B. Tech. (Agricultural Engineering)

Syllabus 2011

Agricultural Engineering College and Research Institute

Tamil Nadu Agricultural University

Kumulur - 621 712, Trichy Dt.

Semester-wise distribution of courses

Sl. No.	Course No	Courses	Cr. Hrs.
Semester I			
1.	MAT 101	Matrices, Analytical Geometry and Differential Equations	2+1
2.	COM 101	Introduction to Computer Technology	2+1
3.	PHY 101	Engineering Physics	2+1
4.	SAC 101	Principles of Analytical Chemistry	1+1
5.	ENG 101	English for Effective Communication	0+1
6.	AGR 121	Production Technology of Field Crops	1+1
7.	FMP 101	Manufacturing Practices	2+1
8.	AST 101	Engineering Drawing	0+1
9.	SWE 101	Geology and Soil Mechanics	2+1
10.	NSS 101	National Service Scheme	0+1*
11.	PED 101	Physical Education	0+1*
		Total	**12+11=23**
*Physical Education and NSS courses are offered for the first four semesters			

Semester II			
1.	MAT 102	Vector Calculus and Complex Analysis	2+1
2.	COM 102	Programming in C^{++}	1+1
3.	AEC 101	Principles of Agricultural Economics	1+1
4.	HOR 121	Basic Horticulture	1+1
5.	FMP 102	Electrical Engineering	2+1
6.	FMP 103	Thermodynamics	2+1
7.	AST 102	Engineering Mechanics	1+1
8.	FPE 101	Heat and Mass Transfer	1+1
9..	SWE 102	Surveying and Leveling Practice	1+2
Total			**12+10=22**

III Semester			
1.	MAT 201	Partial Differential Equations and Transform Theories	2+1
2.	SAC 201	Fundamentals of Soil Science	2+1
3.	FSN 101	Principles of Food Science	2+1
4.	FMP 201	Theory of Machines	2+1
5.	AST 201	Strength of Materials	2+1
6.	SWE 201	Fluid Mechanics and Hydraulics	2+1
7.	FPE 201	Refrigeration and Air Conditioning	1+1
8.	FPE 202	Unit operations in Food Processing	2+1
9.	FMP 202	Machine Drawing	0+1
Total			**15+9=24**

IV Semester			
1	MAT 202	Numerical Methods for Engineering applications	2+1
2	ARM 201	Fundamentals of Agribusiness Management	1+1
3	FOR 211	Forest Resource Management	1+1
4	FMP 203	Electronics and Instrumentation	2+1
5	FMP 204	Machine Design and Computer Aided Drawing	1+2
6	ERG 201	Heat Power Engineering	1+1
7	AST 202	Engineering Materials, Construction, Estimation and Costing	2+1
8.	FPE 203	Post Harvest Engineering of Agricultural Crops	2+1
Total			**12+9=21**

V Semester			
1.	MAT 301	Engineering Statistics	1+1
2.	NST 301	Fundamentals and Applications of Nanotechnology	1+0
3.	FMP 301	Farm Tractors	2+1
4.	FMP 302	Tillage and Sowing Equipment	2+1
5.	ERG 301	Solar and Wind Energy Engineering	2+1
6.	SWE 301	Hydrology	2+1
7.	SWE 302	Soil Conservation and Water Harvesting	2+1
8.	FPE 301	Process Engineering of Spices and Plantation crops	2+1
Total			**14+7=21**

VI Semester			
1.	MAT 302	Operations Research	1+1
2.	ENG 301	Soft Skills for Employability	0+1
3.	AEX 301	Extension Methodologies and Transfer of Agricultural Technology	1+1
4.	ERG 302	Bio and Thermo-chemical Conversion of Biomass	2+1
5.	FPE 302	Food and Dairy Engineering	2+1
6.	SWE 303	Irrigation and Drainage Engineering.	2+1
7.	AGE 301	Project Work	0+2
8.	AGE 302	Study Tour	0+1
9.	FMP 303/ ERG 303	Operation and Maintenance of Farm Equipment / Biomass Power Generation Technologies	0+5
Total			**8+14=22**

VII Semester			
1.	AGE 401	Industry and Institutional Educational Tour (15 days)	0+1
2.	AGE 402	Rural Agricultural Engineering Work Experience (10 days)	0+1
3.	AGE 403	Industrial Internship Programme (80 days)	0+5
Total			**0+7**

VIII Semester			
1.	TAM 401 / ENG 401	,yf;fpa';fspy; ntshz;ika[k; mwptpay; jkpH; gadhf;fKk; / Development Education- for non Tamil students	0+1
2.	FMP 401	Field Crop Machinery	2+1
3.	SWE 401	Application of GIS in Water Resource Management	2+1
4.	SWE 402	Irrigation Equipment, Drip and Sprinkler Technology	2+1
5.	FPE 401	Storage and Packaging Technology	1+1
6.	AGE 404	Project Work	0+2
7.	AGE 405	Study Tour	0+1
8.	SWE 403/ FPE 402	Watershed Management Technologies/ Processing of Agricultural Produces and their Products	0+5
Total			**7+13=20**

Summary of semester wise distribution of credits

Sem.	No. of Courses	Credit Hours	Total
I	11	12 + 11	23
II	9	12 + 10	22
III	9	15 + 9	24
IV	8	12 + 9	21
V	8	14 + 7	21
VI	8+1(Exp. Learning 5)	8+ 14	22
VII	3 (RAWE)	0 + 7	7
VIII	7+1 (Exp. Learning 5)	7 + 13	20
Total	**60 + 3 (RAWE) + (2) Exp. learning**	**80 + 80**	**160**

Sl. No.	Course No	Courses	Cr. Hrs.
		Semester I	
1.	MAT 101	Matrices, Analytical Geometry and Differential Equations	2+1
2.	COM 101	Introduction to Computer Technology	2+1
3.	PHY 101	Engineering Physics	2+1
4.	SAC 101	Principles of Analytical Chemistry	1+1
5.	ENG 101	English for Effective Communication	0+1
6.	AGR 121	Production Technology of Field Crops	1+1
7.	FMP 101	Manufacturing Practices	2+1
8.	AST 101	Engineering Drawing	0+1
9.	SWE 101	Geology and Soil Mechanics	2+1
10.	NSS 101	National Service Scheme	0+1*
11.	PED 101	Physical Education	0+1*
		Total	**12+11=23**
*Physical Education and NSS courses are offered for the first four semesters			

MAT 101 Matrices, Analytical Geometry and Differential Equations (2+1)

Theory

Unit-I

Matrices: Rank of a matrix – Consistency of linear system of equations – Eigen value problem – Eigen values of a real matrix – Characteristic equation – Properties of eigen values and eigen vectors – Cayley – Hamilton theorem (without proof) – Similarity transformation (concept only) – Orthogonal matrices – Orthogonal transformation of a symmetric matrix to diagonal form – Reduction of quadratic form to canonical form by orthogonal transformation.

Unit -II

Three Dimensional Analytical Geometry: Direction cosines and ratios – Angle between two lines – Equations of a plane – Equations of a straight line – Coplanar lines – Shortest distance between skew lines – Sphere – Tangent plane – Plane section of a sphere – Orthogonal spheres.

Unit-III

Geometrical Applications of Differential Calculus: Curvature – Cartesian and polar co-ordinates – Centre and radius of curvature – Circle of curvature – Involutes and evolutes – Envelopes – Properties of envelopes and evolutes – Evolute as envelope of normals.

Unit -IV

Functions of Several Variables: Functions of two variables – Partial derivatives – Total differential – Taylor's expansion – Maxima and minima – Constrained maxima and minima – Lagrange's multiplier method – Jacobians – Differentiation under integral sign.

Unit -V

Ordinary Differential Equations: Simultaneous first order linear differential equations with constant coefficients – Linear differential equations of second order with constant and variable coefficients – Homogeneous equations of Euler type-reducible to homogeneous form – Method of variation of parameters.

Practical

Review : Basic matrix theory-Two dimensional analytical geometry-differential and integral calculus.

Rank of a matrix -Consistency of linear system of equations -Cayley – Hamilton theorem –Eigen values- Eigen vectors and diagonalisation- Similarity transformation– Orthogonal matrices -Angle between two lines – Equations of a plane – Equations of a straight line -Coplanar lines – Shortest distance between skew lines – Sphere – Tangent plane-Curvature– Centre and radius of curvature – Circle of curvature - Involutes and evolutes – Envelopes -Evolutes as envelope of normals -Partial derivatives – Total differential – Taylor's expansion - Maxima and minima – Constrained maxima and minima - Lagrange's multiplier method – Jacobians- Differentiation under integral sign-Simultaneous first order linear differential equations with constant coefficients – Linear differential equations of second order with constant and variable coefficients - Homogeneous equations of Euler type-Reducible to homogeneous form -Method of variation of parameters.

Lecture Schedule

1. Rank of a matrix
2. Consistency of linear system of equations
3. Eigenvalue problem – Eigenvalues of a real matrix
4. Characteristic equation
5. Properties of eigenvalues and eigenvectors
6. Cayley – Hamilton theorem (without prooft)
7. Similarity transformation (concept only)
8. Orthogonal matrices
9. Orthogonal transformation of a symmetric matrix to diagonal form
10. Reduction of quadratic form to canonical form by orthogonal transformation.
11. Direction cosines and ratios
12. Angle between two lines
13. Equations of a plane
14. Equations of a straight line
15. Coplanar lines
16. Shortest distance between skew lines
17. **Mid Semester Examination**
18. Sphere – Tangent plane
19. Plane section of a sphere – Orthogonal spheres.
20. Curvature – Cartesian and polar co-ordinates
21. Centre and radius of curvature – Circle of curvature
22. Involutes and evolutes – Envelopes
23. Properties of envelopes and evolutes
24. Evoute as envelope of normals.
25. Functions of two variables – Partial derivatives – Total differential
26. Taylor's expansion – Maxima and minima
27. Constrained maxima and minima – Lagrange's multiplier method
28. Jacobians – Differentiation under integral sign.
29. Simultaneous first order linear equations with constant coefficients

30. Linear differential equations of second order with constant coefficients
31. Linear differential equations of second order with variable coefficients
32. Homogeneous equations of Euler type
33. Reducible to homogeneous form
34. Method of variation of parameters.

Practical

1. Basic matrix theory and two dimensional analytical geometry
2. Methods of differential and integral calculus.
3. Rank of a matrix -Consistency of linear system of equations
4. Cayley – Hamilton theorem –eigen values- eigen vectors and diagonalisation
5. Similarity transformation– Orthogonal matrices
6. Angle between two lines – Equations of a plane – Equations of a straight line
7. Coplanar lines – Shortest distance between skew lines – Sphere – Tangent plane
8. Curvature– Centre and radius of curvature – Circle of curvature
9. Involutes and evolutes – Envelopes -Evoute as envelope of normals.
10. Partial derivatives – Total differential – Taylor's expansion
11. Maxima and minima – Constrained maxima and minima
12. Lagrange's multiplier method – Jacobians
13. Differentiation under integral sign.
14. Simultaneous first order linear equations with constant coefficients
15. Linear differential equations of second order with constant and variable coefficients
16. Homogeneous equations of Euler type-reducible to homogeneous form-Method of variation of parameters.
17. **Final Practical Examination**

TEXT BOOKS:

1. Veerarajan, T., "Engineering Mathematics (for First Year)," Second Edition, Tata McGraw-Hill Pub. Co. Ltd., New Delhi, 2006.
2. Venkataraman, M.K., "Engineering Mathematics, Volume I," 40th Edition, The National Pub. Co., Chennai, 2003.

REFERENCE BOOKS:

1. Kreyszig, E., "Advanced Engineering Mathematics," Eighth Edition, John Wiley and Sons (Asia) Ltd., Singapore, 2007.
2. Narayanan, S., Manicavachagom Pillay, T.K. and Ramaniah, G., "Advanced Mathematics for Engineering Students ". Volumes I and III, S. Viswanathan (Printers and Publishers) Pvt. Ltd., Chennai, 2002.

E-Journals:

http://www.math.neu.edu/~Suciu/journals.html

E-Reference:

www.mathworld.com
http://en.wikipedia.org/wiki/Portal:Mathematics
http://www.sosmath.com/

COM 101 Introduction to Computer Technology (2+1)

THEORY

UNIT I – Introduction to Computers and Operating Systems

Computer System – Hardware: Input devices, Output devices – Software : System Software - Application Software - Utility Software - Virus: Types of virus – virus preventive and corrective measures - Operating System: Building blocks of a generic Operating System – Types of Operating System - Introduction to Windows Operating System 7.

UNIT II - Office Automation

Introduction to Microsoft Office Suite 2010

Microsoft Word 2010: Menu Bar – Standard Toolbar: create, edit, format, print a document – Status Bar.

Microsoft Excel 2010: Worksheet Manipulation: create – insert – delete – cell manipulation – Mathematical & Trigonometry Functions: sum( ), exp( ), abs( ), sqrt( ), ceiling( ), floor( ), sin( ), cos( ), tan( ) – Statistical Functions: average( ), count( ), max( ), min( ), median( ), mode( ), stdev( ), var( ) – Charts: Generate Bar and Pie charts .

Microsoft PowerPoint 2010: Views - Slide Layout - Slide Design – Create presentation – Slide show – Animation

Microsoft Access 2010: Database - Table Creation – Insert – Delete - Update.

Introduction to Open Source office automation software.

UNIT III – Programming in C

Programming in C - C Compiler - Compilation and Execution - Structure of a C program - Data types – Constants and variables – Operators: Arithmetic operators, Relational operators, Logical operators, Increment & Decrement operators – Input and Output statements - Decision making and branching statements, Looping statements.

Unit IV : Array Handling and String Handling

Overview of C – Arrays - Single dimensional array - Two dimensional array – Multi dimensional arrays -Enumerated data types - User defined types. Handling of character strings: Declaring and initializing string variables - Reading strings from terminal – Writing strings to screen- Arithmetic operations on characters – putting strings together – comparison of two strings – string handling functions

Unit V : Functions, Structures, Pointers and File Management in C

General form of Functions – Function arguments – call by value, call by reference- return statement. Structures – array of structures. Understanding pointers –Accessing the address of a variable – Declaring and initializing pointers – pointer expressions - Defining and opening a file - closing a file - Input and output operations on file - Error handling during I/O operations – File Organization - sequential files – random access files – indexed sequential files in C – command line arguments.

PRACTICALS

Computer innards: CPU, RAM, ROM, Hard Disk Drive, Display, Keyboard and Mouse.

Operating system: Exploring Windows 7 Desktop Environment – Viruses.

Microsoft Word 2010 – Document creation – Formatting a document

Microsoft Excel - Creation of worksheets, insertion of worksheets, rows and columns - Microsoft Excel 2010 - Arithmetic operations in Formula bar, Charts – Bar chart and Pie chart

Microsoft PowerPoint 2010 – Creating presentation – Slide show and Animation.

C program to print the formatted text – C program to perform basic arithmetic operations

using decision making, branching and looping – multiple arrays. Matrix multiplication – computation of variance covariance matrix. Computation of correlation and regression – testing independence of attributes using chi- square test. Creating file – storing data and retrieving data from files.

LECTURE SCHEDULE

1. Computer System – Hardware : Input devices, Output devices
2. Software : System Software - Application Software - Utility Software
3. Virus: Types of virus – virus preventive and corrective measures
4. Operating System: Building blocks of a generic Operating System – Types of Operating System
5. Introduction to Windows Operating System 7.
6. Introduction to Microsoft Office Suite 2010
7. Microsoft Word 2010: Menu Bar – Standard Toolbar: create, edit, format, print a document – Status Bar.
8. Microsoft Excel 2010: Worksheet Manipulation: create – insert – delete – cell manipulation
9. Mathematical & Trigonometry Functions: sum( ), exp( ), abs( ), sqrt( ), ceiling( ), floor( ), sin( ), cos( ), tan( )
10. Statistical Functions: average( ), count( ), max( ), min( ), median( ), mode( ), stdev( ), var( )
11. Charts: Generate Bar and Pie charts
12. Microsoft PowerPoint 2010: Views - Slide Layout - Slide Design – Create presentation – Slide show
13. Animation
14. Microsoft Access 2010: Database - Table Creation – Insert – Delete - Update.
15. Introduction to Open Source office automation software.
16. Programming in C - C Compiler - Compilation and Execution - Structure of a C program
17. **Mid semester examination**
18. Data types – Constants and variables
19. Operators: Arithmetic operators, Relational operators, Logical operators, Increment & Decrement operators – Input and Output statements
20. Decision making and branching statements
21. Looping statements.
22. Overview of C – Arrays - Single dimensional array
23. Two dimensional array -Multi dimensional arrays
24. Enumerated data types - User defined types.
25. Handling of character strings: Declaring and initializing string variables - Reading strings from terminal – Writing strings to screen- Arithmetic operations on characters
26. putting strings together – comparison of two strings – string handling functions
27. General form of Functions – Function arguments
28. call by value, call by reference- return statement.
29. Structures – array of structures.
30. Understanding pointers –Accessing the address of a variable
31. Declaring and initializing pointers – pointer expressions
32. Defining and opening a file - closing a file - Input and output operations on file
33. Error handling during I/O operations
34. File Organization - sequential files – random access files – indexed sequential files in C - command line arguments.

PRACTICAL SCHEDULE

1. Keying practice using online/offline keyboard tutor software
2. Working with MS Windows 7 Desktop , explore - Search, Control panel, Devices, Help & Support in the Startup Menu
3. Microsoft Windows 7 – Exploring Snipping tool & Math Input panel
4. Creating and formatting a document using Microsoft Word 2010.
5. Microsoft Excel 2010 - Cell manipulation using arithmetic operation- charts: bar chart, pie chart
6. Creating a sample presentation, exploring Slide show and Animation using Microsoft PowerPoint 2010.
7. Table creation, deletion and updation using Microsoft Access 2010.
8. Write a C program to print a formatted text.
9. Write a C program to perform basic arithmetic operations.
10. Program to compute grades based on marks using decision making
11. Conversion of number into words using branching and looping
12. Program to check the given string is palindrome.
13. Matrix multiplication
14. Computation of correlation and regression
15. Creating sequential and random access files
16. Storing data and retrieving data from files
17. **Final practical examination.**

TEXT BOOKS

1. Sanjay Saxena, A First Course in Computers, 2003 Edition, Vikas Publishing House Private Limited.
2. Balagurusamy, E., Programming in ANSI C, Fourth Edition, Tata McGraw Hill.

REFERENCES

1. Ramesh Babu and Samyuktha, Computer Practice – I, V.R.B. Publications.
2. Brian W. Kerighan and Dennis M. Ritchie, C Programming Language. Prentice Hall of India, New Delhi.

E-REFERENCE

1. http://www.grassrootsdesign.com/intro/
2. http:// office.microsoft.com/en-in/
3. http://www.exforsys.com/tutorials/c-language

PHY 101 ENGINEERING PHYSICS (2+1)

THEORY

Unit I

Elasticity – twisting of a cylinder – torsional pendulum - viscosity – viscosity of a fluid – Oswald's viscometer. Surface tension – variation with temperature. Gravitation – gravitational constant – Seismic waves - detection and forewarning.

Ultrasonic – production, deduction and application – Industrial applications: Drilling, welding, soldering, cleaning- Non destructive testing. Acoustics – requisites of a good auditorium.

Cryogenics – joule Kelvin effect – porous plug experiment – liquefactions of gases – adiabatic demagnetization – transmission of heat – thermal conductivity – Lee's method thermal conductivity of rubber tubing.

Unit II

Diffraction – principle of zone plate – diffraction at a single slit - resolving power – polarization - double refraction - quarter wave plates – elliptically and circularly polarizes light – polarimeter and its applications – laser technology –He – Ne laser – Solid state Laser- Fiber optics - basic principles- classification of optical fibers based on materials - number of modes and refractive index profile - step index fiber and graded index fiber- doped fibers as amplifiers- optical communication using fibers – Waves and oscillations

Unit III

Dielectric properties- qualitative study of various types of polarization- effect of temperature and frequency on dielectric constant- dielectric loss- ferroelectric materials - classification of ferro electric materials - applications of ferro electric and piezoelectric materials - classification of insulating materials. Nano technology – basics – nano materials – applications

Unit IV

Electrical properties of metals - Drude Lorentz theory of electrical conduction - Thermal conductivity Weidmann Franz Jaw - band theory of solids - Distinction between conductors, semiconductor and insulator based on band theory - Factors affecting resistively of metals: temperature, alloying, magnetic field and strain. Applications of conductor: strain gauges, transmission line contact materials, precision resistors, heating element and resistance thermometers.

Unit V

Atomic physics – DeBrogle's matter waves – Electron microscope (Scanning) - solid state physics – crystal structure analysis by X-ray diffraction, Braggs Law. Laue and powder methods – origin of X-rays –Characteristic X –Ray- Mosley's law and applications

PRACTICAL

Surface tension of liquids – coefficient of viscosity of liquids – Young's modulus of a rectangular bar – rigidity modulus of a cylindrical wire – specific heat of a liquid – thermal conductivity of a bad conductor – refractive index of a glass prism and liquid – wave length of mercury spectrum – Newton's rings experiment – polarimeter experiment – resolving power of a telescope – Polarimeter- Emissivity of a surface – spherical calorimeter-Thermal conductivity of rubber tubing.

LECTURE SCHEDULE

1. Elasticity – introduction – modulus of elasticity – Poisson's ratio - twisting of a cylinder and expression for torsional rigidity – torsional pendulum
2. Viscosity of fluids - relation between viscosity of gases and kinetic theory
3. Surface tension – introduction – relation between surface tension and surface energy - study of variation of surface tension with temperature and impurities
4. Gravitation - gravitational constant - seismic waves - deduction and fore warming
5. Ultrasonic – introduction – production of ultrasonic waves by magnetostriction oscillator and Piezo – electric oscillator methods – detection by different methods and industrial applications
6. Acoustics – introduction – reverberation – reverberation time - requisites for good acoustics (good auditoria)
7. Cryogenics – introduction – Joule – Kelvin effect — theory of porous plug experiment
8. Boyle temperature – critical constants – liquefaction of gases like oxygen, nitrogen, hydrogen and helium by different process
9. Transmission of heat – introduction to thermal conductivity – rectilinear flow and radial flow- spherical and cylindrical flow of heat – solved examples
10. Thermal conductivity of bad conductors by Lee's method and Lee's and Charlton methods – thermal diffusivity – rubber tubing by cylindrical flow of heat method -solved examples
11. Diffraction – Fresnel's assumptions – theory of rectilinear propagation of light
12. Resolving power of optical instruments and Raleigh's criterion for resolution
13. Expression for resolving power of microscope and telescope – polarization –double refraction / quarter and half wave plates
14. Elliptically and circularly polarized light – principle of polarimeter and its applications
15. Principles of Helium – Neon gas laser and solid state laser- applications of laser
16. Fiber optics - basic principles- classification of optical fibers based on materials
17. **Mid semester examination**
18. Refractive index profile - step index fiber and graded index fiber- doped fibers as amplifiers
19. Optical communication using fibers – Waves and oscillations
20. Dielectric properties- qualitative study of various types of polarisation
21. Effect of temperature and frequency on dielectric constant- dielectric loss
22. Ferroelectric materials - classification of ferro electric materials
23. Applications of ferro electric and piezoelectric materials
24. Classification of insulating materials -Nano technology – basics – nano materials – applications
25. Drude Lorentz theory of electrical conduction - thermal conductivity -Weidmann Franz Jaw - band theory of solids
26. Distinction between conductors, semiconductor and insulator based on band theory
27. Factors affecting resistively of metals: temperature, alloying, magnetic field and strain
28. Applications of conductors
29. Strain gauges, transmission line contact materials, precision resistors, heating element and resistance thermometers
30. Atomic physics – Concepts of DeBrogle's matter waves – properties of matter waves – working principles of Davisson – Germer experiments- G.P. Thomson experiment -Scanning electron microscope
31. x-rays – origin of x –types — Characteristic x rays

32. Continuous x-ray spectrum and line x-ray spectrum – properties and applications of x-rays
33. Solid state physics –Bragg's law – crystal structure determination by power method- Laue method
34. Importance of Mosley's law and its applications

PRACTICAL SCHEDULE

1. Viscosity of liquid by Poiseullie's flow method/Stoke's method
2. Young's modulus of a rectangular bar by non-uniform bending method
3. Young's modulus of a rectangular bar by uniform bending method
4. Rigidity modulus of a cylindrical wire by dynamic oscillations method
5. Verification of Newton's law of cooling and specific heat of liquid
6. Thermal conductivity of bad conductor by Lee's method
7. Refractive index of solid prism using spectrometer
8. Wave length of prominent lines of mercury spectrum using a plane transmission grating
9. Radius of curvature of a lens by Newton's tings experiment
10. Specific rotatory power of sugar solution using polarimeter
11. Resolving power of a telescope
12. Polarimeter
13. Emissivity of a surface - spherical calorimeter
14. Thermal conductivity of rubber tubing
15. Visit to Radio astronomy centre Ooty
16. Visit to BHEL Laboratory Bangalore
17. **Final practical examination.**

REFERENCE BOOKS

1. Brijlal and N. Subramanyam, 1995. Properties of matter. Eumasia publishing house pvt. Ltd., Ram Nagar, New Delhi.
2. Brijlal and N. Subramanyam, 1995. Heat and Thermodynamics, Eumasia publishing house pvt. Ltd., Ram Nagar, New Delhi.
3. Brijlal and N. Subramanyam, 2001. Textbook of optics. S. Chand and Co., Ram Nagar, New Delhi.
4. Gerd Keiser, 1997 "Optical Fiber Communications", McGraw Hill Co.
5. Srivastsava C. M and Srinivasan C, 1998 "Science of Engineering Materials", New Age International (P) Ltd.
6. Chih tang sah, Fundamentals of solid state electronics (1997), World scientific
7. Dekkar A. J. "Electrical Engineering Materials", Prentice Hall of India, 1980.
8. Advanced level Physics, (1995) Nelkon & Parker, Longman International Education
9. Saxena,Guptha and Sexena, Solid State Physics (2004), Pragati Prakashan(India)
10. Brijlal and N. Subramanyam, 1990. Magnetism and electricity. S. Chand and Co., Ram Nagar, New Delhi
11. Theraja. BL 1996, Modern Physics. New Age International Limited
12. Nelkon & Parker, 1995 Advanced level Physics Longman International Education

E- REFERENCES

1. www.amazon.com/Science-Projects-About-Properties-Matter/dp/0766021289 - 101k - 16 Apr 2007
2. www.amazon.com/Thermodynamic-Properties-Cryogenic-International-Cryogenics/dp/0306455226 - 108k
3. www.amazon.com/Principles-Physical-Optics-Historical-Philosophical/dp/0486495590 - 95k
4. www.amazon.com/Low-Dielectric-Constant-Materials-Applications/dp/3540678190 - 119k

5. www.amazon.com/Low-Dielectric-Constant-Materials-Applications/dp/3540678190 - 119k
6. www.diesel-ebooks.com/cgi-in/item/047002643X/Superconductivity-Physics-and-Applications-eBook.html - 47k

SAC 101 PRINCIPLES OF ANALYTICAL CHEMISTRY (1+1)

Syllabus-Theory

Unit-I

General principles of analytical chemistry – common analytical methods – qualitative and quantitative analysis – accuracy and precision of analytical results- Preparation of laboratory reagents.

