Patil, “Agro Processing and Value Addition for Entrepreneurship Development”, Satish Serial Publishing, 2014
- 2 D.W. Smith, B.G. Sims, D.H. O'Neill , “Testing and evaluation of agricultural machinery and equipment”, FAO Publications, 1994

REFERENCES

- 1 Rai. G.D., "Non-Conventional Energy Sources", 4th Edition, Khanna Publishers, New Delhi, 2011. (Unit II).
- 2 Anil Kumar. A., “Small Business and Entrepreneurship”, I. K. International Pvt Ltd., New Delhi, 2008
- 3 Sonal Desai, “Handbook of Energy Audit”, McGraw-Hill Education (India) Limited, New Delhi, 2015

COURSE OUTCOMES

At the end of the course student should be able to:

- CO1** Test machines confidently and prepare reports.
- CO2** Perform Energy auditing in various Agro. Industries.
- CO3** Understand the concepts of soil and water testing
- CO4** Apply the principles of food safety standards.
- CO5** Gain knowledge and confidence to become an entrepreneur

16GE313	CAREER DEVELOPMENT PROGRAMME V	L	T	P	C
	(Common to all B.E. / B. Tech. Courses)	1	0	2	2*
UNIT I	QUANTITATIVE ABILITY I				9
	Number theory- Shortcuts, Divisibility criteria- Unit place deduction-LCM &HCF, Square root and Cube Root, Decimal & Fraction, Percentage.				
UNIT II	QUANTITATIVE ABILITY II				9
	Profit, loss and discount, Simple and compound interest, Ratio & Proportions, Mixtures & Allegation, Partnership.				
UNIT III	QUANTITATIVE ABILITY III				9
	Problems on Ages, Average, Venn diagram, Clocks, Calendar, Data Interpretation- Bar chart- Pie chart- Line chart-Tables chart.				
UNIT IV	VERBAL REASONING I				9
	Analytical reasoning - Linear, Circular & Complex arrangement, Blood relation, Direction Problems, Puzzle.				
UNIT V	VERBAL REASONING II				9
	Logical reasoning - Number and Alpha series, Odd man out, Element series, Logical series, Coding and decoding, Analogy, Alphabets, Logical sequence of words.				
		L : 15	T:0	P:30	Total: 45 PERIODS

TEXT BOOKS

- 1 Rajesh Varma, "Fast Track Objective Arithmetic", Arihant Publications.
- 2 BS Sijwali- Indu Sijwali, A New Approach to "Reasoning Verbal, Non-Verbal & Analytical", Arihant Publications.

REFERENCES

- 1 R.V.Praveen, "Quantitative Aptitude and Reasoning" PHI Publication.
- 2 R.S.Agarwal, "Quantitative Aptitude for Competitive Examinations", S.Chand & Company Pvt Limited

COURSE OUTCOMES

At the end of the course students should be able to

- CO1** Know the both analytical and logical reasoning
- CO2** Apply the shortcut methods in quantitative aptitude.
- CO3** Solve application orientated concepts in quantitative aptitude.
- CO4** Improve the quality of the student as a finished product for their corporate life.
- CO5** Understand and practice Logical reasoning.

16AG305

SOLAR AND WIND ENERGY LAB

L	T	P	C
0	0	2	1

LIST OF EXPERIMENTS

1. Problems on solar time – basic earth sun angles
2. Problems on thermal losses and efficiency of flat plate collectors
3. Experiment on thermal efficiency of solar water heater
4. Experiment on thermal efficiency of natural convection solar dryer
5. Experiment on thermal efficiency of forced convection solar dryer
6. Experiment on thermal efficiency of solar still
7. Study of photovoltaic cell characteristics
8. Study on the performance of wind generator in the lab
9. Performance evaluation of a SPV water pumping system
10. Wind Energy conversion calculations for power generation
11. Visit to a solar PV power plant
12. Visit to a wind farm

L : 0 T: 0 P: 30 Total:30 PERIODS

Course outcomes

At the end of the course student should be able to:

- CO1** Solve the problems on solar time and relationship between sun-earth angles
- CO2** Determine the thermal efficiency of solar flat plate collectors(water heater, solar dryers, and solar still)
- CO3** Determine the solar PV cell characteristics and performance of PV pump
- CO4** Know about the different designs of wind mills and their applications
- CO5** Perform wind energy calculations

16AG306

**MACHINE DESIGN & COMPUTER AIDED
DRAFTING LABORATORY**

L	T	P	C
0	0	2	1

LIST OF EXPERIMENTS

1. Computer aided drawing of screw threads.
2. Draw Keys-shaft key, sunk key and hub assemblies.
3. Draw Bearings - journal - solid – bush and draw pulleys - flat and V.
4. Practice in solid modeling.
5. Design and Computer aided drawing of shafts subjected to torsion, bending and combined stress
6. Design and Computer aided drawing of welded joints
7. Design and Computer aided drawing of riveted joints
8. Design and drawing of threaded fasteners and joints
9. Design and drawing of sleeve coupling and flange coupling.
10. Design and drawing of cotter joint, knuckle joint and turn buckle joint
11. Design and drawing of bevel gear and gear teeth.

L : 0 T: 0 P: 30 Total:30 PERIODS

Course outcomes

At the end of the course student should be able to:

- CO1** Use the concept of drafting and modeling with help of software
- CO2** Draw various views of threads, bolts, nuts, keys, shaft, pulleys
- CO3** Draw various views of welded joints, riveted joints
- CO4** Draw the views of bearings and gears
- CO5** Draw the views of screws, couplings, cotter joints and knuckle joints

16AG307

GIS LAB

L T P C

0 0 2 1

LIST OF EXPERIMENTS

1. Simple visual display on screen and Screen management of vector data, raster data
2. Use of Index map
3. Preparation of Drainage maps from Remote Sensing Photographs
4. Exercise on digitizer coding point, line and polygon data
5. Point line-Polygon co-ordinate system
6. Digitizer- Digitizing line and polygon data
7. Data Base Management System
8. Data conversion-Vector to Raster, Raster to Vector
9. Overlay and Surface techniques
10. Standard GIS Packages

L : 0 T: 0 P: 30 Total:30 PERIODS

Course outcomes

At the end of the course student should be able to:

- CO1** Use index maps
- CO2** Prepare drainage maps
- CO3** Know about data base management system
- CO4** Know about data conversions
- CO5** Get acquainted with standard GIS packages

UNIT I INTRODUCTION

Farm mechanisation – objectives. Tillage - objectives - methods – primary tillage implements - secondary tillage implements - animal drawn ploughs - construction. Types of farm implements – trailed, mounted. Scope and benefits of farm mechanization- constraints. Different ploughing methods. Mould board plough- attachments – mould board shapes and types. Disc plough - force representation on disc – Types of disc ploughs – Subsoiler plough - Rotary plough – spading machine - coir pith applicators.

UNIT II PRIMARY AND SECONDARY TILLAGE IMPLEMENTS 9

Cultivators - types - construction. Disc harrows - Bund former - ridger – leveller. Basin lister- implements for wetland preparation. Hitch systems and hitching of tillage implements- virtual and real hitching for single point, single axis and double hitch -mechanics of animal traction- functional requirements, principles of working. Weeding and Interculture equipment- Junior hoe - guntaka - blade harrow - dry land weeders - tractor mounted and engine operated sweeps. Engine operated and rotary weeders for upland and low land - selection, constructional features and adjustments. -Calculation of performance parameters -field capacity, efficiency, application rate and losses- performance requirements- cost analysis of implements and tractors.

UNIT III FORCES ACTING ON THE TILLAGE TOOL AND DESIGN 9
ASPECTS OF TILLAGE IMPLEMENTS

Soil tillage- forces analysis of tillage tools and their measurement- design considerations of tillage implements -Type of Mould board plough and its functions- Theoretical furrow slice inversion- Design of mould board plough bottom- Standard dimensions of plough share and land side. Introduction of disk implements and their design consideration-Design of disk for different tools, spacing in multi disk implements, forces acting on vertical and inclined disk- Cultivators and their application- Design of different soil engaging tools such as shovel and sweep- Design of shank- overload safety devices used in farm machinery-design of safety devices.

UNIT IV SOWING EQUIPMENT AND FERTILIZER APPLICATION 9

Crop planting - methods - row crop planting systems - Devices for metering seeds – furrow openers – furrow closers- types – Types of seed drills and planters. Design considerations of seed and fertilizer box and frame- Design of seed metering mechanism -Drill calibration - application of fertilisers - metering devices – seed cum fertiliser drill - application of liquid fertilisers. Paddy and potato planters and sugar cane planter.

UNIT V SPRAYERS AND DUSTERS 9

Sprayers – classifications - parts and accessories - atomizers - agitators - determination of particle size and distribution. Number Median Diameter (NMD) and Volume Median Diameter (VMD). Sprayer operation – boom sprayer - precaution - coverage - factors affecting drift. Rotating disc sprayers – Controlled Droplet Application (CDA) - Electrostatic sprayers - Arial spraying. Dusters - types - mist blower cum duster - other plant protection devices, care and maintenance.

PRACTICAL 30

1. Operation of a tractor drawn mould board plough - adjustments - determination of field capacity
3. Operation of a tractor drawn disc plough - adjustments - determination of field capacity
4. Hitching of mounted type tillage implements to the tractor and ploughing methods
5. Operation of tractor drawn cultivator - adjustments- and determination of field capacity
6. Experiment on Calibration of seed drills
7. Operation of seed drill and centrifugal broadcasting device in the field
8. Study of paddy transplanter and drum seeder, puddlers and trammers
9. Operation and evaluation of dry land weeder /power operated weeder

10. Dismantling, parts identification and assembly of different components of knapsack power sprayer and duster.

L : 45 T: 0 P:30

Total: 75 PERIODS

TEXT BOOKS

- 1 E.L. Barger, R.A. Kepner, Roy Bainer, *Principles of Farm Machinery* (Third Edition), CBS Publishers & Distributors Pvt. Ltd, ISBN 10 : 8123909772 / ISBN 13 : 9788123909776, 2005.
- 2 Michael and Ojha, *Principles of Agricultural Engineering*, Jain brothers, New Delhi, 2005.
- 3 Brian Bell, *Farm Machinery*, sixth edition, Old Pond Publishing Ltd, Sheffield, U.K., 2015, ISBN-10-1910456063, ISBN-13- 9781910456064

REFERENCES

- 1 Harris Pearson Smith and Lambert Henry Wilkes, *Farm machinery and equipments*, 6th edition, Tata McGraw-Hill, New Delhi, 1990.
- 2 Krutz, Gary, Thompson Lester and Claar, Paul, *Design of Agricultural Machinery*, John Wiley and Sons, 1984.
- 3 Donnell Hunt , *Farm Power and Machinery Management* 10th Edition, Waveland Pr Inc , 2007, ISBN-13: 978-1577665731 , ISBN-10: 1577665732
- 4 A.C. Srivastava, *Elements of Farm Machinery*, Oxford and IBH Pub. Co., New Delhi, 1990.
- 5 Richard Lee , *Tractors and Farm Machinery*, Ipswich, Suffolk, United Kingdom, 2008

COURSE OUTCOMES

At the end of the course student should be able to:

- CO1** Know about the concepts of tillage
- CO2** Know how to hitch and use the farm implements
- CO3** Know the design aspects of tillage implements
- CO4** Know about the sowing, plantation equipments and weeders
- CO5** Possess the knowledge on sprayers and dusters

SEMESTER VI

16GE301	PROFESSIONAL ETHICS	L	T	P	C
	(Common to all B.E. / B. Tech. Courses)	3	0	0	3
UNIT I	ENGINEERING ETHICS				9
Senses of Engineering ethics – Variety of moral issues – Types of inquiry- Moral dilemmas. Moral autonomy – Kolberg’s theory – Gilligan’s theory – consensus and controversy – professions and professionalism – professional ideals and virtues – theories about right action – self-interest – customs and religion – use of ethical theories.					
UNIT II	ENGINEERING AS SOCIAL EXPERIMENTATION				9
Engineering as social experimentation – engineers as responsible experimenters – codes of ethics – a balanced outlook on law – Case studies.					
UNIT III	ENGINEERS RESPONSIBILITY FOR SAFETY				9
Safety and risk – assessment of safety and risk – risk benefit analysis – reducing risk – Case studies.					
UNIT IV	RESPONSIBILITIES AND RIGHTS				9
Collegiality and loyalty – respect for authority – collective bargaining – confidentiality – conflicts of interest –occupational crime – professional rights –employee right – discrimination – intellectual property rights, Case studies.					
UNIT V	GLOBAL ISSUE				9
Multinational corporations – environmental ethics – computer ethics – weapons development – engineers as managers – consulting engineers – engineers as expert witnesses and advisors – moral leadership – sample code of conduct, Case studies.					

L:45 T: 0 P: 0 Total: 45 PERIODS

TEXT BOOKS

- 1 Mike Martin and Roland Schinzinger, “Ethics in Engineering” McGraw hill, New York, 2004.
2. Govindarajan. M, Natarajan. S, Senthilkumar. V.S, “Engineering Ethics” Prentice Hall, New Delhi, 2004.

REFERENCES

- 1 Charles E. Harris, Michael S. Pritchard and Michael J. Rabins, “Engineering Ethics– Concepts and Cases”, Cengage Learning, 2009 .
- 2 Laura P. Hartman and Joe Desjardins, “Business Ethics: Decision Making for Personal Integrity and Social Responsibility” McGraw Hill education, India Pvt.Ltd., New Delhi 2013 .
- 3 Charles B. Fleddermann, “Engineering Ethics”, Pearson Prentice Hall, New Jersey, 2004.
- 4 Prof. (Col) P S Bajaj and Dr. Raj Agrawal, “Business Ethics – An Indian Perspective”, Biztantra, New Delhi, (2004).
- 5 David Ermann and Michele S Shauf, “Computers, Ethics and Society”, Oxford University Press, 2003.

COURSE OUTCOMES

At the end of the course student should be able to:

- CO1** Understand the basic perception of profession, professional ethics, various moral issues and uses of ethical theories.
- CO2** Identify various social issues, industrial standards, code of ethics and role of professional ethics in engineering field.
- CO3** Realize the responsibilities of an engineer for safety and risk benefit analysis.
- CO4** Recognize the professional rights and responsibilities of an engineer.
- CO5** Acquire knowledge about various roles of engineers in variety of global issues and able to apply ethical principles to resolve situations that arise in their professional career.

UNIT I INTRODUCTION

Classification of tractors - history of Engines- tractor engines – engine operation- understanding the working principle of a diesel engine - 4 Stroke compression-ignition engine cycle- inlet and outlet valves – valve timing diagram- engine efficiency - engine operating cycle - firing order –firing interval - combustion chambers –construction details of engine blocks, cylinder head and crankcase - features of cylinder, piston, connecting rod and crankshaft.

UNIT II TRACTOR ENGINE SYSTEMS**10**

Valve and valve mechanism-Air and fuel supply-air cleaner- fuel pump-exhaust – silencer. Cooling and lubrication system- starting and electrical system- Transmission system-clutches, brakes, power train-transmission- gears- types of high and low gears transmission- gear box- differential and final drive mechanism-engine governing. Steering geometry – steering systems - front axle and wheel alignment. Brake – types.

UNIT III POWER OUTLETS AND TRACTOR CONTROL**10**

Tractor PTO, belt-pulley, properties of hydraulic fluids- Hydraulic system -hydraulic couplings, Torque converters- Hydraulic circuits- position and draft control- weight transfer- theory of traction - tractive efficiency – tractor chassis mechanics - stability - longitudinal and lateral. Controls - visibility – operator's seat. Tractor steering mechanism-Types- caster camber- king pin inclination- toe-in and toe-out- Tractor Hitching.

UNIT IV TESTING OF POWER TILLER AND TRACTOR**10**

Power tiller - special features - clutch - gear box - steering and brake. Makes of tractors and power tillers. Types of tests- test procedure - need for testing & evaluation of farm tractor –Test codes for performance testing of tractors and power tillers. Cost of operation of tractors and power tillers.

UNIT V ERGONOMICS AND ENVIRONMENTAL PROTECTION**6**

Ergonomic aspects of tractors and power tillers-substitution of fossil fuels with biofuels to protect the environment from GHG pollution-case studies.

L : 45 T: 0 P: 0**Total: 45 PERIODS****TEXT BOOKS**

- 1 R.K. Veera Selvam, Farm Machinery and Power, Oxford Book Company, 2010,ISBN 10: 9380179634 / ISBN 13: 9789380179636
- 2 A.M. Michael and T. P. Ojha, Principles of Agricultural Engineering, Vol. 1
John B. Liljedahl, Paul K. Turnquist, David W. Smith, Tractors And Their Power Units, Fourth Edition ,
- 3 ISBN-13: 978-1-4684-6634-8, An AVI Book Published by Van Nostrand Reinhold, New York, First edition, 1989.

REFERENCES

- 1 Robert Allen Kepner, Roy Bainer, Edgar Lee Barger, Principle of Farm machinery, AVI Pub. Co., 1978, 527 pages
- 2 Rajeev Kumar, *Farm Power and Machinery Engineering (English)*, First Edition, Standard publishers and distributors, New Delhi. ISBN-10 8180140253, 2008.
- 3 Arun Dahake, An Introduction to Farm Power and Machinery, 2015. ISBN No. 9781312800885, (Standard Copyright License), 1st Edition, 2017, www.lulu.com,
- 4 S.C. Jain and C.R. Rai, *Farm tractor maintenance and repair*. Standard publishers and distributors, New Delhi, 1999.
- 5 E.L. Barger, J.B. Liljedahl and E.C. McKibben, *Tractors and their Power Units*, Wiley Eastern Pvt. Ltd., New Delhi, 1997.

COURSE OUTCOMES

At the end of the course student should be able to:

- CO1** Possess the knowledge on the working principle of diesel engine and engine components
CO2 Know about tractor engine systems
CO3 Know about taking power output from a tractor and tractor control
CO4 Know about testing of tractor and power tiller
CO5 Know about ergonomic aspects of tractors and power tillers

UNIT I THRESHING, MOISTURE MEASUREMENT AND PHYSICAL PROPERTIES OF AGRICULTURAL PRODUCES 9

Post harvest engineering - introduction - objectives - post harvest losses of cereals, pulses and oilseeds - importance - optimum stage of harvest. Threshing - traditional methods mechanical threshers - types-principles and operation-moisture content - measurement - direct and indirect methods - moisture meters - equilibrium moisture content. Engineering properties of agricultural produces.