Unit-II

Volumetric analysis – preparation of primary and secondary standards – standardization. Theory of indicators and buffers – acidimetry, alkalimetry, oxidimetry, complexometry and thio-cyanometry.

Unit-III

Gravimetric analysis – principles of precipitation reactions– solubility product – common ion effect – conditions of precipitation – – choice of filters -washing solutions.

Unit-IV

Instrumental analysis – principles and practices of potentiometry, conductometry, colorimetry, spectrophotometry, absorption and emission spectroscopy and chromatography – choice of analytical methods.

Unit-V

Radiation chemistry – radio activity – radiation decay, detection and measurements - radiological safety – stable isotopes – mass spectroscopy- use of radio active and stable isotopes in agriculture.

Syllabus -Practicals

Analytical techniques and concepts – Gravimetry – Volumetry- Acidimetry - Alkalimetry– Permanganimetry – Dichrometry - Iodimetry, Complexometry - Potentiometry – Conductometry - Colorimetry - Spectrophotometry –Turbidimetry – Flame Photometry - Atomic absorption spectrophotometry- Radioactivity.

Lecture schedule

1. General principles in analytical chemistry – common analytical methods – quantitative and qualitative analysis –Accuracy and precision of analytical results.
2. Preparation of laboratory reagents – digestion and distillation techniques.
3. Volumetric analysis – preparation of primary standard solutions.
4. Volumetric analysis – preparation of primary and secondary standard solutions – standardization.
5. Theory of indicators and buffers. Preparation of indicator and buffer solutions.
6. Theory of acidimetry, alkalimetry, oxidometry, complexometry and thiocyanometry – titration curve.
7. Gravimetric analysis – Principles – techniques.
8. Precipitation – solubility product – commonion effect – conditions of precipitation.
9. Mid semester examination
10. Filtration and choice of filters – washing – washing solutions and washing technique.
11. Instrumental methods of analysis- Principles and practices of potentiometry, conductometry, colorimetry & spectrophotometry.
12. Principles and practices of absorption and emission spectroscopy

13. Principles and practices of chromatography – Paper chromatography, Gas Chromatography, TLC ,HPLC and HPTLC.
14. Radiation chemistry – radio activity.
15. Radiation – detection and measurement of radio activity – radiological safety.
16. Stable isotopes – Mass spectroscopic measurements and their application in agricultural research.
17. Use of radioactive and stable isotopes in analytical applications.

Practical Schedule

1. Study of common laboratory glassware and apparatus - do's and don'ts in the laboratory- Part - I
2. Study of common laboratory glassware and apparatus - do's and don'ts in the laboratory- Part - II
3. Principles of Gravimetry and Moisture estimation.
4. Volumetric analysis – Preparation of primary , secondary standards and indicators
5. Acidimetry – Standardization of bases
6. Alkalimetry – Standardization of acids
7. Permanganimetry – Standardization of KMnO4
8. Dichrometry - Standardization of Ferrous Sulphate
9. Iodimetry - Estimation of Copper
10. Complexometry - Estimation of Calcium and Magnesium
11. Potentiometry and Conductometry - Determination of pH and EC
12. Spectrophotometry - Determination of phosphorus in matrices
13. Turbidimetry - Estimation of Sulphur
14. Flame Photometry - Estimation of Potassium
15. Absorption spectrophotometry – Estimation of Fe / Zn / Mn / Cu
16. Detection and measurement of radioactivity using Geiger Muller (GM) Counter

Practical Examination

References

1. Hessee, P.R. 1971.A Text book of Soil Chemical Analysis. John Murray (Publishers) Ltd. London.
2. Jackson, M.L. 1973.Soil Chemical Analysis. Prentice Hall Pvt.Ltd
3. *Piper*, C.S 1942. Soil and plant analysis: Interscience *Publishers*, New York.
4. Gupta A.K. and Varshney M.L., 1989. Practical manual for Agricultural Chemistry – Kalyani Publishers, New Delhi.
5. Hamilton I.F. and Simpson G.S.G., 1964. Quantitative Chemical Analysis – The Mc Millan Co., New York.
6. Keith A. Smith, 1983. Soil Analysis – Instrumental Techniques and Related Procedures, New York.
7. Kreshkov A.P. and Yaroslavtsev, 1977. Course of Analytical Chemistry Vol.II. Quantitative Analysis – Mir Publishers, Moscow.
8. Sankaram, A. 1966. A Laboratory Manual for Agricultural Chemistry – Asia Publishing House, Bombay.

E-references

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2. http://www.scribd.com/doc/30296831/Instant-Notes-in-Analytical-Chemistry
3. http://sndt.digitaluniversity.ac/downloads/syllabus_M.Sc.pdf
4. http://www-pub.iaea.org/MTCD/publications/PDF/TCS-18_web.pdf
5. http://nzic.org.nz/ChemProcesses/analysis/15B.pdf
6. http://www.tutornext.com/ws/rock-type-chart

ENG 101 ENGLISH FOR EFFECTIVE COMMUNICATION (0 +1)

Syllabus-Theory

UNIT I: Listening Skill

Introduction to listening, - kinds of listening, process of listening, - listening mechanism - listening TOEFL, IELTS, BEC

UNIT II: Reading Skill

Reading: skimming, scanning,SQ3R, intensive reading, extensive reading, critical reading, Cloze texts for integrated grammar and vocabulary, including subtle differences between synonyms, Reading comprehension texts for civil service exams, Bank P.O. exams, IELTS, TOEFLL and GRE

UNIT III: Speaking Skill

English phonemes – stress, intonation and rhythm - genres of speaking, techniques of speaking – public speaking (welcome address, vote of thanks, extempore talk)

UNIT IV: Writing Skill

Mechanics of writing, writing genres, five types of writing, précis paragraph writing, Essay writing- issue- based writing and argument based writing

UNIT V: Integrated Skills

Note-taking, note- making, summarizing, brainstorming and simulation

The practical class schedule for the revised English course is as follows:

1. Introduction to listening - kinds of listening and process of listening
2. English phonemes
3. Stress , intonation , pitch & rhythm
4. Introduction to speaking skill - dialogue & monologue
5. Reading strategies – skimming and scanning -Critical reading
6. Introduction to writing – basic grammar in writing
7. genre - mechanics of writing
8. Welcome address, vote of thanks, and extempore talk
9. **Mid-semester Examination**
10. Listening comprehension and reading comprehension – (five levels of comprehension viz., factual , inferential, referential , global and attitudinal)
11. Cloze texts - grammar and vocabulary in discourse
12. Listening cloze & Reading cloze
13. Brainstorming, simulation for integrated skills
14. paragraph writing and essay writing
15. Précis writing and summarizing
16. integrated skills: SQ3R, factual writing & summarizing note taking, note making
17. Orientation to TOEFL. IELTS & BEC.
18. **Final Practical Exam**

References:

Peter Roach(2009): English phonetics and phonology, A practical Course: (Fourth edition).CUP. U.K

Steven Brown&Dorokyn Smith (2006)-Active Listening: CUP U.K

Christian Evans Carter (2010)Mindscapes: Critical Reading Skills: Wadswoth publishing company. Belmont, Calif. USA

Kory Floid(2008) Interpersonal Communication: the Whole Story Tata McGraw Hill Publishers.
John Langan(2007):College Writing Skills with Readings Tata McGraw Hill Pub. USA
Hariharan.S,(2003)English for Agriculture and Allied Sciences: Orient Longman, Hyderabad)
Interactive software on Effective Communication. Leasrning to Communicate. TOEFL Books pyblished by Orient Longman and Cambridge University Press

Web sources:

www.esl--lab.com
www.eflweb.com
www.teachingenglish.org.uk
www.eaays.com
www.onestopenglish.com

AGR 121 PRODUCTION TECHOLOGY OF FIELD CROPS (1+1)

THEORY

Unit I: Principles of agronomy

Definition of agriculture and agronomy – Factors affecting crop growth – climate and weather parameters – Soil fertility and productivity – tillage and tilth - objective and principles – different kinds of tillage

Unit II: Agronomic inputs, cropping system

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 – I

Package of practices for important field crops – rice, maize, pulses – black gram, green gram and red gram - oilseeds - soybean, groundnut and sunflower

Unit IV: Agronomy of field crops – II

Package of practices of cotton, Sugarcane, biofuel crops - Jatropa, sweet sorghum and sugar beet

LECTURE SCHEDULE

1. Definition of agriculture and agronomy – art, science and business of crop production.
2. Factors affecting crop growth - climate and weather parameters affecting crop production
3. Soil fertility and productivity, Tillage and tilth – objectives, principles, kinds of tillage
4. Seeds and seed treatment, sowing / planting methods – crop geometry
5. Manures and fertilizers – source, nutrient contents – bio fertilizers – application methods
6. Irrigation techniques for different soils and crops
7. Weeds – classification of weeds, principles and methods of weed management
8. **Mid semester examination**
9. Cropping systems – monoculture, inter, mixed, relay, strip, multiple and multitier cropping - advantages and limitations
10. Package of practices for transplanted rice – Conventional and SRI methods
11. Package of practices for direct seeded, semidry and rainfed rice
12. Package of practices for Maize
13. Package of practices for black gram, green gram and red gram
14. Package of practices for soy bean, groundnut and sunflower
15. Package of practices for cotton
16. Package of practices for Sugarcane
17. Package of practices for biofuel crops; Jatropa, sweet sorghum and sugar beet

PRACTICAL SCHEDULE

1. Acquiring skill on the organizational set up of the agricultural farm
2. Identification of different crops in the crop cafeteria
3. Identification of seeds, manures and fertilizers
3. Visit to wet land to learn important cropping systems and Hi Tech nursery
4. Visit to irrigated dryland to learn irrigated dryland cropping systems and irrigation methods
5. Visit to dryland farm to learn dryland cropping systems
6. Visit to NPRC, Vamban to learn about pulses and pulses based cropping systems
7. Visit to SWMRI, Thanjavur to learn about important Rice based cropping systems
8. Working out seed rate for different field crops
9. Working out fertilizer schedule for major crops of wet, garden and dry land
10. Identification of meteorological instruments
11. Identification of farm tools and implements
12. Identification of implements for primary and secondary tillage
13. Practicing different methods of seed treatment, sowing and planting
14. Visit to SRS, Sirugamani to observe and learn about sugarcane crop
15. A visit to ADAC&RI, Trichy to learn about problem soils management
16. Observing crop biometrics in field crops and estimation of yield
17. **Practical examination**

REFERENCE BOOKS

1. Palaniappan, S.P and S. Sivaraman, 1998 (2nd edition) "Cropping systems in the tropics principles and management", New Age international publishers, New Delhi.
2. Sankaran, s. and V.T Subbaiah Mudaliar, 1993. “Principles of Agronomy". The Bangalore printing and pub co. Bangalaore.
3. Balasubramain, P and SP. Palniappan 2001. "Principles and Practices of Agronomy" Agrobios publishers, Ludhiana.
4. Yellamanda Reddy. T and G.H Sankara Reddi. 2005. "Principles of Agronomy", Kalyani publishers, Ludhiana.
5. Chandrasekaran, B. , K. Annadurai and E. Somasundaram, 2007. A Text book of Agronomy. Scientific publishers, Jodhpur

E-REFERENCE

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http://sugarcane-bredding.tn.nic.in
http:// icargoa.res.in
http:// reap - Canada.com

FMP 101 MANUFACTURING PROCESSES (2+1)

HEORY

Unit-I: Properties of metals

Engineering materials - Property definitions– Iron-carbon equilibrium diagram- Ferrous metals and alloys, Non Ferrous metals and alloys – manufacturing processes and properties. Heat treatment of steels – purpose and method of heat treatment. Annealing, normalizing- hardening- tempering- surface hardening.

Unit-II: Forming and welding process.

Mechanical working of metals - hot working processes – hot rolling- hot forging- spinning- extrusion- drawing-piercing. Cold working processes -Cold rolling- shot peening. Smithy and forging operations- types. Welding process - arc welding – Polarity – Types- electrodes. Gas welding –gas flames- gas welding technique –gas cutting of metals. Sheet metal work – tools.

Unit-III: Moulding and casting process –

Pattern making – pattern materials- Types of pattern – core boxes- core prints Foundry – moulding tools - moulding sand- Properties- Moulding- moulding materials- types of moulds- methods of moulding. Special casting process – permanent moulding- slush casting- die casting- centrifugal casting- investment casting- shell moulding – continuous casting.

Unit-IV: Machining process

Lathe - principal parts – types – working principles -basic operations – lathe accessories-. Drilling machine, shaper, planer- principal parts-working principle- operations-. Grinding machine, milling machine, principal parts – types - basic operations.

Unit-V: Advanced Manufacturing process

Manufacturing process for plastics -compression moulding- transfer moulding- injection moulding -jet moulding and blow moulding- Calendaring-casting- slush casting- laminating-. Joining. Modern machining methods, Electro discharge machining (EDM), wire cut Electro discharge machining (WEDM), advantages and limitations. Advanced manufacturing technologies.

PRACTICAL

Carpentry tools, handling, operation, wood cutting, sizing, planning, shaping. Practice in making joints, half lap, open mortise, tenon and mortise, finishing. Fitting tools, handling, operation, bench work, job holding devices. Practice in filing, making joints ,L and square, joints. Lathe, operation, practice in facing, plain turning and thread cutting. Arc welding, striking the arc. Practice in welding joints, butt, lap. Gas welding and cutting. Practice in making joints. Shaper operation. Practice in machining grooves. Milling machine operation, tool mounting. Practice in key way milling. Drilling machine, operations. Practice in drilling and boring. Grinding machine. Practice in grinding operation.

LECTURE SCHEDULE:

1. Introduction to properties of metals – Mechanical properties of metals
2. Ferrous metals and alloys – properties - Pig iron, cast iron, wrought iron. Steel making processes.
3. Allotropic forms of iron, iron -carbon equilibrium diagram
4. Fundamentals of alloys – structure of solids - grain formation- deformation of metals metal alloys – solidification of metals.
5. Non ferrous metals and alloys – properties.
6. Heat treatment of metals and alloys, importance, types of heat treatment processes- annealing, normalising, hardening and tempering.
7. Heat treatment processes, carburising, cyaniding, nitriding, induction hardening, flame hardening, precipitation hardening.
8. Mechanical working of metals-hot working processes. rolling, Forging, piercing, drawing, spinning and Extruding.
9. Cold working processes, rolling, forging, spinning, drawing, peening and bending.
10. Welding process, classification, advantages, application. Arc welding, principles, equipment, welding joints, weld positions, polarity, electrodes, types.
11. Arc welding processes, Carbon arc, Metal inert gas welding (MIG) and Tungsten inert gas welding (TIG), Atomic hydrogen welding.
12. Arc welding processes, submerged arc, flux cored, stud, plasma arc and electro slag welding and thermit welding.
13. Resistance welding, types, spot, seam, projection, percussion and upset welding.
14. Gas welding, principles, equipment, techniques, types of flames and gas cutting.
15. Braze welding, soldering, weld defects.
16. Modern welding processes, electron beam welding, Laser beam welding, applications, limitations.
17. **Mid semester examination**
18. Forging processes, types, forgeability, smith forging operations.
19. Pattern making – pattern materials – pattern making. tools – allowance. Types of pattern – core boxes – core points – colour coding for pattern.
20. Moulding, materials, moulding sand, properties, classification of moulding sand.

21. Moulding processes, types of moulds, methods of moulding.
22. Special casting processes, permanent mould casting, slush casting, die casting, centrifugal casting, Investment casting and shell moulding process.
23. Sheet metal work, metals used in sheet metal work, sheet metal tools.
24. Sheet metal operations, marking, cutting, notching, bending, riveting, soldering, folding edges, seam making, hollowing, sinking, raising, planishing operations.
25. Fabrication of plastics, compression moulding, transfer moulding, injection moulding, jet moulding and blow moulding.
26. Lathe functions, principal parts, types of lathe, tools used, Mechanism of lathe.
27. Basic operations performed on lathe
28. Shaper, principal parts, operation.
29. Planer, principal parts, operation
30. Drilling machine, principal parts, types, tools used, operations.
31. Grinding, kinds of grinding, grinding machines.
32. Milling machine, types, principal parts, tool used, basic operations.
33. Modern machining methods, Electro discharge machining (EDM), wire cut Electro discharge machining (WEDM), advantages and limitations.
34. Advanced manufacturing technologies, Group technology, Robotics, automation, Flexible manufacturing system.

PRACTICAL SCHEDULE

1. Identification of carpentry tools & Exercise in planning a wooden block
2. Practice in making a half lap joint
3. Practice in making a tee halving joint
4. Identification of fitting tools & Exercise in filing a metal piece
5. Practice in making a "L" joint
6. Exercise in fitting a square joint
7. Identification of smithy tools and exercise in making a ring.
8. Exercise in making a "S" hook.
9. Visit to foundry and identification of foundry and pattern making tools
10. Identification of arc welding equipments and tools & Exercise in welding a butt joint
11. Identification of gas welding equipment and tools & Exercise in welding a Tee joint
12. Study of lathe and its functional components and Exercise in facing operation
13. Plain and Step turning exercise in lathe
14. Thread cutting exercise on lathe.
15. Practice in drilling and grinding operation
16. Practice in shaping and milling operation
17. **Final practical examination.**

TEXT BOOK

1. Khurmi, R.S. and J.K. Kupta. 2000. A Textbook of workshop Technology. Publication division of NIRJA construction and development Co. (P) Ltd. Ramnagar, New Delhi-110055.
2. Sharma, P.C. 2004. A textbook of Production Technology. S. Chand & Company Ltd. Ram Nagar, New Delhi-110055.

REFERENCE BOOKS

1. Khanna, O.P. 1990. A textbook on welding technology. Dhanpat Rai. New Delhi.
2. Hajra Chowdry, S.K.1986. Elements of Workshop Technology, Vol.I & II. Manufacturing Process. Asian Book Co., New Delhi.
3. Adithan, M. and A.D.Gupta. 2001. Manufacturing technology. New Age International (p) Ltd. Publishers, Chennai.

WEB RESOURCES

www.engineershandbook.com/MfgMethods/casting3.htm
www.moderncasting.com/

www.khake.com/page88.html
www.msm.cam.ac.uk/phase-trans/2001/slides.IB/photo.html
http://www.msm.cam.ac.uk/phase-trans/abstracts/L1-2.pdf
http://web.mit.edu/3.091/www/archives/Notes_6.pdf
http://heberge.univ-tlemcen.dz/~aourag/cours1.doc
http://www.eng.auburn.edu/~wfgale/intro_metals/toc.htm
http://www.nde-ed.org/EducationResources/CommunityCollege/ Materials/Introduction/introduction.htm
http://www.sjsu.edu/faculty/selvaduray/page/phase/binary_p_d.pdf
http://www.virginia.edu/bohr/mse209/class.htm
http://www.technologystudent.com/equip1/equipex1.htm
www.design-technology.info/.../default.htm
http://www.substech.com/dokuwiki/doku.php?id=main_page
www.budgetmachinery.co.uk/.../voumard5a.htm
http://ecow.engr.wisc.edu/cgi-bin/get/ie/415/ceglarek/1lecturenot/

AST 101 ENGINEERING DRAWING (0+1)

SYLLABUS

PRACTICAL

Introduction – drawing Instruments and their uses – lettering and dimensioning – scales and their construction – types of lines - principles of orthographic projections – orthographic projection of points, straight lines planes and solids – sections of solids – Isometric projections – Development of surfaces.

PRACTICAL SCHEDULE

1. Introduction – drawing instruments
2. Types of lines used in Engineering Drawing
3. Thickness and shade of lines – scales
4. Lettering – single stroke letters – Gothic letters – dimensioning
5. Projection – orthographic projection – planes of projection
6. Quadrants – first angle projection – reference planes
7. Projections of points and straight lines
8. **Mid semester examination**
9. Projection of straight lines – different types
10. Line inclined to both the planes – contained by a plane – perpendicular to both the planes
11. Traces of lines
12. Projection of planes – perpendicular planes – oblique planes
13. Projection of planes – parallel to one plane – perpendicular to both the planes perpendicular to one and inclined to the other - Traces of planes
14. Projection of solids - polyhedra
15. Sections of solids – pyramids- development of surfaces
16. Isometric projection – Isometric axis, lines and planes
17. **Final practical examination**

TEXT BOOK

1. Bhatt,N.D., 1996. Elementary Engineering Drawing, Chartor Book Stall

REFERENCE BOOKS

1. Venugopal.K. 2001. Engineering drawing and graphics with Auto CAD, New age International (p) Ltd., publishers, New Delhi – 110 002.
2. Natarajan,K.V. 1999. A text book on Engineering Drawing + Auto CAD, Dhanalakshmi Publications, Chennai.
3. Jaypoovan,T. 2001. Engineering Drawing with Auto CAD 2000, Vikas Publishing House Pvt. Ltd., New Delhi – 110 014.
4. Narayana, K.N. and Kannaiah,P. 2000. Textbook on Engineering Drawing, Scitech Publications, Chennai – 600 017.

SWE 101 GEOLOGY AND SOIL MECHANICS (2+1)

THEORY

Unit I – Geology

Geology-Earth Evolution and composition-Petrology- Rock cycle-Rock formation, nature and classification -Igneous rocks, Sedimentary rocks and metamorphic rocks- Physical properties of minerals-Structural Geology-fold, strike, dip, fault and joints.

Unit II – Engineering properties of soil

Introduction to Soil mechanics - Physical characteristics of soil –soil texture-Particle size distribution – Sieve analysis –Grain size distribution curves - Sedimentation analysis – Stoke's law – assumptions – validity- soil structure –types- Soil phase relationship, mass–volume relationship, weight – volume relationship - Index properties of soils –determination of specific gravity – soil water-Soil Classification – field identification – soil consistency - Atterberg limits - liquid limit, plastic limit and shrinkage limit-Relative density of cohesionless soils.

Unit III – Permeability

Permeability - Darcy's law-discharge velocity – validity of Darcy's law- seepage velocity - Factors affecting permeability - Hydraulics of laminar flow through soils-Seepage - Drainage - Flow net construction-characteristics.

Unit IV – Compaction

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

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 - Stability of slopes - Stability of earthen embankments - Bearing capacity of soils – testing the bearing capacity of soils – method of improving the bearing capacity of soils.

PRACTICAL

Determination of Field Density by Core cutter and Sand Replacement methods-Mechanical analysis of Soil Sieving-Hydrometer analysis for Grain Size Distribution-Determination of Atterberg's Limits of Soil Consistency-Determination of Hydraulic Conductivity by Constant Permeameter-Variable Head Permeameter-Field method of determination of Coefficient of Permeability-Proctor Compaction test of soils-Consolidation test of soils-Direct Shear Test-Vane Shear Test of soils-Problems on Weight - Volume Relationships- Permeability- Compaction and Compressibility - Bearing Capacity- Field visit for Landslides areas and control measures

LECTURE SCHEDULE:

1. Geology-Earth Evolution and composition
2. Petrology- Rock cycle-Rock formation
3. Nature and classification -Igneous rocks
4. Sedimentary rocks and metamorphic rocks.
5. Physical properties of minerals.
6. Structural Geology-fold, strike
7. Dip, fault and joints.
8. Introduction to Soil mechanics - Physical characteristics of soil.
9. Soil texture-types of soil texture.
10. Particle size distribution-Sieve analysis
11. Grain size distribution curves
12. Sedimentation analysis – Stoke's law – assumptions – validity.
13. Soil structure –types- Soil phase relationship

14. Mass–volume relationship, weight – volume relationship.
15. Index properties of soils –determination of specific gravity – soil water.
16. Soil Classification – field identification.
17. Mid semester examination
18. Soil consistency - Atterberg limits - liquid limit, plastic limit and shrinkage limit.
19. Relative density of cohesionless soils.
20. Permeability, Darcy's law-discharge velocity – validity of Darcy's law.
21. Seepage velocity - Factors affecting permeability.
22. Hydraulics of laminar flow through soils.
23. Seepage - drainage.
24. Flow net construction and characteristics.
25. Compaction – objectives -relationship with water content
26. The standard proctor compaction test –factors affecting compaction.
27. Methods of compaction in field -Compressibility -coefficient of Compressibility.
28. Consolidation of soils –stages of consolidation.
29. Shear strength –concept of shearing resistance and shearing strength.
30. Coulomb's law - Mohr's circle of stresses.
31. Earth pressure at rest - active pressure - passive pressure.
32. Stability of slopes - Stability of earthen embankments.
33. Bearing capacity of soils – testing the bearing capacity of soils.
34. Method of improving the bearing capacity of soils.

PRACTICAL SCHEDULE:

1. Determination of field density by core cutter.
2. Determination of field density by sand replacement methods.
3. Mechanical analysis of soil sieving.
4. Hydrometer analysis for grain size distribution.
5. Determination of Atterberg's limits of soil consistency.
6. Determination of hydraulic conductivity by constant permeameter
7. Determination of hydraulic conductivity by variable head permeameter.
8. Field method of determination of co efficient of permeability.
9. Proctor compaction test of soils.
10. Consolidation test of soils.
11. Direct shear test.
12. Problems on Weight - Volume relationships.
13. Problems on Permeability.
14. Problems on Bearing Capacity of soil.
15. Problems on Compaction and Compressibility.
16. Field visit Landslides areas and control measures
17. **Final Practical Examination.**

Text books

1. Murthy, V.N.S.2006. "*A textbook of Soil Mechanics and Foundation Engineering*", Sri Kripa Technical Consultants, Bangalore.
2. Modi, P.N.2010."*Soil Mechanics and Foundation Engineering*", Rajsons publication, Standard book house, New Delhi.

REFERENCE BOOKS:

1. Bharat Singh, 2006. "*A text book of soil mechanics*", Nem chand and Bros, Roorkee
2. Garg, S.K. 2005. "*Soil mechanics*", Khanna publishers, New Delhi.
3. Sehgal, S.B., 2006."*A text book of soil mechanics*", CBS publishers and Distributors, New Delhi.