UNIT II PSYCHROMETRY AND DRYING 9

Psychrometry – importance – Psychrometric charts and its uses – Drying – principles and theory of drying – thin layer and deep bed drying – Hot air drying – methods of producing hot air – Types of grain dryers – selection – construction, operation and maintenance of dryers – Design of dryers

UNIT III CLEANING AND GRADING MACHINES 9

Principles - air screen cleaners – adjustments - cylinder separator-spiral separator – magnetic separator-colour sorter-inclined belt separator – length separators -effectiveness of separation and performance index.

UNIT IV SHELLING AND HANDLING EQUIPMENTS 9

Principles and operation – maize sheller, husker sheller for maize – groundnut decorticator –castor sheller – material handling –belt conveyor –screw conveyor – chain conveyor – bucket elevators – pneumatic conveying.

UNIT V PADDY , PULSES AND OIL SEED PROCESSING 9

Paddy processing – parboiling of paddy – methods – merits and demerits – dehusking of paddy – methods – merits and demerits – rice polishers –types – constructional details – polishing –layout of modern rice mill - wheat milling – pulse milling methods – oil seed processing.

L : 45 T: 0 P: 0 Total: 45 PERIODS

TEXT BOOKS

- 1 Chakraverthy, A ,Third Edition, Post harvest technology for Cereals, Pulses and Oilseeds. Oxford & IBH publication & Co. Pvt. Ltd, New Delhi, 2000.
- 2 Mohsenin, N.N., Physical Properties Of Plant And Animal Materials, Gordon and Breach publishers, New York,pp-1206, 1986.

REFERENCES

- 1 Sahay, K.M., and Singh, K.K. Unit operations of Agricultural Processing. Vikas publishing house Pvt. Ltd., New Delhi, 1994.
- 2 W.L. McCabe and J.C. Smith and P.Harriot Unit Operations in Chemical Engineering, McGraw Hill Inc. Kosaido Printing Ltd. Tokyo, Japan, 2001.
- 3 Pande, P.H. Principles of Agricultural Processing, Kalyani Publishers, Ludhiana,pp-278, 1994.

COURSE OUTCOMES

At the end of the course student should be able to:

- CO1** Know about threshing methods and determine the properties of cereals, pulses and oil seeds
- CO2** Know about psychrometry and drying
- CO3** Know about shelling and handling equipments
- CO4** Know about the processing of paddy , pulses and oil seed
- CO5** Possess the skills to apply suitable post harvest operation for value addition of farm produces and utilize the post harvest machines to increase the market value of the processed food products

16GE312 CAREER DEVELOPMENT PROGRAMME VI **L T P C**
 (Common to all B.E. / B. Tech. Courses) **1 0 2 2***

UNIT I LINGUISTIC SKILLS 10

Parts of Speech, Sentences - Simple, Compound & Complex sentences, Logical sequence of words, Reading Comprehension, Paragraph writing, Jumbled words, Jumbled sentences, Error Spotting, Idioms & Phrases, Word Substitution, Synonyms & Antonyms.

UNIT II QUANTITATIVE ABILITY 10

Number theory, Percentage, Profit loss and discount, Simple and compound interest, Problems on Average & Ages, Ratio & Proportions, Partnership, Mixtures and allegation, Time speed and distance, Time and work, Probability, Permutation and combination, Mensuration, Clocks, Calendars.

UNIT III VERBAL & NON-VERBAL REASONING 10

Analytical reasoning - Linear, Circular & Complex arrangement, Blood relation, Direction Problems, Decision making.

Logical reasoning - Number and Alpha series, Odd man out, Element series, Logical series, Coding and decoding, Syllogisms, Alphabets Machine Input & Output Coded Inequalities, Puzzles, Cubes, Data sufficiency, Analogy.

Critical reasoning - Statement – Argument & Assumption, Causes & effects, Courses of Action, Inferences.

Non-Verbal reasoning - Insert the missing character, Figure series, Cubes & Dices, Logical Venn diagram.

UNIT IV PERSONALITY DEVELOPMENT & SOFT SKILLS 8

Body Language – Introduction, Grooming, Body Language - Postures and Gestures, Dressing Etiquettes, Hygiene & Cleanliness, Time Management

Interview Etiquettes – Meaning, Purpose, Interview process and types, checklist – do’s and don’ts, Dress code, Self-Introduction.

Resume Building – Introduction, transformation between Resume and CV, Strategy of Resume Writing, Body of the resume, clarity and crispness, format and content.

Group Discussion – Types, Key steps to succeed in Group Discussion, Guidelines – Do’s and Don’ts during Group Discussion, the technique of summing up.

UNIT V COMPANY SPECIFIC TRAINING 7

Company specific training.

L:15 T:0 P:30 Total: 45 PERIODS

TEXT BOOKS

- 1 John Eastwood, “Oxford Practice Grammar”, Oxford.
- 2 Rajesh Varma, “Fast Track Objective Arithmetic”, Arihant Publications.
- 3 M.K.Panday, “Analytical Reasoning”, Magical Series.

REFERENCES

- 1 R.V.Praveen, “Quantitative Aptitude and Reasoning” PHI Publication.
- 2 R.S.Agarwal, “Quantitative Aptitude for Competitive Examinations”, S.Chand & Company Pvt Limited.
- 3 S.P.Bakshi, “Objective English” Arihant Publications.
- 4 Edgar Thorpe & Showick Thorpe, “Winning Interviews”, Pearson Publications.

COURSE OUTCOMES

At the end of the course students should be able to

- CO1** Communicate well both in oral and written English.
- CO2** Solve the complicated problems with the thorough knowledge on the basics.
- CO3** Think both critical and logical to solve the problems.
- CO4** Be a better personality in their professional and social life.
- CO5** Face the recruitment challenges.

16GE314	CAREER DEVELOPMENT PROGRAMME VI	L	T	P	C
	(Common to all B.E. / B. Tech. Courses)	1	0	2	2*
UNIT I	QUANTITATIVE ABILITY IV				9
	Time, speed & distance-Average speed- Relative speed- Train problems- Boats and streams- Races, Chain rule, Time and work -Pipes and cisterns.				
UNIT II	QUANTITATIVE ABILITY V				9
	Permutation & Combination, Probability, Mensuration, Data sufficiency (Quants).				
UNIT III	VERBAL REASONING III				9
	Machine Input and Output, Coded Inequalities, syllogisms, Problems on Cubes, Data sufficiency(Reasoning).				
UNIT IV	CRITICAL REASONING				9
	Statement and Argument, Statement and Assumption, Statement and Conclusion, Course of action, Inference, Decision Making.				
UNIT V	NON- VERBAL REASONING				9
	Figure series, Odd man out, Mirror Image, Water image, Embedded Image, Cubes and Dices, shape construction, Insert the Missing Characters, Analytical reasoning, Logical venn diagram.				
		L:15	T:0	P:30	Total: 45 PERIODS

TEXT BOOKS

- 1 Rajesh Varma, "Fast Track Objective Arithmetic", Arihant Publications.
- 2 BS Sijwali- Indu Sijwali, A New Approach to "Reasoning Verbal, Non-Verbal & Analytical", Arihant Publications.

REFERENCES

- 1 R.V.Praveen, "Quantitative Aptitude and Reasoning" PHI Publication.
- 2 R.S.Agarwal, "Quantitative Aptitude for Competitive Examinations", S.Chand & Company Pvt Limited.

COURSE OUTCOMES

At the end of the course students should be able to

- CO1** Increase the students knowledge in both analytical and logical reasoning
- CO2** Apply the shortcut methods in quantitative Aptitude
- CO3** Solve application orientated concepts in quantitative aptitude.
- CO4** Improve the quality of the student as a finished product for their corporate life
- CO5** Use their logical thinking and analytical abilities to solve Quantitative aptitude questions.

16AG311

FARM TRACTORS LAB

L	T	P	C
0	0	2	1

LIST OF EXPERIMENTS

1. Hand tools used in garage - fault diagnosis.
2. Study of tractor engine systems using a working model of a tractor engine
3. Piston and cylinder- inspection - reconditioning and assembly of cranking system.
4. Study of valve and valve actuation system.
5. Study of fuel system assembly and adjustment
6. Study of lubricating system components.
7. Study of cooling system components.
8. Study of transmission system-assembly of gear box, differential and final drive.
9. Study of brake and its adjustment-Steering system – assembly and adjustment-wheel tread adjustment
10. Study of tyres, rims and balancing methods of a tractor
11. Visit to tractor/power tiller manufacturing companies

L : 0 T: 0 P: 30 Total:30 PERIODS

Course outcomes

At the end of the course student should be able to:

- CO1** Know dismantling and assembling of tractor engine components
- CO2** Know about servicing of different engine systems
- CO3** Know about power transmission system of a tractor
- CO4** Know about brake system of a tractor
- CO5** Know about balancing methods of a tractor

16AG313

POST HARVEST ENGINEERING LAB

L T P C

0 0 2 1

LIST OF EXPERIMENTS

1. Determination of moisture content by direct and indirect methods
2. Determination of true density, bulk density, porosity of grains.
3. Experiment on drying characteristics of grains
4. Performance evaluation of separators (Spiral and Specific Gravity)
5. Performance evaluation of fluidized bed dryer
6. Determination of shelling efficiency of groundnut decorticator
7. Determination of the efficiency of bucket elevator and screw conveyor
8. Performance evaluation of paddy parboiling drum
9. Performance evaluation of a grain cleaning cum grading machine
10. Evaluation of shelling efficiency of rubber roll sheller
11. Performance evaluation of seed separators (inclined belt and winnower)
12. Visit to modern rice mill

L : 0 T: 0 P: 30 Total:30 PERIODS

Course outcomes

At the end of the course student should be able to:

- CO1** Determine the moisture content of food grains
- CO2** Determine the different physical properties of grains
- CO3** Evaluate the performance of different grain dryers
- CO4** Evaluate the performance of grain cleaner cum grading machines
- CO5** Evaluate the performance of rice processing machines

16AG314

MINI PROJECT

L	T	P	C
0	0	2	1

GUIDELINES

The students will take up research on topics pertaining to agricultural engineering and conduct the research and will submit report form. The report should be presented before a committee constituted by the head of the Institution, which shall evaluate the project work done for 50 marks. The committee will consist of head of the department, the supervisor of the mini project and two senior faculty member of the department.

L : 0 T: 0 P: 30 Total:30 PERIODS

Course outcomes

At the end of the course student should be able to:

- CO1** Under the mini project the students will learn new developments
- CO2** Develop new ideas into practice and it will form the basis for doing main projects
- CO3** They can also take up projects relating to industrial problems and find solutions to them

SEMESTER VII

16AG401	HARVESTING AND THRASHING MACHINERY	L	T	P	C
		3	0	0	3
UNIT I	HARVESTERS				9

Principles and types of cutting mechanisms. Harvesters - types – mowers- mechanism – construction and adjustments - registration and alignment. windrowers, reapers, reaper binders and forage harvesters. Self-Propelled Walking Type Vertical Conveyor Reaper-self-propelled Fodder Harvester (Cutter bar Type)- Tractor Front Mounted Vertical Conveyor Reaper- Tractor Mounted Fodder Harvester- Tractor Mounted Root Crop Harvester cum Elevator- Tractor Operated Groundnut Digger Elevator- Tractor Operated Cassava Harvester- Tractor Drawn Turmeric Digger- Tractor Operated Potato Digger.

UNIT II THRESHERS **9**

Threshing principle – manual and power threshing –types of power thresher-hammer-mill , rasp bar, spike-tooth cylinder and drum types-cleaning-threshing efficiency- Pedal Operated Thresher-power operated paddy threshing and winnowing machine- power wheat thresher- groundnut thresher- precautions and care in the operation of threshers- construction and working of multi crop thresher - advantages- Power operated axial flow sunflower thresher- maize thresher.

UNIT III COMBINE HARVESTERS **9**

Combine harvester – advantages-types - parts - construction and working-japanese type paddy combine. Sugarcane harvesters-parts-construction and working. Corn harvesters and shellers.

UNIT IV FRUIT HARVESTERS **9**

Fruit pluckers - tree shakers – fruit harvesting machinery. Tractor operated banana clump remover- Self-propelled Platform Type Fruits Harvesting System

UNIT V OTHER MACHINERY **9**

Groundnut-cum-Castor Decorticator- Tractor or Electric Motor Operated Multi-crop thresher for grains. Spice harvesters- tree climber- cotton pickers - tractor operated garlic harvester-aerial access hoist for management of coconut and tall trees. Forest machinery - shrub cutters - tree cutting machines – post hole digger – Chaff cutter.

L : 45 T : 0 P : 0 Total: 45 PERIODS

TEXT BOOKS

- 1 Harris Pearson Smith and Lambert Henry Wilkes, Farm machinery and equipments, 6th edition, Tata McGraw-Hill, New Delhi, 1990
- 2 Robert Allen Kepner, Roy Bainer, Edgar Lee Barger, Principles of farm machinery, AVI Publishers, 527 pages, 1978.

REFERENCES

- 1 Donnell Hunt and David Wilson, Farm Power and Machinery Management, Eleventh Edition, ISBN 10: 1-4786-2696-8, ISBN 13: 978-1-4786-2696-1, 360 pages, 2016. contact : comps@waveland.com
- 2 Rajeev Kumar, *Farm Power and Machinery Engineering (English)*, First Edition, Standard publishers and distributors, New Delhi. ISBN-10 8180140253, 2008.
- 3 Michael and Ojha, Principles of Agricultural Engineering. Jain brothers, New Delhi, 2005.
- 4 A.C. Srivastava, Elements of Farm Machinery. Oxford and IBH Pub. Co., New Delhi, 1990.
- 5 Lal, Radhey and A.C. Dutta, "Agricultural Engineering through solved examples", Saroj Prakashan Publishers, Allahabad, 1971.

COURSE OUTCOMES

At the end of the course student should be able to:

- CO1** Evaluate the performance of potato harvester and tapioca harvester
- CO2** Evaluate the performance of power operated paddy thresher
- CO3** Evaluate the performance of Performance evaluation of power tiller attached implements
- CO4** Possess knowledge on multi crop thresher, sugarcane harvester, paddy reaper, combine harvester
- CO5** Evaluate the performance of groundnut thresher and fruit harvester

16AG402

DAIRY AND FOOD ENGINEERING

L T P C
3 0 0 3

UNIT I PROPERTIES OF FOODS AND METHODS OF FOOD CONCENTRATION

9

Constituents of food and their energy values - Thermal, electrical, rheological properties of food- texture of food materials - definition - Terminologies -viscometry - basic concepts Concentrations of foods - freeze concentration – membrane concentration .

UNIT II THERMAL PROCESSING OF FOODS

9

Thermal processing of foods - cooking, blanching, sterilization, pasteurization, canning -interaction of heat energy on food components - reaction kinetics - Decimal reduction time – Temperature dependence of kinetics - Arrhenius equation - Thermal Death Time Curves. Preservation by irradiation –retort processing –principles and applications – microwave and radio frequency heating in food processing.

UNIT III DRYING AND DEHYDRATION

9

Food spoilage – causes of spoilage -Moisture content – free moisture – bound and unbound moisture – equilibrium moisture content – Water activity – sorption behaviour of foods – dehydration –methods of dehydration – types of dryers – advantages and disadvantages – osmotic dehydration – foam mat drying of materials.

UNIT IV MILK PROCESSING

9

Physical, chemical, thermal and rheological properties of milk - storage tanks. Receiving, handling and testing of milk – storage. Pasteurization - principles and methods - equipment – Low Temperature Long Time - High Temperature Short Time - Ultra High Temperature pasteurization.

UNIT V DAIRY EQUIPMENT AND PRODUCTS

9

Homogenization - theory and working of homogenizers - cream separation - principles - types of separators. Clarifiers - butter churns – ghee manufacture - equipment – whey manufacture – techniques –equipment – ice cream freezers – condensed milk – milk powder manufacturing – drying equipment - drum drier and spray drier - milk products – paneer – casein – probiotic dairy products – milk plant sanitation requirements - Cleaning In Place unit and its functions.

L : 45 T: 0 P: 0 Total: 45 PERIODS

TEXT BOOKS

- 1 Sukumar De. Outlines of Dairy Technology, Oxford University Press, New Delhi, ISBN: 9780195611946 , 2001.
- 2 Singh, R.Paul. and Heldman, R. Dennis, Introduction to Food Engineering. 3rd Edition. Academic Press, London, 2004.

REFERENCES

- 1 Norman N. Potter and Joseph H. Hotchkiss, Food Science, Fifth Edition, Food Science Text Series, 3. ISBN: 978-1-4613-7263-9 (Print) 978-1-4615-4985-7 (Online), 1995.
- 2 H.G.Kessler, Food Engineering and Dairy Technology, Freising, Germany, Verlag A.Kessler, 1981
- 3 Chandra Gopala Rao. Essentials of Food Process Engineering. B.S. Publications, Hyderabad., 2006.

COURSE OUTCOMES

At the end of the course student should be able to:

- CO1** Know about different methods of food concentration
- CO2** Know about thermal processing of foods
- CO3** Possess knowledge on drying and dehydration
- CO4** Know about processing of milk
- CO5** Possess the knowledge on dairy equipments and products

16AG403 IRRIGATION AND DRAINAGE ENGINEERING L T P C

3 0 0 3

UNIT I SOIL WATER TENSION AND MEASUREMENT OF SOIL WATER 9

Rooting characteristics-soil water tension and soil water stress-Soil water potential concept-total and gravitational potential-soil water retention-infiltration-factors influencing infiltration rate-measurement of infiltration –permeability-determination- movement of water in soils-hydraulic conductivity-determination.

UNIT II WATER RESOURCE AND IRRIGATION REQUIREMENT OF CROPS 9

Water Resources- River basins-Development and Utilization in India and Tamil Nadu-Irrigation-Moisture use of crop, Evapotranspiration - ET – plot. Crop water requirement - duty and delta - Effective rainfall - Scheduling - Irrigation requirement - Irrigation frequency, Irrigation efficiencies.