4. Verma, B.P .2006."*Problems in soil mechanics and foundation Engineering*" Dhanpat Rai and Sons New Delhi.
5. Punmia, B.C.2004. "*Soil mechanics and foundation*". Laxmi publishers, New Delhi.
6. Duty,B.N.2002 ,Estimating and Costing in Civil Engineering, UBS publishers and distributors Ltd., New Delhi 110002
7. Vazirani V.N and Chandola,2001 Highways and soil engineering ,Khanna publishers,Naisarak, Delhi.110006

Journals of reference

a. ASCE journal of transportation engineering
b. ASCE journal urban planning and development

Web address

i. http://ocw.mit.edu/OcwWeb/Civil-and-Environmental-Engineering/1-361Fall-2004/CourseHome/index.htm
ii. http://www.engineeringcivil.com/theory/highway-engineering

NSS.101 NATIONAL SERVICE SCHEME 0+1

I YEAR

Orientation – NSS origin – motto – symbol – NSS administration at different levels – programme planning – Rural Projects – Urban projects – Government schemes – Career guidance – Self help groups – Environment protection – Use of natural energy – Conventional energy resources – Soil and Water conservation – Community health programmes – Women and child welfare – Education for all – National days – commemorative days – NSS thematic programmes – literacy & computer awareness campaigns.

II YEAR

Popularization of agro techniques – Self employment opportunities – Animal health, Dairy and Poultry farming – Road safety – Training on First aid and emergency cell. Popularization of small savings – communal harmony and National integration – Care of Senior citizens – Personality development – meditation, Yoga Art of living – Activities on the preservation of National monuments, cultural heritage and folklore – special camp activities – National days – commemorative days – NSS thematic progammes – literacy & computer awareness campaigns.

PRACTICAL SCHEDULE

I Semester

1. Orientation of NSS volunteers and programme coordinator and Programme officers.
2. Origin of NSS in India and its development
3. NSS motto, symbol and NSS awards
4. Organizational set up of NSS at Central, State University and college levels.
5. Programme planning – Theme of the year – planning implementation at PC, PO and NSS volunteer level.
6. Visit to selected village - gathering basic data on socio economic status.
7. Participatory rural appraisal – studying the needs of the target group.
8. Visit of urban slum and gathering data on socio economic status.
9. Self involvement and methods of creating rapport with the target group.
10. Awareness campaign on welfare schemes of the central and state government.
11. Formation career guidance group with NSS volunteers and students welfare unit
12. Cycle rally on environmental protection.
13. Campus development activities – clean environment campaign, formation of plastic free zones.

14-16 Campus development, tree planting maintenance and greening the campus cleaning.

17. FINAL EXAMINATION.

II Semester

1–3: Motivation of rural and urban youth for formation of SHG (Self Help Groups) in collaboration with Government machinaries and NGOs.

4. Campaign on ill effects of plastics in the adjoining campus areas – Villages / urban areas.
5. Campaign on *Parthenium* eradication.
6. Cycle rally on air pollution – Vehicle exhaust and other means.
7. Popularization of biogas and smokeless chulah.
8. Demonstration on the use of wind energy and solar energy.
9. Demonstration of water harvesting techniques.
10. Demonstration on soil conservation techniques wherever possible.
11. Campaign on Community health programmes of central and state Government – involving Health department officials.
12. AIDS awareness campaign ; campaign on diabetes and healthy food habits and drug abuse
13. Planning formation of blood donors club – involving NGOs.
14. Campaign on gender equality and women empowerment.
15. Campaign on child health care – immunization, food habits and child labour abolition.

III Semester

1. Conducting field days with KVK to popularize improved agro techniques.
2. Conducing seminar / workshop in a nearby village to motivate the youth on agribusiness (involving DEE, KVK, NGO and local agro-entrepreneurs).

3–5 Campaign on self employment opportunities like Apiculture, mushroom cultivation, Food processing and value addition, production of biocontrol agents and biofertilizers, nursery techniques, seed production, tissue culture, vermicompost, manucacture of small gadgets and agricultural implements as per local needs and feasibility.

6. Animal health care campaign – Dairy and poultry farming - Forage production techniques and silage making.
7. Training the NSS volunteers on road safety measures in involving traffic wardens and RTO.
8. Training NSS volunteers on First AID and emergency call involving NGOs and organizations like St. John's Ambulance, Red Cross, etc.,
9. Organizing Road safety rally.
10. Motivating NSS Volunteers on small savings concept and conveying the message to the public through them.
12. Observation of National integration and communal harmony.

14 – 16 : Campus development and greening activities

16. Examination.

IV Semester

1 – 3 : Visit to orphanages and old age homes to look after their needs.

4. Personality development programmes – Building up self confidence in youth.

5 – 7 : Teaching NSS volunteers on mediation Yoga and art of healthy living with trained teachers

8 – 9 : Visit of nearby National Monument / Places of tourist importance and campaign on cleanliness and preservation.

10–11 : Exploration of hidden talents of village youth and public on folklore, traditional art, sports, martial arts and cultural heritage.

12–13. Campus improvement activities

14–16 : Visit to special camp village and pre camp planning.

17. Examination

- Besides the above NSS volunteers will attend work during important occasions like Convocation, Farmers day, Sports meet and other University / College functions.
- NSS Volunteers will attend one special camp in the selected village for duration of 10 days and undertake various activities based on the need of that village people.

- For all out door regular activities villages / slums nearby the campus may be selected to avoid transport cost (Cyclable distance)
- Special camp activity may be carried out in a village situated within a radius of 15 – 20 Km.

PED 101	PHYSICAL EDUCATION	0+1

PRACTICAL

I Year

Exercises for strength, agility, co-ordination, flexibility, co-operation, vitalcapacity endurance, speed and for various systems of our body and team spirit.

Exercise for Good Posture – Conditioning and calisthenics for various Athletic activities *i.e (*a) Before start – Arm stretch, hand stretch and cat stretch (b) Loosening up jogging, bending and twisting (c) Standing – Lateral Arc, triangle and hands to feet pose (d) Sitting – camel kneel, spinal twist and supine knee bend (e) Relaxation – The corpse pose, quick and deep relaxation.

Basic gymnastic exercises – participation of athletic events – running, throwing and jumping events.

Skill development in anyone of the following games

Warming up, suitable exercise, lead up games, advance skill for all the games.

Basket Ball : Dribbling, pass, two or three men pass, pivot, lay up shot, shooting, pass break, hook pass, screening, positional play, defence and offence tactics.

Volley Ball : Fingering, under arm pass, over head pass, setting, spiking, back pass, jump pass, stunts, elementarty dive, flaying dive, roll, blacking and various types of services.

Ball Badminton : Grip, service, foot work, fore hand stroke, back hand stroke, lob, smash, volley, wall practice, spin service and defence tactics.

Foot ball : Dribbling, passing, dodging, kicking, heading, screening, chest pass, throwing, dragging, goal kick, defence and offence tactics.

Hockey : Grip, bully, dribbling, hitting, drive, push strokes, scoop, flick, stopping, various types of passes, dodging, defence and offience tactics.

Kho-Kho : Quadra ped, bi-ped, how to given kho, taking a direction, recede, parallel toe method, bullet tow method, distal method, foot out, dive, ring game, chains and persue and defence skills.

Chess : Moves, move of king, move of pawns, move of rooks, move of bishops, move of queen, move of knights, en passant, castling, check and notation.

Kabaddi : Raid, touch, cant, catch, struggle, various types of defence and offence tactics.

Cricket : Grip, bowling, spin, leg spin, off spin, medium, batting, dive, sweep, mode of delivery, fielding, rolling etc.

Tennis : Grip, forehand drive, back hand drive, stroke, backhand ground stroke, service, volley, smash, wall practice, foot work, defence and offence tactics.

Table Tennis : Grip, tossing and serving, spin serve, rally, smash, flick, defence and offence tactics.

Shuttle Badminton : Grip, foot work, service, setting, smash, volley, forehand and back hand stroke, back hand serve and defence.

Gymnastics : Balanced walk, execution, floor exercise, tumbling/acrobatics, grip, release, swinging, parallel bar exercise, horizontal bar exercise, flic-flac-walk and pyramids.

ATHLETICS

(a) **Sprint** : Medium start, long start, bunch start, set, pick up, finish, upsweep, downsweep, placement, receiving and exchanging.

(b) **Jumps** : Western roll, belly roll, eastern cut off, fass ferry flop, approach, take off, straddle, hitch-kick, handging, clearance, landing, strides etc.

(c) **Throws** : Grip, momentum, pre shift, sub phase, the wind up, foot work, entry to the turn, shift, angle of release, follow throw, delivery, front cross step, rear cross step, hop step, fuck method pary obraine, discoput, rotation, carry and glide.

(d) **Hurdles** : Finding lead leg, use of lead leg and trial leg, flight, clearing, finish.

Lead up games, advance skills and game for any one of the above games.

II Year

Rules and regulations of anyone of the games and athletic events.

Aims and objectiaves of yoga – asanas : ie. padmasana, pujankasana, sarvangasana, chakrasana,dhanurasana, halasana, mayurasana and savasana, asanas for ailments, back pain, arthritis, abdominal problesm, stress, fatiguel, Insomnia, obsity, circulation, hypertension, varicose veins, respiration, heart, digenstion, headaches, depression, addiction and eye problems.

Mental balance and importance – development of concentration suriyanamaskar – advance skills of any one of the games which were taught in the I semester.

Semester II			
1.	MAT 102	Vector Calculus and Complex Analysis	2+1
2.	COM 102	Programming in C^{++}	1+1
3.	AEC 101	Principles of Agricultural Economics	1+1
4.	HOR 121	Basic Horticulture	1+1
5.	FMP 102	Electrical Engineering	2+1
6.	FMP 103	Thermodynamics	2+1
7.	AST 102	Engineering Mechanics	1+1
8.	FPE 101	Heat and Mass Transfer	1+1
9..	SWE 102	Surveying and Leveling Practice	1+2
Total			**12+10=22**

MAT 102 VECTOR CALCULUS AND COMPLEX ANALYSIS (2+1)

Theory

Unit –I

Multiple Integrals- Double integration – Cartesian and polar coordinates – Change of order of integration – Area as a double integral – Triple integration in Cartesian coordinates – Change of variables between Cartesian and polar coordinates and between Cartesian and cylindrical / spherical polar coordinates.

Unit-II

Vector Calculus- Gradient, divergence and curl – Line, surface and volume integrals – Green's, Gauss divergence and Stoke's theorems (without proof) – Verification of the above theorems and evaluation of integrals using them.

Unit –III

Analytical Functions- Function of a complex variable – Analytic function – Necessary conditions – Cauchy – Riemann equations in Cartesian coordinates – Sufficient conditions (Proof not included) – Properties of analytic function – Determination of harmonic conjugate by Milne – Thomson method – Conformal mapping - $z + a,\ az, \frac{1}{Z}, z^2$,sin z, cos z, sinhz, coshz and bilinear transformation.

Unit-IV

Complex Integration-Statement and application of Cauchy's theorem and Cauchy's integral formula – Taylor and Laurent expansion – Singularities – Classification – Residues – Cauchy's residue theorem – Contour integration – Unit circle and semi-circular contours (excluding poles on real axis).

Unit –V

Laplace Transform- Sufficient conditions – Transforms of elementary functions– Basic properties – Inverse transforms – Derivatives and integrals of transforms – Transforms of derivatives and integrals – Convolution theorem – Transform of periodic functions – Application to solution of linear ordinary differential equations up to second order with constant coefficients.

Practical

Double integration – Cartesian and polar coordinates - Change of order of integration- Area as a double integral – Triple integration in Cartesian coordinates - Change of variables between Cartesian and polar coordinates and between Cartesian and cylindrical / spherical polar coordinates.- Gradient, divergence and curl and Line, surface and volume integrals - Green's, Gauss divergence and Stoke's theorems-verification - Analytic function- Cauchy – Riemann equations in Cartesian coordinates - Determination of harmonic conjugate by Milne – Thomson method - Conformal mapping - $z+a,\ az, \frac{1}{Z}, z^2$,sinz, cosz, sinhz, coshz and bilinear transformation- Application of Cauchy's theorem and Cauchy's integral formula - Taylor and Laurent expansion – Singularities– Residues - Contour integration – Unit circle and semi-circular contours Laplace Transform– Transforms of elementary functions – Basic properties – Inverse laplace transforms - Derivatives and integrals of transforms – Transforms of derivatives and integrals -Convolution theorem – Transform of periodic functions - Application to solution of linear ordinary differential equations up to second order with constant coefficients.

Lecture Schedule

1. Double integration – Cartesian and polar coordinates
2. Change of order of integration
3. Area as a double integral
4. Triple integration in Cartesian coordinates
5. Change of variables between Cartesian and polar coordinates
6. Change of variables between Cartesian and between Cartesian and cylindrical / spherical polar coordinates.
7. Gradient, divergence and curl
8. Line, surface integrals
9. Volume integrals
10. Green's, Gauss divergence and Stoke's theorems (without proof)
11. Verification of the above theorems
12. Function of a complex variable – Analytic function
13. Cauchy – Riemann equations in Cartesian coordinates
14. Determination of harmonic conjugate by Milne – Thomson method
15. Conformal mapping - $z+a,\ az$ and bilinear transformation.
16. Conformal mapping - $\frac{1}{Z}, z^2$
17. Mid Semester Examination
18. Conformal mapping-sin z, cos z, sinhz, coshz
19. Bilinear transformation.
20. Statement and application of Cauchy's theorem -Cauchy's integral formula
21. Taylor and Laurent expansion
22. Singularities – Classification – Residues
23. Cauchy's residue theorem
24. Contour integration – Unit circle contours (excluding poles on real axis).
25. Contour integration – semi-circular contours (excluding poles on real axis).

26. Laplace Transform – Transforms of elementary functions
27. Basic properties
28. Inverse transforms
29. Derivatives and integrals of transforms
30. Transforms of derivatives and integrals
31. Convolution theorem
32. Transform of periodic functions
33. Application to solution of linear ordinary differential equations of first order with constant coefficients.
34. Application to solution of linear ordinary differential equations of second order with constant coefficients.

Practical Schedule

1. Double integration – Cartesian and polar coordinates - Change of order of integration
2. Area as a double integral – Triple integration in Cartesian coordinates
3. Change of variables between Cartesian and polar coordinates and between Cartesian and cylindrical / spherical polar coordinates.
4. Gradient, divergence and curl and Line, surface and volume integrals
5. Green's, Gauss divergence and Stoke's theorems -verification
6. Analytic function- Cauchy – Riemann equations in Cartesian coordinates
7. Determination of harmonic conjugate by Milne – Thomson method
8. Conformal mapping - $z+a,\ az, \frac{1}{Z}, z^2$,sinz, cosz, sinhz, coshz and bilinear transformation.
9. Application of Cauchy's theorem and Cauchy's integral formula
10. Taylor and Laurent expansion – Singularities– Residues
11. Contour integration – Unit circle and semi-circular contours (excluding poles on real axis).
12. Laplace Transform– Transforms of elementary functions – Basic properties –
13. Inverse laplace transforms
14. Derivatives and integrals of transforms – Transforms of derivatives and integrals
15. Convolution theorem – Transform of periodic functions
16. Application to solution of linear ordinary differential equations up to second order with constant coefficients.
17. **Final Practical Exanimation**

TEXT BOOKS:

1. Kandasamy, P., Thilagavathy, K., and Gunavathy, K., " Engineering Mathematics", Volumes II, S. chand & Co, New Delhi, 2008.
2. Grewal, B.S., "Higher Engineering Mathematics". 40th Edition, Khanna Publishers, Delhi, 2007.

REFERENCE BOOKS

1. Kreyzig, E., "Advanced Engineering Mathematics". Eighth Edition, John Wiley & Sons (Asia) Pte, Ltd., Singapore, 2007.
2. Narayanan, S., Manicavachagom Pillay, T.K. and Ramaniah, G., "Advanced Mathematics for Engineering Students ". Volumes I and III, S. Viswanathan (Printers and Publishers) Pvt. Ltd., Chennai, 2002.

E-Journals:

http://www.math.neu.edu/~Suciu/journals.html

E-Reference:

www.mathworld.com

http://en.wikipedia.org/wiki/Portal:Mathematics

http://www.sosmath.com/

COM 102 PROGRAMMING IN C++ (1+1)

Theory

Unit I: Classes and Objects

Object Oriented Programming Paradigm - Basic concepts of Object oriented programming – Benefits of OOP - Structure of C++ program – creating the source file – Compiling and Linking - Classes and objects: Specifying a class – Defining a member function- making an outside function inline - nesting of member function – friend function

Unit II: Constructors, Destructors , Overloading

Constructors – Parameterized Constructors - Multiple constructors in a class – Constructors with default arguments - Copy constructor - Destructors. Defining Operator Overloading – Overloading Unary operators – Overloading Binary Operator

Unit III: Inheritance

Defining derived classes - Single Inheritance – Making a private member inheritable – Multilevel Inheritance - Multiple Inheritance – Multilevel Inheritance –Hierarchical Inheritance – Hybrid Inheritance

Unit IV: Virtual Functions, Polymorphism

Virtual Base Classes – Abstract Classes – Pointers to Objects – this Pointer - Virtual Functions – Polymorphism

Unit V: Console I\O operations

C++ streams - C++ Stream classes – Unformatted I/O operations – Formatted Console I/O operations - Classes for file stream Operations – Opening and Closing a file – Detecting End-of-File

PRACTICALS

Simple program in C++ using a class -Class with constructors - Class with destructors-Operator Overloading -Overloading of Unary operators - Overloading of Binary operators -Employee pay bill program using single inheritance - Employee pay bill program using multilevel inheritance -Create a class bank -account using multiple inheritance -Create a class student details using hierarchical inheritance -Create a class bank -account using hybrid inheritance -Create a class farmers details using virtual base class –Polymorphism -Abstract classes - Program to create a student for stream Operations - Program to detecting End-of-File

LECTURE SCHEDULE

1. Object Oriented Programming Paradigm - Basic concepts of Object oriented programming – Benefits of OOP
2. Structure of C++ program – creating the source file – Compiling and Linking
3. lasses and objects: Specifying a class – Defining a member function- making an outside function inline
4. nesting of member function – friend function

5. Constructors – Parameterized Constructors - Multiple constructors in a class – Constructors with default arguments
6. Copy constructor - Destructors. Defining Operator Overloading – Overloading Unary operators
7. Overloading Binary Operator
8. Defining derived classes - Single Inheritance – Making a private member inheritable
9. **Mid Semester Examination**
10. Multilevel Inheritance - Multiple Inheritance
11. Hierarchical Inheritance – Hybrid Inheritance
12. Virtual Base Classes – Abstract Classes
13. Pointers to Objects – this Pointer - Virtual Functions
14. Polymorphism
15. C++ streams - C++ Stream classes
16. Unformatted I/O operations – Formatted Console I/O operations
17. Classes for file stream Operations – Opening and Closing a file – Detecting End-of-File

PRACTICAL SCHEDULE

1. Simple program in C++ using a class
2. Class with constructors
3. Class with destructors
4. Operator Overloading
5. Overloading of Unary operators
6. Overloading of Binary operators
7. Employee pay bill program using single inheritance
8. Employee pay bill program using multilevel inheritance
9. Create a class bank -account using multiple inheritance
10. Create a class student details using hierarchical inheritance
11. Create a class bank -account using hybrid inheritance
12. Create a class farmers details using virtual base class
13. Polymorphism
14. Abstract classes
15. Program to create a student for stream Operations
16. Program to detecting End-of-File
17. Final practical examination

TEXT BOOKS

1. Balagurusamy, E., Programming in C++, TataMcGrawHill, 2003
2. Stephen R.Davis, C++ Weekend Crash Course, IDG Book India, 2000
3. C++ A Beginner's Guide, Herbert schildt, Tata McGrawHill, publishing company ltd,2002

REFERENCE BOOKS

1. Biame Stroustrap. 2000, The C++ Programming Language. Addison Wesley Publishing Co., 2000
2. Herbert Schildt. 2002, C++ The Complete Reference. Tata McGraw Hill Publishing Co Ltd., 2002 Delhi.
3. Rajaraman, V., Computer programming in C, Prentice Hall of India Private Limited, 2000.
   Programming with C++, P.Radha Ganesan, Scitech Publication Pvt, 2002.

E-REFERENCE

http://www.iu.hio.no/~mark/CTutorial/CTutorial.html

http://www.studiesinn.com/learn/Programming-Languages/C-Language.html

AEC 101 PRINCIPLES OF AGRICULTURAL ECONOMICS (1+1)

Theory

Unit 1: Nature and Scope of Economics

Nature and scope of economics: Importance – Subject matter, science vs. art, positive vs. normative science - deductive and inductive methods - Different economic systems: merits and demerits - Definitions of Economics: Wealth, welfare, scarcity and growth definitions - Divisions of Economics – Micro and Macro economics - Agricultural Economics: definition and scope - Basic concepts: Goods, Service, Value, Cost, Price, Wealth, Welfare - Wants: Characteristics and classification.

Unit 2: Theory of Consumption

Utility: Definition, Measurement - Cardinal and ordinal utility - Marginal utility - Law of Diminishing Marginal Utility & Law of Equi-marginal Utility: Definition – Assumptions - Limitations and Applications - Demand: Definition - Kinds of demand, Demand schedule, Demand curve, Law of demand, Determinants of demand - Extension and Contraction Vs Increase and decrease in demand - Elasticity of Demand: Types, Degrees of price elasticity of demand, Methods of measuring elasticity, Factors influencing elasticity of demand - Importance of Elasticity of demand - Engel's law of family expenditure - Consumer's surplus: Definition – Importance.

Unit 3: Theory of Production

Concept of production – Factors of production – Land and its characteristics - Labour – Division of labour - Malthusian theory and modern theory of population - Capital – characteristics of capital - capital formation – Entrepreneur, characteristics and functions of entrepreneur - Supply definition – law of supply – factors influencing supply
- elasticity of supply.

Unit 4: Theory of Distribution

Pricing of factors of production – rent and Ricardian theory of rent – quasi rent - wage – real wage and money wage – marginal productivity theory of wage - Interest – liquidity preference theory – profit – Risk bearing theory of profit.

Unit 5: Macroeconomic Concepts

National Income: Concepts – GNP, GDP, NNP, Disposable income and Per capita income- Measurement of National Income - Public Finance: Meaning, Principles. Public Revenue: Meaning, Classification of taxes - service tax - Cannons of taxation, public expenditure: principles - Inflation: Meaning, definition, kinds of inflation - Welfare Economics: Meaning, Pareto's optimality – Millennium Development Goals (MDG).

Practical

Law of Diminishing Marginal Utility - Law of Equi Marginal Utility - Individual and market demand - Indifference curve analysis and consumer equilibrium - Measurement of arc elasticity and point elasticity of demand - own price elasticity, income and cross elasticity of demand - consumer surplus - law of diminishing marginal returns – relationship between TPP, APP and MPP - Cost concepts and graphical derivation of cost curves - Population growth and food grain production - Supply elasticity - Causes of inflation and control measures – Consumer price

index and wholesale price index - Types and functions of money - Computation of National Income - Study of structural changes in the economy - welfare indicators.

Lecture Schedule

1. Nature and scope of economics: Importance – Subject matter, science vs. art, positive vs. normative science - deductive and inductive methods -Different economic systems: merits and demerits.
2. Definitions of Economics – Wealth, welfare, scarcity and growth definitions - Divisions of Economics –Micro and Macro economics - Agricultural Economics: definition and scope.
3. Basic concepts – Goods, Service, Value, Cost, Price, Wealth, Welfare. Wants: Characteristics and classification.
4. Utility: Definition, Measurement - Cardinal and ordinal utility - Marginal utility - Law of Diminishing Marginal Utility & Law of Equi-marginal Utility: Definition – Assumptions - Limitations and Applications.
5. Demand: Definition - Kinds of demand, Demand schedule, Demand curve, Law of demand, Determinants of demand - Extension and contraction Vs Increase and decrease in demand.
6. Elasticity of Demand: Types, Degrees of price elasticity of demand, Methods of measuring elasticity, Factors influencing elasticity of demand - Importance of Elasticity of demand.
7. Engel's law of family expenditure - Consumer's surplus: Definition – Importance.
8. Concept of production – Factors of production – Land and its characteristics – Labour – Division of labour.
9. **Mid-semester Examination.**
10. Malthusian theory and modern theory of population.
11. Market Structure – Price determination in perfect competition & monopoly.
12. Capital – characteristics of capital - capital formation – Entrepreneur, characteristics and functions of entrepreneur.
13. Supply: Definition – law of supply – factors influencing supply – elasticity of supply.
14. Pricing of factors of production – rent and Ricardian theory of rent – quasi rent - wage – real wage and money wage – marginal productivity theory of wage.
15. Interest – liquidity preference theory – profit – Risk bearing theory of profit - National Income: Concepts – GNP, GDP, NNP, Disposable income and Per capita income- Measurement of National Income.
16. Public Finance: Meaning, Principles. Public Revenue: Meaning, Classification of taxes - service tax - Cannons of taxation, public expenditure: principles.
17. Inflation: Meaning, definition, kinds of inflation - Welfare Economics: Meaning, Pareto's optimality - Millennium Development Goals (MDG).

Practical Exercises

1. Exercise on Law of Diminishing Marginal Utility.
2. Exercise on Law of Equi Marginal Utility.
3. Demand schedule - graphical derivation of individual and market demand.
4. Indifference curve analysis – properties, budget line and consumer equilibrium.
5. Measurement of arc elasticity and point elasticity of demand - Estimation of own price elasticity, income and cross elasticity of demand.
6. Estimation of consumer surplus.
7. Exercise on law of diminishing marginal returns – relationship between TPP, APP and MPP.
8. Cost concepts and graphical derivation of cost curves.

9. Analysis of growth in population and food grain production in India.
10. Estimation of supply elasticity.
11. Market Structure – Price determination.
12. Analysis of causes of inflation and control measures. Measurement of inflation –consumer price index and wholesale price index.
13. Types and functions of money.
14. Approaches to computation of National Income.
15. Analysis of trends in National Income and study of structural changes in the economy
16. Exercise on welfare indicators – HDI, PQLI, PPP, Poverty Line, etc
17. **Practical Examination.**

Reference Books

1. Dewett, K.K. 2002. Modern Economic Theory, Syamlal Charitable Trust, New Delhi.
2. Samuelson, P. 2004. Economics, (18/e), Tata Mcgraw-Hill, New Delhi.
3. Koutsoyiannis,A. 1983.Modern Microeconomics, The Macmillan Press Ltd., Hongkong
4. Varian, H. R. 1987. Intermediate Microeconomics, WW Norton & Company, New Delhi
5. Seth, M.L. 2000. Principles of Economics, Lakshmi Narain Agarwal Co., Agra. New Delhi

HOR 121 BASIC HORTICULTURE (1+1)

THEORY

UNIT I. Fundamentals of horticulture

Horticulture - Definition – scope and importance – nutritive value and global scenario of horticultural crops - Division and classification of horticultural crops –Horticultural zones in India.