UNIT III TRANSPORTATION OF WATER FOR IRRIGATION 9

Methods of Irrigation - Hydraulics and design - Erodible and non-erodible, alluvial channels- Materials for lining water courses and field channel, Water control and diversion structure - Underground pipeline irrigation system - Land grading - Land levelling methods.

UNIT IV IRRIGATION STRUCTURES 9

Irrigation structures, channel lining- land grading, different design methods and estimation of earth work and cost; soil water plant relationship, soil water movement , infiltration and its equations, soil moisture constants, depth of irrigation, frequency of irrigation, irrigation efficiencies; surface irrigation methods of water application, border, check basin, furrow and contour irrigation.

UNIT V AGRICULTURAL DRAINAGE SYSTEMS 9

Agricultural drainage - Drainage coefficient; principles of flow through soils, Darcy's law – infiltration theory, Surface drainage systems - Subsurface drainage - Design of subsurface drainage - Pipe materials - mole drains, drainage wells, Leaching requirements - irrigation and drainage water quality - recycling of drainage water for irrigation.

L : 45 T: 0 P: 0 Total: 45 PERIODS

TEXT BOOKS

- 1 Dilip Kumar Majumdar, *Irrigation water Management-Principles and Practice*, Prentice-Hall of India Pvt Ltd, New Delhi, 2006.
- 2 A.M. Michael, *Irrigation -Theory and Practice*, Vikas publishing house, New Delhi, 1990.

REFERENCES

- 1 J.N. Luthin, *Drainage Engineering*, John Wiley and Sons, New York, 1966.
- 2 V.V.N. Murthy, *Land and water management*, Kalyani publishing, New Delhi, 1998.

COURSE OUTCOMES

At the end of the course student should be able to:

- CO1** Determine soil moisture
- CO2** Estimate evapotranspiration
- CO3** Estimate water requirement and irrigation efficiencies
- CO4** Determine irrigation schedule for different crops and know about different drainage systems
- CO5** Measure the flow of water using different flow measuring devices

16AG404	MANAGEMENT OF FARM MACHINERY AND IMPLEMENTS LAB	L	T	P	C
		0	0	2	1

LIST OF EXPERIMENTS

1. Identification of major systems of a tractor and learn the preliminary check measures, trouble shooting and remedies in tractor.
2. Practice of driving the tractor with implements in the field.
3. Study on Periodical maintenance and safety aspects for various tillage implements and sowing equipment attached to the tractor
4. Study on periodical maintenance aspects of tractor including tyre and battery.
5. Identification of components of power tiller and study on preliminary check measures and safety aspects before starting a power tiller - procedure for starting, running and stopping the power tiller with implements.
6. Practice of driving the power tiller along with implements in the field.
7. Performance evaluation of potato harvester
8. Performance evaluation of tapioca harvester
9. Study of groundnut thresher and groundnut decorticator
10. Study of sugarcane planter and harvester
11. Study of multicrop thresher
12. Study of paddy harvester

L : 0 T: 0 P: 30 Total:30 PERIODS

Course outcomes

At the end of the course student should be able to:

- CO1** Possess knowledge on periodical maintenance aspects of tractor
- CO2** Possess knowledge on periodical maintenance aspects of power tiller
- CO3** Possess knowledge on working of different grain harvesters
- CO4** Possess the knowledge on working of different threshing equipments
- CO5** Possess the knowledge on working of other equipments like groundnut thresher and decorticator, sugarcane planter and harvester

16AG405

DAIRY AND FOOD ENGINEERING LAB

L T P C

0 0 2 1

LIST OF EXPERIMENTS

1. Measurement and estimation of some textural parameters of a solid food and properties of parboiled and raw rice
2. Estimation of SNF, TSS, lactic acid content and density of milk
3. Measurement of size of fat globule in milk and determination of homogenization efficiency
4. Determination of thermal conductivity of food materials
5. Determination of the separation efficiency of cream separator
6. Estimation of thermal processing time and degree of sterilization in canned food using a batch sterilizer
7. Determination of drying of fluid entrainment and rate of drying in a drum dryer
8. Performance evaluation of a spray dryer
9. Experiment on osmotic dehydration of foods
10. Performance evaluation of food extruder
11. Evaluation of cooking using microwave oven
12. Visit to a dairy industry

L : 0 T: 0 P: 30 Total:30 PERIODS

Course outcomes

At the end of the course student should be able to:

- CO1** Estimate the properties of food materials and milk
- CO2** Evaluate the performance of dairy equipments
- CO3** Evaluate the performance of drum dryer
- CO4** Evaluate the performance of spray dryer
- CO5** Evaluate the performance of food extruder and microwave oven

16AG406

**IRRIGATION AND DRAINAGE
ENGINEERING LAB**

L	T	P	C
0	0	2	1

LIST OF EXPERIMENTS

1. Determination of soil moisture by different methods
2. Study of evapotranspiration measuring device
3. Problems on duty of water - Duty and delta relationship.
4. Estimation of water requirement by different methods.
5. Estimation of Evapotranspiration.
6. Determination of irrigation efficiencies
7. Design of underground pipeline system.
8. Problems on Irrigation scheduling.
9. Design of surface and sub-surface drainage systems.
10. Measurement of water flow using V- notch, rectangular notch, circular notch and parshall flume
11. Visit to a dam

L : 0 T: 0 P: 30 Total:30 PERIODS

Course outcomes

At the end of the course student should be able to:

- CO1** Measure soil water tension and soil water potential
- CO2** Design and construct irrigation structures
- CO3** Possess a good understanding of the factors related to drainage, essential to design, construct and manage a drainage system
- CO4** Design, monitor and maintain drainage systems
- CO5** Determine water requirements of crops and the irrigation schedule for different crops

16AG407

PROJECT WORK PHASE - I

L	T	P	C
0	0	4	2

GUIDELINES

1. Project periods shall be utilized by the students to receive the directions from the guide, on library reading, laboratory work, computer analysis or field work as assigned.
2. The aim of the project work is to deepen comprehension of principles by applying them to a new problem which may be the design and manufacture of a device, a research investigation, a computer or management project or a design problem.
3. The students will take up research on topics pertaining to agricultural engineering and conduct the research, Analyze data, evaluate the results and conclude the appropriate solution, suggestion for future work.
4. The continuous assessment shall be made as prescribed in the regulations.
5. The progress of the project is evaluated based on a minimum of three reviews.
6. The review committee may be constituted by the Head of the Department.
7. Each student shall finally produce a comprehensive report covering background information, literature survey, problem statement, project work details and conclusion.
8. This final report shall be typewritten form as specified in the guidelines.

L : 0 T: 0 P: 60 Total:60 PERIODS

Course outcomes

At the end of the course student should be able to:

CO1 Under the project the students will learn to do research systematically

CO2 Develop new ideas into practice and develop prototypes

CO3 They can also take up projects relating to industrial problems and find solutions to them.

SEMESTER VIII

16GE302	ENGINEERING ECONOMICS AND COST ANALYSIS (Common to all B.E. / B. Tech. Courses)	L	T	P	C
		3	0	0	3
UNIT I	BASIC ECONOMICS				9
Definition of economics - nature and scope of economic science - nature and scope of managerial economics - basic terms and concepts - goods - utility - value - wealth - factors of production - land - its peculiarities - labour - economies of large and small scale - consumption - wants - its characteristics and classification - law of diminishing marginal utility – relation between economic decision and technical decision.					
UNIT II	DEMAND AND SCHEDULE				9
Demand - demand schedule - demand curve - law of demand - elasticity of demand - types of elasticity - factors determining elasticity - measurement – its significance - supply – supply schedule - supply curve - law of supply - elasticity of supply - time element in the determination of value - market price and normal price - perfect competition - monopoly – monopolistic competition.					
UNIT III	ORGANISATION				9
Forms of business - proprietorship - partnership - joint stock company - cooperative organization - state enterprise - mixed economy - money and banking - banking - kinds - commercial banks - central banking functions - control of credit - monetary policy - credit instrument.					
UNIT IV	FINANCING				9
Types of financing - Short term borrowing - Long term borrowing – Internal generation of funds - External commercial borrowings - Assistance from government budgeting support and international finance corporations - analysis of financial statement – Balance Sheet - Profit and Loss account - Funds flow statement.					
UNIT V	COST AND BREAK EVEN ANALYSES				9
Types of costing – traditional costing approach - activity base costing - Fixed Cost – variable cost – marginal cost – cost output relationship in the short run and in long run – pricing practice– full cost pricing – marginal cost pricing – going rate pricing – bid pricing – pricing for a rate of return – appraising project profitability –internal rate of return – pay back period – net present value – cost benefit analysis – feasibility reports – appraisal process – technical feasibility economic feasibility – financial feasibility. Break even analysis - basic assumptions – break even chart – managerial uses of break even analysis.					

L:45 T: 0 P:0 Total: 45 PERIODS

TEXT BOOKS

- 1 Dewett K.K. & Varma J.D., Elementary Economic Theory, S Chand & Co., 2006.
2. Sharma JC “Construction Management and Accounts” Satya Prakashan, New Delhi, 2006.

REFERENCES

- 1 Barthwal R.R., Industrial Economics - An Introductory Text Book, New Age, 2007.
- 2 Jhingan M.L., Micro Economic Theory, Konark, 1989.
- 3 Samuelson P.A., Economics - An Introductory Analysis, McGraw Hill.

COURSE OUTCOMES

At the end of the course student should be able to:

- CO1** Know the basic terms and concepts of economic.
- CO2** Understand the major capability and limitations of cash flow analysis for proposed capital investment.
- CO3** Recognize, formulate, analyze and solve cash flow models in practical situations.
- CO4** Develop the ability to account for time value of money using engineering economy factors and formulas, as well as implication and importance of considering taxes, depreciation and inflation.
- CO5** Evaluate engineering alternatives by economic analysis techniques and models.

16AG408

PROJECT WORK PHASE - II

L	T	P	C
0	0	20	10

GUIDELINES

1. The students will continue the research on topics pertaining to agricultural engineering and conduct the research, develop prototypes and will submit reports.
2. The scope of the project work is to enable the students in convenient groups of not more than 4 members on a project involving theoretical and experimental studies.
3. Every project work shall have a guide who is the member of the faculty of the institution.
4. Shall consist of identification of the project after literature survey.
5. Students should present a review paper and submit it to the internal examiners.
6. Report should summarise the methodology to be adopted, work plan for the proposed project work.
7. The final report shall be type written form as specified in the guidelines.
8. The continuous assessment shall be made as prescribed in the regulations.
9. Awarding Credit value is based on the performance of the above said criteria.

25% of the project work and its methodologies are to be completed.

L : 0 T: 0 P: 300 Total:300 PERIODS

Course outcomes

At the end of the course student should be able to:

- CO1** Under the project the students will learn to do research systematically
- CO2** Develop new ideas into practice
- CO3** They can also take up projects relating to industrial problems and find solutions to them
- CO4** The research may lead to a product development

PROFESSIONAL ELECTIVE (PE) I

16AG315 BUILDING MATERIALS, ESTIMATION AND COSTING L T P C

3 0 0 3
8

UNIT I STONES AND BRICKS

Classification of rocks - Characteristics of Stones -Testing of Stones-Manufacture of Bricks -Moulding -Drying and Burning of bricks-Properties of good Brick -Classification of bricks -Clay Products-Ceramics - Tiles - Earthenware and Stoneware and uses.

UNIT II LIME AND CEMENT

9

Lime- Natural Sources -Types of lime – Calcination-Cement -Raw materials – Water Cement Ratio-Manufacture of Portland Cement Wet and Dry process-Standard Specifications- Storage of cement-Timber – Definition - Defects in timber-Qualities of good timber.

UNIT III BRICK & STONE MASONRY AND FOUNDATION

11

Concept of Foundation -Factors affecting Selection of Foundations -Types of soils-Subsurface Investigations -Bearing Capacity of soil -Testing &Improving Bearing Capacity of soil- Types of Foundations-Piles -Foundation in Black Cotton soil-Site Selection - General principles –classification of brick masonry-precautions in brick masonry -Stone Masonry -Comparison between Brick and Stone Masonry -Classification -General Principles and precautions in stone masonry.

UNIT IV BUILDING CONSTRUCTION

11

Walls -Classification of walls - Dampness -Causes of Dampness -Methods of Preventing Dampness – Damp Proofing materials - Methods of providing Damp Proofing Materials-Mortars -Functions and Types of mortars -Concrete -Characteristics -Types and uses - Cube Strength of Concrete-Roofs - Classification - Floors –Types of Floor-Types of Plastering and Pointing –Painting and Distempering.

UNIT V ESTIMATING AND COSTING

6

PWD schedule of rates – data sheet – detailed estimate – abstract estimate - preparation of estimate.

L : 45 T: 0 P: 0 Total: 45 PERIODS

TEXT BOOKS

- 1 S.V Deodhar and Singhal, Civil engineering materials. Khanna publishers, 2B, Nath market, Naisark, Delhi – 2001.
- 2 S.C. Rangwala, Building construction, Charotar publishing house, Anand, 2000.

REFERENCES

- 1 B.L. Handoo and V.M. Mahajan, Civil engineering materials. Sathyaprakasam, 16/7698, New market, New Rohtak road, New Delhi-5, 1995.
- 2 N.L. Arora and B.R. Gupta, Building construction. Sathyaprakasham, 16/7698, New market, New Rohtak road, New Delhi -5, 1995.
- 3 S.C Rangwala, Estimating and costing, Charotar book stall, Station road, Anand, 1991.

COURSE OUTCOMES

At the end of the course student should be able to:

- CO1** At the end of this course the students will know the classification of stones, bricks and their manufacturing practices
- CO2** Know about calcification, manufacture of cement and qualities of timber
- CO3** Possess knowledge about different brick masonry, stone masonry and foundations
- CO4** Will be in a position to design and construct buildings
- CO5** Prepare estimates and costing for different types of buildings

16AG316

STRENGTH OF MATERIALS

L T P C
3 0 0 3

UNIT I STRESS, STRAIN AND DEFORMATION OF SOLIDS

9

Rigid bodies and deformable solids – Tension, Compression and Shear Stresses – Deformation of simple and compound bars – Thermal stresses – Elastic constants – Volumetric strains – Stresses on inclined planes – principal stresses and principal planes – Mohr’s circle of stress.

UNIT II TRANSVERSE LOADING ON BEAMS AND STRESSES IN BEAM

9

Beams – types transverse loading on beams – Shear force and bending moment in beams – Cantilevers – Simply supported beams and over – hanging beams. Theory of simple bending – bending stress distribution – Load carrying capacity – Proportioning of sections – Flitched beams – Shear stress distribution.

UNIT III TORSION

9

Torsion formulation stresses and deformation in circular and hollow shafts – Stepped shafts – Deflection in shafts fixed at the both ends – Stresses in helical springs – Deflection of helical nsprings, carriage springs.

UNIT IV DEFLECTION OF BEAMS

9

Double Integration method – Macaulay’s method – Area moment Theorems for computation of slopes and deflections in beams - Conjugate beam and strain energy – Maxwell’s reciprocal theorems.

UNIT V THIN CYLINDERS, SPHERES AND THICK CYLINDERS

9

Stresses in thin cylindrical shell due to internal pressure circumferential and longitudinal stresses and deformation in thin cylinders – spherical shells subjected to internal pressure – Deformation in spherical shells – Lamé’s theory – Application of theories of failure.

L : 45 T: 0 P: 0 Total: 45 PERIODS

TEXT BOOKS

- 1 Bansal, R.K., Strength of Materials, Laxmi Publications (P) Ltd., 2007
- 2 Jindal U.C., Strength of Materials, Asian Books Pvt. Ltd., New Delhi, 2007

REFERENCES

- 1 Egor. P.Popov “ Engineering Mechanics of Solids” Prentice Hall of India, New Delhi, 2001.
- 2 Subramanian R., Strength of Materials, oxford University Press, Oxford Higher Education Series, 2007.
- 3 Hibbeler, R.C., Mechanics of Materials, Pearson Education, Low Price Edition, 2007.

COURSE OUTCOMES

At the end of the course student should be able to:

- CO1** Know about the stress, strain and deformation of solids
- CO2** Possess knowledge about transverse loading on beams and stresses in beam
- CO3** Calculate torsion stresses and deformation in circular and hollow shafts
- CO4** Estimate deflection of beams
- CO5** Determine the thin cylinders, spheres and thick cylinders

16AG317	DESIGN OF FARM POWER AND MACHINERY	L	T	P	C
		3	0	0	3
UNIT I	MODERN TRENDS, DESIGN CONSIDERATIONS, PROCEDURES AND THEIR APPLICATIONS IN TRACTORS				9

Fundamental and economic considerations for design and development of farm power and machinery systems- Trends in tractor design- Selection of engine for tractors- Design of engine systems, tractor clutches and brakes- Design of power transmission elements- Design and selection of ground drive components

UNIT II	RELIABILITY CRITERIA AND TRACTOR LINKAGES AND STABILITY ASPECTS				9
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Reliability criteria in design and its application- Design and performance evaluation of traction and transport devices-Design of tractor chassis- Tractor stability analysis- Single and three point hitch systems.

UNIT III	DESIGN OF SELECTED FARM IMPLEMENTS/EQUIPMENT				9
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Design of primary and secondary tillage implements- Design of seeders, planters, transplanting machines, fertilizer distributors, interculture and plant protection equipments- Design of harvesting and threshing machines for cereals, pulses and root crops- Design of farm transport equipment. Design of rotary, vibrating and oscillating machines.

UNIT IV	DESIGN, SELECTION AND MATCHING OF POWER UNIT				9
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Dynamic properties of soil in compression and shear- rheological properties of soil. Determination of rolling resistance of towed and powered wheels-Drawbar power determination-matching of suitable capacity tractor with the implements.

UNIT V	SAFETY DEVICES FOR TRACTORS & FARM IMPLEMENTS				9
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Quick attaching couplers- Hydraulic controls and systems-Design of mechanical and power steering. Human factors involved in tractor design.

L : 45 T: 0 P: 0 Total: 45 PERIODS

TEXT BOOKS

- 1 Arther W Judge, High Speed Diesel Engines, Chapman & Hall, 1967.
- 2 EL Barger, JB Liljedahl and EC McKibben Tractors and their Power Units, Wiley Eastern, 1967.