UNIT II. Propagation techniques

Propagation – definition – propagation methods – seed propagation-vegetative propagation - cutting, layering, grafting and budding methods – specialized plant parts for propagation – micro propagation.

UNIT III. Systems of production

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.

UNIT IV. Crop management practices

Weed management – irrigation and moisture conservation– nutrient application methods in horticultural crops – Root architecture – Special practices - training, pruning, ringing, notching, disbudding and pinching - Canopy management and crop regulation – physical and chemical regulation.

UNIT V. Harvest operations

Maturity indices — harvesting methods, pre cooling – packaging, packing methods – storage of horticultural crops.

PRACTICAL

Features of an orchard – Tools, implements and machineries used for horticultural operations – Preparation of pot mixture, potting and repotting - Identification of major horticultural crops and their varieties – Commercial propagation methods - cutting, grafting, layering and budding – Plant propagation structures - training and pruning practices - Maintenance of lawn, hedges and edges through machineries - Visit to nearby commercial orchards - Maturity standards and harvesting methods.

THEORY SCHEDULE

1. Definition, scope and importance of horticultural crops
2. Nutritive value and global scenario of horticultural crops - Division and classification of horticultural crops.
3. Horticultural zones of India and Tamil Nadu including hilly and high rainfall zone crops
4. Propagation – definition, merits and demerits and propagation methods
5. Seed propagation – seed treatments, sowing and seedling establishment.
6. Vegetative propagation and methods viz., cutting, layering, grafting and budding.
7. Specialized plant parts for propagation and micro propagation technique
8. Planting systems (HDP, UHDP, Meadow Orchard) and cropping systems – intercropping, mixed cropping, cover cropping, multi-tier cropping in horticultural crops.
9. Mid semester exam
10. Protected cultivation- principles and structures and special structures used for propagation.
11. Intercultural operations – weed management. practices
12. Irrigation and moisture conservation practices in relation to root architecture
13. Nutrient application practices in horticultural crops
14. Crop regulation – Training and pruning and Special horticultural techniques
15. Canopy management and crop loading practices.
16. Maturity indices for horticultural crops and harvesting methods.
17. Harvest operations in horticultural crops including pre-cooling, packaging, packing and storage.

PRACTICAL SCHEDULE

1. Visit to Orchard and study of different components
2. Horticultural tools and implements used for various operations.
3. Preparation of pot mixture, potting and repotting.
4. Commercial propagation techniques in horticultural crops - practicing layering and cutting.
5. Practising propagation method- budding and grafting
6. Practices training and pruning in horticultural crops
7. Study of major fruit crops and important varieties
8. Study of major vegetable crops and important varieties
9. Study of major flower crops and important varieties
10. Study of major spices and plantation crops
11. Study of major medicinal and aromatic crops.
12. Irrigation, fertilizer application and weed management practices
13. Maturity indices for harvesting of horticultural crops
14. Maintenance of lawn, hedges and edges through machineries
15. Plant propagation structures
16. Visit to private orchards to identify different features of an orchard.
17. Practical examination

REFERENCES

I.Text Books

1. George Acquaah. 2002. Horticulture-principles and practices. Prentice-Half of India Pvt. Ltd., New Delhi.
2. Kumar, N.2010. Introduction to Horticulture, Oxford and IBH Publication, New Delhi.

II. Further reading

1. Christopher, E.P. 2001. Introductory Horticulture, Biotech Books, New Delhi.
2. Edmond, J.B. T.L.Senn, F.S. Andrews and P.G.Halfacre, 1975. Fundamentals of Horticulture, Tata MC. Graw Hill Publishing Co.New Delhi.
3. Hartman, H.T. and Kester, D.E. 1986. Plant propagation – Principles and Practices – Prentice Hall of India Ltd., New Delhi.
4. Veeraragavathatham, D., M.Jawaharlal, S. Jeeva, Rabindran and Umapathi. 2004. Scientific fruit culture. Suri Associates, Coimbatore.

III. Journals

1. Indian Horticulture
2. Floriculture Today

IV. e Reference

http://aggie-horticulture.tamu.edu/propagation/propagation.html http://www.britannica.com/
http://www.horticulture.com.au/export/hmac.asp
http://www.horticultureworld.net/hort-india.htm
http://www.fao.org

FMP 102 ELECTRICAL ENGINEERING (2+1)

THEORY

Unit I Basic concepts

Basic electrical quantities – specific resistance – temperature coefficient. DC circuits – Kirchoff's laws – Thevenin, Superposition theorem – star delta transformation.

Unit II Electrical Machines

Concept of magnetic circuit - inductance, self and mutual - laws of electromagnetic induction – simple loop generator – induced emf – DC generators, shunt, series and compound- DC motors – torque equation – types of motors and characteristics.

Unit III AC Fundamentals

Single phase AC circuits and basics – RMS and average quantities – Phasor representation - Three phase AC circuits – reasons for use of three phase systems – star and delta for generation and load - power factor - power and energy measurement - single phase transformer basics – construction and characteristics.

Unit IV Induction motor

Electric motors, types and classification - three phase induction motors – construction – principle – characteristics – methods of starting – starters – single phase motors – types – principle.

Unit V Electrical illumination and instruments

Electrical lighting – types of lamps – Electrical measurement and instruments – ammeters - volt meters - watt meter – operating –principle load estimation in the industry – electrical tariff and safety.

PRACTICAL

Tests on shunt, series and compound motors and generators test on transformer, experiments with energy measurement and power factor determination, wiring practice on simple household circuits – load test on three phase motors –Star delta and DOL starters – connections.

LECTURE SCHEDULE

1. Basic electrical quantities, specific resistance, electrical units, Temperature coefficient.

2. DC circuits, Kirchoff's first law
3. Kirchoff's second law , problem on this law
4. Thevenins theorem, superposition theorem, problem solving
5. Star delta transformation
6. Magnetic fields and circuits, principles and definition
7. Self and mutual inductance, Laws of electromagnetic induction
8. DC generators, principle, Induced emf - loop generator
9. Types of generators, Shunt, series and compound generators
10. Construction of generator, characteristics of generators
11. Problem solving in shunt, series and compound generators
12. DC motors, principles of operation – Torque equation derivation
13. Shunt, series and compound motor characteristics
14. Single phase, AC circuits, basics - RMS and average quantities
15. Phasor representation of single phase AC circuits
16. Circuits with inductance and capacitance – vector solutions
17. Mid semester examination
18. General series circuits – phasor solutions
19. Poly phase fundamentals, three phase generation, principle - Three phase AC circuits, reasons for use of three phase systems
20. Interconnection in star and delta, principal relationship between quantities
21. Star and delta loading, vectorial solution of three phase loads
22. Advantages of star and delta connected systems
23. Power factor, disadvantages of low power factor, improvement in single phase circuits
24. Power factor improvement banks for three phase loads, KVAR capacity
25. Power measurement in three phase circuits, two watt meter method
26. Transformer, types, Construction of a single phase transformer
27. Single phase transformer, principle and voltage equation
28. Electric motors, types and classification
29. Three phase induction motors, construction, principle of operation, characteristics
30. Methods of starting squirrel cage motors, starters
31. Single phase motors, types, principle.
32. Electrical measurement and instruments, principle of operation ammeters, volt meters, watt meter, operating principle
33. Electrical lighting - types of lamps and working principles
34. Principle of electrical load estimation in the industry, electrical tariff and safety.

PRACTICAL SCHEDULE

1. Determination of power factor of a AC load by using energy meter
2. Determination of performance characteristics of DC shunt motor
3. Determination of performance characteristics of DC series motor
4. Determination of performance characteristics of DC compound motor
5. Determination of performance characteristics of a DC shunt generator
6. No load and load characteristics of a single phase transformer
7. Mapping and preparation of wiring plan for an electrical installation
8. Practice household/ industrial and godown wiring

9. Practice on staircase and hostel wiring
10. Practices on signal and dim/bright wiring
11. Determination of performance characteristics of 3-phase induction motor
12. Study of DOL starter and its connections
13. Study of Star delta starters and its connections
14. Characteristics of a RLC circuit
15. Installation practice for AC electrical motors
16. Determination of electrical load for an installation
17. Final practical examination.

TEXT BOOKS

1. Mehta.V.K., Rohit Mehta, 2003. Principles of Electrical Engineering. S.Chand & Company Ltd., Ram Nagar, New Delhi-110 055.
2. Theraja, B. L. 2001. Fundamentals of Electrical Engineering and Electronics. S.Chand & Company Ltd., Ram Nagar, New Delhi-110 055.

REFERENCE BOOKS

1. Samuel, L. Oppenheimer. 1984. Fundamentals of electrical circuits. Prentice Hall inc., New Delhi.
2. Uppal, S.L. 1992. Electrical power. Khanna publishers, New Delhi.
3. Cotton.H. 1999. Advanced Electrical Tehnology. Wheeler Publishing, A Division of A.H. Wheeler & Co. Ltd., New Delhi.

WEB RESOURCES

www.docnmail.com/learnmore/engineering.htm
http://en.wikipedia.org/wiki/Electrical_generator
http://hyperphysics.phy-astr.gsu.edu/Hbase/magnetic/motdc.html
http://sound.westhost.com/xfmr.htm

FMP 103 THERMODYNAMICS (2+1)

Unit I: Basic concepts

Types of thermodynamics – Microscopic & macroscopic approach, thermodynamic systems – classification – properties and state of a system. Thermodynamic process, cycle and equilibrium. Point and path functions – Zeroth law of thermodynamics. Unit of temperature and pressure. Energy – types – Law of conservation of energy. Heat – specific heat – thermal capacity and water equivalent. Mechanical equivalent of heat, work – Heat and work – a path function. Comparison of heat and work – power. First law of thermodynamics – Energy balance of closed systems. Limitations of first law of thermodynamics.

Unit II: Properties and Processes of perfect gases

Laws of perfect gas – general and characteristic gas equation – Avogadro's law – universal gas constant. Specific heats of a gas - Internal energy, enthalpy and molar specific heat of a gas. Regnault's law – relation and ratio between specific heats.

Reversible and irreversible process, classification of thermodynamic processes. Work done during a non-flow process – Application of first law of thermodynamics to a non-flow process. Perfect gas processes – P-V, P-T relationship, work done, change in internal energy heat transfer and change in enthalpy during constant volume, constant pressure, constant temperature, adiabatic and polytropic processes.

Flow process – application of first law of thermodynamics to a steady flow process. Work done for constant volume, constant pressure, constant temperature, adiabatic and polytropic flow processes. Application of steady flow energy equation to boiler, condenser, evaporator, nozzle, turbine, rotary and reciprocating compressor.

Unit III: Second law of thermodynamics and entropy of perfect gases

Kelvin planck and Clausius statements – Equivalence of Kelvin – planck and Clausius statements. Relation between heat and entropy – Importance and units of entropy – available and unavailable heat energy – Clausius inequality – principle of increase of entropy – change of entropy of a perfect gas – in terms of volume and absolute temperature, pressure and absolute temperature, pressure and volume.

Change of entropy of a perfect gas during constant volume, constant pressure, constant temperature, reversible adiabatic and polytropic processes.

Unit IV: Thermodynamic air and vapour cycles

Thermodynamic air standard Carnot, Otto and Diesel cycles.

Carnot vapour cycle and ideal Rankine cycle.

Unit V: Properties and entropy of steam

Formation of steam at a constant pressure – Temperature vs total heat graph during steam formation. Wet, dry saturated and super heated steam – Dryness fraction of wet steam – Enthalpy and specific volume of steam – uses of steam tables. Phase rule – PV, PT, TV, TS and h-s diagram for water and steam.

Entropy of water – Entropy increase during evaporation. Entropy of wet, dry and super heated steam.

PRACTICALS

Problems on conversion of pressure and temperature units, heat and work in non-flow quasi static process, first law of thermodynamics, perfect gas non-flow processes – constant volume, pressure and isothermal, adiabatic and polytropic, combination of processes, steady flow processes. Problems on second law of thermodynamics, application of steady flow equation to boiler, condenser and evaporator, steady flow equation to nozzle, turbine, rotary and reciprocating compressor. Problems on entropy of perfect gas, Carnot, Otto and Diesel cycles. Problems on vapour cycles – Carnot and ideal Rankine cycle. Problems using steam tables and Molliar chart, entropy of steam

LECTURE SCHEDULE

1. Basic concepts, types of thermodynamics and definitions of system
2. Properties of a system – state of a system, cyclic and quasi-static process.
3. Point function and path function – thermodynamic equilibrium – pressure units and relationship.
4. Zeroth law – temperature scales – relationship – energy – heat and thermal capacity.
5. Mechanical equivalent of heat – work heat a path function – comparison of heat and work.
6. First law of thermodynamics – energy balance of closed system – limitations of first law.
7. Perfect gas laws – characteristic equation of gas - Avogadro's law – universal gas constant.
8. Specific heat of gas – internal energy, enthalpy, Regnault's law – relation between specific heats.
9. Reversible and irreversible processes – classification of thermodynamic processes – work done and application of first law of thermodynamics to a non-flow process.
10. Work done and heat transferred during constant volume and pressure non-flow processes.
11. Work done and heat transferred during isothermal non-flow process.
12. Work done and heat transferred during polytropic and adiabatic non-flow processes.

13. Application of first law of thermodynamics to a steady flow process and work done for constant volume and pressure process.
14. Work done for steady flow process – constant temperature, adiabatic and polytropic.
15. Application of steady flow energy equation – boiler, condenser, evaporator, nozzle, turbine, rotary and reciprocating compressor.
16. Second law of thermodynamics – Kelvin planck and Clausius statement – equivalence. COP of refrigerator and heat pump.
17. Mid semester examination
18. Relation between heat and entropy – importance of entropy – Clausius inequality – principle of increase of entropy
19. Expression for change of entropy of a perfect gas in terms of V-T., P-T. and P-V.
20. Change of entropy of a perfect gas during constant volume, constant pressure, isothermal, adiabatic and polytropic process.
21. Thermodynamic cycles – ideal and real cycle. Reversibility and irreversibility of thermodynamic processes – important terms.
22. Derivation of efficiency of a Carnot air cycle
23. Derivation of efficiency of Otto cycle
24. Derivation of efficiency of Diesel cycle
25. Derivation of efficiency of Carnot cycle with steam as working substance.
26. Derivation of efficiency of ideal Rankine vapour cycle.
27. Steam formation at a constant pressure from water – temperature vs total heat graph.
28. Important terms of steam – wet, dry and super heated steam – dryness fraction
29. Sensible heat, latent heat and total heat – specific volume of steam.
30. Steam tables and their uses
31. Phase rule – P-V and P-T diagram for water and steam.
32. T-V and T-S diagram for water and steam
33. h-S diagram (Molliar chart)
34. Entropy of water, wet, dry and super heated steam.

PRACTICAL SCHEDULE

1. Problems on conversion of pressure and temperature units
2. Problems on heat and work in non-flow quasi static process
3. Problems on first law of thermodynamics
4. Problems on perfect gas non-flow processes – constant volume, pressure and isothermal
5. Problems on perfect gas non-flow processes – adiabatic and polytropic
6. Problems on perfect gas non-flow processes – combination of processes
7. Problems on steady flow processes
8. Problems on second law of thermodynamics
9. Problems on application of steady flow equation to boiler, condenser and evaporator
10. Problems on application of steady flow equation to nozzle, turbine, rotary and reciprocating compressor
11. Problems on entropy of perfect gas
12. Problems on air cycles – Carnot, Otto and Diesel
13. Problems on vapour cycles – Carnot and ideal Rankine cycle.
14. Problems using steam tables and Molliar chart

15. Problems on entropy of steam
16. Visit to industry
17. Final practical examination.

TEXT BOOK:

1. Khurmi.R.S. 1992. Engineering thermodynamics, S. Chand and Co.

REFERENCES

1. Ballaney, P.L. 1991. Thermal engineering, Khanna Publishers
2. Michael .J. Moran, and Howard N Shapiro 2000. Fundamentals of Engineering Thermodynamics, John Wiley & Sons. USA.
3. Valan Arasu. A. 2006. Engineering Thermodynamics, Vijay Nicole Imprints Limited Chennai-600029
4. Vijayaraghavan, G.K. and S.Sundaravalli 2006. Engineering Thermodynamics, Lakshmi Publication, Arapakkam, Sirkali, Nagappatinam – 609 111

WEB RESOURCES

www2.lib.udel.edu/subj/mee/internet.htm
www.elitethermalengineering.com
www.teatucson.com

AST 102 ENGINEERING MECHANICS (1+1)

THEORY

Unit I Force systems

Fundamentals of engineering mechanics, vector and scalar quantity. Composition and resolution of forces – analytical and graphical method. Principle of moments and their applications – Couples. Equilibrium of forces – analytical and graphical method.

Unit II Support Reactions

Types Loading – Types of Beams – Support reactions of beams – trusses – free body diagram – related problems. Principle of virtual work – applications of principle of virtual work

Unit III Friction

Application of laws of friction, wedge and block, screw jacks and brakes. Machines, reversible machine and non - reversible machine. Law of machine, velocity ratio, mechanical advantage and efficiency of simple lifting machines.

Unit IV Motion

Linear motion, velocity, acceleration, projectile. Angular and curvi-linear motion. Laws of motion, Newton's Laws of motion relative velocity, rotational and translation motion.

Unit V Kinetics

Work, power and energy. Laws of conservation of energy and momentum. Collision of elastic bodies. Loss of kinetic energy on impact. Centrifugal and centripetal forces, super elevation.

PRACTICAL:

Composition and resolution of forces – Equilibrium of forces – support reactions of simply support beam, cantilever beam and frames – moments - virtual work - wedge & screw fiction – principle of lifting machines – simple lifting machines – projectile - Graphical method of representation of velocity, time and distance - Laws of motion and Laws of collision of rigid bodies - Centrifugal and centripetal forces.

LECTURE SCHEDULE:

Unit I Force systems

1. Fundamentals of engineering mechanics, vector and scalar quantity. Composition and resolution of forces – analytical and graphical method.
2. Principle of moments and their applications – Couples.
3. Equilibrium of forces – analytical and graphical method.

Unit II Support Reactions

4. Types Loading – Types of Beams – Support reactions of Simply supported beams and overhanging beams - problems
5. Support reactions of trusses – free body diagram – related problems.
6. Principle of virtual work – applications of principle of virtual work on beams, ladders, lifting machines and framed structures

Unit III Friction

7. Application of laws of friction, wedge and block, screw jacks and brakes.
8. Mid Semester Examination
9. Lifting Machines, reversible machine and non - reversible machine. Law of machine, velocity ratio, mechanical advantage and efficiency of Simple lifting machines.

Unit IV Motion

10. Linear motion - velocity - acceleration
11. Projectile
12. Angular and curvi-linear motion. Laws of motion, Newton's Laws of motion
13. Relative velocity - rotational and translation motion.

Unit V Kinetics

14. Newton's laws of motion. Work, power, energy
15. Laws of conservation of Energy and Momentum
16. Collision of elastic bodies and loss of kinetic energy on Impact
17. Centrifugal and centripetal forces and super – elevation

PRACTICAL SCHEDULE:

1. Determination of Resultant by Analytical and graphical method
2. Determination of Equilibrium by Analytical and Graphical method
3. Applications of Moments
4. Reactions of supports of simply supported beams
5. Reactions of supports of cantilever beams
6. Reactions of supports of frames – I
7. Reactions of supports of frames - II
8. Problems on wedge and screw friction
9. Principles of lifting machines
10. Simple lifting machines
11. Projectile on a horizontal plane
12. Graphical representation of velocity, time and Distance traveled by a body
13. Study of laws of motion
14. Study of laws of collision of elastic bodies
15. Study of centrifugal forces
16. Study of centripetal forces
17. **Practical Examination**

Text Book

1. Khurmi, R.S. 2009, A text book of Engineering mechanics, S. Chand and Company Ltd. Ram Nagar, New Delhi - 110 055.

REFERENCE BOOKS:

1. Bansal, R.K. 1992, Engineering mechanics and Strength of Materials, Laxmi Publication, 7/21, Ansari Road, Daryaganj, New Delhi - 110 002.
2. Kotteswaran.N, 2009, Engineering mechanics- Statics and dynamics, Balaji Publications, Coimbatore-42.
3. Kannan.T. and S.Baskar, 2007, Engineering mechanics- Statics and dynamics, Anuradha agencies, Kumbakonam-612605.

E-reference:

1. http://www.civil.port.ac.uk
2. www.ebookee.com/Mechanics-and-Strength-of-Materials_67103.html

FPE 101 HEAT AND MASS TRANSFER (1+1)

THEORY

UNIT I: Heat Transfer – Conduction

Basic transfer processes – heat, mass and momentum – heat transfer process - conductors and insulators - conduction – Fourier's fundamental equation – thermal conductivity and thermal resistance - linear heat flow – heat transfer through homogenous wall, composite walls, radial heat flow through cylinders and sphere – extended surfaces (fins) — solving problems in heat transfer by conduction.

UNIT II: Heat Transfer - Convection

Newton Rikhman's law – film coefficient of heat transfer - convection – free and forced convection - dimensional analysis and its application – factors affecting the heat transfer coefficient in free and forced convection heat transfer – overall heat transfer coefficient - solving problems in heat transfer by convection.

UNIT III: Heat Transfer – Heat Exchanger

Heat exchangers – parallel, counter and cross flow – evaporator and condensers - Logarithmic Mean Temperature Difference – overall coefficient of heat transfer – tube in tube heat exchanger, shell and tube heat exchanger, plate heat exchanger – applications of heat exchangers - solving problems in heat exchangers.

UNIT IV: Heat Transfer: Radiation

Radiation heat transfer – concept of black and grey body - monochromatic total emissive power – Kirchoff's law – Planck's law - Stefan-Boltzman's law – heat exchange through non-absorbing media - solving problems in heat transfer by radiation.

UNIT III: Mass Transfer

Mass transfer – introduction – Fick's law for molecular diffusion - molecular diffusion in gases – equimolar counters diffusion in gases and diffusion of gas A through non diffusing or stagnant B - diffusion through a varying cross sectional area and diffusion coefficients for gases - molecular diffusion in liquids, biological solutions and gels.

PRACTICAL

Measurement of thermal conductivity by composite wall and lagged pipe method- determination of heat transfer coefficients in free and forced convection – experiments with parallel and counter flow heat exchangers– determination of emissivity, Stefan-Boltzmann's constant –solving problems on heat and mass transfer.

LECTURE SCHEDULE

1. Heat transfer – steady state and unsteady state – conduction, convection and radiation - conduction heat transfer – Fourier's law of heat conduction.
2. Heat transfer through homogenous and composite walls.
3. Heat transfer through hollow and composite cylinders.
4. Heat transfer through spheres – extended surfaces – fins.
5. Newton-Rikhman's law of heat transfer – film coefficient of heat transfer.
6. Heat exchangers – types – parallel flow, counter flow and cross flow – application
7. Logarithmic mean temperature difference of parallel and counter flow heat exchangers – overall heat coefficient of heat transfer.
8. Heat transfer by convection – types – free convection and forced convection – principles and examples.
9. Mid semester Examination
10. Dimensional analysis and its application – free convection heat transfer and forced convection heat transfer – overall heat transfer coefficient.
11. Radiation heat transfer –.concept of black and grey body.
12. Monochromatic total emissive power – Kirchoff's law – Planck's law.
13. Stefan-Boltzman's law – heat exchange through non-absorbing media.
14. Mass transfer – introduction – Fick's law for molecular diffusion.
15. Molecular diffusion in gases – equimolar counters diffusion in gases and diffusion of gas A through non diffusing or stagnant B.
16. Molecular diffusion in gases – diffusion through a varying cross sectional area and diffusion coefficients for gases.
17. Molecular diffusion in liquids, biological solutions and gels.

PRACTICAL SCHEDULE

1. Determination of thermal conductivity in a composite wall
2. Determination of thermal conductivity by lagged pipe method
3. Solving problems on conduction and convection heat transfer
4. Determination of heat transfer coefficient in a parallel flow heat exchangers
5. Determination of heat transfer coefficient in a counter flow heat exchangers
6. Determination of heat transfer coefficient in forced convection
7. Solving problems on convection heat transfer
8. Determination of heat transfer coefficient in free convection
9. Solving problems on radiation heat transfer
10. Determination of emissivity of the given test surface
11. Determination of Stefan-Boltzmann's constant in radiation heat transfer
12. Determination of effectiveness of heat transfer in a radiator
13. Determination of effectiveness of heat transfer in a coiled type heat exchanger
14. Determination of effectiveness of a condenser
15. Solving problems on mass transfer
16. Solving problems on mass transfer
17. Final practical examination.

TEXT BOOKS

1. Bellaney, P.L. 2001. Thermal Engineering. Khanna Publishers, New Delhi.

2. Geankoplis C.J.1999. Transport Process and Unit Operations. Prentice-Hall of India Private Limited, New Delhi.

REFERENCE BOOKS

1. Jacob and Hawkins. 1983. Elements of Heat Transfer. John Willey and Sons Inc. New York.p.284.
2. EcKert, E.R.G. 1981. Heat and Mass Transfer. McGraw Hill Book Co., New York.
3. Holman, E.P.2001. Heat Transfer. McGraw-Hill Publishing Co. New Delhi.p.485.

E - REFERENCES

http://rpaulsingh.com/teachingfirstpage.htm
http://nptel.iitk.ac.in/Mech_Engg. htm

JOURNALS

Transaction of the American Society of Agricultural Engineers
Journal of Biosystems Engineering
Journal of Food Engineering

SWE 102 SURVEYING AND LEVELLING PRACTICE (1+2)

THEORY:

Unit I-Principles of Surveying

Principles and basic concepts, objects 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

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

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

PRACTICAL:

Use of different types of chains and tapes - folding and unfolding - ranging - field recording. Chaining - use of cross staff - optical square. Linear measurement and offset setting area computation by

cross staff survey - Plotting of cross-staff survey -Chain traversing of cropped area - Correction of Errors in chains and Problems - Computation of Area from field notes and plotted plan, Mid-ordinate rule - Average ordinate rule, Trapezoidal rule- problems - Simpson rule and Coordinate method of finding area and problems - Closed compass traversing - Plotting of closed compass traverse and correction of closing error - Open compass traversing - Problems on Compass traversing - Area computation by plane table survey - radiation method intersection & resection methods traversing - Use of Dumpy of level - limitation - handling – shifting. Simple levelling - temporary adjustments - Differential levelling - Profile levelling - Profile levelling – plotting -Cross-sectioning - Cross sectioning – plotting -Contouring - plotting of contour - preparation of map - estimation of volume - Permanent adjustments in Dumpy Level, Use of Minor instruments, Finding area using Planimeter – Theodolite -cross sectioning with Theodolite – Traversing with a Theodolite – Volume of earth work computation.

LECTURE SCHEDULE:

1. Principles and basic concepts, objects and uses of surveying - classification and basic methods of surveying. Types of chains.
2. Ranging rod, Ranging-Direct and Indirect and chaining.
3. Method of Chaining on level and sloping ground - Obstacles in chaining.
4. Principles of chain surveying - selection of survey stations and lines
5. Offsets-types, Measurement - cross staff and optical square
6. Steps involved in Chain Survey- Reconnaissance, Index sketch, Reference sketch, Booking entries in field book
7. Plan and Map, Scales -Plain and diagona
8. Testing of Chain, Degree of accuracy in chaining, Errors -positive -negative – Compensating - cumulative, mistakes, Determination of limiting length of offset and problems.
9. Mid Semester Examination
10. Area computation, Mid-Ordinate rule, Average ordinate rule, Trapezoidal rule, Simpson rule and Coordinate method of finding area.
11. Computation of volume
12. Basic terminologies of Compass traversing Prismatic and Surveyors Compass, Checking the accuracy of traverse, Errors and mistakes in Compass survey
13. Plane tabling - instruments & accessories, Radiation, Traversing, Orientation Errors and mistakes in compass survey - Intersections and Resection.
14. Levelling - definition - types of benchmarks - different types of levels - optical principle - lenses - telescopes.
12. Basic principles of levelling - different methods of reduction of levels - types of levelling.
13. Theory of simple, compound, precision, profile, Cross sectional and reciprocal levelling Contouring – definition – contour characteristics - direct and indirect methods – gradient contour – uses.
15. Minor instruments - Hand level - Clinometer - Abney level - Box Sextant - Planimeter
16. Theodolite types-adjustments-Setting up-reading angles - Measurements.
17. Area and elevation determination.

PRACTICAL SCHEDULE:

1. Use of different types of chaining and tapes - folding and unfolding - ranging - field -recording.
2. Ranging and chaining - use of cross staff - optical square

3. Linear measurement and offset setting
4. Area computation by cross staff survey and Plotting
5. Chain traversing of cropped area and error correction.
6. Computation of Area from field notes and plotted plan, Mid-ordinate rule, Average ordinate rule, Trapezoidal rule- problems
7. Simpson rule and Coordinate method of finding area and problems
8. Compass Survey – radiation method.
9. Closed compass traversing, Plotting and correction of closing error
10. Open compass traversing
11. Problems on Compass traversing
12. Area computation by plane table survey - radiation method
13. Plane table survey - intersection
14. Plane table traversing resection methods
15. Use of Dumpy of level - limitation - handling - shifting. Simple levelling - temporary adjustments
16. Differential levelling in field
17. Differential levelling problems
18. Profile levelling - plotting
19. Cross-sectioning plotting
20. Finding Sensitiveness of Bubble tube
21 Contouring – Direct
22 Contouring – Grid method
23. Plotting of contour - preparation of map - estimation of volume
24. Permanent adjustments in Dumpy Level
25 Computation of Volume – Problems
26 Use of Minor instruments
27 Finding area using Planimeter
28. Theodolite types – adjustments – setting up – reading angles
29. Measurement of horizontal angles by repetition and reiteration – reading magnetic bearings
30. Cross sectioning with theodolite and plotting
31. Area and elevation determination by measuring horizontal and vertical angles
32. Traversing with a Theodolite - Plotting theodolite survey
33 Volume of earthwork computation
34. Final Practical Examination

REFERENCE BOOKS:

1. Kanetkar, T.P. & Kulkarni, S.V., 1984. "Surveying & leveling". Part –I, A.V.G. Prakashan, Poona.
2. Punmia. B.C 1991 "Surveying (Vol- I & Vol-II)" Laxmi publications, New Delhi
3. Basak. V.N, 1994, "Surveying and Levelling", Tata McGraw hill publications, New Delhi.

III Semester			
1.	MAT 201	Partial Differential Equations and Transform Theories	2+1
2.	SAC 201	Fundamentals of Soil Science `	2+1
3.	FSN 101	Principles of Food Science	2+1
4.	FMP 201	Theory of Machines	2+1
5.	AST 201	Strength of Materials	2+1
6.	SWE 201	Fluid Mechanics and Hydraulics	2+1
7.	FPE 201	Refrigeration and Air Conditioning	1+1
8.	FPE 202	Unit operations in Food Processing	2+1
9.	FMP 202	Machine Drawing	0+1
Total			**15+9=24**

MAT 201 PARTIAL DIFFERENTIAL EQUATIONS AND TRANSFORM THEORIES (2+1)

THEORY

Unit-I: Partial Differential equations

Formation – Solutions of standard types of first order equations – Lagrange's Linear equation – Linear Partial differential equations of second and higher order with constant coefficients**.**

Unit-II: Fourier Series

Fourier series expansion- Dirichlet's conditions- change of intervals-even and odd functions– General Fourier series – Half –range Sine and cosine series – Parseval's identity (without proof) – Harmonic Analysis.

Unit-III: Applications of Partial Differential equations

Classification of second order linear partial differential equations – solutions of one – dimensional wave equation, one – dimensional heat equation – Steady state solution of two- dimensional heat equation- Fourier series solutions in Cartesian coordinates.

Unit-IV

Fourier Transform *:* Statement of Fourier integral theorem- Fourier transform pairs – Fourier sine and Cosine transforms – Properties – Transforms of simple functions- convolution theorem – Parseval's identity (without proof)

Unit-V

Z-Transform - Definition of Z-Transforms – Properties– z-transform of basic functions – convolution theorem – inverse z-transforms – z-transforms to solve the difference equations**.**

PRACTICAL

Formation and solution of Partial differential equations-Lagrange's Linear equation - Linear Partial differential equations of second and higher order with constant coefficients-Fourier series expansion of functions-Change of intervals and even and odd functions- Half –range Sine and cosine series -Harmonic Analysis.-Classification and solution of second order linear partial differential equations -Solutions of one –dimensional wave equation-Solution of one – dimensional heat equation - Steady state solution of two- dimensional heat equation- Fourier series solutions in Cartesian coordinates-Fourier

integral theorem- Fourier transform pairs-Transforms of simple functions- convolution theorem -Z-Transforms – Properties – convolution theorem - Z-transform of basic functions and z-transforms to solve the difference equations.

LECTURE SCHEDULE

1. Formation of partial differential equation
2. Solutions of standard types of first order equations(type 1 &type 2)
3. Solutions of standard types of first order equations (type 3 &type 4)
4. Lagrange's Linear equation
5. Linear Partial differential equations of second with constant coefficients
6. Linear Partial differential equations of higher order with constant coefficients with right hand side e^x, x^n.
7. Linear Partial differential equations of higher order with constant coefficients with right hand side sinx, cosx .
8. Fourier series- Dirichlet's conditions
9. General Fourier series –Euler's constants
10. Fourier series expansion if even and odd functions
11. Change of intervals
12. Fourier series expansion of periodic functions
13. Half –range Sine and cosine series
14. Parseval's identity (without proof)
15. Harmonic Analysis.
16. Classification of second order linear partial differential equations
17. **Mid semester examination**
18. Solutions of one –dimensional wave equation
19. Solution of one – dimensional heat equation
20. Steady state solution of two- dimensional heat equation
21. Fourier series solutions in Cartesian coordinates.
22. Statement of Fourier integral theorem
23. Fourier transform pairs
24. Fourier sine and Cosine transforms – Properties
25. Transforms of simple functions
26. Convolution theorem
27. Parseval's identity (without proof)
28. Definition of Z-Transforms and basic principles
29. Properties of Z- transforms
30. Z-transforms of simple functions
31. Convolution theorem
32. Z-transform of basic functions
33. Inverse z-transforms
34. Z-transforms to solve the difference equations.

PRACTICAL SCHEDULE

1. Formation and solution of Partial differential equations
2. Lagrange's Linear equation
3. Linear Partial differential equations of second and higher order with constant coefficients.

4. Fourier series expansion of functions
5. Change of intervals and even and odd functions- Half –range Sine and cosine series
6. Harmonic Analysis.
7. Classification and solution of second order linear partial differential equations
8. Solutions of one –dimensional wave equation
9. Solution of one – dimensional heat equation
10. Steady state solution of two- dimensional heat equation
11. Fourier series solutions in Cartesian coordinates.
12. Fourier integral theorem
13. Fourier transform pairs
14. Transforms of simple functions- convolution theorem
15. Z-Transforms – Properties – convolution theorem
16. Z-transform of basic functions and z-transforms to solve the difference equations.
17. **Final Practical Examination**

TEXT BOOKS

1. Kandasamy, P., Thilagavathy, K., and Gunavathy, K., "Engineering Mathematics", Volumes II & III(6th revised edition) , S. chand & Co, New Delhi, 2008.
2. Grewal, B.S., "Higher Engineering Mathematics".40th Edition, Khanna Publishers, Delhi, 2007.

REFERENCE BOOKS:

1. Kreyzig, E., "Advanced Engineering Mathematics". Eighth Edition, John Wiley & Sons (Asia) Pte, Ltd., Singapore, 2007.
2. Narayanan, S., Manicavachagom Pillay, T.K. and Ramaniah, G., "Advanced Mathematics for Engineering Students ". Volumes I and III, S. Viswanathan (Printers and Publishers) Pvt. Ltd., Chennai, 2002.

E-REFERENCE

http://en.wikipedia.org/wiki/Fourier_series
http://math.ucsd.edu/~driver/231-02-03/lecture_notes.htm
http://en.wikipedia.org/wiki/Fourier_transform

E-JOURNALS

http://www.math.neu.edu/~Suciu/journals.html

SAC 201 Fundamentals of Soil Science (2 + 1)

Syllabus – Theory

Unit I

Soil – Pedalogical and edaphological concepts – Origin of the Earth – Composition of Earth's crust - Rocks and minerals – primary and secondary minerals.

Unit II

Weathering of rocks & minerals - Physical, chemical and biological weathering – Soil formation - factors-active & passive. Soil forming processes - fundamental and specific soil forming processes- Soil profile.

Unit III

Phases of soil. Soil physical properties and their significance – Soil texture and textural classes - Soil structure and classification – Soil consistency

Unit IV

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 V

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

Unit VI

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.

Syllabus-Practical

Identification of rocks and minerals - Study of a soil profile - collection and processing of soil samples - Determination of bulk density, particle density and porosity – Particle size analysis – Feel method – International pipette method - Soil moisture determination – Gravimetric method, gypsum block, tensiometer,TDR and neutron probe moisture meter. Determination of infiltration rate and hydraulic conductivity - Soil colour – Munsell colour chart - Soil temperature. Soil pH and EC - Organic carbon - Chemical constituents of soil - Field study of different soil types.

Theory -Lecture Schedule

1. Soil definition – soil as a three dimensional natural body - pedagogical and edaphological concepts.
2. Origin or Earth – theories – planetesimal and nebular hypothesis - Composition of Earth's crust.
3. Rocks – definition, formation, classification – igneous, sedimentary and metamorphic rocks
4. Brief description of important rocks – mineralogical composition
5. Minerals – definition, occurrence, classification of important soil forming primary minerals - silicate and non silicate minerals, ferro and non-ferro magnesium minerals
6. Formation of secondary minerals – clay minerals and amorphous minerals
7. Weathering of rocks and minerals – Physical, chemical and biological
8. Soil profile description – master horizons – pedon and poly pedon
9. Factors of soil formation - Active soil forming factors
10. Factors of soil formation - Passive soil forming factors
11. Fundamental soil forming process – elluviation, illuviation and humification.
12. Specific Soil forming processes – podzolization, laterization, salinization, alkalization, calcification, decalcification, pedoturbation.
13. Phases of soils – solid, liquid and gaseous phases – Properties of soil – defining the physical, chemical and biological properties
14. Soil texture – particle size distribution – textural classes – textural triangular diagram – significance of soil texture
15. Soil structure – classification – genesis - factors influencing structural stability – significance of soil structure
16. Soil consistence – cohesion, adhesion, plasticity, Atterberg's constants – upper and lower plastic limits, plasticity number- significance of soil consistence

17. Mid Semester Examination
18. Soil bulk density, particle density and porosity – factors influencing – significance
19. Soil colour – causes and measurement – Munsell colour chart – factors influencing soil colour – significance
20. Soil temperature – measurement, soil air – composition - aeration, measurement - significance of soil temperature and soil air
21. Soil water – forms of water, measurement, units of expression and pF scale
22. Soil water potentials – gravitational, matric, osmotic – soil moisture constants
23. Movement of soil water under saturated and unsaturated flow – infiltration, hydraulic conductivity, percolation, permeability and drainage
24. Soil colloids – types, properties – inorganic colloids and organic colloids
25. Layer silicate clays – genesis and classification – 1:1, 2:1 expanding and non expanding, 2:2 clay minerals, amorphous minerals
26. Sources of charges in expanding and non expanding crystalline lattice clays, amorphous minerals and organic colloids
27. Ion exchange reactions – cation exchange, anion exchange and base saturation - significance
28. Soil reaction (pH) – definition, pH scale, factors affecting soil pH, buffering capacity - signification
29. Soil Electrical Conductivity – factors affecting EC – significance
30. Soil organic matter – composition, decomposition, mineralization and immobilization
31. Carbon cycle, C : N ratio, biomass carbon and nitrogen
32. Fractions of soil organic matter – humus formation and stabilization
33. Soil organisms – soil flora and fauna –beneficial and harmful roles – earth worms – micro-organisms and their influence on soil properties
34. Importance of soil properties in crop growth

Practical Schedule

1. Identification of common rocks and minerals
2. Soil sample collection
3. Visit to soils of different terrains and study of soil profiles
4. Determination of bulk density, particle density and porosity – cylinder, wax coating and core methods.
5. Soil textural analysis – feel method, International pipette method (part 1)
6. International pipette method (part 2)
7. International pipette method (part 3)
8. Determination of soil colour and temperature.
9. Determination of soil moisture– Gravimetric and gypsum block method
10. Determination of soil moisture–Tensiometer, TDR and neutron probe
11. Determination of Infiltration rate
12. Determination of hydraulic conductivity
13. Determination of soil pH and EC
14. Estimation of soil organic carbon
15. Colloquium 1. – Chemical constituents of soil – water soluble elements, total elemental composition – relevance in soil properties and behaviour

16. Colloquium 2. – Preparation of interpretative reports of soil analysis and assignments
17. Final Practical Examination

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3. http://www.pedosphere.com/volume01/pdf/Section_01.pdf
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5. http://wfrec.ifas.ufl.edu/landscape_horticulture/PDFdocuments/SoilProp.pdf
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7. http://www.soils.wisc.edu/courses/SS325/morphology.htm
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FSN 251 PRINCIPLES OF FOOD SCIENCE (2+1)

THEORY

Unit - I Introduction to Food Science

Definition of food. Nutrients - macro and micro constituents. Functions of foods. Food groups. Food Science - Definition - objectives and applications.

Unit - II Methods of cooking and sensory evaluation of foods

Methods of cooking - moist heat, dry heat and combination methods. Nutrient losses during cooking and processing. Sensory evaluation of foods - methods and applications.

Unit - III Cooking qualities of foods

Nutritive value, Factors affecting during cooking of foods- Cereals, pulses, nuts and oilseeds, vegetables, milk, meat, fish, egg and poultry. Spices and condiments – types – use in cookery

Unit -IV Properties of foods

Gelatinization, denaturation, colloids, emulsion, foam, sol, gel, fermentation, crystallization, enzymatic and non - enzymatic browning of foods. Antinutritional factors in foods.

Unit - V Food additives

Classification and role - preservatives, antioxidants, chelating agents, flour improvers, artificial sweeteners, flavours, colours, nutrient enhancement, stabilizers, emulsifier firming agent, leavening and releasing agent. Food fortification - enrichment - need - application in foods.

PRACTICAL

Cooking quality tests - cereals, pulses, vegetables, meat, poultry and fish - Gelatinization of starch - Denaturation of protein, stages of sugar cookery – formation of emulsion - enzymatic and non enzymatic browning. Leavening agents - clarifying agents - foam and its stability. Food enrichment.

LECTURE SCHEDULE

1. Food - Nutrients - Food groups and functions
2. Food science - objectives and applications
3. Cooking - definition, advantages and disadvantages. Nutrient losses during cooking
4. Methods of cooking - dry heat, moist heat and combination method.
5. Sensory evaluation of food -methods and application
6. Cereals - rice, wheat and millets - nutritive value and cooking qualities
7. Pulses - types, composition, nutrients
8. Pulse cookery - factors affecting - methods to reduce cooking time - effect of sprouting
9. Crystallization - factors affecting - stages of sugar cookery.
10. Nuts and oilseeds - types, properties of oils and fats.
11. Use of fat in cookery -functions - changes in cooking, absorption during frying
12. Rancidity in fats - types, prevention
13. Vegetables - classification, composition
14. Cooking of vegetables - changes in texture colour, flavour - factors affecting - effect of acid and alkaline on natural pigments.
15. Milk - composition - use in cookery
16. Meat - composition - post mortem changes - tenderization - factors affecting tenderness.
17. **Mid semester examination**
18. Meat cookery - types - changes during cooking
19. Fish - composition - characteristics of fresh fish - spoilage - cooking of fish
20. Egg - structure and composition - characteristics, grading - changes on cooking
21. Poultry - composition - methods of cooking
22. Spices and condiments - types, use in cookery
23. Properties - gelatinization of starch and its characters. Denaturation of protein – milk and egg.
24. Colloids - formation and types. Emulsion - types, formation, properties stability
25. Foam - formation stability, antifoaming agents sol - gel - formation and properties
26. Enzymatic and non-enzymatic browning- prevention
27. Anti- nutritional factors in legumes - methods to reduce
28. Food additives – functions, uses and classification.
29. Role of preservatives and its application.
30. Role of anti oxidants, chelating agents and flavour improvers.
31. Role of artificial flavours and colouring agents.
32. Role of nutrient enhancement, stabilizer, emulsifier, firming agent, clarifying and releasing agents.
33. Role of leavening agents – classification – physical, chemical, biological.

34. Food fortification and enrichment - need - methods

PRACTICAL SCHEDULE

1. Cooking Qualities -Cereals
2. Cooking Qualities - Pulses
3. Cooking Qualities - Vegetables
4. Meat - Tenderization
5. Egg - Changes in cooking
6. Fish - Cooking qualities - curing
7. Gelatinization of starch
8. Milk – Changes in cooking
9. Stages of sugar cookery
10. Preparation of emulsion and its evaluation
11. Preparation of mayonnaise and its characters
12. Studies on enzymatic browning of fruits and vegetables
13. Study on leavening agents
14. Study on clarifying agents
15. Study on foam formation and its stability
16. Food fortification and evaluation
17. **Final practical examination**

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1. Potter, N. 2005. Food Science, CBS Publishers and Distributors, Delhi.
2. Srilakshmi, B. 2005. Food Science. New Age International (P) Ltd., Publishers, New Delhi.

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1. Benion, M. 1970. Introductory Foods, 8th Edn., The MacMillan Co.London
2. Swaminathan, M. 1995. Food Science and Experimental Foods, Ganesh and Co., Madras.
3. Bernard, W.M. 1997. Chocolate, cocoa and confectionery : Science and Technology (Third Edition) CBS Publishers and distributors, New Delhi.
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5. Desrosier, N.W. and J.N. Desrosier.2002.The technology of food preservation (4th edition). CBS Publishers and Distributors. New Delhi.

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1. Journal of Food Science and Technology
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FMP201 THEORY OF MACHINES (2+1)

THEORY

UNIT I Basic Concepts of machines

Basic concept of machines - kinematics - links - pairs - chain - machines and mechanism - Different mechanisms and uses - Inversion of mechanisms - Four bar linkage - its inversions - synthesizing a mechanism for predefined motion - velocity and acceleration in mechanisms – Determination of velocity and acceleration by vector polygon and instantaneous centre methods.

UNIT II Friction and friction drives

Friction - pivot and collar friction - bearings - types - loss of power due to friction in bearings - theory of lubrication - viscosity ratings - Brakes – - types - band, shoe - Clutches - types - single and multiple disc - cone and their applications.

Power drives - belt - flat and V belts - Tension ratio - centrifugal tension – creep - Chain drives - Gears - classification – gear nomenclature – gear profiles - law of gearing - minimum number of teeth - interference between rack and pinion - efficiency - Gear trains - simple - compound.

UNIT III Cams

Cam and follower - types - application - profiles for uniform velocity and acceleration, simple harmonic, cycloidal motion and uniform angular velocity.

UNIT IV Speed and inertia in machines

Governors – watt and porter governor – sensitivity and hunting, Fly wheel – function – flucturation of speed and energy - Balancing of masses in single and multiple planes.

PRACTICAL

Mechanisms - locus of mechanisms - Drawing of velocity and acceleration diagram by vector polygon and instantaneous centre method, drawing of cam profiles - Problems and experiments on balancing - working out problems on - friction - brakes - clutches - belt drives - chains - gear - gear trains, governors.

LECTURE SCHEDULE

1. Definitions - kinematic links - pairs - chain - explanation with examples.
2. Structure and machine - machine and mechanism - difference - examples and explanations.
3. Different types of the mechanisms and their applications.
4. Four bar chain - inversions of mechanisms - slider crank chain.
5. Velocity and acceleration in mechanisms.
6. Relative velocity and acceleration - concepts and derivations.
7. Methods of finding velocity and acceleration - principles involved and brief descriptions - Kennedy's theorem.
8. Instantaneous centre method and solving velocity problems.
9. Vector polygon method and its application for finding velocity of points in mechanisms.
10. Corriollis acceleration - Acceleration polygon .
11. Friction - introduction - coefficient of friction and angle of repose - force analysis of a sliding body - Friction on inclined plane - Nut with screw.
12. Pivot and collar friction - flat - collar - conical pivots.
13. Bearings - lubrication - oils - viscosity rating

14. Different types of bearings - expression for loss of power - calculation of friction moment
15. Brakes - types -Band and internal shoe brakes - description and principle of working.- Determination of pressure and braking torque
16. Clutches - types - torque transmitted - description and working principles
17. Mid semester examination
18. Problems related to brakes and clutches, trouble shooting and remedies.
19. Belt transmission - flat and V - belts - Open and cross belting - Determination of belt length V belt specification and classes
20. Expression for tension ratio - centrifugal tension - creep - power transmitted by belts. Pulleys - flat, V, stepped, cone - crowning
21. Chain drives - kinematics - chain classification - chain length determination - sprocket terminology
22. Toothed gears - introduction - Nomenclature - types and application - law of gearing.
23. Involute functions - characteristics of involute
24. Interference - Number of teeth of gears and length of contact.
25. Gear trains - Applications.
26. Method of solving problems for simple compound and reverted trains
27. Cams - types and application - followers - types and application.
28. Procedure for obtaining cam profile for uniform velocity, acceleration and deceleration.
29. Cam profile for simple harmonic and cycloidal motions.
30. Governors – Watt and Porter – principle of operation – problems
31. Sensitivity and hunting of governors – governor power and effort
32. Fly wheel – introduction – fluctuations of speed and energy – its expression – problems.
33. Balancing - static and dynamic - balancing of rotating masses in single plane.
34. Balancing of rotating masses in multiple planes.

PRACTICAL SCHEDULE

1. Drawing of locus of points in four bar and slider crank mechanisms.
2. Location of instantaneous centres in mechanisms.
3. Determination of velocity of points in mechanisms by instantaneous centre method.
4. Determination of velocity by vector polygon method
5. Drawing of acceleration polygon for four bar and slider crank mechanisms.
6. Determination of acceleration in scotch yoke and shaper mechanisms.
7. Problems in belt transmissions and brakes.
8. Problems on clutches and brakes.
9. Drawing of cam profile for uniform velocity.
10. Drawing of cam profile of uniform acceleration and deceleration.
11. Drawing of cam profile for simple harmonic and cycloidal motions.
12. Balancing of masses in single and multiple planes.
13. Experiment with static balancing machine to find out the unbalanced mass and its position.
14. Problems on gears and gear trains.
15. .Problems on governors.
16. Problems on fly wheels.
17. Practical examination.

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2. Jagdish Lal. 1992. Theory and mechanisms and machines. Metropoliton Book Pvt. Ltd. New Delhi
3. Khurmi, R.S. and Gupta, J. K. 2005. S Chand & Co Ltd; 14th edition.
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AST 201 STRENGTH OF MATERIALS (2+1)

THEORY

Unit I: Stresses and Strains

Simple stresses and strains – elasticity and plasticity - force deformation curve for biological materials - Hooke's Law – Principle of superposition – Stresses in bars of different sections – stresses in bars of uniformly tapering sections and in composite bars.

Unit II: Thermal stress and Elastic Constants

Thermal stresses and strains in simple bars and composite bars – lateral and linear strain – Poisson's ratio – volumetric strain of a rectangular body subjected to an axial force - relation between elastic constants and their derivation.

Unit III: Centre of gravity and Moment of Inertia

Centroid – plane figures, symmetrical, unsymmetrical sections, solid bodies and cut out holes - moment of inertia – rectangular section, perpendicular axis theorem – circular section, parallel axis theorem – unsymmetrical section.

Unit IV: Shear Force and Bending moment

Types of loads acting on the beams – different types of beams – shear force – bending moment – sign conventions – relation between shear force and bending moment. Analysis of perfect frame – bending stresses in beams – shearing stresses in beams

Unit V: Deflection of beams, Cylindrical Shells and Columns

Deflection of beams – double order differential equation method – Macaulay's method. Thin cylindrical and spherical shell – combined bending and direct thrust – columns and struts – torsion of circular shafts – Shaft coupling – Design of keys and bolts.