REFERENCES

- 1 C Bernacki, J Haman and CZ. Kanafajski , Agricultural Machines, Oxford & IBH, 1972.
- 2 OS Bindra & Singh Harcharan, Pesticides Application Equipments, Oxford & IBH, 1971.
- 3 ES Bosoi, OV Verniaev and EG Sultan-Shakh, Theory, Construction and Calculations of Agricultural Machinery, Vol. I, Oxonian Press, 1990.

COURSE OUTCOMES

At the end of the course student should be able to:

- CO1** Develop knowledge modern trends, design considerations, procedures and their applications in tractors.
- CO2** Know about the reliability criteria and tractor linkages and stability aspects
- CO3** Design of selected farm implements/equipment
- CO4** Design, selection and matching of power unit
- CO5** Possess knowledge about the safety devices for tractors & farm implements

16AG318 CO-GENERATION AND WASTE HEAT RECOVERY SYSTEMS

L T P C

3 0 0 3
6

UNIT I INTRODUCTION

Cogeneration principles and definition-thermodynamics power cycle analysis-Rankine and Brayton cycles- topping and bottoming cycles

UNIT II COGENERATION SYSTEMS 10

Performance indices of cogeneration systems- Cogeneration systems based on steam turbine, gas turbine, combined cycle, and IC engines- Cogeneration systems based on Stirling Engines

UNIT III APPLICATIONS OF COGENERATION 10

Applications in sugar mills, rice mills, textile factories, and other process and engineering industries- Impacts of cogeneration plants- fuel- electricity

UNIT IV WASTE HEAT SOURCES 10

Selection criteria for waste heat recovery technologies. Recuperative and regenerative heat exchangers for waste heat recovery. Waste heat boilers- classification- design considerations- sizing- location- performance calculations. Heat pumps - types- design

UNIT V COST ANALYSIS AND ENVIRONMENTAL IMPACT OF COGENERATION SYSTEMS 9

Economic analysis of cogeneration and waste heat recovery systems. Regulatory and financial framework for cogeneration and waste heat recovery systems. Environmental considerations- mitigation of harmful emissions from energy production- conversion and utilization technologies- control of air, water and ground pollution

L : 45 T: 0 P: 0 Total: 45 PERIODS

TEXT BOOKS

- 1 Charles H.Butler, Cogeneration , McGraw Hill Book Co, 1984
- 2 David Hu and Gerald HRD, Waste recycling for Energy Conservation, John Wiley and Sons, New York,1981

REFERENCES

- 1 Sydney Reiter,Industrial and Commercial Heat Recovery Systems, Van Nostrand Reinhold, 1985.
- 2 Spiewak Scott A, Cogeneration and Small Power Production Manual, The Fairment Press, 1987
- 3 Khartchenko N.V. Green Power: Eco-Friendly Energy Engineering, Tech Books, New Delhi, 2004.

COURSE OUTCOMES

At the end of the course student should be able to:

- CO1** Know about the basics of cogeneration and thermodynamic power cycle
- CO2** Possess knowledge about different cogeneration systems
- CO3** Learn about waste heat sources
- CO4** Identify waste heat sources and provide solutions related to them
- CO5** Do Cost Analysis and Environmental assessment of Cogeneration systems

16AG319	TECHNOLOGY OF SEED PROCESSING	L	T	P	C
		3	0	0	3
UNIT I	SEED PRODUCTION TECHNOLOGY				9

General Principles- Foundation and certified seed production - Seed production of cereals, pulse, oil seeds, fibre crops, forage crops, sugar crops and their hybrid varieties- physiological and harvestable maturity of different kinds of seeds.

UNIT II	SEED PROCESSING TECHNOLOGY	9
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Preparing seed for processing - Seed moisture and drying - Air screen cleaner, shape and size separators, gravity separators, surface texture separators, affinity for liquid separators, colour separators, electrical conductivity separators - seed treatment - seed elevators – conveyors - safe seed storage, seed packaging and handling - seed bins - dust removal, seed blending - seed marketing and distribution- methods for assessment of seed quality.

UNIT III	SEED TESTING	10
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Sampling methods - Determination of seed density – Tolerances – heterogeneity – Purity - genuineness of variety – moisture estimation- Germination – equipments –seed scarification - presowing treatment – seed priming - pelleting Viability - Vigour and health

UNIT IV	SEED CERTIFICATION AND LEGISLATION	9
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Objectives and concepts of seed certification - seed certification agencies - minimum seed certification standards for breeder's seed - certified seeds - field and seed inspection - methods of inspection - Post harvest inspection- seed legislation laws.

UNIT V	SEED INDUSTRY IN INDIA AND THEIR ROLE IN AGRICULTURAL DEVELOPMENT	8
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Development of Seed industries in India – overview -National seeds corporation - State seeds Development corporation - Five year plans - Private seed industries.

L : 45 T: 0 P: 0 Total: 45 PERIODS

TEXT BOOKS

- 1 R.L Agrawal, A text book on "Seed Technology", Oxford & IBH Publication, Co. Pvt Ltd, New Delhi-1992.
- 2 Vanangamudi et.al, "Recent techniques and participatory approaches on quality seed production" Kaiser graphics Ltd., Coimbatore, 2001

REFERENCES

- 1 Vanangamudi et.al, "Recent techniques and participatory approaches on quality seed production" Kaiser graphics Ltd., Coimbatore, 2001
- 2 B.R Gregg, A.G. Law, S.S Viridi and J.S Balis "Seed Processing", National seed corporation. New Delhi, 1990.
- 3 L.O Copeland and M.B Mc Donald, "Principles of Seed Science and Technology, Chapman and Hall, New York, 1995

COURSE OUTCOMES

At the end of the course student should be able to:

- CO1** Know about the basic principles about seed production technology
- CO2** Have ideas about technology
- CO3** Detailed knowledge about Seed Testing
- CO4** Learn about seed certification and their legislation
- CO5** Understand about the seed industry and its role in Agriculture

PROFESSIONAL ELECTIVE (PE) II

16AG320

THEORY OF MACHINES

L	T	P	C
3	0	0	3

UNIT I INTRODUCTION TO MECHANISM

Definition of a machine-kinematic pair-types-links-types of constrained motion- types of joints-degrees of freedom. Kinematic chain-Classification of kinematic pairs-four bar chain, slider crank chain and their inversions. Mechanical advantages Synthesizing a mechanism for predefined motion-velocity and acceleration in mechanisms. Determination of velocity and acceleration by relative velocity method for simple mechanism

UNIT II FRICTION AND FRICTION DRIVES

Brakes-types-band, shoe. Clutches-types-single and multiple discs- cone and their applications. Power drives-belt drives-types-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.

UNIT III GEAR AND GEAR TRAINS

Gears-law of gearing-velocity of sliding between two teeth in a mesh. Involute and cycloidal profile for gear teeth. Types of gears- spur gear-interference, gears trains –simple, compound, reverted and epicyclic – determining velocity ratio by tabular method. Power transmission-gear box’s need-sliding mesh, synchro mesh, and epicyclic gear box.

UNIT IV CAM AND FLYWHEEL

Cam and follower-types-application-profiles for uniform velocity and acceleration. Simple harmonic, cycloidal motion and uniform angular velocity. Turning moment diagrams-coefficient of fluctuation of speed and energy-weight of fly wheel and its applications

UNIT V GOVERNORS

Types of governors-constructural details and analysis of Watt, Porter and Proel governors. Sensitiveness, stability, hunting, isochronisms, power and effort of a governor

L : 45 T: 0 P: 0 Total: 45 PERIODS

TEXT BOOKS

- 1 R.S.Khurmi and J.K. Gupta, *Theory of Machines*, Eurasia publishing House Pvt Ltd, New Delhi, 2005.
- 2 S. Rattan, *Theory of Machines*, Tata McGraw Hill Publishing Company pvt Ltd, New Delhi, 2009.

REFERENCES

- 1 R. L. Norton, *Kinematics and Dynamics of Machinery*, Tata McGraw Hill Publishing Company Pvt Ltd. New Delhi, 2005.
- 2 Ashok, G. Ambekar, *Mechanism and Machine Theory*, Prentice Hall of India, New Delhi, 2009.
- 3 John J. Uicker and Joseph E. Shigley, *Theory of Machines and Mechanism*, Tata McGraw Hall Publishing Company Pvt Ltd., New Delhi, 2005.

COURSE OUTCOMES

At the end of the course student should be able to:

- CO1** Have an introduction to mechanism
- CO2** Know about friction and friction drives
- CO3** Know about gear and gear trains
- CO4** Know about cam and flywheel
- CO5** Know about the working principle of governors

16AG322 INSTRUMENTATION AND TESTING OF AGRICULTURAL MACHINERY

L T P C
3 0 0 3

UNIT I INTRODUCTION AND PRINCIPLES OF INSTRUMENTATION 9

Standardization and quality-Testing and evaluation organizations-parameters in testing and evaluation of agricultural machinery-Strategy for modernization of testing & evaluation. Importance and role of instrumentation in testing of production and post production machinery and value added products. Basic theory and principles of mechanical measurement and instrumentation-Measuring instruments used in manufacturing and inspection of agricultural machinery-Instrumentation for testing of agricultural machinery-data acquisition, retrieval and analysis, using data logger. General guidelines and test procedure for agricultural machinery.

UNIT II INSTRUMENTATION FOR TRACTORS AND ENGINES 10

Instrumentation theory and principles of measurement for tractors and engines- Instrumentation for testing of internal combustion engines-Instrumentation for testing of materials used in agricultural machinery-Instrumentation for ergonomic evaluation of agricultural machinery-Measurement and evaluation of noise and vibration on agricultural machinery-Field performance testing of rotary tiller-Drawbar performance of power tillers- Testing of equipment for seedbed preparation.

UNIT III TESTING OF SEEDING, PLANTING AND PLANT PROTECTION EQUIPMENT 8

Soil bin instrumentation for tillage research- Testing of seeding and planting equipment-Performance testing of rice seeder and transplanter-Testing of vegetable transplanter. Testing of pneumatic planters. Computerised testing of centrifugal pumping system-Testing and evaluation of weeders-Testing of plant protection equipment.

UNIT IV TESTING OF HARVESTING AND THRESHING MACHINES AND ENERGY GADGETS 9

Testing of harvesting machine-Instrumentation and testing of power threshers -Instrumental methods used in biochemical analysis-Techniques for measurement of physical characteristic of food extrudates-Evaluation procedure and instrumentation of renewable energy gadgets-Measurements in biomass and wind energy research

UNIT V ROLE OF CAD IN AGRICULTURAL MACHINERY DESIGN AND STATISTICAL ANALYSIS AND INTERPRETATION OF TEST DATA 9

Role of CAD in agricultural machinery design-Internet information search: tools and techniques-Graphical presentation and interpretation of test results of testing of agricultural machinery-Test data analysis using Relational database management system concept and MS Access 2000-Statistical analysis and interpretation of test data.

L : 45 T : 0 P : 0 Total: 45 PERIODS

TEXT BOOKS

- 1 M.L. Mehta, S.R. Verma and, S. K. Misra, Testing and Evaluation of Agricultural Machinery, 253 pp, Daya Publishing House,2005.
- 2 Indian Standard Codes for Agril. Implements. Published by ISI, New Delhi. Inns FM. 1986.

REFERENCES

- 1 Anonymous. 1983. RNAM Test Code & Procedures for Farm Machinery. Technical Series 12.
- 2 Barger EL, Liljedahl JB & McKibben EC, Tractors and their Power Units. Wiley Eastern, 1967.
- 3 Metha ML, Verma SR, Mishra SK & Sharma VK., Testing and Evaluation of Agricultural Machinery. National Agricultural Technology Information Centre, Ludhiana, 1995.

COURSE OUTCOMES

At the end of the course student should be able to:

- CO1** Know the introduction and principles of instrumentation
- CO2** Possess knowledge about instrumentation for tractors and engines
- CO3** Testing of seeding, planting and plant protection equipment
- CO4** Perform evaluation of testing of harvesting and threshing machines and energy gadgets
- CO5** Use role of cad in agricultural machinery design and statistical analysis and interpretation of test data

16AG324 FOOD SAFETY REGULATIONS AND QUALITY CONTROL

L T P C
3 0 0 3

UNIT I GENERAL PRINCIPLES FOR FOOD SAFETY AND HYGIENE 6

Principles of food safety and quality - Food Safety System - Quality attributes - Total Quality Management. Good Hygienic Practices, Good Manufacturing Practices - Risk Analysis, Risk Management, Risk Assessment, Risk Communication – Traceability and authentication.

UNIT II GENERAL PRINCIPLES FOR FOOD SAFETY REGULATION AT NATIONAL/REGIONAL LEVEL 4

The Structure of Food Law, Food Regulation What Should be Regulated?, Laws and Regulations to Prevent Adulteration and Cross Contamination, Microbial Contamination, Hygienic Practice, Chemical and Environmental Contamination, Food Additives, Labeling, Food Laws and Regulations at the International Level for Harmonization.

UNIT III Standard Operating Procedures 12

Preparing scope, quality policy and quality objectives of food processing company, Defining Standard operating procedure – purpose- Format - developing and implementing, effective writing. SOP for purchasing raw materials, receiving raw materials, storage, cleaning, holding, cooling, freezing, thawing, reheating, personal hygiene, facility and equipments. Systems in laboratory accreditation

UNIT IV INTERNATIONAL BODIES DEALING IN STANDARIZATION 12

International Standardization Organization (ISO), Joint FAO/WHO Food Standards Program. Codex Alimentarius Commission (CAC), Other International Organizations Active in Food Standard Harmonization. Advantages of Utilizing International Standards. Rapid Alert system.

UNIT V NATIONAL STANDARDS 11

Food Safety and Standard Authority of India regulations - Agricultural and Processed food Export Development Authority - Marine Product Export Development Authority - Export Inspection council and Export Inspection Agency. International food standards., Trends in Food Standardization, An Overview and structure of 9001:2000/2008, Clause wise Interpretation of ISO 9001:2000, Case Studies, An overview and Structure of 22000:2005, Clause wise Interpretation of ISO 22000:2005, Case Studies.

L : 45 T: 0 P: 0 Total: 45 PERIODS

TEXT BOOKS

- 1 Neal D. Fortin. 2009. Food regulation, Wiley Publishers.
- 2 Naomi Rees. David Watson. 2000. International standards for food safety, An Aspen Publications.

REFERENCES

- 1 O'Rourke. 2005. European Food law, 3rd Edition, Thomson, Sweet and Maxwell.
- 2 Andres Vasconcellos J. 2005. Quality Assurance for the Food industry - A practical approach. CRC press.
- 3 Inteaz Alli. 2004. Food quality assurance - Principles & practices. CRC Press. New York.

COURSE OUTCOMES

At the end of the course student should be able to:

- CO1** Possess sound knowledge about the general principles for food safety and hygiene
- CO2** Know about the general principles for food safety regulation at national regional level
- CO3** Possess knowledge about the standard operating procedures
- CO4** Gain about the facts of the international bodies dealing in standardization
- CO5** Sound knowledge about different national standards

PROFESSIONAL ELECTIVE (PE) III

16AG325 **GROUNDWATER HYDROLOGY AND WELL
HYDRAULICS** **L T P C**

3 0 0 3

UNIT I GROUNDWATER INTRODUCTION **9**

Scope - utilization of groundwater sources - groundwater development in India – occurrence different groundwater structures – types of aquifer – confined – unconfined – perched – artesian – aquifuge – aquitard – aquiclude – movement of groundwater – Evaluation of aquifer properties – specific yield – storage coefficient - Darcy's law and its limitations - Field and laboratory measurement of saturated and unsaturated coefficient of permeability.

UNITII GROUNDWATER POTENTIAL AND RECHARGE **10**

Components of ground water balance equation - Method of estimation of safe yield: ground water potential in India - Ground water recharge - Artificial ground water recharge techniques - through pits - rivers and canals – groundwater investigation – groundwater monitoring programme – governing equations of groundwater flow - conjunctive use of groundwater-Legislation.

UNIT III WELL HYDRAULICS **9**

Classification of wells - Steady and unsteady state flow into wells in confined and unconfined aquifers - Methods of estimating aquifer parameters – Transmissivity and storage coefficient – pumping test – steady state analysis – Dupit Forcheimer assumptions and derivations – unsteady state analysis - Multiple well system: Well characteristics and efficiency.

UNIT IV WELL DESIGN **8**

Theis Jacob method – concept of image well theory – design of well characteristics – sedimentary – igneous – metamorphic - Design of well housing and well screen; Selection and installation of well screens; Criteria and methods of gravel packing; Methods of well development Well testing; Selection and Installation of pumps; Sanitation and well protection – design problems – location and number – diameter – casing and screening – development – well efficiency.

UNIT V WELL DRILLING AND CONSTRUCTION METHODS **9**

Ground water exploration and test drilling - Drilling principles – methods – application – monitoring well drilling methods – well development – gravel packing - well casing – drill pipe – plumpness and alignment – sterilization - Method of construction of shallow wells and deep wells - Manual method - percussion method, hydraulic rotary, reverse circulatory and other methods – well maintenance - dewatering

L : 45 T: 0 P: 0 Total: 45 PERIODS

TEXT BOOKS

- 1 Fletcher.G.Driscoll, "Groundwater and Wells", Johnson Revision, New York, 1987.
- 2 K Subramanya, "Engineering Hydrology", Tata McGraw Hill Pub Co, New Delhi, 1990

REFERENCES

- 1 D.K Todd, "Groundwater Hydrology", John Wiley and Sons, New York, 1994 .
- 2 H.M. Raghunath "Groundwater",Third Edition,New Age International Publishers, 2007.

COURSE OUTCOMES

At the end of the course student should be able to:

- CO1** Learn about different ground water resources and aquifers
- CO2** Estimate ground water and know about aquifers
- CO3** Know about the classification of wells
- CO4** Design wells and select suitable pumps for them
- CO5** Possess knowledge about different drilling and construction methods

16AG326

**HUMAN ENGINEERING AND SAFETY IN
AGRICULTURE**

L T P C

3 0 0 3

UNIT I INTRODUCTION

Importance of ergonomics and its application agriculture; Human biological: digestion and absorption of foodstuffs, liberation and transfer of energy. Concept of indirect, calorimetry, physiological responses and techniques of their measurements. Energetic efficiency of muscular work.