PRACTICAL

Stresses and strains – principle of superposition – bars of varying section – volumetric strain - centriod of unsymmetrical sections - moment of inertia of unsymmetrical sections and cutout sections – shear force and bending moment diagrams for simply supported, cantilever, one-side overhanging, double-side overhanging beams – force determination in members of simply supported trusses, cantilever trusses - thin cylindrical and spherical shell - eccentric loading of symmetrical and unsymmetrical columns

LECTURE SCHEDULE

Unit I: Stresses and Strains

1. Simple stresses and strains – elasticity
2. Elasticity and plasticity – yield point, bio yield point and rupture point – non-linear stress and strain diagram – force deformation curve for biological materials. Types of stresses – Hooke’s Law – Young’s modulus of elasticity
3. Simple stresses and strains – problems
4. Stresses in composite bars

5. Problems in composite bars

Unit II: Thermal stress and Elastic Constants

6. Thermal stresses in straight bars
7. Problems
8. Thermal stresses in composite bars - problems
9. Elastic constants – primary strain – secondary strain - Poisson's ratio – problems
10. Volumetric strain due to axial force – problems
11. Relation between E, N and K – derivation of equations – problems

Unit III: Centre of gravity and Moment of Inertia

12. Centroid – determination of centroid for unsymmetrical plane sections by moment method
13. Centroid of cut out sections - problems – integration method
14. Moment of Inertia – parallel axis theorem – perpendicular axis theorem – radius of gyration – modulus of section
15. Moment of inertia for cut out sections and unsymmetrical sections
16. Solving problems in moment of inertia.
17. **Mid semester examination**

Unit IV: Shear Force and Bending moment

18. Shear force diagram and bending moment diagram for simply supported beam subjected to different types of loads
19. Shear force diagram and bending moment diagram for cantilever beam subjected to different types of loads
20. Shear force diagram and bending moment diagram for one side and double side overhanging beams subjected to different types of load
21. Bending stresses in beams – derivation of bending equations
22. Bending stresses in symmetrical and unsymmetrical sections – problems
23. Shearing stresses in beams – derivation of shear stress equation
24. Shear stress equation for rectangular, circular, I Section and T section – problems
25. Analysis of Frame by method of a) Joint b) Section

Unit V: Deflection of beams, Cylindrical Shells and Columns

26. Deflection of beams – derivation of double order differential equation
27. Deflection of cantilever, simply supported beam – problems – Macaulay's method
28. Derivation of equations – thin cylindrical shell – problems, thin spherical shell – problems
29. Combined bending direct thrust – middle third rule – uniaxial and biaxial eccentric load – problems
30. Columns and Struts – short and long column
31. Euler's Buckling load for different end conditions of column
32. Empirical formulae – problems
33. Torsion of circular shafts – horse power transmitted by shaft
34. Shaft coupling – Design of keys and bolts.

PRACTICAL SCHEDULE

1. Principle of superposition
2. Stresses and strain in bars of varying section
3. Volumetric strain
4. Centroid of unsymmetrical sections
5. Moment of inertia of unsymmetrical sections

6. Moment of inertia of cutout sections
7. Shear force diagram and bending moment diagram for simply supported beams
8. Shear force diagram and bending moment diagram for cantilever beams
9. Shear force diagram and bending moment diagram for one side overhanging beams
10. Shear force diagram and bending moment diagram for double side - overhanging beams
11. Force determination in members of simply supported trusses
12. Force determination in members of a cantilever trusses
13. Deflection of simply supported beams – Macaulay's method
14. Deflection of cantilever beams – Macaulay's method
15. Thin cylindrical and spherical shell
16. Eccentric loading of symmetrical and unsymmetrical columns
17. Final practical examination.

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1. Khurmi.R.S. 2007. Strength of materials. S.Chand and Company, New Delhi.
2. Punmia, B.C. 2004. Strength of Materials. Standard Publishers Distributors, New Delhi.

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1. Aggarwal, S.K. and P.K.Gupta. 1994. Strength of materials. Metropolitan Book Co., New Delhi.
2. Bansal. 1992. Engineering mechanics and strength of materials. Laximi Publishers, New Delhi.
3. Barre, H.T. and Sammet 1990. Farm Structures. M.C. Graw Hill Book Co., New York.
4. Basavarajaiah, B.S. and Mahadevappa. P. 1991. Strength of Materials, Standard Publishers and distributors, New Delhi.

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SWE 201 FLUID MECHANICS AND HYDRAULICS (2+1)

Theory

Unit I - Properties of fluids

Properties of fluids – definition – units of measurement - Mass density – specific weight, specific volume – specific gravity equation of state – perfect gas - Viscosity – vapour pressure – compressibility and elasticity surface tension – capillarity. Fluid pressure and measurement – simple, differential and micro manometers - Mechanical gages – calibration. Hydrostatic forces on surfaces – total pressure and centre of pressure - Horizontal- vertical and inclined plane surface - Pressure diagram – total pressure on curved surface. Archimedes principles – buoyancy – meta centre – metacentric height

Unit II - Fluid flow analysis

Types of fluid flow – velocity and acceleration of a fluid particle - Rotational – irrotational – circulation and vorticity - Flow pattern – stream line – equipotential line – stream tube – path line – steak line – flow net – velocity potential – stream function. Principles of conservation of mass – energy – momentum – continuity equation in Cartesian co-ordinates - Euler's equation of motion.

Unit III – Flow measurements

Bernoulli's equation – applications - Venturimeter – orifice meter – nozzle meter rota meter – elbow meter pitot tube – Orifice – sharp edged orifice discharging free – submerged orifice – mouth piece - Flow through orifice under variable head – time of emptying a tank with and without inflow. Flow through pipes – laminar and turbulent flow in pipes - Reynold's experiment - Darcy – Weisbach equation for friction head loss – Chezy's formula – Manning's formula – Hazen-William's formula - Major and minor losses in pipes – hydraulic gradient line – energy gradient line. Siphon – water hammer in pipes – gradual and sudden closure of values

Unit IV – Open channel flow

Types of flow in channel – uniform flow – most economical section of channel – rectangular – trapezoidal. Specific energy and critical depth - momentum in open channel flow – specific force - critical flow – computation. Flow measurement in channels – notches – rectangular, Cippollette and triangular – float method - Flow measurement in rivers/ streams/ canals – weirs – free and submerged flow – current meter – Parshall flume.

Unit V - Dimensional analysis & Pumps

Dimensional analysis – concept of geometric, kinematic and dynamic similarity. Important non-dimensional numbers – Reynolds, Froude, Euler, Mach and Weber. Pump terminology – suction lift, suction head, delivery head, discharge, water horse power – selection of pump capacity. Centrifugal pumps – components – working – types of pumps and impellers - Priming – cavitation – specific speed – characteristics curves. Turbine and submersible pumps - Jet pump – jet assembly - Other pumps – Air lift pump - reciprocating pump - sludge pump and vacuum pump-Hydraulic ram

Practical

Problems on properties of fluid - Pressure measurement - hydrostatic forces - kinematics of flow - continuity equation - tank emptying - Measurement of head loss in pipe lines and pipe fittings - Flow measurement in pipes with venturi meter & orifice meter - Flow measurement in channels - most economical channel section - Design of channel - Dimensional Analysis - Study on performance of centrifugal pumps - mono-block pump - reciprocating pump

Lecture schedule

Unit I - Properties of fluids

1. Properties of fluids – definition – units of measurement
2. Mass density – specific weight, specific volume – specific gravity equation of state – perfect gas
3. Viscosity – vapour pressure – compressibility and elasticity surface tension – capillarity
4. Fluid pressure and measurement –simple, differential and micro manometers
5. Mechanical gages - calibration
6. Hydrostatic forces on surfaces – total pressure and centre of pressure. Horizontal- vertical and inclined plane surface
7. Pressure diagram – total pressure on curved surface
8. Archimedes principles – buoyancy – meta centre – metacentric height

Unit II - Fluid flow analysis

9. Types of fluid flow – velocity and acceleration of a fluid particle
10. Principles of conservation of mass – energy – momentum – continuity equation in Cartesian co-ordinates
11. Rotational – irrotational flow – circulation and vorticity
12. Flow pattern – stream line – equipotential line – stream tube – path line – steak line – flow net – velocity potential – stream function
13. Euler's equation of motion

Unit III – Flow measurements

14. Bernoulli's equation – applications - Venturimeter – orifice meter – nozzle meter rota meter – elbow meter pitot tube
15. Orifice – sharp edged orifice discharging free – submerged orifice – mouth piece
16. Flow through orifice under variable head – time of emptying a tank with and without inflow.
17. Mid semester examination
18. Flow through pipes – laminar and turbulent flow in pipes - Reynold's experiment

19. Darcy – Weisbach equation for friction head loss – Chezy's formula – Manning's formula – Hazen-William's formula
20. Major and minor losses in pipes – hydraulic gradient line – energy gradient line.
21. Siphon – water hammer in pipes – gradual and sudden closure of values

Unit IV – Open channel flow

22. Types of flow in channel – uniform flow – most economical section of channel – rectangular – trapezoidal
23. Specific energy and critical depth
24. Momentum in open channel flow – specific force.
25. Critical flow – computation
26. Flow measurement in channels – notches – Rectangular, Cippollette and triangular – float method
27. Flow measurement in rivers/ streams/ canals – weirs – free and submerged flow – current meter – Parshall flume.

Unit V - Dimensional analysis & Pumps

28. Dimensional analysis – concept of geometric, kinematic and dynamic similarity
29. Important non-dimensional numbers – Reynolds, Froude, Euler, Mach and Weber
30. Pump terminology – suction lift, suction head, delivery head, discharge, water horse power – selection of pump capacity
31. Centrifugal pumps – components – working – types of pumps and impellers
32. Priming – cavitation – specific speed – characteristics curves
33. Turbine and submersible pumps - jet pump – jet assembly
34. Other pumps – Air lift pump - reciprocating pump - sludge pump and vacuum pump-Hydraulic ram

Practical schedule

1. Problems on properties of fluid
2. Problems in Pressure measurement
3. Problems on hydrostatic forces
4. Problems on kinematics of flow
5. Problems on continuity equation
6. Measurement of head loss in pipe lines and pipe fittings with manometers
7. Flow measurement in pipes with venturi meter
8. Flow measurement in pipes with orifice meter
9. Problems on tank emptying
10. Problems on most economical channel section
11. Problems on Dimensional Analysis
12. Design of channel
13. Flow measurement in channels
14. Study on performance of centrifugal pumps
15. Study on performance of mono-block pump
16. Study on reciprocating pump
17. Final practical examination.

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1. Modi, P.N. and Seth S.M., 2010. Hydraulics and fluid mechanics. Standard Publishers Distributors, New Delhi.

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1. Bansal, R.K., 2002. A text book of fluid mechanics and hydraulic machinery, Laxmi publications (P) Ltd., New Delhi.
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2. ASCE Journal of Hydraulic Engineering

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1. www.onesmartclick.com/engineering/fluid-mechanics.html
2. www.it.iitb.ac.in/vweb/engr/civil/fluid_mech/course.html

FPE 201 REFRIGERATION AND AIR CONDITIONING 1+1

UNIT I: Refrigeration principles

Refrigeration – principles - refrigeration effect – coefficient of performance – units of refrigeration - simple vapour compression cycle – T-S diagram – p-h chart - application of refrigeration and air conditioning.

UNIT II: Vapour compression refrigeration and components

Vapour compression system - refrigeration components – compressor and condenser – types, construction and working - expansion device and evaporators – types, construction and working.

UNIT III : Refrigerants and vapour absorption cycle

Refrigerants – properties – classification – comparison and advantages – chloro flouro carbon (CFC) refrigerants - effect on environmental pollution - alternate refrigerants - vapour absorption cycle – theoretical - deviation in practice - Electrolux refrigerator – construction and principles.

UNIT IV: Air Conditioning - Psychrometry

Properties of moist air, psychrometric properties and measurement – psychrometric chart - saturation line – relative humidity line – constant specific volume lines – constant thermodynamic wet bulb temperature lines – constant enthalpy lines – different psychrometric process-air mixing process and simple air conditioning process – solving problems using psychrometric chart.

UNIT V: Air Conditioning system

Air conditioning systems - winter and summer air conditioning system - cooling and heating coils - bypass factor - effective sensible heat factor, determination of apparatus dew point (ADP) – air distribution system – room air distribution system - ducts classification - duct design –evaporative cooling and its application - estimation of cooling load and application of refrigeration and air conditioning.

PRACTICAL

Solving problems on air-cycle – vapour compression cycle – vapour absorption cycle – experiments on determination of coefficient of performance of refrigeration system using refrigeration tutor, domestic refrigerator, ice plant tutor and air-conditioning tutor – experiments on cooling and heating systems – solving problems on air-conditioning using psychrometric chart and duct design.

Lecture schedule

1. Refrigeration – principles and types – refrigeration effect – coefficient of performance – units of refrigeration.
2. Simple vapour compression cycle – T-S diagram –p-h chart.
3. Refrigeration components – compressor and condenser.
4. Types of expansion device and evaporators.
5. Refrigerants – properties – classification – comparison and advantages
6. CFC refrigerants - effect on environmental pollution - alternate refrigerants

7. Vapour absorption cycle – theoretical- deviation in practice
8. Electrolux refrigerator – construction and principles
9. Mid semester examination
10. Properties of moist air, psychrometric properties
11. Psychrometric chart – sensible heating – sensible cooling process – different psychrometric process
12. Air mixing process and simple air conditioning process
13. Air conditioning systems-winter and summer air conditioning system
14. Cooling and heating coils-bypass factor
15. Effective sensible heat factor, determination of ADP – air distribution system – room air distribution system
16. Ducts classification-pressure loss in ducts-duct design –methods of determination of duct size-systems in series-systems in parallel
17. Evaporative cooling and its applications-estimation of cooling load and application of refrigeration and air conditioning.

Practical schedule

1. Solving problems on air cycles
2. Solving problems on vapour compression cycle
3. Experiments with refrigeration tutor
4. Experiments on coefficient of performance of domestic refrigerator
5. Experiments on ice plant tutor
6. Solving problems on vapour absorption cycle
7. Experiment on air conditioning tutor
8. Solving problems on air conditioning with psychrometric tables
9. Solving problems on air conditioning with psychrometric charts
10. Experiments with humidification chamber
11. Experiments with dehumidification chamber
12. Experiments on cooling coils
13. Experiments on heating coils
14. Estimation of cooling load
15. Solving problems and design of ducts
16. Visit to a cold storage
17. Final practical examination

TEXT BOOKS

1. Bellaney, P.L. 2001. Thermal Engineering. Khanna Publishers, New Delhi.
2. Kurmi.R.S and J.K.Gupta 2002. A Text book of Refrigeration and Air conditioning. Eurasia Publishing House (P) Ltd, Ram Nagar, New Delhi.

REFERENCE BOOKS

1. Arora, C. P. 1981. Refrigeration and Air conditioning. Tata-McGraw-Hill Publishing Co., New Delhi.
2. William, H.S., R.F. Julian, 1986. Air conditioning and Refrigeration. John Wiley & Sons, Inc. London.

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JOURNALS
Transaction of the American Society of Agricultural Engineers
Journal of Biosystems Engineering
Journal of Food Engineering

FPE 202 UNIT OPERATIONS IN FOOD PROCESS ENGINEERING 2+1

THEORY

UNIT I: Evaporation and concentration

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-performance of evaporators and boiling point elevation – capacity – economy and heat balance-types of evaporators – once through and circulation evaporators – short tube evaporators and long tube evaporators – agitated film evaporator

UNIT II: Mechanical separation

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

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.

UNIT IV: Contact equilibrium separation

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 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 and Distillation

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-distillation equipments – construction and operation – factors influencing the operation.

PRACTICAL

Economy and thermal efficiency of evaporator for concentration of juice-separation efficiency of centrifugal separator, energy requirement in size reduction using burr mill, ball mill, hammer mill, muller

mill, collection efficiency of cyclone separator, liquid-solid separation by filtration, particle size determination by sieve analysis – visit to a food industry.

Lecture schedule

1. Introduction – unit operations involved in food processing
2. Conservation of mass and energy – overall view of an engineering process
3. Dimensions and units – dimensional consistency – unit consistency – dimensionless ratios
4. Evaporation – definition – difference between drying, distillation and crystallization – liquid characteristics
5. Performance of evaporators and boiling point elevation – single effect evaporator – multiple effect evaporator – capacity – economy and heat balance
6. Types of evaporators – once through and circulation evaporators – short tube evaporators and long tube evaporators – agitated film evaporator
7. Filtration – definition –filter media – types and requirements
8. Constant rate filtration – constant pressure filtration – filter cake resistance
9. Filtration equipment – rotary vacuum filter – filter press
10. Sedimentation – gravitational sedimentation of particles in a fluid – Stoke's law, sedimentation of particles in gas
11. Cyclones – settling under sedimentation and gravitational sedimentation
12. Centrifugal separations – rate of separations – liquid – liquid separation – centrifuge equipment
13. Size reduction – grinding and cutting – principles of comminuting – characteristics of comminuted products – particle size distribution in comminuted products
14. Energy and power requirements in comminuting – crushing efficiency – Rittinger's, Bond's and Kick's laws for crushing
15. Size reduction equipments – crushers – jaw crusher and gyratory crusher
16. Crushing rolls – grinders – hammer mills – rolling compression mills
17. Mid semester examination
18. Attrition mills – revolving mills – rod mills, ball mills and tube mills – construction and operation
19. Contact equilibrium separation processes – concentrations – gas-liquid equilibrium.
20. Solid-liquid equilibrium – equilibrium concentration relationships – operating conditions
21. Calculation of separation in contact – equilibrium processes
22. Gas absorption – rate of gas absorption – stage – equilibrium gas – absorption equipment
23. Properties of tower packing – types – construction – flow through packed towers
24. Extraction – rate of extraction – stage equilibrium extraction
25. Equipment for leaching coarse solids – intermediate solids – basket extractor
26. Extraction of fine material – Dorr agitator – continuous leaching – decantation systems – extraction towers
27. Washing – equipments – solubility and equilibrium diagram
28. Crystallization – equilibrium – rate of crystal growth – equilibrium crystallization
29. Crystallization equipment – classification – construction and operation
30. Tank, agitated batch, Swenson-Walker vacuum crystallizers
31. Distillation – binary mixtures – flash and differential distillation
32. Steam distillation – theory – consumption – continuous distillation with rectification – vacuum distillation
33. Batch distillation – operation and process – advantages and limitations

34. Distillation equipments – construction and operation – factors influencing the operation.

Practical schedule

1. Determination of economy and thermal efficiency of evaporator
2. Solving problems on single effect evaporator
3. Solving problems on multiple effect evaporators
4. Determination of separation efficiency of centrifugal separator
5. Determination of collection efficiency in cyclone separator
6. Determination of efficiency of liquid solid separation by filtration
7. Determination of absorption efficiency in a packing tower
8. Determination of particle size of granular foods by sieve analysis
9. Performance evaluation of a sieve
10. Determination of performance characteristics in size reduction using the burr mill
11. Determination of energy requirement in size reduction using the ball mill and hammer mill
12. Performance evaluation of pin mill
13. Performance evaluation of a hammer mill
14. Performance evaluation of a steam distillation process
15. Visit to a solvent extraction industry
16. Visit to a sugar industry
17. Practical examination.

Text books

1. Earle, R.L. 2003. Unit Operations in Food Processing. Pergamon Press. Oxford. U.K.
2. Geankoplis C.J.1999. Transport Process and Unit Operations. Prentice-Hall of India Private Limited, New Delhi.

Reference books

1. Coulson, J.M and J.F. Richardson. 1999. Chemical Engineering. Volume I to V. The Pergamon Press. New York.
2. McCabe, W.L., J.C.Smith and P.Harriot. 2001. Unit Operations of Chemical Engineering. McGraw-Hill. Inc. Kosaido Printing Ltd. Tokyo, Japan.
3. Sahay, K. M. and K.K.Singh. 2004. Unit operation of Agricultural Processing, Vikas Publishing House Pvt. Ltd., New Delhi.

Journals:

1. Journal of Food Engineering
2. Journal of Biosystems Engineering
3. Transactions of the American Society of Agricultural Engineers

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1. www.nzifst.org.nz/unitoperations/.htm

http://rpaulsingh.com/teaching/Lectures.htm

FMP 202 MACHINE DRAWING (0+1)

Practical

Projections – orthographic – isometric – oblique and perspective, dimensioning – terms and notations, conversion of pictorial views into orthographic views, sectional views – full – half – partial or broken – removed and offset sections – sectioning convension – section lines – cutting plane lines, orthographic reading and interpretation of views.

Forms of screw threads – BSW – square – metric, conventional representations of threads, bolts – headed countersunk – stud, screws and set screws, nuts – hexagonal – square, keys – types – taper – sunk tapper – hollow saddle – flat saddle – round – gib head – feather and woodruff keys, spline shaft.

Bearings – types – journal – soiled – bushed and plummer block, pully – flat and V – assembly drawing of tailstock – plummer block and simple agricultural implements.

Practical schedule

1. Dimensioning – different methods – terms and notations
2. Conversion of pictorial views of machinery parts into orthographic views
3. Sectional views – full and half sections
4. Partial or broken section – resolved section – removed section
5. Offset section – sectioning convention – section lines – cutting planes
6. Isometric view of machine parts and objects
7. Oblique view of machine parts and objects
8. Perspective view of machine parts and objects
9. Forms of screw threads – BSW – metric and square threads
10. Conventional representation of different materials and standard parts.
11. Hexagonal nut – square nut, hexagonal headed bolt – square headed bolt – counter sunk bolt – stud bolt and set screws
12. Types of keys – taper key – sunk taper key – hollow key – saddle key – flat saddle key – round key, spline shaft
13. Bearings – journal bearing – solid bearing – bush bearing
14. Plummer block – parts drawing – assembly drawing
15. Pulleys – flat – V pulley – different views
16. Assembly drawing of tailstock/simple agricultural implements
17. Practical examination

TEXT BOOKS

1. Gill .P.S. 1992. A text book 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.

REFERENCE BOOKS

1. Narayana, K.L. and P. Kannaiah. 1992. Engineering graphics. Tata Mcgraw Hill pub.
2. Parkinson, A.C. 1972. Foundation of technical drawing. Pitman pub. co. London.
3. Abbott, W. 1978. Technical drawing. Blackie and son, London.
4. Charles J Wierck. 1978. Engineering drawing and graphic technology. McGraw Hill.

WEB RESOURCES

1. http://www.tpub.com/content/draftsman/14040/css/14040_49.htm
2. http://chestofbooks.com/crafts/popular-mechanics/Amateur-Work-3/Machine-Drawing-III.html

IV Semester			
1	MAT 202	Numerical Methods for Engineering applications	2+1
2	ARM 201	Fundamentals of Agribusiness Management	1+1
3	FOR 211	Forest Resource Management	1+1
4	FMP 203	Electronics and Instrumentation	2+1
5	FMP 204	Machine Design and Computer Aided Drawing	1+2
6	ERG 201	Heat Power Engineering	1+1
7	AST 202	Engineering Materials, Construction, Estimation and Costing	2+1
8	FPE 203	Post Harvest Engineering of Agricultural Crops	2+1
Total			**12+9=21**

MAT 202 Numerical Methods for Engineering Applications (2+1)

THEORY

Unit-I: Numerical Solutions of equations and Eigen value Problem.

Iterative method, Newton – Raphson method for single variable. Solutions of a linear system by Gaussian, Gauss-Jordan, Jacobi and Gauss-Seidel methods. Inverse of a matrix by Gauss-Elimination method. Eigen value of a matrix by Power and Jacobi methods. Curve fitting – linear, quadratic , exponential and power function

Unit-II: Interpolation

Newton's divided difference formulae, Lagrange's and Hermite's polynomials. Newton forward and backward difference formulae. Stirling's and Bessel's Central difference formulae (without proof),

Unit-III: Numerical differentiation and integration

Numerical differentiation with interpolation polynomials. Numerical integration by Newton's cotes method ,Trapzoidal and Simpson's (both $1/3^{rd}$ and $3/8^{th}$) rules - Two and Three point Gaussian quadrature formula-Romberg Integration

Unit-IV: Initial value problems of ordinary differential equations

Single step Methods – Taylor Series, Euler and Modified Euler, Runge – Kutta method of order second, third and fourth for first and second order differential equations.

System of equations-Taylor series method ,Runge – Kutta method of order second, third and fourth for system of differential equations. Multistep method-Miline and Adams - **Bashforth predictor and corrector methods.**

Unit-V: Boundary value Problems

Finite difference solution for the second order ordinary differential equations. Finite difference solution for one dimensional heat equation (both implicit and explicit), One-dimensional wave equation and two-dimensional Laplace and Poisson equations.

PRACTICAL

Newton – Raphson method for single variable-Solutions of a linear system by Different Methods-Inverse of a matrix by Gauss-Elimination method - Eigen value of a matrix by Power and Jacobi methods. Curve fitting – linear, quadratic , exponential and power function. Newton's divided difference formulae, Lagrange's ad Hermite's polynomials- Newton forward and backward difference formulae- Stirling's and Bessel's Central difference formulae- Numerical differentiation with interpolation polynomials-Numerical integration by Newtons's cotes methos,Trapzoidal and Simpson's (both $1/3^{rd}$ and $3/8^{th}$) rules-Two and Three point Gaussian quadrature formula-Romberg Integration. Single step Methods- Taylor Series, Euler and Modified Euler method- Runge – Kutta method of order four for first and second order differential equations- System of equations-Taylor series method **,**Runge – Kutta method of order second, third and fourth for first order differential equations. Multistep method-Miline and Adams -Bashforth predictor and corrector methods. Finite difference solution for the second order ordinary differential equations-Finite difference solution for one dimensional heat equation (both implicit and explicit)- One-dimensional wave equation and two-dimensional Laplace and Poisson equations.

LECTURE SCHEDULE

1. Iterative method, Newton – Raphson method for single variable.
2. Solutions of a linear system by Gaussian, Gauss-Jordan methods
3. Solutions of a linear system Jacobi and Gauss-Seidel methods
4. Inverse of a matrix by Gauss-Elimination method
5. Eigen value of a matrix by Power methods.
6. Eigen value of a matrix by Jacobi methods.
7. Curve fitting – linear and quadratic function
8. Curve fitting- exponential and power function
9. Newton's divided difference formulae
10. Lagrange's and Hermite's polynomials
11. Newton forward difference formulae
12. Newton backward difference formulae
13. Stirling's and Bessel's Central difference formulae (without proof)
14. Numerical differentiation with interpolation polynomials
15. Numerical integration by Newton's cotes method
16. Numerical integration by Trapzoidal rules
17. **Mid Semester Examination**
18. Numerical integration by Simpson's (both $1/3^{rd}$ and $3/8^{th}$) rules
19. Two and Three point Gaussian quadrature formula
20. Romberg Integration
21. Single step Methods – Taylor Series method
22. Euler and Modified Euler method
23. Runge – Kutta method of order second & third for first and second order differential equations
24. Runge – Kutta method of order fourth for first and second order differential equations

25. System of equations-Taylor series method
26. Runge – Kutta method of order second & third for system of differential equations
27. Runge – Kutta method of order fourth for system of order differential equations
28. Multistep method-Miline and Adams methods
29. Bashforth predictor and corrector methods
30. Finite difference solution for the second order ordinary differential equations
31. Finite difference solution for one dimensional heat equation (both implicit and explicit)
32. One-dimensional wave equation
33. two-dimensional Laplace equations
34. **Two-dimensional Poisson equations.**

PRACTICAL SCHEDULE

1. Problems in Newton – Raphson method for single variable
2. Solutions of a linear system by Different Methods
3. Inverse of a matrix by Gauss-Elimination method- Eigen value of a matrix by Power & Jacobi methods
4. Problems in fitting linear ,quadratic, exponential and power function
5. Newton's divided difference formulae, Lagrange's ad Hermite's polynomials
6. Newton forward and backward difference formulae
7. Sterling's and Bessel's Central difference formulae
8. Numerical differentiation with interpolation polynomials.
9. Numerical integration by Newton's cotes method,Trapezoidal, Simpson's (both $1/3^{rd}$ and $3/8^{th}$) rules , using Gaussian quadrature formula and Romberg Integration
10. Problems in Taylor Series method, Euler and Modified Euler method
11. Problems in Runge – Kutta method of order second, third and fourth for first and second order differential equations
12. Problems in System of equations-Taylor series method, Runge – Kutta method of order second, third and fourth for first and second order differential equations
13. Problems in Miline and Adams method- Bashforth predictor and corrector methods
14. Finite difference solution for the second order ordinary differential equations
15. Problems in one dimensional heat and wave equation
16. Problems in two-dimensional Laplace and Poisson equations
17. **Final Practical Examination**

TEXT BOOKS

1. Kandasamy, P., Thilakavathy, K. and Gunavathy, K. "Numerical Methods", S. Chand and Co., New Delhi, 2005.
2. Sastry, S.S., "Introductory Methods of Numerical Analysis (Third Edition)", Prentice Hall of India, New Delhi, 2003.