UNIT II ANTHROPOMETRY AND BIO-MECHANICS **9**

Structural and functional body dimensions, Instrumentation and their methods of measurement, Analysis and application of anthropometric data. Visual displays; Process of seeing, Horizontal and Vertical fields of hand, Colour discrimination, Quantitative and qualitative visual displays, signals and warning lights.

UNIT III DESIGN OF CONTROLS AND WORK SPACE ENVELOPE **9**

Functions of controls, Identification of Controls. Design aspects of hand and foot controls mainly. Steering, clutch, accelerator, brake and pedal design of tractors. Arrangements of controls, work-space envelope. Analysis and design of job requirements. Work physiology in agriculture. Scaling of physiological work. Fatigue allowance and indices, shift work, work-rest scheduling.

UNIT IV PHYSIOLOGICAL FACTORS AFFECTING OPERATOR – MACHINE PERFORMANCE **10**

Limitations of human in relation to stresses and demands of working environments. Thermal – heat exchange process and coefficients, physiological mechanics of heat regulation, management of temperature problems, work load and allowance in hot environment. Mechanical – noise and loss of hearing, physiological effects acceptable limits, handling of noise problems, ear protection devices. Vibration – sources of vibration, effects in physiological responses control of vibration on agricultural equipment. Illumination – nature and measurement of light, colour systems, amount of illumination, roadway features influencing visibility, vehicle light.

UNIT V POSTURAL COMFORT AND OPERATOR SAFETY **9**

Problems of posture and comfort. Science of seating cushion functional requirements, static and dynamic compatibility of operator-seat machine. Engineering principles applied to industrial and agricultural safety. Road, accidents, road signs and accident prevention. Safety symbols and signs, hand signals, colour codes for agricultural equipment.

L : 45 T: 0 P: 0 Total: 45 PERIODS

TEXT BOOKS

- 1 Sanders, M.S. and McComack, E.J. Human factors in Engineering and Design. Tata McGraw Hill, New York, 1992
- 2 Obome, David.J. Engineering Work. John Wiley and Sons Ltd., 1982

REFERENCES

- 1 Astand, P.P. and Rodaid, K. Text book of Work Physiology. McGraw Hill Book Company, New York, 1970
- 2 Grandjean, E. Fitting the Track of the Man, Taylor and France Ltd., U.K. 1981

COURSE OUTCOMES

At the end of the course student should be able to:

- CO1** Know the importance of ergonomics and its application agriculture
- CO2** Possess knowledge about anthropometry and bio-mechanics
- CO3** Design of controls and work space envelope
- CO4** Realize the physiological factors affecting operator – machine performance
- CO5** Arrive at the postural comfort and operator safety

16AG327 CLEAN DEVELOPMENT MECHANISM (CDM) AND CARBON TRADING

L T P C

3 0 0 3

UNIT I GREEN HOUSE GASES AND ENVIRONMENTAL CHANGE 9

Global Environmental changes-United nations framework convention on climate change-United (UNFCCC)-ozone layer depletion –land degradation-air and water pollution-sea-level rise-loss of biodiversity-climatic change problem GHG emissions by different countries-developing country responsibilities-India’s Greenhouse gas emissions-The conference of parties.

UNIT II KYOTO PROTOCOL AND CDM PROJECTS 9

Kyoto protocol and clean development mechanism- CDM and cooperative mechanism-CDM overview administration –participation –CDM institutions-procedures CDM project cycle-project design and formulation – eligibility-additionality. Approval of (DNA) Designated National Authority. Validation and registration-monitoring-validation and certification through the source of Certified Emission Reduction(CER).

UNIT III TYPES AND FEATURES OF CDM 9

Types of CDM-typology -project activity -small scale CDM project categories- accusation and cater station projects. PDO- project design document –General description of project activity-baseline methodology-monitoring methodology-auditing period-technical aspects.

UNIT IV MONITORING OF CDM 9

Monitoring and verification-verification process principles of verification-report preparation-pitfalls. Joint implementation (JI)-institutions and procedures-guidelines-JI or small scale projects-JI Land Use, Land Use Change and Forestry (LULUCF) projects.

UNIT V SUSTAINABLE ENERGY DEVELOPMENT 9

Low carbon technologies-low carbon building-alternative approaches-energy efficiency projects-sustainable energy policy concepts-mitigating energy related GHG emissions through renewable energy-carbon trading.

L : 45 T: 0 P: 0 Total: 45 PERIODS

TEXT BOOKS

- 1 CDM Manual for project developers and policy makers 2007-UNFCCC Publication.
- 2 MyungKyoon Lee, Baseline Methodologies for clean Development Mechanism Projects- A Guide Book- Vol.1, UNEP publication, 2005

REFERENCES

- 1 Carbon sequestration in dryland soils, World Soil Resources report No.102, Food and Agriculture Organization, Rome,2004.
- 2 Robbins M, Carbon Trading Agriculture and World Assn of Soil and water Conservation, Bangkok, 2004.
- 3 Murty V.V.N., Land and Water Management Engineering , Kalyani Publishers, New Delhi, 1990.

COURSE OUTCOMES

At the end of the course student should be able to:

- CO1** Possess know about the green house gases and environmental changes due to it
- CO2** Have an idea of the Kyoto Protocol and CDP projects
- CO3** Understand the types and features of CDM
- CO4** Know how to monitor CDM
- CO5** Develop sustainable energy development

16AG328

BOILER AND STEAM ENGINEERING

L	T	P	C
3	0	0	3

10

UNIT I FUELS AND COMBUSTION

Fuels- types and properties- higher and lower heating values, their determination- properties of gases and gas mixtures, ideal and real gases- Dalton's law of partial pressures-internal energy, enthalpy, entropy and specific heats of gas mixtures- Gibb's function- combustion of fuels, stoichiometric air requirement- excess air- gravimetric analysis and volumetric analysis of products of combustion and their conversions.

UNIT II PROPERTIES OF STEAM

11

Steam- properties- P-V diagram for a pure substance- triple point- critical state- saturation pressure and temperature- phase equilibrium on P-T co-ordinates- T-S diagram, h-S diagram-wet fraction, dryness fraction and super heated steam-enthalpy and entropy of wet, dry and saturated steam- steam tables- measurement of steam quality- throttling process- separating and throttling calorimeter- electrical calorimeter.

UNIT III BOILER MOUNTINGS AND ACCESSORIES

10

Heat exchangers- principle- types- boilers- classification- working principle of fire tube and water tube boilers- vertical and horizontal boilers- principles, construction and operation- Cochran, Lancashire, Cornish, Scotch, Velox, Locomotive, Babcock and Wilcox boilers- principles- boiler mountings and accessories- pressure regulations- blow off fittings- boiler performance- boiler operation, inspection, safety and maintenance.

UNIT IV TYPES OF BOILERS

9

Pulverized coal fired boilers- circulating fluidized bed boilers- high pressure boilers-burners- types; features- draught- classification- forced draft- chimney efficiency- feed water characteristics- scale and sludge formation in boilers- caustic embrittlement- boiler corrosion- priming and foaming- water softening methods.

UNIT V INSTALLATION AND MAINTENANCE

5

Selection of steam pipes- material and size- layout plan for boiler operated process plant- energy audit in boilers- insulation techniques- heat recovery- air pre-heaters, economizers super heaters- economy of heat energy utilization- boiler codes- Indian boiler act- handling and storage of fuel in a boiler plant.

L : 45 T: 0 P: 0 Total: 45 PERIODS

TEXT BOOKS

- 1 Ballaney, P.L. Thermal Engineering. Khanna Pubs. New Delhi. 1991.
- 2 Chattopadhyay, P. Boiler Operation and Engineering, Tata McGraw Hill Publishing Co. Ltd., New Delhi. 2000.

REFERENCES

- 1 Nag, P.K., Engineering thermodynamics, Tata McGraw Hill Publishing Co, New Delhi. 2000.
- 2 Jain, P.C. and Monika Jain. Engineering Chemistry. Dhanpat Rai Publishing Co., New Delhi 2006
- 3 Khurmi, R.S., Engineering thermodynamics. S.Chand and Co, New Delhi. 1992.

COURSE OUTCOMES

At the end of the course student should be able to:

- CO1** Gain knowledge about different types of fuels and combustion
- CO2** Know about boiler mounting and its accessories
- CO3** Idea about the properties of steam
- CO4** Identify and use different types of boilers
- CO5** Know to install and maintain boilers

16AG415

FAT AND OIL PROCESSING

L T P C
3 0 0 3

UNIT I PHYSICAL AND CHEMICAL PROPERTIES

7

Fats and oils —formation – functions of oil in human body - fatty acids – double bonds and their position in oil – Geneva type classification - sources of vegetable oils – production status-oil content – coconut , palm, peanut , rice bran, sesame, mustard and sunflower seeds oil - physical and chemical properties of fats and oils - chemical reactions of oil – hydrolysis – hydrogenation, oxidation and polymerization.

UNIT II EXTRACTION METHODS

11

Oil extraction methods –mechanical expression – ghani , power ghani, rotary, hydraulic press, screw press, expellers, filter press - principle of operation and maintenance-solvent extraction process – steps involved, batch and continuous-continuous solvent extraction process for rice bran, soy bean and sunflower-oil extraction process for groundnut and cotton seed-production of special oils – palm oil, virgin coconut oil – extraction process.

UNIT III REFINING OF OILS

11

Refining of oils – objectives – characterization - degumming – Zeneath process – deacidification process – continuous acid refining-bleaching of oil – continuous bleaching process – decolourising agents-deodorization process winterization processes-hydrogenation of oil – selectivity – catalyst – batch type hydrogenation – regeneration of catalyst-vasnaspasi, ghee and margarine – production process-partial sterilization, emulsification, chilling, kneading and rolling, incorporation of salt, colouring substances-production of special fats – butter – types - production and storage.

UNIT IV PACKAGING OF EDIBLE OILS

8

Packaging of edible oils – requirements – types – tinfoil, semi rigid, glass, Polyethylene Terephthalate, Poly Vinyl Chloride, flexible pouches – packaging for vasnaspasi and ghee changes during storage of oil –rancidity – causes – atmospheric oxidation and enzyme action

UNIT V INDUSTRIAL APPLICATIONS AND QUALITY STANDARDS

8

Industrial applications of fats and oils – properties of omega 3 fatty acids-quality regulations - manufacture of soap, candle, paints and varnishes –non edible oils-castor oil, linseed oil,neem oil,vegetable waxes-production and processing- ISI and Agmark standards – site selection for oil extraction plant- safety aspects HACCP standards in oil industries.

L : 45 T : 0 P : 0 Total: 45 PERIODS

TEXT BOOKS

- 1 Harry Lawson, Food oils and Fats, Technology, Utilization and Nutrition. CBS Publishers and Distributors, New Delhi, 1997.
- 2 T.J. Weiss, Food Oils and their uses, The AVI Publishing Company, Inc. Westport, Connecticut, 1970.

REFERENCES

- 1 K.T. Acharia, Oil seeds and oil milling in India. Oxford and IBH publication, New Delhi, 1990.
- 2 H. Panda, Essential oils – Hand book, National Institute of Industrial Research, ISBN, New Delhi, 2000.
- 3 Anonymous, Handbook of oils, fats and derivatives with refining and packaging technology, Engineers India Research Institute, New Delhi, 2004.

COURSE OUTCOMES

At the end of the course student should be able to:

- CO1** Understand the physical and chemical properties of oilseeds
- CO2** Know about the different extraction methods
- CO3** Know how to refine oils
- CO4** Gain knowledge about the packaging of edible oils packaging of edible oils
- CO5** Confidence to industrially apply as per quality standards

PROFESSIONAL ELECTIVE (PE) IV

16AG330	REFRIGERATION AND AIR CONDITIONING	L	T	P	C
		3	0	0	3
UNIT I	INTRODUCTION				7

Recapitulation of Thermodynamics- Thermodynamics processes pertaining to refrigeration and air conditioning. First and Second law of thermodynamics applied to refrigerating machines, Carnot principles, unit of refrigeration, co-efficient of performance, Air refrigeration cycle. Reversed Carnot cycle, Bell-Coleman cycle. Air refrigeration systems- Types, thermodynamic processes, priority criteria, and suitability.

UNIT II VAPOR COMPRESSION SYSTEM 10

Need for modification of Carnot cycle, Thermodynamic processes in vapour compression cycle. Simple vapour compression system, various conditions of vapour refrigerant in the system, improvement in simple system. Flash chamber, Flash intercooler. Compound vapor compression system- Need for compound compression, two stage compression and various arrangements for improvement in co-efficient of performance. Refrigerants. Desirable properties of refrigerants - R-12, R-22, R-717, R-134, Butane. Recent substitute for refrigerants.

UNIT III VAPOUR ABSORPTION AND OTHER REFRIGERATION SYSTEMS 10

Vapor absorption system -System components, representation of system on various charts, steam ejector system, representation on T-s and P-v plane, applications and limitations, co-efficient of performance-Thermo electric and vortex refrigeration systems. Cascade refrigeration system.

UNIT IV APPLIED PSYCHROMETRY 8

Principle and properties of psychrometry, Representation of various psychrometric processes on psychrometric chart and their analysis, by-pass factor, sensible heat factor, room sensible heat factor, equipment sensible heat factor, grand sensible heat factor, apparatus dew point, ventilation and infiltration, energy efficiency ratio. Use of psychrometric charts. Cooling and heating load calculations.

UNIT V AIR CONDITIONING SYSTEMS 10

Human Comfort and Air Conditioning - requirements of temperature and humidity-concept of effective temperature, comfort charts. Air Conditioners - Air conditioning systems and their types, selection of system, Components and controls of air distribution, Window air conditioners, split air conditioners, Central air conditioners, Human comfort parameters, load estimation, infiltration, internal heat gains.

L : 45 T : 0 P : 0 Total: 45 PERIODS

TEXT BOOKS

- 1 C. P. Arora, Refrigeration and Air Conditioning, Tata McGraw Hill Publishing Company Private Limited, New Delhi, 2008.
- 2 Langley and C. Billy, Refrigeration and Air conditioning, Ed. 3, Engle wood Cliffs (NJ), Prentice Hall of India, New Delhi, 2009.

REFERENCES

- 1 Roy J. Dossat, Principles of Refrigeration, Pearson Education, New Delhi, 2007.
- 2 N. F Stoecker and Jones, Refrigeration and Air Conditioning, Tata McGraw Hill, New Delhi, 2008.
- 3 Manohar Prasad, Refrigeration and Air Conditioning, Wiley Eastern Ltd., 2007.

COURSE OUTCOMES

At the end of the course student should be able to:

- CO1** Introduction about the concepts of Thermodynamics
- CO2** Basics of vapor compression system, Carnot cycle and refrigerator
- CO3** Vapour absorption and other refrigeration systems
- CO4** Principle and properties of psychrometry
- CO5** Know about the air conditioning systems

16AG332

AGRI BUSINESS MANAGEMENT

L T P C
3 0 0 3

UNIT I INTRODUCTION

9

Farm management - definition, nature, characteristics and scope - principles and decision making, Production function, technical relationships. Decision making under risk and uncertainty. Farming systems and types. Cost concepts, curves and functions - Factor - product, relationship, Factor - factor relationship and Product - product relationship, optimum conditions - Principles of opportunity cost, equi-marginal returns and comparative advantages. Time value of money, economic of scale, returns to scale - Cost of cultivation and production and break even analysis .

UNIT II BUSINESS MANAGEMENT

9

Meaning, definition of management- functions of management. Planning - meaning, steps and methods of planning, types of plan, characteristics of effective plans. Functional areas of management - operations management - physical facilities, implementing the plan. Scheduling the work, controlling production in terms of quantity and quality. Materials management - types of inventories, inventory costs, managing the inventories, economic order quantity (EOQ) . Personnel management - recruitment, selection and training, job specialization. Budgeting as a tool for planning and control. Record keeping as a tool of control.

UNIT III ORGANIZATIONS

9

Forms of business organizations, organizational principles, division of labour -Job design and span of control -Responsibility, power, authority and accountability -Direction - guiding, leading, motivating, supervising. Coordination - meaning, types and methods of controlling - evaluation, control systems and devices .

UNIT IV MARKETING MANAGEMENT

9

meaning, marketing functions -Marketing Institutions - shandies, co-operative and regulated marketing institutions . Marketing Institutions - other marketing institutions and WTO- Marketing channels, marketing costs, margins, price spread and marketing efficiency

UNIT V FINANCIAL AND PROJECT MANAGEMENT-

9

Price analysis – forecasting and market integration -Planning the marketing programmes, marketing mix and four P's of marketing of mix. Market segmentation - methods of market segmentation, product -life cycle. Pricing policy, pricing method, price at various stages of marketing . Financial management - credit, types of credit, 3R's of credit, types of repayment . Important financial institutions-Financial statements and ratios, capital budgeting.Project management - definition, project preparation evaluation measures.

L : 45 T: 0 P: 0 Total: 45 PERIODS

TEXT BOOKS

- 1 Koontz.H and Weihrich.H, 2007, 'Principles of management', Tata McGraw Hill, New Delhi.
- 2 Charles W L Hill and Steven L McShane, 2007, 'Principles of Management', Tata McGraw Hill, New Delhi.

REFERENCES

- 1 Massie, J.L, 1995, 'Essentials of Management', Prentice Hall of India Pvt. Ltd., New Delhi.
- 2 Prasad, L.M, 2005, 'Principles and Practices of Management', Sultan Chand and Sons Educational Publishers, New delhi.

COURSE OUTCOMES

At the end of the course student should be able to:

- CO1** Know about farm management practices – definitions, characteristics and scope
- CO2** Gain knowledge about business management
- CO3** Information about organizations
- CO4** Possess information about marketing management
- CO5** Manage financial and project management

16AG333	AGRO-ENERGY AUDIT AND MANAGEMENT	L	T	P	C
		3	0	0	3
UNIT I	INTRODUCTION				8

Types of energy resources - renewable and non-renewable forms of energy and their use. Energy resources on the farm- Energy equivalents and energy coefficients for different agricultural inputs and products. Pattern of energy consumption and their constraints in production agriculture.

UNIT II	ENERGY REQUIREMENT OF CROPS	8
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Energy audit of production agriculture-estimation of energy requirement of important crops-sugar cane, paddy and sorghum. Energy conservation practices applicable to the farms.

UNIT III	TECHNIQUES OF ENERGY ANALYSIS	11
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Identification of energy efficient machinery systems, energy losses and their management- Energy audit of pumps and motors -Energy analysis techniques and methods: energy balance, output and input ratio, resource utilization, conservation of energy sources.

UNIT IV	ENERGY AUDITING OF AGRO BASED INDUSTRIES	11
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Environment, climate change and sustainability. Energy management- Energy supply management and energy demand management. Energy auditing of agro based industries such as sago industry, sugar industry, fruit processing industry, etc.

UNIT V	ENERGY FORECASTING AND ENERGY ECONOMICS	7
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Energy conservation planning and practices. Energy forecasting, Energy economics, Energy pricing and incentives for energy conservation, factors effecting energy economics.

L : 45 T : 0 P : 0 Total: 45 PERIODS

TEXT BOOKS

- 1 Pimental D., Handbook of Energy Utilization in Agriculture, CRC Press, 1980.
- 2 Verma SR, Mittal JP & Surendra Singh, Energy Management and Conservation in Agricultural Production and Food Processing, USG Publs, Ludhiana, 1994.

REFERENCES

- 1 Kennedy WJ Jr. & Wayne C Turner, Energy Management, Prentice Hall, 1984.
- 2 Fluck RC & Baird CD., Agricultural Energetics, AVI Publs, 1984.
- 3 L.C. Witte, P.S. Schmidt, D.R. Brown, Industrial Energy Management and Utilisation , Hemisphere Publication, Washington, 1988.

COURSE OUTCOMES

At the end of the course student should be able to:

- CO1** Idea about the types of energy resources - renewable and non-renewable forms
- CO2** Calculate the energy requirements of crops
- CO3** Learn about the techniques of energy analysis
- CO4** Do energy auditing of agro based industries
- CO5** Forecast energy needs and plan to expend energy economically

16AG334	PRODUCTION TECHNOLOGY OF AGRICULTURAL MACHINERY	L	T	P	C
		3	0	0	3
UNIT I	INTRODUCTION TO PRODUCTION OF AGRICULTURAL MACHINERY				9
	Status of agricultural machinery in Tamil Nadu and India-problems faced in the manufacture of agricultural machinery-requirements of industries-Critical appraisal.				
UNIT II	ADVANCES IN MATERIAL FOR TRACTOR AND AGRICULTURAL MACHINERY AND MANUFACTURING TECHNIQUES				9
	Material used for tractor and agricultural machinery, cutting tools, cutting tools for CNC machines, cutting tools for finishing operations. Advanced manufacturing techniques, electrical discharge machining, powder metallurgy. Heat treatment of steel, pack carburizing, shot peening, chemical vapour deposition (CVD).				
UNIT III	INDUSTRIAL LAY OUT PLANNING AND QUALITY MANAGEMENT				9
	Limits, fits and tolerance, micro structure analysis of metals, industrial layout planning and quality management.				
UNIT IV	ECONOMICS OF PROCESS				9
	Economics of process selection. Techno economic feasibility of project report, case study on agricultural tines, case study of manufacturing of weeders, critical components and their selection				
UNIT V	SERVO MOTORS, DRIVES , CONTROLLERS AND CNC PROGRAMMING				9
	Introduction – working principles of servo motors, drives, controllers. CNC programming-tools selection.				

L : 45 T: 0 P: 0 Total: 45 PERIODS

TEXT BOOKS

- 1 C.J. Studman, Agricultural and horticultural engineering, Butterworths PVT Ltd, 1990.
- 2 J.M. Shippen, C.R.Ellin and C.H. Clover, Basic farm machinery, Pergamon Press Ltd, 1987.

REFERENCES

- 1 R.N. Kaul, and C.O. Egbo, Introduction to Agricultural Mechanisation, Macmillan, London, 1985.
- 2 S. Nath, Manual of Practicals in Farm Mechanisation, Unitech Printery, 1988.
- 3 C.P. Crossley, and J. Kilgour, Small Farm Mechanisation for Developing Countries, Wiley, London, 1983.

COURSE OUTCOMES

At the end of the course student should be able to:

- CO1** Aware of the Status of agricultural machinery in Tamil Nadu and India and the problems faced in the manufacture of agricultural machinery
- CO2** Learn about the advances in material for tractor and agricultural machinery manufacturing
- CO3** Prepare industrial layouts with quality
- CO4** Know about the economics of process
- CO5** Gain knowledge about motors, drives, controllers

PROFESSIONAL ELECTIVE (PE) V

16AG410

HEAT AND MASS TRANSFER

L	T	P	C
3	0	0	3

9

UNIT I CONDUCTION

Basic concepts - Mechanism of Heat transfer. Conduction - Fourier's Law, General differential equation in Cartesian and cylindrical coordinates, one dimensional steady state heat conduction, conduction through plane wall, cylinders and spherical systems. Composite Systems. Extended surfaces-Use of Heisler chart.

UNIT II CONVECTION

Basic Concepts – Heat transfer coefficients, boundary layer concept. Types of convection – Forced convection, dimensional analysis, non-dimensional numbers, external flow, flow over plates, cylinders and spheres, internal flow, laminar and turbulent flow, combined laminar and turbulent. Free convection – Dimensional analysis, flow over vertical plate, horizontal plate.

UNIT III PHASE CHANGE HEAT TRANSFER AND HEAT EXCHANGERS

Modes of boiling – Nusselt's theory of condensation, types of condensation - correlations in boiling and condensation. Heat exchangers – Types, heat exchanger analysis, fouling factor, LMTD (Logarithmic mean temperature difference) and Effectiveness-NTU (number of transfer units) Method - Overall Heat Transfer Coefficient.

UNIT IV RADIATION

Laws of Radiation – Stefan-Boltzmann Law, Kirchhoff's Law – Black body radiation – Grey body radiation - Shape factor algebra – Electrical analogy – Radiation shields.

UNIT V MASS TRANSFER

Basic concepts - Diffusion mass transfer – Fick's law of diffusion, Steady state molecular diffusion. Convective mass transfer – momentum, heat and mass transfer analogy, convective mass transfer correlations.

L : 45 T: 0 P: 0 Total: 45 PERIODS

TEXT BOOKS

- 1 R. K. Rajput, *Heat and Mass Transfer*, S Chand and Company, New Delhi, 2009.
- 2 R. C. Sachdeva, *Fundamentals of Engineering Heat and Mass Transfer*, New Age International private limited, New Delhi, 2010.

REFERENCES

- 1 Yunus A.Cengel, *Heat and Mass Transfer: a Practical Approach*, Tata McGraw Hill publishing Company private limited, New Delhi, 2007.
- 2 J. P. Holman, *Heat Transfer*, Tata McGraw Hill publishing Company private limited, New Delhi, 2009.
- 3 C. P. Kothandaraman and S. Subramanian, *Heat and Mass Transfer Data Book*, New Age International private limited, New Delhi, 2014.

COURSE OUTCOMES

At the end of the course student should be able to:

- CO1** Know about the concepts about mechanism of heat and mass transfer
- CO2** Be familiar with convection and concepts regarding convection
- CO3** Phase changes, heat transfer and heat exchangers
- CO4** Basic concepts of radiation
- CO5** Possess knowledge about diffusion and mass transfer

16AG411	MECHANICS OF TILLAGE AND TRACTION	L	T	P	C
		3	0	0	3
UNIT I	MECHANICS OF TILLAGE				8
Introduction to mechanics of tillage tools, engineering properties of soil, principles and concepts, stress strain relationship					
UNIT II	DYNAMICS OF TILLAGE				9
Design of tillage tools principles of soil cutting, design equation, force analysis, application of dimensional analysis in solid dynamics performance of tillage tools.					
UNIT III	TRACTION				9
Introduction to traction and mechanics, off road traction and mobility, traction model, traction improvement, traction prediction.					
UNIT IV	TYRES				10
Tyre size, tyre lug geometry and their effects, tyre testing.					
UNIT V	APPLICATIONS				9
Soil compaction and plant growth, variability and geo statistics, application of GIS in soil dynamics.					
		L : 45	T : 0	P : 0	Total: 45 PERIODS

TEXT BOOKS

- 1 Ralph Alcock, Tractor Implements System, AVI Publs, 1986.
- 2 Jain S. C. and Philp Grace, Farm Machinery - an approach. Standard Publisher and distributor, New Delhi, 2003.

REFERENCES

- 1 William R. Gill, and Glen E. Vanden Berg, Soil dynamics in tillage and traction, Scientific Publisher, ISBN: 9788172338039. 2013.
- 2 E. McKyes, Soil Cutting and Tillage, Volume 7, 1st Edition, Elsevier Science, eBook ISBN: 9780444601049, 1985.

COURSE OUTCOMES

At the end of the course student should be able to:

- CO1** Possess about the mechanics of tillage
- CO2** Know the dynamics of tillage
- CO3** Introduction to traction and mechanics
- CO4** Design and decide tyres
- CO5** Application of soil compaction and plant growth

16AG412

PACKAGING TECHNOLOGY

L T P C
3 0 0 3

UNIT I FUNCTIONS OF PACKAGING MATERIALS

7

Introduction- Packaging strategies for various environment- functions of package- package materials- cushioning materials- bio degradable packaging materials- shrink and stretch packaging materials- retortable pouches- retorting types.

UNIT II CANS AND ALUMINUM FOILS

8

Food packaging materials-metals-tin plate-three piece can manufacture-end and body manufacture-double seaming-two piece tin can manufacturing process- productive coatings-aluminum as food packaging materials for fruits and vegetables, meat, milk, marine, carbonated and alcoholic beverages.

UNIT III FLEXIBLE PACKAGING MATERIALS

10

Paper as food packaging materials-corrugated paper board manufacturing process- plastics-properties of-different types of polyethylene, polyethylene teraphthalate, polyester materials-heat sealing- adhesive tapes- nano composite as packaging materials- multilayer packaging for aseptic packaging and retort packaging.

UNIT IV FILLING SYSTEMS AND LABELING

10

Filling systems for aseptic packaging, vacuum packaging, cook in / ship in packaging, bag in box system, microwave ovenable and retortable packages- filling system for form fill sealing system- bottle filling system- labels and bar coding- importance and application- printing- different types of printing on packaging materials.

UNIT V TESTING OF PACKAGING MATERIALS

10

Properties of packaging materials- tensile, bursting, impact, tear, crease or flex resistance, blocking, orientation and shrinkage- packaging materials testing machine- Universal testing machine- drop tester, bursting tester, water absorption tester- principle of operation and its application- moisture transmission measurements by different methods- water vapour and flavor transmission measurements- oxygen and carbon di oxide transmission measurements.

L : 45 T: 0 P: 0 Total: 45 PERIODS

TEXT BOOKS

- 1 Gordon L. Robertson, Food Packaging Principles and Practice Marcel Dekker Inc, New york 2003.
- 2 Coles, R., Dowell, D.M., Kirwan, J. "Food Packaging Technology", Wiley-Blackwell Publishing Ltd, ISBN-9781405147712, 2009.
- 3 Anonymous. Modern Food Packaging. Indian Institute of Packaging, Mumbai 1998.

REFERENCES

- 1 Mathloushi.. Food packaging and preservation. Blackie Academi and professional, Western claddens Road, Glasgow, U.K. 1994.
- 2 NIIR Board. Hand book on modern packaging industries. Asia Pacific Press Inc. Delhi, India 2000.
- 3 M. Mahadevah and R.V. Gowramma. Food Packaging Materials. Tata- McGraw-Hill Pub. Company, Limited, New Delhi. 1996.

COURSE OUTCOMES

At the end of the course student should be able to:

- CO1 Know about the functions of packaging materials
- CO2 Understand the uses of can and Aluminium foils
- CO3 Learn and use flexible packaging materials
- CO4 Possess knowledge about filling systems and labeling
- CO5 Developed skills to test packaging materials

16AG413

PROTECTED CULTIVATION

L T P C
3 0 0 3

UNIT I PROTECTED CULTIVATION AND ITS TYPES 9

Importance and methods of protected culture in horticultural crops – Importance and scope of protected cultivation – different growing structures of protected culture viz., green house, poly house, net house, poly tunnels, screen house, protected nursery house – study of environmental factors influencing green house production – cladding / glazing / covering material – ventilation systems – cultivation systems including nutrient film technique / hydroponics / aeroponic culture – growing media and nutrients – canopy management – micro irrigation and fertigation systems.

UNIT II PROTECTED CULTIVATION OF VEGETABLE CROPS 9

Protected cultivation technology for vegetable crops – Hi-tech protected cultivation techniques for tomato, capsicum nursery, cucumber, gherkins strawberry and melons – integrated pest and disease management – post harvest handling.

UNIT III PROTECTED CULTIVATION OF FLOWER CROPS 9

Protected cultivation technology for flower crops – Hi-tech protected cultivation of cut roses, cut chrysanthemum, carnation, gerbera, asiatic lilies, anthurium, orchids, cut foliage and fillers – integrated pest and disease management – postharvest handling.

UNIT IV PRECISION FARMING TECHNIQUES 9

Concept and introduction of precision horticulture – importance, definition, principles and concepts – Role of GIS and GPS – Mobile mapping system and its application in precision farming – design, layout and installation of drip and fertigation in horticultural crops – role of computers in developing comprehensive systems needed in site specific management (SSM) – georeferencing and photometric correction – Sensors for information gathering – geostatistics – robotics in horticulture – postharvest process management (PPM) – remote sensing – information and data management and crop growth models – GIS based modeling.

UNIT V PRECISION FARMING OF HORTICULTURAL CROPS 9

Precision farming techniques for horticultural crops – Precision farming techniques for tomato, chilli, bhendi, bitter gourd, bottle gourd, cauliflower, cabbage, grapes, banana, rose, jasmine, chrysanthemum, marigold, tuberose, china aster, turmeric, coriander, coleus and gloriosa.

L : 45 T: 0 P: 0 Total: 45 PERIODS

TEXT BOOKS

- 1 Lyn. Malone, Anita M. Palmer, Christine L. Vloghat Jach Dangeermond. 2002. Mapping out world: GIS lessons for Education. ESRI press.
- 2 David Reed. 1996. Water, media and nutrition for green house crops. Ball publishing USA.

REFERENCES

- 1 Adams, C.R. K.M. Bandford and M.P. Early. 1996. Principles of Horticulture. CBS publishers and distributors. Darya ganj, New Delhi.

COURSE OUTCOMES

At the end of the course student should be able to:

- CO1** Learn about protected cultivation and its types
- CO2** Know about the protected cultivation of vegetable crops
- CO3** Possess knowledge about cultivation of flower crops
- CO4** Use different precision farming technique
- CO5** Have confidence and knowledge to grow horticultural crops

16AG414	CLIMATE CHANGE AND ADAPTATION	L	T	P	C
		3	0	0	3

UNIT I EARTH'S CLIMATE SYSTEM 9

Role of ozone in environment – ozone layer – ozone depleting gases – Green House Effect, Radiative effects of Greenhouses Gases – Hydrological Cycle – Green House Gases and Global Warming – Carbon Cycle.

UNIT II ATMOSPHERE AND ITS COMPONENTS 9

Importance of Atmosphere – Physical Chemical Characteristics of Atmosphere – Vertical structure of the atmosphere – Composition of the atmosphere – Atmospheric stability – Temperature profile of the atmosphere – Lapse rates – Temperature inversion – effects of inversion on pollution dispersion.

UNIT III IMPACTS OF CLIMATE CHANGE 9

Causes of Climate change : Change of Temperature in the environment – Melting of ice Pole-sea level rise-Impacts of Climate Change on various sectors – Agriculture, Forestry and Ecosystem – Water Resources – Human Health – Industry, Settlement and Society – Methods and Scenarios – Projected Impacts for Different Regions – Uncertainties in the Projected Impacts of Climate Change – Risk of Irreversible Changes.

UNIT IV OBSERVED CHANGES AND ITS CAUSES 9

Climate change and Carbon credits – CDM – Initiatives in India-Kyoto Protocol Intergovernmental Panel on Climate change – Climate Sensitivity and Feedbacks – The Montreal Protocol – UNFCCC-IPCC – Evidences of Changes in Climate and Environment – on a Global Scale and in India.

UNIT V CLIMATE CHANGE AND MITIGATION MEASURES 9

Clean Development Mechanism – Carbon Trading – examples of future Clean Technology – Biodiesel – Natural Compost – Eco-Friendly Plastic – Alternate Energy – Hydrogen – Bio-fuels – Solar Energy – Wind – Hydroelectric Power – Mitigation Efforts in India and Adaptation funding Key Mitigation Technologies and Practices – Energy Supply – Transport – Buildings – Industry – Agriculture – Forestry – Carbon sequestration – Carbon capture and storage (CCS) – Waste (MSW) & Bio waste, Biomedical, Industrial waste – International and Regional cooperation.

L : 45 T: 0 P: 0 Total: 45 PERIODS

TEXT BOOKS

- 1 Adaptation and mitigation of climate – Scientific Technical Analysis, Cambridge University Press, Cambridge, 2006
- 2 Jan C. van Dam, Impacts of “Climate Change and Climate Variability on Hydrological Regimes”, Cambridge University Press, 2003

REFERENCES

- 1 Juha I. Uitto, Jyotsna Puri and Rob D. van den Berg, Evaluating Climate Change Action for Sustainable Development, Springer International Publishing, 2017.
- 2 Atmospheric Science, J.M. Wallace and P.V. Hobbs, Elsevier / Academic Press 2006.
- 3 Climate Change: Impacts, Vulnerabilities And Adaptation In Developing Countries-UNFCCC Publication, 2007.

COURSE OUTCOMES

At the end of the course student should be able to:

- CO1** Possess knowledge about the earth’s climate system
- CO2** Realize the importance of Atmosphere – Physical Chemical Characteristics of Atmosphere
- CO3** Understand the impacts about climate change
- CO4** Interpret the observed changes and its causes
- CO5** Calculate the effects of climate change and know about the mitigation measures to be taken

PROFESSIONAL ELECTIVE (PE) VI

16AG329	FOOD PLANT LAYOUT AND MANAGEMENT	L	T	P	C
		3	0	0	3
UNIT I	PLANT LOCATION AND LAYOUTS				11

Introduction to food plant design- special features of food and agricultural process industry- plant location- location factors, site selection, location theory and models- layout- objectives, classical and practical layout- preparation of process chart and machinery layout- product layout and process layout- plant layout for size reduction machinery, evaporation plant, drying plant, bake ovens and frying plant, heat exchanger plant, refrigeration and air conditioning plant, boiler, packaging plant and ancillary equipments plant.