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1. Grewal B.S., Grewal J.S., "Numerical Methods in Engineering and Science", Khanna Publishers, New Delhi, 2005.
2. Jain M.K., Iyengar S.R.K and Jain R.K., "Numerical Methods for Engineering and Scientific Computation (Third Edition)", New Age International (P) Ltd., New Delhi, 1995.
3. Gerald C.F., Wheatley P.O., Applied Numerical Analysis (Fifth Edition), Addison–Wesley, Singapore, 1998.

4. Narayanan S., Manickavachakam Pillai K. and Ramanaiah G., "Advanced Mathematics for Engineering Students-Vol.III", S. Viswanathan Pvt. Ltd., Chennai, 1993.

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http://en.wikipedia.org/wiki/Newton's_method
http://www.cs.ut.ee/~toomas_l/linalg/lin2/node30.html
http://en.wikipedia.org/wiki/Boundary_condition

E-Journals:

http://www.math.neu.edu/~Suciu/journals.html

ARM 201 FUNDAMENTALS OF AGRIBUSINESS MANAGEMENT (1+1)

THEORY LECTURE SCHEDULE

UNIT I AGRIBUSINESS

1.Agribusiness – Definition – Structure of Agribusiness (input, farm and product sectors) 2.Agribusiness Management - Special features of Agribusiness - Importance of Agribusiness in Indian Economy.

UNIT II MANAGEMENT

3. Management – Definition and Importance – Management functions – Nature
4. Management - Skills, Levels and functional areas of management
5. Forms of Business Organisation – Sole Proprietorship – Partnership –Private and Public Limited, Cooperatives, MNCs

UNIT III MANAGEMENT FUNCTIONS I

6. Planning – Definition – Types of plans (Purpose or Mission, Goals or Objectives, Strategies, Policies, Procedures, Rules, Programmes, Budget)
7. Steps in planning – Characteristics of Sound plan. Objectives – MBO
8. Organizing – Principles of Organizing – Concept of Departmentation-Delegation- Centralization – Decentralization
9. Mid Term

UNIT IV MANAGEMENT FUNCTIONS II

10. Staffing – Concept – Human Resource Planning – Process.
11. Directing – Concept – Principles – Techniques, Supervision.
12. Motivation – Concept - Maslow's "Need Hierarchy Theory – Types – Techniques.
13. Communication – Definition and Process – Models – Types – Barriers.
14. Leadership – Definition – Styles – Difference between leadership and management

UNIT V MANAGEMENT FUNCTIONS III

15. Controlling – Concept - Steps – Types – Importance – Process.
16. Project- Definition- project cycle- identification- sources of projects,
17. Formulation- issues and budgeting the project, appraisal

PRACTICAL LECTURE SCHEDULE

1. Exercise on Operations Management in agribusiness firms
2. Logistics Management
3. Inventory Management - inventory types, costs and Economic Order Quantity
4. Procurement systems and vendor rating methods
5. ABC analysis
6. Exercise on Supply Chain Management
7. Market Research and Segmentation

8. Demand forecasting methods
9. Visit to agri hi-tech bank branch / commercial banks/RRB/ NABARD
10. Exercises on Human Resource Planning and Management
11. Farmers survey – Buying behaviour of agricultural inputs
12. Market Promotion measures
13. Pricing methods
14. Assessing and acquiring finance for agribusiness firms
15. Procedure and constraints in establishing agro based industries
16. New agribusiness venture proposal preparation
17. **Final Practical examination**

REFERENCES

1. Prasad, L.M, 2005, '**Principles and Practices of Management'**, Sultan Chand and Sons Educational Publishers, New Delhi.
2. Richard, B Chase, Nicholas J., Acquilano and F.Robert Jacobs, 2007, `**Production and Operations Management - Manufacturing and service**, Tata Mc Graw Hill Publishing Company Limited, New Delhi.
3. Aswathappa, K, **Human Resource Management: Text and Cases**, Tata McGraw-Hill Pub. Co. Ltd. New Delhi, 5th Edition, 2008.
4. Philip Kotler, **Marketing Management**, Pearson Education, India, 2003.
5. Chandra Prasanna. 2000. **Financial Management - Theory and Practice.** Tata Mc Graw Hill Publishing Company Ltd., New Delhi.
6. R.K.Sapru, **Project Management**, Excel Books, New Delhi, 1997.

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www.management.about.com
www.bized.co.uk
http:// managementhelp.org/
www.entrepreneurship.org
www.fma.org
http://www.ifmr.ac.in

FOR 211 FOREST RESOURCE MANAGEMENT (1+1)

THEORY

Unit I. Forestry and Forest Regeneration

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

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

Forest utilization – wood and non-wood forest products – Solid Wood- Timber- Wood composites- plywood, fibre board and particle boards – Non wood forest products

Unit IV. Agroforestry

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

Techniques and management of urbanforestry and recreation forestry – Ecotourism concepts and applications.

PRACTICALS

Nursery layout and other nursery techniques – Nursery technology for Teak, Dalbergia, Neem, Eucalyptus. Casuarina, Bamboo and Acacia's – Clonal propagation methods - tree planting techniques – Tending and cultural operations -- Felling, transportation and conversion methods - Pulp and paper technology– Plywood production technology – Match manufacturing process –Social forestry - Agroforestry system .

THEORY SCHEDULE

1. Indian forest – forest – forestry – classification of forest Role of forests – production and protection role.
2. Silvics – silviculture – Locality factors (climate, edaphic, physiographic and biotic factors).
3. Regeneration techniques for forest trees – natural regeneration.
4. Artificial regeneration – quality planting stock production techniques – clonal forestry techniques.
5. Silvicultural techniques for some primary timber species – Teak, Sal, Rose wood and Sandal
6. Silviculture techniques for some pulpwood species – Eucalyptus, Casuarina, Bamboo.
7. Silvicultural techniques for some TBOs& Fodder – Neem, Pungam, and Bassia,Subabul and white babul
8. Silvicultural techniques for some fuel wood species – (Acacia's, Prosopis) and match wood species (Ailanthus and Melia)
9. *Mid semester examination*
10. Forest utilization – Solid wood- timber and its products.
11. Forest utilization – non wood forest products (fibres, flosses, grasses, bamboos and canes) – value addition to non wood forest products.
12. Non wood forest products (oil, tannin, dyes, gum, resins) – status and value addition.
13. Social forestry concepts,history, objectives and applications-JFM concepts
14. Agroforestry –Agroforestry concepts,objectives and classifications - distiction between social forestry and agroforestry
15. Agroforestry systems and their applications for different agro climatic zones of Tamil Nadu.
16. Techniques for urban forestry ,Recreation forestry
17. Eco-tourism – concepts and its application.

PRACTICAL SCHEDULE

1. Nursery layout and other nursery techniques.
2. Nursery technology for Teak and Sandal.
3. Nursery technology for Rose wood
4. Nursery technology for Eucalyptus
5. Nursery technology for Casuarina.
6. Nursery technology for Bamboo and Acacia
7. Nursery technology for TBO's.
8. Visit to a forest nursery to study the Nursery techniques
9. Visit to a Agro forestry model unit.
10. Clonal propagation techniques for forest trees.
11. Practicing tree planting techniques.

12. Practicing tending and cultural operations in forest plantations.
13. Visit to Pulp and paper manufacturing industry
14. Study of plywood production technology – visit to plywood industry.
15 .Study of match manufacturing process – visit to matchwood industry.
16. Visit to a NWFP value addition unit
17. Practical examination.

REFERENCES

I. 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.
3. Khanna. L.S 1999 Principles and Practice of Silviculture, IBD Publishers, Dehra Dun
4. Negi. S.S.2008 Hand Book of Forestry, IBD Publishers, Dehra Dun

II. Further reading

1. Heygreen, G. and J.L.Bowyer. 1982. Forest products and wood science. The Ohio State University Press, Ames.
2. Lal, J.B. 1992. India's forest – Myth and reality. Natraj Publishers, Dehra Dun.

III. Journals

1. Indian Journal of Forestry
2. Indian Journal of Agroforestry

E. references

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www.swsc.com
www.Candia.com
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FMP 203 ELECTRONICS AND INSTRUMENTATION (2+1)

THEORY

UNIT I Basic Electronics Circuits

Passive devices – Semi conductor devices – Transistors – Diode circuits – Amplifier circuits – Oscillator circuits – Thyristor circuits

Unit II Integrated and Digital circuits

Integrated circuits and operational Amplifier – Logic gates – Flip Flop – Counters – Digital to Analog – Analog to Digital converters – Microprocessor introduction.

Unit III Basic concepts of measurement

General measurement systems – Static & Dynamic characteristics of instruments – Transducer elements – Basic input circuits

Unit IV Instrumentation for measurement of physical parameters

Transducer for motion measurement – Force measurement – Torque and power measurement – Pressure and temperature measurement –Flow measurements – pH, Humidity, speed measurement using Photo electric & reluctance principles

Unit V Principles of process control and microprocessor based instrumentation

Automatic process control system and controllers – programmable logic controllers – introduction – computerized data acquisition system

PRACTICAL

Experiment on elementary analog and digital circuits. Experiment on use of transducers and circuits for measurement of motion, pressure, temperature, humidity, speed and pH – Calibration of such

instruments – Study of microprocessor and PLC based systems and their use for control applications – Data acquisition and control using computers.

LECTURE SCHEDULE

1. Introduction to passive circuit components viz., resistors, capacitors and inductors, their type, characteristics and application.
2. Introduction and classification of Semi conductor diodes. Theory of PN junction diode, modes of operation, characteristics and application.
3. Diode circuits - half wave, full wave and bridge rectifiers
4. Transistor construction and biasing, operation of PNP and NPN transistors. Input and output characteristics and common emitter mode operation
5. Field effect transistors, characteristics, MOSFET and JFET construction and operation, comparison and application.
6. Thyristor introduction, principle of operation and its characteristics, ratings and protection.
7. Rectifier circuit using SCR.construction characteristics and applications.
8. Integrated circuits introduction and advantages. Operational amplifier introduction, pin details, characteristics of actual and ideal amplifiers
9. Applications of operational amplifier, inverting, non-inverting, summing, difference, integrating and differentiating amplifier
10. Amplifier, introduction and classification. Single stage amplifier, feed back amplifier, instrumentation amplifier and their construction and application
11. Oscillators classification, general form of LC oscillator, monostable, bistable and multivibrator
12. Comparators, active positive limiter and clampers. Filters, introduction, types, active low pass and high pass filters and application
13. Digital circuits, Logic gates, Flip flop circuit, RS Flip flop, JK Flip flop construction, truth table and application - half and full adder circuits.
14. Counters -types, ripple, ring and decade counter usage and application
15. Encoders, decoders, Digital to analog conversion and analog to digital conversion.
16. Microprocessor introduction, organization and applications. Microprocessor based systems
17. **Mid Semester examination**

18. Instrumentation introduction, functional description of measuring instruments, static and dynamic performance characteristics of instruments
19. Basic input circuits, ballast circuit, voltage divider circuit and bridge circuits. Sensitivity and loading error of the circuits
20. Transducer, introduction, types, requirement, selection and applications
21. Motion measurement, translational, rotational and relative displacement transducers calibration and application
22. Capacitive transducers, inductive transducers and LVDT construction, operation and applications
23. Strain gauges, basic, types and gauge factor. Mounting of strain gauges and strain bridges, calibration and balancing
24. Force measurement standards and calibration, basic methods of force measurement, characteristics of elastic force transducers
25. Torque measurement on rotating shaft and shaft power measurement.
26. Pressure measurement, standards, basic methods, high pressure measurement and sound measurement techniques
27. Flow measurement, velocity, magnitude and directions measurements, hot wire and hot film anemometers, gross volume flow rate and mass flow rate measurements
28. Temperature measurement standards and calibration, thermal expansion methods, bimetallic thermometer, liquid in glass and pressure thermometers
29. Thermo electric sensors - basics, common thermo couples, construction, reference junction consideration and techniques. Electric resistance and semi conductor temperature sensors construction and application
30. Speed measurement and event counting with photo electric and reluctance principles. pH, liquid level and humidity measurement techniques
31. Automatic process control system and controllers, basic principles, block diagram, components, open loop and closed loop control systems.
32. Proportional, Integral and Derivative (PID) controllers,
33. Programmable logic controllers, introduction, ladder diagram application of programmable logic controllers
34. Computerized data acquisition and processing system, its organization, operation and compact data loggers.

PRACTICAL SCHEDULE

1. Practice in use of measuring and testing instruments– multimeter and oscilloscope
2. Circuit practice on 741 op-amp applications – I
3. Circuit practice on 741 op-amp applications – II
4. Building timer based circuits using 555 IC
5. Power supplies – building basic rectifier supplies
6. Digital circuits – gates, AD and DA converters
7. LDR transducer for displacement sensing
8. Strain gauge transducer – cantilever beam transducer
9. Capacitive displacement transducer
10. Inductive pick up – Piezoelectric pick up
11. Photoelectric and variable reluctance speed pick ups
12. Thermo couple – use and calibration

13. Experiments on RTD – Thermistor and thermocouple
14. Study of 8085 microprocessor kit
15. Study of Programmable logic controllers
16. Data loggers – computerized data acquisition and data processing
17. Practical examination.

TEXT BOOKS

1. Salivahanan.S., N.Suresh Kumar and A.Vallavaraj, 2006. Electronic Devices and Circuits. Tata McGraw-Hill Publishing Company Limited, New Delhi.
2. Ernest O.Doebelin, 1990. Measurement Systems – Application and Design. McGraw-Hill Publishing Company, London.

REFERENCE BOOKS

1. Gupta.B.R., 1999. Electronics and Instrumentation Second Edition. Wheeler Publishing, New Delhi.
2. Singh.S.K., 2005. Industrial Instrumentation and Control. Second Edition. Tata McGraw-Hill Publishing Company Limited, New Delhi

WEB RESOURCES

www.onesmartclick.com/engineering/basic-electronics-engineering.html
web-ee.com/tutorials
www.electronics-tutorials.com

FMP 204 MACHINE DESIGN AND COMPUTER AIDED MACHINE DRAWING (1+2)

THEORY

Unit I : Fundamentals of Machine Design

General considerations 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 – combined stresses. Theories of failure – Rankine's and Guest theory

Unit II : Design of Fasteners

Design of permanent joints – Welded joints – comparison of welded and riveted joints – types of welded joints – transverse and parallel strength of fillet welds – design of butt joints – Rivets and riveted joints – failure modes of riveted joints – design of non-permanent joints – threaded fasteners – stresses in screwed fastening due to static loading

Unit III: Design of Machine Elements

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. Power screws – design of screw jack.

Unit IV: Design of Transmission System Components

Belt drives - flat belts – Euler's formula – V-belt design – power calculation and selection – chain drive – design. Spur gear – classification – gear terminology – law of gearing – Strength of gear teeth – Lewis equation – Buckingham equation – bevel gear – terminology – design of gear teeth. Bearings – types of bearings - rolling contact bearings– principles behind selection of bearings. Springs – types of springs – properties of spring material – terminology – design of helical springs.

PRACTICAL

Projections - orthographic – isometric. Dimensioning - terms and notations. Conversion of pictorial views into orthographic views. Sectional views - Sectioning convention. Orthographic reading and interpretation of views.

Computer aided drawing – Learning any one CAD software for making machine drawings. Form of screw threads. - conventional representation of threads. Hexagonal bolts and nuts. Keys-shaft-key and hub assemblies. Bearings - journal - solid – bushed. Pulley - flat and V. Drawing simple assemblies of machines on CAD. Practice in solid modeling. Working out design problems and making drawings of the designed components.

LECTURE SCHEDULE:

1. Introduction to machine design and general considerations in machine design.
2. Review of strength properties of engineering materials and limits and tolerances Types of Fits
3. Identification of simple stresses in machine elements like tension, compression, shear, and bearing stresses.
4. Concept of torsional and bending stresses in machine parts - torsional stresses in shafts, bending stresses in beams.
5. Combined stresses
6. Introduction to theories of failures - Rankine andGuest theory
7. Types of welded joints and comparison of welded and riveted joints
8. Design of transverse and parallel fillet welds – Eccentrically loaded joints - butt welds
9. Mid Semester Examination
10. Types of rivets, and design of riveted joints
11. Threaded fasteners and stresses in screwed fastening due to static loading.
12. Belt drives, calculation of flat belt design parameters and application of Euler's formula
13. V belt design, power calculation and selection of drive components.
14. Chain drive, principles and design.
15. Bearings, types of bearings – Journal bearings - Rolling contact - principles behind selection of bearings.
16. Types of springs, properties of spring material, terminology, and design of helical springs.
17. Classification gear and terminology, law of gearing

PRACTICAL SCHEDULE

1. Projections – orthographic
2. Conversion of pictorial views of machine parts into orthographic views.
3. Conversion of pictorial views of machine parts into orthographic views.
4. Conversion of pictorial views of machine parts into orthographic views.
5. Dimensioning - different methods - terms and notations.
6. Orthographic reading and interpretation of views
7. Isometric view of machine parts and objects.
8. Problems on simple stresses – axial, shear, bending and torsional stresses
9. Design of levers – problems
10. Exercises in orthographic projections on CAD.
11. Design of shafts subjected to torsion, bending and combined stress
12. Computer aided drawing – Learning any one CAD software for making machine drawings
13. Design of welded joints – axial and eccentric loadings – problems

14. Sectional views and conventions - Half sections - Offset sections - conventions.
15. Design of rivetted joints - axial and eccentric loadings – problems
16. Forms of screw threads – Drawing of hexagonal nut and hexagonal headed bolt
17. Design of threaded fasteners and joints - axial and eccentric loadings – problems
18. Solid modeling - practice
19. Design of power screws – screw jack.
20. Solid modeling - practice
21. Design of keys - sunk keys
22. Design and drawing of sleeve coupling and flange coupling.
23. Design and drawing of cotter joint
24. Design and drawing of knuckle joint and turn buckle joint
25. Design of belt drives – Flat belt drives – problems
26. Design of belt drives –Vee belt drives - problems
27. Design of chain drives - problems
28. Bearings – Lubrication theory - design of solid journal bearing.
29. Selection of rolling contact bearings – static and dynamic loadings – Life of bearing
30. Drawing of machine assemblies
31. Design of spur gears - Strength of gear teeth, Lewis equation and Buckingham equation
32. Drawing of machine assemblies
33. Design of bevel gear, terminology and design of gear teeth.
34. **Final Practical examination.**

TEXT BOOKS

1. Khurmi, R.S. and Gupta, J.S. 2006. Reprint. A text book of Machine design. Eurasia Publishing House Pvt Ltd.,New Delhi
2. Narayana, K.L. and P.Kannaiah. 1992. Engineering graphics. Tata McGraw-Hill pub.

REFERENCE BOOKS

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. Kannaiah,P.2003. Machine Design Scitech Publishers (India) Pvt Ltd. Chennai.

WEB RESOURCES

1. machinedesign.com/
2. onesmartclick.com/engineering/machine-design.html
3. utm.edu/departments/engin/lemaster/machine_design.htm
4. mech.uwa.edu.au/DANotes/intro/contents.html

ERG 201 HEAT POWER ENGINEERING (1+1)

THEORY

Unit I: Types and properties of Fuels

Fuels – types and properties-higher and lower heating values, their determination -properties of 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.

Unit II. Combustion

Combustion of fuels, stoichiometric air requirement – excess air-gravimetric analysis and volumetric analysis of products of combustion and their conversions.

Unit III. Classification and Principles of IC engines

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-carburettors-types-fuel pump-coil ignition and magneto systems-sparking plug. Compression ignition engine-working principle and thermal efficiency-fuel pump and injector. Gas engine –working principle-turbocharging.

Unit III. Performance analysis of IC engines

Testing of IC engines-rope brake, prony brake, hydraulic and electrical dynamometers--Morse test for mechanical efficiency. Heat balance and Sankey diagrams for IC engines.

Unit IV: Air compressors and boilers

Air compressors-reciprocating, rotary and centrifugal types-work done and efficiency-slip factor. Measurement of steam quality – throttling process – separating and throttling calorimeter – electrical calorimeter. 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 regulators – blow off fittings - boiler performance – boiler operation, inspection, safety and maintenance.

PRACTICAL SCHEDULE

Determination of calorific value of solid fuels, properties of gas mixtures, stoichiometric air requirement of fuels, gravimetric and volumetric analysis of products of combustion- conversion of mass to volumetric analysis and vice versa. Determination of calorific value of solid and liquid fuels using Bomb calorimeter-Flue gas composition using Orsat apparatus- study of diesel and petrol engines-problems on performance of IC engines- problems on properties of steam -study of boilers - Cochran, Lancashire, Cornish, Lamont boilers, Velox and Locomotive boilers –problems on heat exchangers - determination of performance efficiency of boilers - visit to an industrial boiler.

LECTURE SCHEDULE

1. Types of fuels and properties of fuels
2. Higher and lower heating values of fuels – their relationship-determination of calorific value using standard formula, Dulongs' formula and Boie's formula, Bomb calorimeter.
3. Ideal and real gases – Dalton's law of partial pressures-Internal energy, enthalpy and specific heats of gas mixtures – entropy of gas mixtures – Gibbs function of mixture of gases.
4. Principles and chemistry of combustion of fuels – stoichiometric air requirement – excess air-Gravimetric analysis of products of combustion.
5. Volumetric analysis of products of combustion.
6. Conversion of gravimetric to volumetric analysis and vice versa.
7. Classification-engine components-Four stroke cycle- principle-valve timing diagram-P-V diagram-two stroke cycle- principle-valve timing diagram-P-V diagram.
8. Spark ignition engine-working principle and thermal efficiency-carburettors-types-fuel pump-coil ignition and magneto systems-sparking plug.
9. **Mid-semester examination**
10. Compression ignition engine-working principle and thermal efficiency-fuel pump and injector-lubrication system- cooling systems.

11. Gas engine –working principles-turbocharging. Air compressors-reciprocating, rotary and centrifugal types-work done and efficiency-slip factor.
12. Performance analysis of IC engines.-indicated mean effective pressure-brake mean effective pressure-indicated power-brake power-friction power-specific fuel consumption-brake thermal efficiency-mechanical efficiency-performance curves.
13. Testing of IC engines-Rope brake, prony brake, hydraulic and electrical dynamometers--Morse test for mechanical efficiency-Heat balance and Sankey diagrams for engines
14. Properties of steam-Measurement of steam quality – throttling calorimeter – throttling process – separating and throttling calorimeter – electrical calorimeter.
15. Heat exchangers – principle – types – design.
16. Boilers – classification – working principle of fire tube and water tube boilers – vertical and horizontal boilers. Boiler mountings and accessories – pressure regulators – blow off fittings.-Boiler performance
17. Principles, construction and operation of boilers - Cochran, Lancashire, Cornish , Scotch, Velox, Locomotive, Babcock and Wilcox boilers.

PRACTICAL SCHEDULE

1. Determination of calorific value of solid fuels using standard formula, Dulongs' formula and Boie's formula
2. Determination of calorific value of fuels using Bomb Calorimeter
3. Determination of calorific value of gaseous fuels using gas calorimeter
4. Determination of flue gas composition using Orsat apparatus
5. Problems on properties of gas mixtures
6. Problems on determination of stoichiometric air requirement of fuels – gravimetric analysis of products of combustion
7. Problems on determination of stoichiometric air requirement – volumetric analysis of products of combustion
8. Problems on combustion of fuels – conversion of mass to volumetric analysis and vice versa.
9. Problems on properties of steam.
10. Study of diesel and petrol engines
11. Problems on performance of IC engines and air compressors
12. Study of types of boilers - Cochran, Lancashire, Cornish, Lamont boilers, Velox and Locomotive boilers
13. Study on boiler mounting and accessories
14. Problems on heat exchangers
15. Problems on determination of performance efficiency of boilers.
16. Visit to an industrial boiler
17. Practical examination

TEXT BOOKS

1. Rayner Joel, 2009. Basic engineering Thermodynamics, Pearson publishers.
2. Ballaney, P.L. 1991. Thermal Engineering. Khanna Publs. New Delhi.
3. Chattopadhyay, P. 2000. Boiler operation and engineering, Tata McGraw Hill Publishing Co. Ltd., New Delhi.

REFERENCE BOOKS

1. Nag, P.K., 1992. Engineering thermodynamics, Tata-McGraw Hill Publishing Co, New Delhi.

2. Khurmi, R.S., 1992. Engineering thermodynamics. S.Chand and Co, New Delhi.
3. Jain, P.C. and Monika Jain. 2006. Engineering Chemistry. Dhanpat Rai Publishing Co., New Delhi.
4. Indian Boiler Codes (ISI Publications)
5. Vasandani, V.P. and Kumar. D.S., 1972. Heat Engineering. Metropolitan Book Co. Pvt. Ltd.,
6. Rudramoorthy R, "Thermal Engineering", Tata McGraw-Hill, New Delhi, 2003.
7. Kothandaraman.C.P., Domkundwar.S. and A.V.Domkundwar., "A course in Thermal Engineering", Dhanpat Rai & Sons, Fifth edition, 2002.
8. Holman. J.P., "Thermodynamics", McGraw-Hill, 1985.
9. Rogers, Meyhew, "Engineering Thermodynamics", ELBS, 1992.

AST 202 ENGINEERING MATERIALS, CONSTRUCTION, ESTIMATION AND COSTING (2+1)

THEORY

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

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 and stone masonry

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 - Design of Foundation - General principles - precautions in brick masonry -Stone Masonry -Comparison between Brick and Stone Masonry -Classification -General Principles and Precautions in Stone Masonry –Specification

Unit IV – Building construction

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 - Preparation and Strength-Concrete -Characteristics -Types and uses-Measurement of Ingredients -their requirements and functions - Cube Strength of Concrete-Roofs -Classification - Floors –Types of Floor-Types of Plastering and Pointing –Painting and Distempering

Unit V Estimating and costing

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

PRACTICAL

Design of foundation – types of foundation – types of bonds in brick work – sectional elevation of an external wall of a building showing its different parts – types of stone masonry – section showing different components of stone masonry wall – design of lintel – types of roofs – methods of estimate – estimate of a single roomed buildings, masonry plat form, masonry tank, R.C.C. slab, R.C.C. beam and roof truss.