UNIT II	PLANT CONSTRUCTION AND MATERIALS				11
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Construction materials- sand, brick, cement, steel, blue metal, plastics and wood- foundation- requirements- types- roof types- RCC, polished sheet, aluminum sheet, asbestos and thatched roof- flooring for different food industries- pulp, bakery and confectionary. Materials for windows and doors- air curtainers- construction of effluent treatment plant structures.

UNIT III	ELECTRICAL AND WATER SUPPLY				9
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Estimation of services- peak and critical load- preparation of electrical layout- selection of fittings and accessories for electrical and water supply- provision of water supply- design of water storage system- selection of pipe, valves and safety devices- drainage- systems, pipeline, traps, safety devices- illumination and ventilation- materials, mounting, operation and maintenance- power supply of effluent treatment plant.

UNIT IV	PRODUCTION PLANNING AND CONTROL				8
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Production planning and control- continuous and intermittent production- scheduling- routing and dispatching- activity chart and Gantt chart- Network planning methods- PERT and CPM- application- method study- work study- methods- man- machine chart- time study- standard time of a job- inventory control- economic ordering quantity- inventory models.

UNIT V	REPAIR AND MAINTENANCE OF EQUIPMENT				6
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Repair and maintenance of equipment- preventive maintenance and breakdown maintenance- replacement of equipment- alternative methods and analysis- method of annual equivalence, present worth method and internal rate of returns.

L : 45 T : 0 P : 0 Total: 45 PERIODS

TEXT BOOKS

- 1 Khanna, O.P. 1995. Industrial Engineering and Management. Dhanpath Rai and Sons, Delhi.
- 2 Arora, N.L and Gupta, B.R. 2000, Building construction Satya Prahasham, 16/7698, New Rohtak road, New Delhi- 110 005.

REFERENCES

- 1 Slade, F.H. Food Processing Plant. Leonardhill Books, London. 1987
- 2 Kumar, B. Industrial Engineering. Khanna Publishers, Delhi. 2001
- 3 James, M. Plant Layout and Design. MacMillian Publishing Co., New York. 2001

COURSE OUTCOMES

At the end of the course student should be able to:

- CO1** Gain knowledge about the different types of layout in food processing
- CO2** Aware of the plant construction materials
- CO3** Idea to calculate electricity and water supply
- CO4** Know about production planning and control
- CO5** Confidence and knowledge to repair and maintain equipment

UNIT I INTRODUCTION TO DISASTERS

9

Definition: Disaster, Hazard, Vulnerability, Resilience, Risks – Disasters: Types of Disasters – Earthquake, Landslide, Flood, Drought, Fire etc – Classification, Causes, Impacts including social, economic, political, environmental, health, psychosocial, etc. – Differential impacts – in terms of caste, class, gender, age, location, disability – Global trends in disasters: urban disasters, pandemics, complex emergencies, Climate change – Dos and Don'ts during various types of Disasters.

UNIT II APPROACHES TO DISASTER RISK REDUCTION (DRR)

9

Disaster cycle – Phases, Culture of safety, prevention, mitigation and preparedness community based DRR, Structural – nonstructural measures, Roles and responsibilities of – community, Panchayati Raj Institutions/Urban Local Bodies (PRIs/ULBs), States, Centre, and other stake-holders – Institutional Processes and Framework at State and Central Level – State Disaster Management Authority (SDMA) – Early Warning System – Advisories from Appropriate Agencies.

UNIT III INTER-RELATIONSHIP BETWEEN DISASTERS AND DEVELOPMENT

9

Factors affecting Vulnerabilities, differential impacts, impact of Development projects such as dams, embankments, changes in Land-use etc. – Climate Change Adaptation – IPCC Scenario and Scenarios in the context of India – Relevance of indigenous knowledge, appropriate technology and local resources.

UNIT IV DISASTER RISK MANAGEMENT IN INDIA

9

Hazard and Vulnerability profile of India, Components of Disaster Relief: Water, Food, Sanitation, Shelter, Health, Waste Management, Institutional arrangements (Mitigation, Response and Preparedness, Disaster Management Act and Policy – Other related policies, plans, programmes and legislation – Role of GIS and Information Technology Components in Preparedness, Risk Assessment, Response and Recovery Phases of Disaster – Disaster Damage Assessment.

UNIT V DISASTER MANAGEMENT : APPLICATIONS AND CASE STUDIES AND FIELD WORKS

9

Landslide Hazard Zonation : Case Studies, Earthquake Vulnerability Assessment of Buildings and Infrastructure: Case Studies, Drought Assessment: Case Studies, Coastal Flooding: Storm Surge Assessment, Floods: Fluvial and Pluvial Flooding: Case Studies; Forest Fire : Case Studies, Man Made disasters: Case Studies, Space Based Inputs for Disaster Mitigation and Management and field works related to disaster management

L : 45 T: 0 P: 0 Total: 45 PERIODS

TEXT BOOKS

- 1 Govt. of India : Disaster Management Act, Government of India, New Delhi, 2005.
- 2 Government of India, National Disaster Management Policy, 2009.

REFERENCES

- 1 Rajib Shaw and R. R. Krishnamurthy, Disaster Management- Global Challenges and local solutions, Universities press, ISBN : 8173716560, 9788173716560, 2009.
Ashu Pasricha, Kiyanoosh Ghalavand and Jai Narain Sharma, Management and Disaster Strategies
Concept & Methods, Risk Reduction & Insurance, Experiences & Case Studies, ISBN:
8184844069, 9788184844061, 2014
- 3 Parag Diwan, A Manual on Disaster Management, ISBN: 8182744385, 9788182744387,2010.

COURSE OUTCOMES

At the end of the course student should be able to:

CO1 Know about various disasters occurring in the world

CO2 Know about Disaster risk management

CO3 Interpret the relationship between disaster and risk management

CO4 Studied about the disaster risk management in India

CO5 Apply the learnt methods to help the society in disaster management and know about various works at field level

16AG417 WATER AND WASTEWATER ENGINEERING L T P C

3 0 0 3

UNIT I INTRODUCTION 6

Water and Wastewater Quantity Estimation-Population forecast- Water demand for various purposes- Estimation of wastewater quantity- Variation in quantity of water and wastewater - Water Supply/Distribution Systems - Wastewater Collection Systems.

UNIT II WATER/WASTEWATER QUALITY ENHANCEMENT 4

Wastewater characteristics- Philosophy of treatment- Unit operations and processes- Physical, chemical and biological methods- Primary, secondary and tertiary treatment. Physical Unit Processes- Screening, Commutation, Grit Removal, Equilization and Sedimentation.

UNIT III BIOLOGICAL UNIT PROCESSES 12

Introduction to Microbiology-Microbial ecology and Growth kinetics- Types of microorganisms-aerobic vs. anaerobic processes. Aerobic treatment; Suspended growth aerobic treatment processes; Activated sludge process and its modifications; Attached growth aerobic processes; Tricking filters and Rotating biological contactors; Anaerobic treatment; suspended growth, attached growth, fluidized bed and sludge blanket systems; nitrification, denitrification; Phosphorus removal.

UNIT IV SLUDGE TREATMENT AND NATURAL WASTEWATER TREATMENT SYSTEMS 12

Thickening, Digestion, Dewatering, Sludge drying and Composting. Wastewater Treatment Plant Characteristics. Sequencing of unit operations and processes; Plant layout; Hydraulic considerations. Natural Wastewater Treatment Systems- Ponds and Lagoons, Wetlands and Root-zone systems. Surface and Ground Water Treatment for Potable Water Supply-Water Characteristics, Sequencing of unit operations, plant layout and Hydraulic considerations and processes.

UNIT V CHEMICAL UNIT PROCESSES 11

Coagulation-Flocculation, Filtration, Disinfections, Aeration and Gas transfer. Precipitation, Softening, Adsorption and Ion exchange, Membrane processes- Rural Water Supply- Low Cost Sanitation- Septic tanks, Soak-pits.

L : 45 T: 0 P: 0 Total: 45 PERIODS

TEXT BOOKS

- 1 Reynolds, T. D., and P. A. Richards. *Unit Operations and Processes in Environmental Engineering*. 2nd ed. Boston, MA: PWS Publishing Company, 1996. ISBN: 0534948847.
- 2 Mara, D. *Domestic Wastewater Treatment in Developing Countries*. London, UK: Earthscan, 2003. ISBN: 1844070190.

REFERENCES

- 1 Viessman, W., Jr., and M. J. Hammer. *Water Supply and Pollution Control*. 7th ed. Pearson Education, Inc., Upper Saddle River, NJ: Pearson Prentice Hall, 2005, ISBN: 0131409700.
- 2 Tchobanoglous, G., F. L. Burton, and H. D. Stensel. *Wastewater Engineering: Treatment and Reuse*. 4th ed.
- 3 MWH Staff. *Water Treatment: Principles and Design*. 2nd ed. New York, NY: Wiley, 2005, ISBN: 0471110183.

COURSE OUTCOMES

At the end of the course student should be able to:

CO1 Estimate waste water availability and its quality

CO2 Know how to improve water quality

CO3 Idea about the biological unit processes

CO4 Gain knowledge about the sludge treatment and natural waste water treatment and natural wastewater treatment systems

CO5 Know about the chemical unit processes

UNIT I TYPES OF PUMPS AND OTHER WATER LIFTING DEVICES 7

Indigenous water lifts - types and their working –Types of pumps - Positive displacement and variable displacement pumps. Reciprocating pump - principle - components - single acting and double acting - work done - coefficient of discharge – slip.

UNIT II CENTRIFUGAL, SUBMERSIBLE AND TURBINE PUMPS 12

Centrifugal pump- classification-principle and working - fundamental equations of centrifugal pumps - ideal, virtual and manometric heads of centrifugal pumps-net positive suction head- Work done by centrifugal pump – Pump characteristics and efficiencies – priming and cavitation in centrifugal pumps- Multistage centrifugal pumps-Design of impellers and casing-selection of centrifugal pumps. Submersible, Turbine pumps- Mixed flow, Axial flow, jet and Airlift pumps. Pump selection and installation - pump troubles and remedies.

UNIT III MICRO-IRRIGATION SYSTEM 9

Drip irrigation –components- equations governing flow through drippers. Wetting pattern - Derivation of equation for flow through pipes with uniform spaced outlets. Emission devices-types -Simple Emitters, Micro-sprinklers, Line sources, Bubblers, micro-tubes and other devices- Filters, screen, media and hydro-cyclone- Ventury injection system- Emitter flow variation and uniformity coefficients of emitter flow- Design of laterals – paired - tapered, sub main – paired - tapered, main lines - pump capacity. Filters and Fertigation tanks -Operation and maintenance of drip irrigation system – automation.

UNIT IV SPRINKLER IRRIGATION 9

Sprinkler irrigation – components -performance - Uniformity and efficiency of sprinkler systems-sprinkler discharge - Distance of throw- Distribution pattern- application rate - Droplet size. Sprinkler selection and spacing - capacity of sprinkler system. Design of laterals – tapered Design of Main lines - pump capacity -Operation and maintenance of sprinkler irrigation system.

UNIT V SPECIAL TYPES OF IRRIGATION 8

Surge and Cablingation. Greenhouse irrigation system design. Types of valves - pressure relief valve - Gate valve. Non-return valve – butterfly valve, Solenoid valves. Underground pipeline irrigation system - structures for underground pipelines.

L : 45 T: 0 P: 0 Total: 45 PERIODS

TEXT BOOKS

- 1 A.M.Michael, Irrigation - theory and practice, Vikas publishers, New Delhi, 2010.
- 2 Jack Keller and Rond Belisher, Sprinkler and Trickle irrigation, Van Nostrand Reinhold, New York, 1990.
- 3 L.J. James, Farm Irrigation System Design, John Wiley & Sons, 1988

REFERENCES

- 1 A.J. Stepanoff, "Centrifugal and Axial Flow Pumps, Design and Applications". John Wiley and Sons, New York, 1948.
- 2 I.J. Kavassik, Engineers Guide to Centrifugal pumps, McGraw Hill Book Company, 1964.
- 3 P.N. Modi and S.M.Seth, Hydraulics and fluid mechanics, Standard book house, New Delhi, 2010.

COURSE OUTCOMES

At the end of the course student should be able to:

- CO1** Possess knowledge on different types of water lifting devices
- CO2** Know about different types of pumps
- CO3** Know about drip irrigation systems
- CO4** Know about sprinkler irrigation systems
- CO5** Possess the knowledge on special types of irrigation systems

PROFESSIONAL ELECTIVE (PE) VII

16AG420

PUBLIC HEALTH ENGINEERING

L	T	P	C
3	0	0	3

UNIT I QUANTITY AND SOURCES OF WATER

9

Introduction- estimation of rate of demand and population- sources of water- surface and subsurface sources- quantity of water-quality of water- physical, chemical and biological- water treatment process- methods adopted.

UNIT II WATER TREATMENT

9

Plain sedimentation tanks- theory, types and design of tanks- coagulation- usual coagulants- feeding and mixing of coagulants. Filtration- theory and classification of filters - double filtration. Water softening- temporary and permanent hardness-removal- types of processes to remove permanent hardness.

UNIT III SEWAGE: COLLECTION & QUANTITY

9

Introduction to sanitary engineering- definitions- collection and conveyance- methods of carrying refuse- systems of sewerage- quantity of sewage-dry weather flow- storm water- design of sewers- sizes of sewers- design procedure

UNIT IV SEWAGE: QUALITY & DISPOSAL

9

Quality of sewage- analysis of sewage- physical, chemical and bacteriological tests- natural methods of sewage disposal- disposal by dilution and land treatment- sludge disposal- methods of sludge disposal and digestion

UNIT V SEWAGE TREATMENT

9

Primary treatment- Screens, grit chamber and detritus tanks- skimming and sedimentation tanks- filtration of effluent- contact beds and intermittent sand filters. Activated sludge process- different types of aeration of septic tank and Imhoff tank

L : 45 T: 0 P: 0 Total: 45 PERIODS

TEXT BOOKS

- 1 Canter, R.L., Environmental impact assessment, McGraw Hill Inc., New Delhi. 1996
- 2 John G. Rao and David C Hooten(Ed), Environmental impact analysis Handbook. McGraw Hill book company. New Delhi. 1990.

REFERENCES

- 1 Shukla, S.K. and P.R. Srivastava, Concepts in environmental impact analysis. Common Wealth publishers, New Delhi. 1996
- 2 World Bank Reports, Environmental assessment source book, Vol. I, II & III. Washington, D.C. 1991.
- 3 Judith Petts, Hand book of environmental impact assessment Vol. I& II, Blackwell science, London.

COURSE OUTCOMES

At the end of the course student should be able to:

- CO1** Quantity and resources of water
- CO2** Know about water treatment
- CO3** Possess knowledge about sewage collection and quality
- CO4** Find out the sewage quality and disposal of sewage
- CO5** Confident in designing sewage handling

16AG418	ENERGY CONSERVATION IN FOOD INDUSTRY	L	T	P	C
		3	0	0	3

UNIT I INTRODUCTION TO ENVIRONMENT 9

Components of the environment- ecosystems, biological interactions, bio nutrient and energy cycle; food industry pollution- an introduction, types of industries, wastes, quantity of wastes generated- Organic and GM Foods- Impacts

UNIT II WASTEWATER MANAGEMENT IN FOOD INDUSTRIES 9

Water pollution- waste water from food industries- sugar, distillery, fruit, vegetable beverage, meat and fish, dairy waste, sago processing industries and oil refiners; waste water from different industries and their advanced treatment systems- Bioremediation- Microbial and phytoremediation- Engineered reed bed system- standards for land and water body disposal.

UNIT III AIR POLLUTION CONTROL 9

Air pollution- global climate change- greenhouse effect- carbon dioxide effect chlorofluorocarbon- methane- Carbon reduction- Methanotrophs and methylotrophs- SPM- indoor air quality- food industry atmosphere- Odor pollution- air quality monitoring and Control

UNIT IV SOLID WASTE MANAGEMENT 9

Solid wastes- types- characteristics- land disposal problems- Pesticide Residues in Food and Drinking Water- Human Exposure and Risks; Value addition- enzymes- pectin and other products- 3R concept, composting- vermicomposting; Bioconversion- aerobic and anaerobic treatment- incineration- pyrolysis

UNIT V ADVANCED WASTE MANAGEMENT OPTIONS 9

Eco friendly products in food industry- Bio colorants- Eco friendly packaging- Eco labeling- GM organisms in waste management- Biosensors- bio indicators. Nanoparticles in food industry waste management- CDM;EMP and Environmental Acts

L : 45 T: 0 P: 0 Total: 45 PERIODS

TEXT BOOKS

- 1 Gilbert M. Masters. Treatment of water and wastes. In: Introduction to environmental engineering and science. 2004
- 2 Jogdhand, S.N. Environmental Biotechnology: Industrial Pollution Management. (III ed). Himalaya Publishing House, New Delhi. 2006

REFERENCES

- 1 Metcalf and Eddy. Waste Water Engineering Treatment & Reuse. 4th Edition. TATA McGraw Hill Publications:1818 2003
- 2 Environmental Science and Technology: A Sustainable Approach to Green Science and Technology, Second Edition Stanley E. Manahan CRC Press October 2006
- 3 Pesticide Residues in Food and Drinking Water- Human Exposure and Risks Edited by Hamilton, Denis, Crossley, Stephen John Wiley & Sons November 2003

COURSE OUTCOMES

At the end of the course student should be able to:

- CO1** Have an introduction to environment
- CO2** Gain knowledge about the waste water management practices
- CO3** Know about air pollution control measures
- CO4** In a position to evaluate solid waste management
- CO5** Able to use advanced waste management practices

16AG422	ENVIRONMENTAL IMPACT ASSESSMENT	L	T	P	C
		3	0	0	3
UNIT I	INTRODUCTION				10

Impact of development projects under Civil Engineering on environment - Environmental Impact Assessment (EIA) - Environmental Impact Statement (EIS) – EIA capability and limitations – Legal provisions on EIA.

UNIT II	METHODOLOGIES				10
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Methods of EIA – Check lists – Matrices – Networks – Cost-benefit analysis – Analysis of alternatives – Case studies

UNIT III	PREDICTION AND ASSESSMENT				9
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Assessment of Impact on land, water and air, noise, social, cultural flora and fauna; Mathematical models; public participation – Rapid EIA.

UNIT IV	ENVIRONMENTAL MANAGEMENT PLAN				8
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Plan for mitigation of adverse impact on environment – options for mitigation of impact on water, air and land, flora and fauna; Addressing the issues related to the Project Affected People – ISO 14000

UNIT V	CASE STUDIES				8
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EIA for infrastructure projects – Bridges – Stadium – Highways – Dams – Multi-storey Buildings – Water Supply and Drainage Projects

L : 45 T: 0 P: 0 Total: 45 PERIODS

TEXT BOOKS

- 1 Canter, R.L., “Environmental Impact Assessment”, McGraw-Hill Inc., New Delhi, 1996.
- 2 Shukla, S.K. and Srivastava, P.R., “Concepts in Environmental Impact Analysis”, Common Wealth Publishers, New Delhi, 1992.

REFERENCES

- 1 John G. Rau and David C Hooten (Ed)., “Environmental Impact Analysis Handbook”, McGraw-Hill Book Company, 1990.
- 2 “Environmental Assessment Source book”, Vol. I, II & III. The World Bank, Washington, D.C., 1991.
- 3 Judith Petts, “Handbook of Environmental Impact Assessment Vol. I & II”, Blackwell Science, 1999.

COURSE OUTCOMES

At the end of the course student should be able to:

- CO1** Realize the importance of communication and program planning
- CO2** Learn about various extension teaching methods
- CO3** Know about the modern communication gadgets
- CO4** Understand diffusion and adoption
- CO5** Capacity building skills

16AG423 GIS AND NATURAL RESOURCES MANAGEMENT L T P C
3 0 0 3

UNIT I REMOTE SENSING 9

Introduction-Fundamentals of Remote Sensing-Definition, Advantages-Components- Physics of Remote Sensing-Electro Magnetic Spectrum(EMR)-Radiation laws – Wave theory-Stefan-Boltzmann Laws-Interaction of EMR with Atmosphere- Scattering-Rayleigh, Mie and Non-Selective scattering-Absorption-Atmospheric windows-interaction of EMR with Earth objects-Spectral signature-Spectral reflectance characteristics of vegetation, soil and water.

UNITII REMOTE SENSING SATELLITES AND SENSORS 9

Platforms-Types-Applications – Sun synchronous and geo synchronous orbits-Active and Passive sensors-Resolution-Spatial, Spectral, Radiometric and Temporal, significance of Resolution-Satellites and Sensors- LANDSAT, SPOT, IRS, RESOURCESAT, CARTOSAT, LISS Images, Thematic Mapper-High Resolution commercial satellites-METEOSAT,NOAA-ERS, RADARSAT.

UNIT III DIGITAL IMAGE INTERPRETATION AND PROCESSING 9

Activities of image interpretation-Elements-Techniques- Digital Data-Ordering- Visual interpretation elements-Rating Scales-Image processing-Image enhancement-image classification-rectification-Supervised and Unsupervised, maximum likelihood analysis-minimum distance – Vegetation Indices-Applications in soil mapping-problem soil identification- soil erosion and sedimentation studies-water quality analysis

UNIT IV GEOGRAPHIC INFORMATION SYSTEM(GIS) 9

Definition-Concepts of GIS –Maps and their influences-Map scale-Projection-Coordinate system-sources of spatial data- basic component -standard GIS packages- Data types- Raster and Vector-files and their organization-Data Base Management System-digitizer- reclassification-Spatial analysis-buffering-map overlay-interpolation-Digital Elevation Model-output data-devices for output

UNIT V GIS APPLICATIONS 9

Land and Water resources Management-Agriculture-Surface and Ground water hydrology-Soil erosion assessment-Pollution abatement-Earth sciences-watershed management

L : 45 T: 0 P: 0 Total: 45 PERIODS

TEXT BOOKS

- 1 M.Anji Reddy, Textbook of Remote Sensing and Geographical Information System, 3rd Edition, BS Publications, 2008.
- 2 Floyd F.Sabins, Remote Sensing: Principles and Interpretation, III edition, Freeman and Company, New York, 1997.

REFERENCES

- 1 Ian Heywood, An Introduction to GIS, Pearson Education, New Delhi, 2001.
- 2 P.A. Burrough, Principle of GIS for land resources assessment, Oxford Publications, 1990.

COURSE OUTCOMES

At the end of the course student should be able to:

- CO1** Realize the importance of remote sensing
- CO2** Know about different remote sensing satellites and sensors
- CO3** Possess knowledge about digital image interpretation and processing
- CO4** Understand the value of GIS
- CO5** Work with GIS and use the applications of GIS

16AG424

STORAGE TECHNOLOGY

L T P C
3 0 0 3

UNIT I STORAGE STRUCTURES

9

Storage losses in agricultural commodities. Physical properties of grain affecting storability- Factors of spoilage- fungi and mycotoxins- Treatments for enhancing shelf life- Protection against Rodents, Fungi, Pests and Mites- Fumigation Processes for bag storage piles.

UNIT II BAG STORAGE AND CAP

9

Rural storage structures- Bag Storage - Advantages and Disadvantages - Bag Storage structure design. Parameters of good storage structure, Cover Plinth Storage Structures, CAP storage (Ceiling and Plinth Storage).

UNIT III BULK STORAGE

9

Bulk Storage in silos and large Bins - Problems of Silo storage, Construction of Silos - concrete and Metal Silos, Physical load and mechanical strength of Silos, Silo flow problems, Relative merits and demerits of Silo storage to Bag Storage, Relative Costs of Silo and Bag Storage. Conveyors and Elevators for feeding and discharging into Silos. Aeration and Drying in silo.

UNIT IV PROBLEMS IN STORAGE

9

Problems of Dust Explosion in Grain Storages, Quality Changes of Grains during storages and remedial measures to prevent unwanted quality changes. Storage of perishables/ semi-perishables - effect of temperature, humidity, season, moisture, respiration, maturity, delay.

**UNIT V CONTROLLED ATMOSPHERE STORAGE AND MODIFIED
ATMOSPHERE PACKAGING**

9

Definition of CA Storage-history & practice of CA storage Biochemical aspects of CA storage- Temperature & Humidity Control, Gas Control Equipment, Oxygen Control, Carbon Dioxide Control, Equipment for creating and maintaining controlled atmosphere. MAP-Film & Coating types, Permeability, Gas Flushing, Chilling Injury, Shrink wrapping, Vacuum Packing, , Minimal Processing.

L : 45 T: 0 P: 0 Total: 45 PERIODS

TEXT BOOKS

- 1 A. Chakraverty, Post Harvest Technology of Cereals, Pulses and Oilseeds. Oxford and IBH Publishing Co, Calcutta, India, 1995.
- 2 Gordon L. Robertson, Food Packaging- Principles and Practice Marcel Dekker Inc, USA, 1993.

REFERENCES

- 1 M. Mathlouthi (Editor), Food Packaging and Preservation Elsevier Applied Science Publications Essex, UK, 1986.
- 2 Shirley J. VanGarde, Margy J. Woodburn, Food Preservation and Safety: Principles and Practice, 261 pages, Surbhi Publications, Jaipur, 1999.
- 3 NIIR Board. Hand book on modern packaging industries. Asia Pacific Press Inc. Delhi, India 2000.

COURSE OUTCOMES

At the end of the course student should be able to:

- CO1** Assess of Storage losses in agricultural commodities
- CO2** Know Bag storage and CAP
- CO3** Learn about Air Pollution control
- CO4** Realize the importance of Solid Waste management
- CO5** Apply advanced waste management practices

16AGOE2	FOREST RESOURCE MANAGEMENT	L	T	P	C
		3	0	0	3
UNIT I	FORESTRY AND FOREST REGENERATION				9

Indian forest – Forestry — Role of forests – Classification of forests -Silvics – silviculture – Locality factors – Regeneration of forests – Natural and artificial regeneration.

UNIT II	SILVICULTURAL TECHNIQUES FOR TREE SPECIES	12
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Site selection - Choice of species - Modern silvicultural techniques in site preparation – Planting and tending operations – Mechanization in silviculture -Silvicultural packages for Timber species(Teak, Sal, Sandal wood Rosewood and sandal), Pulpwood species (Eucalyptus, Casuarina, Bamboo), Fuel wood species (Acacia’s, Prosopis), (Ailanthus, Melia) Tree borne oilseeds (Neem, Pungam, Bassia), Fodder trees (Subabul, White babul).

UNIT III	FOREST UTILIZATION	9
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Forest utilization – wood and non-wood forest products – Solid Wood- Timber- Wood compositesplywood, fibre board and particle boards – Non wood forest products .

UNIT IV	AGROFORESTRY	10
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Social Forestry concepts and applications –JFM concepts - Agroforestry- Agroforestry classification - Agroforestry systems for different agro climatic zones of Tamil Nadu –Distinction between social forestry and agroforestry.

UNIT V	URBAN AND RECREATION FORESTRY	5
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Techniques and management of urban forestry and recreation forestry -Ecotourism concepts and applications.

L : 45 T: 0 P: 0 Total: 45 PERIODS

TEXT BOOKS

- 1 Brown, H. 1989. Indian wood technology. IBD Publishers, Dehra Dun.
- 2 Dwivedi, A.P. 1992. Agroforestry – Principles and practices. Oxford and IBH Publishing Co., New Delhi.

REFERENCES

- 1 Khanna. L.S 1999 Principles and Practice of Silviculture, IBD Publishers, Dehra Dun
- 2 Negi. S.S.2008 Hand Book of Forestry, IBD Publishers, Dehra Dun II.
- 3 Heygreen, G. and J.L.Bowyer. 1982. Forest products and wood science. The Ohio State University Press, Ames.
- 4 Lal, J.B. 1992. India’s forest – Myth and reality. Natraj Publishers, Dehra Dun.

COURSE OUTCOMES

At the end of the course student should be able to:

- CO1** Know about Forestry and Forest Regeneration
- CO2** Possess knowledge on Silvicultural Techniques for Tree Species
- CO3** Know about Forest Utilization
- CO4** Know about Agroforestry
- CO5** Know about urban and recreation forestry

16AGOE3 ENERGY MANAGEMENT IN AGRICULTURE L T P C

3 0 0 3

UNIT I ENERGY RESOURCES IN THE FARM 10

Conventional and non-conventional forms of energy and their use- Heat equivalents and energy coefficients for different agricultural inputs and products- Pattern of energy consumption and their constraints in production of agriculture- Direct and indirect energy-Commercial and non-commercial energy-renewable and non-renewable energy sources in the farm.

UNIT II ENERGY AUDIT IN PRODUCTION AGRICULTURE 8

Energy audit -types-steps in energy audit - energy audit in production agriculture- energy audit in rural living and scope of energy conservation.

UNIT III ENERGY ANALYSIS TECHNIQUES AND METHODS 9

Identification of energy efficient machinery systems, energy losses and their management. Energy analysis techniques and methods- energy balance, output and input ratio, resource utilization, conservation of energy sources.

UNIT IV ENERGY CONSERVATION PLANNING AND PRACTICES 10

Energy forecasting- energy economics- energy pricing and incentives for energy conservation- factors affecting energy economics. Energy modeling for the farms.

UNIT V CASE STUDIES 8

Case studies conducted on energy audit in agricultural farms and comparative study.

L : 45 T: 0 P: 0 Total: 45 PERIODS

TEXT BOOKS

- 1 Kennedy WJ Jr. & Wayne C Turner, Energy Management, Prentice Hall, 1984.
- 2 Pimental D, Handbook of Energy Utilization in Agriculture, CRC Press, Boca Raton, FL, 1980.

REFERENCES

- 1 CRC Fluck & Baird CD, Agricultural Energetics, AVI Publs, 1984.
- 2 JW Twindal & Anthony D Wier, Renewable Energy Sources, E & F.N. Spon Ltd, 1986.
- 3 SR Verma, JP Mittal and Surendra Singh, Energy Management and Conservation in Agricultural Production and Food Processing, USG Publ, Dist, Ludhiana, 1994.

COURSE OUTCOMES

At the end of the course student should be able to:

- CO1** Evaluate double integral and triple integral to compute area, volume for two dimensional and three dimensional solid structure
- CO2** Know the gradient, divergence and curl, related theorems useful for engineering applications
- CO3** Test the analyticity and to construct the analytic function and transform complex functions from one plane to another plane graphically
- CO4** Evaluate real and complex integrals over suitable closed paths or contours
- CO5** Know the applications of laplace transform and its properties & to solve certain linear differential equations using laplace transform technique

UNIT I THE SCOPE OF MECHANIZATION INDIAN AGRICULTURE 10

Introduction to the concept of mechanization - definition and its impact in the agricultural development of the country and the role of agriculture in the economic progress of the country. Precision farming-its significance-history of farm mechanization in India. Different Sources of Power in agriculture -tractors, power tillers-bulldozers etc. -History of Development of farm tractors in India.

UNIT II TILLAGE AND PROBLEMS IN FARM MECHANISATION 6

Major problems in adopting and adapting farm mechanisation inputs suitable to their specific needs-possible solutions to overcome them. Tillage-definition -objectives-types- their functions and applications.

UNIT III IMPLEMENTS USED IN FARMING OPERATIONS 10

Types of implements based on usage-primary and secondary-trailed and mounted- functions-applications- animal drawn ploughs. Planting machinery-Intercultural operations-weeders-types and their functions.

UNIT IV HARVESTING EQUIPMENTS AND PLANT PROTECTION MACHINERY 10

Different kinds of crop harvesting machinery-features-functions and applications. Basics of knapsack sprayers, foot pedal operated sprayers, power sprayers, boom sprayers and dusters.

UNIT V ERGONOMICS AND AUTOMATION 9

Ergonomic aspects of farm implements-automation of agricultural machinery-latest developments in automation- application of electronics in agriculture.

L : 45 T: 0 P: 0 Total: 45 PERIODS

TEXT BOOKS

- 1 J.M. Shippen, C.R.Ellin and C.H. Clover, Basic farm machinery, Pergamon Press Ltd, 1987.
- 2 C.J. Studman, Agricultural and horticultural engineering, Butterworths PVT Ltd, 1990.

REFERENCES

- 1 R.N. Kaul, and C.O. Egbo, Introduction to Agricultural Mechanisation, Macmillan, London, 1985.
- 2 S. Nath, Manual of Practicals in Farm Mechanisation, Unitech Printery, 1988.
- 3 C.P. Crossley, and J. Kilgour, Small Farm Mechanisation for Developing Countries, Wiley, London, 1983.

COURSE OUTCOMES

At the end of the course student should be able to:

- CO1** Develop knowledge modern trends, design considerations, procedures and their applications in tractors
- CO2** Know about the reliability criteria and tractor linkages and stability aspects
- CO3** Design of selected farm implements/equipment
- CO4** Design, selection and matching of power unit
- CO5** Possess knowledge about the safety devices for tractors & farm implements

ONE CREDIT COURSES

16AGOC1

CROP DISEASE MANAGEMENT

1. Introduction to concepts in Plant diseases management
2. Principles in Plant disease management – Avoidance of pathogen
3. Eradication of Plant diseases – Direct, cultural and destructive
4. Fungicide formulations and auxillary spray materials
5. Classification of fungicides – General use, translocation and chemical nature
6. Role of antibiotics in plant disease management
7. Calculation of fungicide requirement and Plant protection appliances
8. Methods of application of fungicides – seed treatment and soil application.
9. Influences of climatic changes on fungicides
10. Biological control of plant pathogen – important antagonistic fungi-Mode of actiondiseases controlled
11. Biological control of plant pathogen – important antagonistic bacteria- Mode of actiondiseases controlled
12. Mycoherbicides in plant disease management
13. Role of Mycorrhiza in plant disease management
14. Area Wide Management (AWM) of pests: guidelines and resources
15. Biotechnological methods in crop disease management

Total: 15 PERIODS

16AGOC2**RECYCLING OF WASTE**

1. Environment value additions, global policy, regulation
2. Waste energy management, recycling and recovery of waste and their effect on environment
3. Estimation of power requirement and efficiency of size reduction operation of waste, environment pollution aspects
4. Need for the concept-Variety Types - Handmade Paper production – Reuse of materials-Recycle of materials
5. Need for recycling-sorting and segregation
6. Processing techniques – purposes mechanical volume reduction
7. Definition and concepts of different composting methods.
8. Waste-to-energy combustors
9. Pyrolysis and gasification
10. Methane generation by anaerobic digestion
11. Anaerobic decomposition in mixed digesters
12. Methane extraction from landfills
13. Technologies for recovery of resources from electronic waste, resource recovery potential of e-waste
14. Steps in recycling and recovery of e-materials-mechanical processing.
15. Solidification & stabilization of hazardous wastes- treatment of biomedical wastes

Total: 15 PERIODS

16AGOC3

**MANUFACTURING TECHNOLOGY OF
AGRICULTURAL MACHINERY**

1. Engineering materials - their classification - Mechanical properties of materials
2. Steels and cast irons: Carbon steels, their classification based on percentage of carbon as low, mild, medium & high carbon steel, their properties & applications.
3. Wrought iron, cast iron. Alloy steels: Stainless steel, tool steel.
4. Basic principles of lathe, machine and operations performed on it.
5. Basic description of machines and operations of Shaper-Planner, Drilling, Milling & Grinding.
6. Introduction, classification of welding processes.
7. Gas welding, types of flames and their applications.
8. Abrasive flow machining - abrasive jet machining ,water jet machining –
9. Electro Discharge Machining (EDM), Wire cut EDM
10. Numerical control (NC) machine tools - CNC: types, constitutional details,
11. special features – design considerations of CNC machines for improving machining accuracy –
12. Structural members - slide ways - linear bearings - ball screws - spindle drives and feed drives.
13. Part programming fundamentals - manual programming.
14. Electro Chemical Machining (ECM) - Ultrasonic Machining / Drilling (USM / USD)
15. Basic principles of finishing tools, types of finishing tools

Total: 15 PERIODS