LECTURE SCHEDULE

1. Classification of rocks - Characteristics of Stones -Testing of Stones.
2. Manufacture of Bricks -Moulding -Drying and Burning of bricks
3. Properties of good Brick -Classification of bricks
4. Clay Products - Ceramics
5. Tiles -Earthenware and Stoneware and uses
6. Lime- Natural Sources -Types of lime - Calcination
7. Cement -Raw materials – Water Cement Ratio
8. Manufacture of Portland Cement Wet and Dry process
9. Standard Specifications- Storage of cement
10. Timber –Definition-- Defects in timber
11. Qualities of good timber
12. Concept of Foundation -Factors affecting Selection of Foundations -Types of soils
13. Subsurface Investigations -Bearing Capacity of soil -Testing &Improving Bearing Capacity of soil.
14. Types of Foundations-Piles -Foundation in Black Cotton soil
15. Site Selection - Design of Foundation
16. General principles - precautions in brick masonry
17. Mid semester examination
18. Stone Masonry - Classification -General Principles and Precautions in Stone Masonry –Specification
19. Comparison between Brick and Stone Masonry

20. Walls -Classification of walls
21. Dampness -Causes of Dampness -Methods of Preventing Dampness
22. Damp Proofing materials - Methods of providing Damp Proofing Materials
23. Mortars -Functions and Types of mortars -Preparation and Strength
24. Concrete -Characteristics -Types and uses
25. Measurement of Ingredients -their requirements and functions - Cube Strength of Concrete
26. Roofs -Classification
27. Floors –Types of Floor
28. Types of Plastering and Pointing
29. Painting and Distempering.
30. PWD schedule of rates – standard specifications
31. Data sheet
32. Detailed estimate
33. Abstract estimate
34. Preparation of estimate.

PRACTICAL SCHEDULE

1. Isometric view of a standard brick with their parts – elevation of a portion of a brick wall and various types of brickbats and closers.
2. Elevation of english bond and flemish bond .
3. Drawing of header bond, stretcher bond, garden wall bond, and raking bond.
4. Study of english cross bond, hoop iron bond, facing bond, dutch bond, monk bond, zigzag bond, brick on edge bond and silver locks bond.
5. Design and drawing of foundation
6. Cross section of a stone masonry wall showing its components.
7. Drawing of uncoursed rubble masonry, random rubble masonry, coursed rubber masonry and dry rubble masonry components.
8. Elevation of lean to roof, coupled roof, couple closed roof and collar roof.
9. Drawing the elevation of steel roof truss.
10. Estimation of a wall with foundation.
11. Estimation of a single room building.
12. Estimation of a masonry platform.
13. Estimation of a masonry tank.
14. Estimation of a one way R.C.C. slab.
15. Estimation of a singly reinforced beam.
16. Estimation of a roof truss.
17. Final practical examination.

TEXT BOOKS

1. Deodhar, S.V. and Singhal, 2001. Civil engineering materials. Khanna publishers, 2B, Nath market, Naisark, Delhi -6.
2. Rangwala. S.C., 2000. Building construction. Charotar publishing house, Anand.

REFERENCE BOOKS

1. Deodhar, S.V. and Singhal, 2001. Civil engineering materials. Khanna publishers, 2B, Nath Market, Naisark, Delhi -6.
2. Handoo, B.L. and Mahajan,V.M., 1995. Civil engineering materials. Sathyaprakasam, 16/7698, New market, New Rohtak road, New Delhi-5.
3. Arora, N.L. and Gupta, B.R., 1995. Building construction. Sathyaprakasham, 16/7698, New market, New Rohtak road, New Delhi -5.
4. Rangwala. S.C., 1991. Estimating and costing. Charotar book stall, station road, Anand.
5. Datta. B.N, 2002. Estimation and costing. Published by the Author, Tagore Palli, Motilal Bose road, Lucknow - 1.

FPE 203 POST HARVEST ENGINEERING OF AGRICULTURAL CROPS (2+1)

THEORY

Unit I Introduction

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.

Unit II Psychrometry and Drying

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

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

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 and crop processing

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.

Practical

Determination of moisture content – determination of engineering properties of grain- testing of paddy thresher-paddy winnower.Testing of groundnut decorticator-maize Sheller - evaluation of thin layer drier- study of LSU drier. Determination of oil content of oilseeds Determining the efficiency of bucket elevator and screw conveyor-study of paddy parboiling drum-evaluation of shelling efficiency of rubber roll sheller-study of cone polisher-visit to modern rice mill – visit to pulse milling industry.

Lecture schedule

1. Post-harvest engineering – introduction - post- harvest losses of cereals, pulses and oil seeds – optimum stage of harvest for various crops.
2. Engineering properties of crops – its importance in relation to the various crop processing operations.
3. Physical properties – methods of determination – effect of moisture content and other parameters on the properties.
4. Threshing – traditional methods – mechanical threshing – types of threshing cylinders, threshing efficiency.
5. Types of mechanical threshers – suitability for different crops – axial flow type threshers – crop and machine factors affecting threshing.

6. Moisture content – definition – wet and dry basis – methods of determination – standards – direct and indirect methods – over methods – oven methods, Brown – Dual Distillation Method - moisture meters.
7. Equilibrium moisture content – determination – static and dynamic method - Henderson's equation – relative humidity – EMC relationships – solving problems.
8. Psychrometry – properties of air-water vapour mixture – Psychrometric chart – Psychrometric processes related to crop processing – solving problems using psychrometric chart.
9. Drying – traditional methods of drying – merits and demerits – mechanical drying depending on modes of heat transfer.
10. Theory of grain drying – constant and falling rate period of drying – effect of different falling rate period of drying – effect of different factors on drying process – thin layer and deep bed drying – solving problems.
11. Mechanical driers – batch type and continuous types – merits and demerits.
12. Design of a mechanical drier and its components.
13. Cleaning and grading – physical characteristics of seeds for cleaning and grading – types of cleaners and graders – air screen cleaner – types of screens and their selection.
14. Cylinder separator and spiral separator – working principles and construction details-disc separator, gravity separator – working principles.
15. Magnetic separator, colour sorter and inclined belt separator – working principles and construction details.
16. Effectiveness of separation of binary material – performance index – worked examples
17. Shelling and decortication, maize sheller and husker sheller for maize – construction and operation.
18. Mid semester examination
19. Groundnut decorticator – hand operated and motorised – castor sheller – construction and operation – factors affecting shelling efficiency.
20. Materials handing - functions and types – belt, bucket, screw and pneumatic conveyors
21. Belt conveyor and bucket elevator- construction, operation, maintenance and safety.
22. Screw conveyor and pneumatic conveyor – construction, operation and maintenance.
23. Chain conveyors – types – operation and maintenance
24. Rice processing – parboiling of paddy – merits and demerits – traditional methods – single boiling and double boiling process.
25. Modern methods – CFTRI method, pressure parboiling, dry heat parboiling –process and advantages.
26. Dehusking of paddy – traditional methods – Engleburg huller, under runner disc sheller.
27. Modern methods of dehusking paddy – advantages and constraints – centrifugal dehusker, rubber roll sheller – principles of operation – design calculations – factors affecting performance.
28. Rice polisher – abrasion and friction types – equipments – construction and operation details – degree of polish – products and their uses.
29. Rice products – beaten, puffed and expanded rice – traditional and improved methods – equipments used.
30. Layout of modern rice mill – cost economics for processing of paddy and seeds – improved layout.

31. Parboiling of wheat – methods – principles of size reduction – milling of wheat – methods and equipment used.
32. Milling of corn and pulses – dry and wet milling – processing and equipments – factors affecting milling.
33. Oil seed processing – objectives – flow diagram of sequence of operations – separation of seeds – basis equipment – operation and maintenance.
34. Oil extraction methods – equipments – solvent extraction methods – oil refining.

Practical Schedule

1. Determination of moisture content of grains by oven method and moisture meter.
2. Determination of porosity of grains.
3. Determination of coefficient of friction and angle of repose of grains.
4. Testing of paddy thresher
5. Testing of paddy winnower.
6. Testing of groundnut decorticator.
7. Testing of maize sheller
8. Evaluation of thin layer drier
9. Evaluation of L.S.U. drier.
10. Determining the efficiency of bucket elevator and screw conveyor
11. Study of paddy parboiling drum
12. Evaluation of shelling efficiency of rubber roll sheller
13. Study of cone polisher
14. Determining the oil content of soil seeds.
15. Visit to modern rice mill
16. Visit to pulse milling industry
17. Practical examination

Text Books

1. Chakraverty, A.2000.Third Edition, Post harvest technology for Cereals, Pulses and oilseeds. Oxford &IBH publication Pvt Ltd, New Delhi
2. Sahay, K.M., and Singh, K.K. 1994. Unit operations of Agricultural Processing. Vikas publishing house Pvt. Ltd., New Delhi.

Reference Books

1. Pande, P.H. 1994. Principles of Agriculture Processing. Kalyani Publishers, Ludhiana
2. Mohsenin, N.N.1970. physical properties of plant and animal materials Grodon and Breach publishers, Ludhiana.

Journals

1. Journal of Agricultural Engineering, Indian Society of Agricultural. Engineers, New Delhi
2. Journal of Agricultural Engineering Today, Indian Society of Agricultural Engineers, New Delhi.

Web resources

www.sspindia.com/industrial-dryers/index.html
www.perryvidex.com/perry/perryvidex2.nsf/psearchfood.html

V Semester			
1.	MAT 301	Engineering Statistics	1+1
2.	NST 301	Fundamentals and Applications of Nanotechnology	1+0
3.	FMP 301	Farm Tractors	2+1
4.	FMP 302	Tillage and Sowing Equipment	2+1
5.	ERG 301	Solar and Wind Energy Engineering	2+1
6.	SWE 301	Hydrology	2+1
7.	SWE 302	Soil Conservation and Water Harvesting	2+1
8.	FPE 301	Process Engineering of Spices and Plantation crops	2+1
Total			**14+7=21**

MAT 301 ENGINEERING STATISTICS (1+1)

THEORY

Unit-I: Probability theory and Random variables

Random experiment- definitions of Probability - Conditional probability- events. Theorems on probability, Baye's theorem. Discrete and Continuous random variable – Probability function — Distribution function–properties. Two dimensional random variables-Joint probability function-Cumulative distribution functions – properties. Marginal probability Distribution.

Unit-II: Functions of Random variables and Statistical Averages

Function of one Random variable and one function of two Random variables Expected values of Two Dimensional Random variable – Properties. Covariance and Correlation – Conditional expected values - properties — Characteristic function, Moments generating function(MGF) and properties

Unit-III: Probability Distributions and Tests of Hypothesis

Discrete Distribution-Bernoulli, Binomial, Poisson Distributions –Mean and variance. Recurrence Formula for the Central moments of the Binomial, Poisson Distributions. Mean and Variance of the Exponential Distribution – Memory less property. Mean and Variance of Gamma Distribution. Standard Normal Distribution – Properties and its importance.

Unit-IV: Random Processes And Markov Chains

Classification - stationary process - Markov process – Poisson process - birth and death process - Markov chains - transition probabilities - limiting distributions.

UNIT- V: Queuing Theory

Queuing system and elements of queueing system –classification of queueing models-Poission queuing system- {(M/M/1) : (∞ / FIFO)}-Formula for average waiting time – average queue length(without proof) – Problems in M/M/1 model

PRACTICALS

Problems in Conditional probability- Independent events, Total probability- Baye's theorem. Problems in Discrete and Continuous distributions. Problems in Joint probability density function, Cumulative distribution function. Problems in Marginal probability Distribution. Problems in Expected values of Two Dimensional Random variable – Problems in Properties of Expected values, Covariance

and Correlation. Problems in Conditional expected values - properties — Problems in Characteristic function and Moments generating function. Problems in Bernoulli, Binomial, Poisson Distributions – Mean and variance. Problems in Mean and Variance of the Exponential Distribution. Problems in Mean and Variance of Gamma Distribution. Problems in Standard Normal Distribution. Problems in stationary process - Markov process – Poisson process - birth and death process - Markov chains - transition probabilities . Problems in Queueing system -Poission queueing system- {(M/M/1) : (∞ / FIFO)}-average waiting time – average queue length(without proof) – Problems in M/M/1 model

Lecture Schedule:

1. Random experiment- Mathematical, Statistical, Axiomatic definitions of Probability
2. Conditional probability- Independent events – Theorem of Total probability- Baye's theorem.
3. Discrete and Continuous random variable – Probability function –Distribution function – properties
4. Two dimensional random variables – probability function –Joint probability density function.
5. Cumulative distribution function and properties – Marginal probability Distribution
6. Function of one Random variable and one function of two Random variables Expected values of a Two Dimensional Random variable – Properties-
7. Covariance and Correlation – Conditional expected values – properties- Characteristic function and Moments generating function (MGF) and its properties
8. Bernoulli, Binomial, Poisson Distributions –Mean and variance. Recurrence Formula for the Central moments of the Binomial, Poisson Distributions
9. **Mid semester examination**
10. Mean and Variance of the Exponential Distribution – Memory less property.
11. Mean and Variance of Gamma Distribution. Standard Normal Distribution – Properties and its importance.
12. Classification - stationary process - Markov process – Poisson process - birth and death process
13. Markov chains - transition probabilities - limiting distributions.
14. Queueing system and elements of queueing system
15. classification of queueing models
16. Poission queueing system- {(M/M/1) : (∞ / FIFO)}
17. Formula for average waiting time – average queue length(without proof) – Problems in M/M/1 model

PRACTICAL SCHEDULE

1. Problems in Conditional probability- Independent events – Total probability- Baye's theorem.
2. Problems in Discrete and Continuous random variable – Probability function –Distribution function
3. Problems in Two dimensional random variables – probability function –Joint probability density function.
4. Problems in Cumulative distribution function– Marginal probability Distribution

5. Problems in Function of one Random variable and one function of two Random variables
6. Problem in Expected values of a Two Dimensional Random variable
7. Problems in Covariance and Correlation – Conditional expected values - Characteristic function and Moments generating function (MGF)
8. Problems in Bernoulli, Binomial, Poisson Distributions
9. Problems in Exponential Distribution– Memory less property.
10. Problems in Gamma Distribution
11. Problems in Standard Normal Distribution
12. Problems in Markov process – Poisson process - birth and death process
13. Problems in Markov chains - transition probabilities
14. Problems in Queueing system
15. Problems in Poission queueing system- {(M/M/1) : (∞ / FIFO)}
16. Problems in M/M/1 model
17. **Final practical examination**

TEXT BOOKS

1. Kapoor, J.N. and Saxena, V.C. 2005. Mathematical Statistics, S.Chand & Co, New Delhi.
2. Veerarajan, T, 2002, Probability, Statistics and Random Process, Tata McGraw –Hill Publishing company Limited, New Delhi

REFERENCE BOOKS

1. Richard A Johnson 2000 , Miller and Freund's Probability and Statistics for Engineers, Eastern Economy Edition, Prentice Hall of India P/Ltd., New Delhi.
2. Kandasamy,P, Tilagavathi, K and Gunavathi,K,(2004) –Probability Statistics and Queueing theory – S.Chand & Com.Ltd., New Delhi
3. Kishor S. Trivedi, 2003, Probability & Statistics with Reliability, Queuing and Computer Science Applications --Prentice Hall of India Publisher, New Delhi

E-REFERENCE:

http://en.wikipedia.org/wiki/Newton's_method
http://www.cs.ut.ee/~toomas_l/linalg/lin2/node30.html
http://en.wikipedia.org/wiki/Boundary_condition

E-JOURNALS:

http://www.math.neu.edu/~Suciu/journals.html

NST 301 FUNDAMENTALS AND APPLICATIONS OF NANOTECHNOLOGY (1+0)

Principles of Nanoscience (4 Lecture): History, definition, terminologies in nanoscience - Importance of Moore's law- Introduction to nanomaterials – Semiconductor – Diode – Quantum Dots- Buckyball - CNT - Polymers- types – PLGA – coreshell nanoparticles - micelle - Introduction to nanobiosensor- types- properties and applications

Synthesis of Nanomaterials (4 Lectures): Top-down and bottom-up approaches - Physical, Mechanical, Chemical and Biological synthesis of nanomaterials

***Properties and Characterization of Nanomaterials (4 Lectures)*:** Physical, Mechanical, optical, magnetic, thermal and electrical properties – Characterization – SEM, TEM, AFM, FT-IR, XRD

Application of Nanotechnology (4 Lectures): Agriculture, Food Industry, Energy, Environment, Health – Social, Economic and Ethical issues – Nanotoxicology

Lecture schedule

Unit 1: Principles of Nanoscience (4 lectures)

1. History, definition, terminology in nanoscience and importance of Moore's law.
2. Nanomaterials – Semiconductor – Diode – Quantum Dots - Buckyball - CNT -characteristics – applications.
3. Nanomaterials: Polymers - Types – PLGA – Coreshell nanoparticles - Micelles - characteristics – Applications.
4. Biosensors – Principle, Components, Types, Applications.

Unit 2: Synthesis of Nanomaterials (4 lectures)

5. Top down and Bottom up approaches - Physical method, Physical Vapour Deposition (PVD), Etching - Molecular Beam Epitoxy – Sputtering – Lithography.
6. Mechanical synthesis - Ball milling – Types - Mechanical alloying.
7. Chemical synthesis – Sol-gel Method – Chemical Vapour Deposition (CVD) – electro-deposition-thin film.
8. Biological synthesis using Microorganisms and Plants.

Unit 3: Properties and Characterization of Nanomaterials (4 lectures)

9. Mechanical, magnetic and thermal properties of nanomaterials.
10. Optical and electrical properties of nanomaterials.
11. *Principle, components and application of nanotechnology equipments*: Scanning Electron Microscope (SEM) and Transmission Electron Microscope (TEM).
12. *Principle, components and application of nanotechnology equipments*: X-ray Diffraction (XRD) – Fourier Transform Infra Red Spectroscopy (FT-IR) – Atomic Force Microscope (AFM).

Unit 4: Applications of Nanotechnology (4 Lectures)

13. Agriculture – Nano fertilizers – Nano-herbicides – Nano-pesticides – Seed technology.
14. Energy, Environment and Health.
15. Nanotechnology in Food Systems – Nano foods, Nano-encapsulation of functional foods, Nano-packaging, Quality assessment.
16. Social, Economic and Ethical Issues in Nanotechnology and Nano-toxicology.

REFERENCES

1. Nano: The essentials understanding nanoscience and Nano- T. Pradeep - 2009 - Mc Graw Hill.
2. Nano materials - B. Viswanathan - 2009 - Narosa.
3. Introduction to nanotechnology - Charles P. Poole; Frank J. Owens – 2008 – Wiley.
4. Fundamentals of biomems and medical microdevices - Steven S. Saliterman – 2006 - Wiley Interscience.
5. Instrumental methods of analysis - Hobart H. Willam; Lynne L. Merrit – 2006 - CBS.
6. Fundamentals of physics - David Halliday; Robert Resnick – 2007 – Willey.
7. Chemistry Raymond Chang – 2009 - Tata Mcgraw Hill.
8. Nanomaterial chemistry - C.N. Rao, A.K. Chettam, A. Muller – 2007 – Wiley – VCH.
9. Nanotechnology Applications in Agriculture – C.R. Chinnamuthu, B. Chandrasekaran and C. Ramasamy – 2008.
10. http://www.crnano.org.
11. http://www.nanotech-now.com.
12. http://www.nanowerk.com.

FMP 301 FARM TRACTORS (2+1)

Theory

Unit I –Tractors

Classification of tractors - Tractor engines – construction of engine blocks, cylinder head and crankcase - features of cylinder, piston, connecting rod and crankshaft – firing order- combustion chambers.

Unit II - Engine systems

Valves-inlet and outlet valves – valve timing diagram. Air cleaner- exhaust – silencer. Cooling systems - lubricating systems - fuel system – governor- electrical system.

Unit III - Transmission systems

Transmission - clutch - gear box - sliding mesh - constant mesh - synchro mesh. Differential, final drive and wheels. Steering geometry - steering systems - front axle and wheel alignment. Brake - types - system.

Unit IV- Hydraulic systems

Hydraulic system - working principles, three point linkage - draft control - weight transfer, theory of traction - tractive efficiency – tractor chassis mechanics - stability - longitudinal and lateral. Controls - visibility - operators seat.

Unit V- Power tiller and Tractor Testing

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 code for performance testing of tractors and power tillers.

Practical

Garage tools. Tractor fault diagnosis and disassembly. Disassembly of tractor engine and study of engine subsystems- their inspection - repair - assembly and adjustment. Tractor transmission - disassembly - assembly and adjustment. Maintenance and adjustment of steering, brakes, tyres, and hitch and hydraulics. Solving problems on centre of gravity and mechanics of tractors.

Lecture schedule

1. Types of tractors - classifications - models – manufacturers – cost - Bulldozer
2. Crank shafts and firing order.
3. Valves and valve assembly - timing and valve opening area.
4. Connecting rod and flywheel.
5. Combustion chamber and characteristics.
6. Lubricating system - types -components
7. Lubricating oils - properties.
8. Cooling system - types - components.
9. Fuel supply system - CI engines - fuel transfer pump - filters.
10. Fuel supply system - fuel injection pump and injectors.
11. Governing system - requirements of good governor
12. Variable speed mechanical governor
13. Governing system - pneumatic governor.
14. Electrical system - battery- dynamo- regulator.
15. Electrical system - starting motors and other electrical accessories.
16. Transmission system – power train.
17. Mid - semester Examination.
18. Single plate dry type clutch

19. Gear boxes - types - sliding mesh
20. Constant mesh and synchromesh gear box.
21. Differential and its function
22. Final drive and PTO shaft
23. Brake and its function.
24. Wheels, tyre specification and use
25. Front axle alignment - Steering gear boxes.
26. Traction-Factors affecting traction-Tractive efficiency
27. Tractor chassis mechanics - stability - longitudinal and lateral
28. Hydraulic system of tractor - Position and draft control-Hitch system.
29. Power tiller-special features
30. Clutch, gear box, steering and rotovator drive
31. Maintenance of power tillers.
32. Makes of tractors and power tillers.
33. Types of tests- test procedure - need for testing & evaluation of farm tractor
34. Test code for performance testing of tractors & power tillers.

Practical schedule

1. Hand tools used in garage - fault diagnosis.
2. Dismantling of engine from tractor – engine disassembly.
3. Piston and cylinder- inspection and reconditioning.
4. Inspection and assembly of cranking system.
5. Reconditioning and assembly of valve and valve actuation system.
6. Servicing of fuel system assembly and adjustment – CI engine.
7. Servicing and assembly of lubricating system components.
8. Servicing and assembly of cooling system components.
9. Maintenance of electrical sub systems.
10. Transmission train - clutch - dismantling, inspection and reconditioning - adjustment.
11. Dismantling of transmission system.
12. Assembly of gear box, differential and final drive.
13. Brake and its adjustment.
14. Steering system – assembly and adjustment.
15. Wheel tread adjustment
16. Solving problems on centre of gravity and mechanics of tractors.
17. Final Practical Examination.

Text Book

1. Jain, S.C. and C.R. Rai. 1999. Farm tractor maintenance and repair. Standard publishers and distributors, New Delhi.

Reference Books

1. Barger, E.L., J.B. Liljedahl and E.C. McKibben, 1997. Tractors and their Power Units. Wiley Eastern Pvt. Ltd., New Delhi.
2. Domkundwar A.V. 1999. A course in internal combustion engines. Dhanpat Rai & Co. (P) Ltd., Educational and Technical Publishers, Delhi.
3. Black, P.O. 1996. Diesel engine manual. Taraporevala Sons& Co., Mumbai.
4. Grouse, W.H. and Anglin, D.L. 1993. Automative mechanics. Macmillan McGraw- Hill, Singapore.
5. Indian Standard Codes for Agril. Implements. Published by ISI, New Delhi.

Journals

1. Journal of Agricultural Engineering (JAE) . Indian Society of Agricultural Engineers. New Delhi -110012

2. Agricultural Engineering Today (AET). Indian Society of Agricultural Engineers. New Delhi -110012
3. International Journal of Automotive Technology, ISSN-1229- 9138
4. Review of automotive engineering published by the Japanese. Society of Automotive Engineers

Web Resources

1. www.idavette.net
2. www.autorepair.about.com

FMP 302 TILLAGE AND SOWING EQUIPMENT (2+1)

Theory

Unit I- Farm Mechanization

Farm mechanisation – objectives. Tillage - objectives - methods – primary tillage implements - secondary tillage implements - animal drawn ploughs - construction. Types of farm implements – trailed, mounted . Field capacity - forces acting on tillage tool.

Unit II – Primary Tillage Implements

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 III – Secondary Tillage Implements

Cultivators - types - construction. Disc harrows - Bund former - ridger – leveller. Basinlister- Wetland preparation implements. Hitch systems - vertical and horizontal hitching of pull type and mounted implements.

Unit IV- Sowing Equipment

Crop planting - methods - row crop planting systems - Devices for metering seeds – furrow openers – furrow closers- types – Types of seed drills and planters.

Unit V- Fertilizer Application

Drill calibration - application of fertilisers - metering devices – seed cum fertiliser drill - application of liquid fertilisers.

PRACTICAL

Construction details, identification of components, adjustments and working of mould board plough, disc plough, rotary plough, subsoiler plough, cultivator, disc harrows, ridger, bund former, basin lister, sowing equipment, rice transplanter, and direct rice seeder. Hitching - adjustments - Measurement of power and field efficiency. Calibration of seedrill. Laboratory and field testing of primary and secondary tillage implements.

Lecture schedule

1. Farm mechanisation – advantages and bottlenecks – importance and challenges – constraints.
2. Stage of mechanisation and comparison with advanced countries
3. Tillage - objectives – methods - Primary tillage implements
4. Secondary tillage implements - animal drawn ploughs - construction.
5. Types of farm implements – trailed, mounted . field capacity , pull, draft, side draft, unit draft - Power – calculations
6. Factors affecting draft and field capacity
7. Indigenous plough – construction - hitching - merits and demerits
8. Forces acting on tillage tool

9. Animal drawn primary tillage implements- Turn wrest plough, reversible plough
10. Mould board plough- types – mould board shapes and types
11. Mould board plough accessories – adjustments
12. Disc plough – construction and uses – methods of ploughing
13. Subsoiler, rotary plough, spading machine and coir pith applicator – construction and uses
14. Cultivators - types – construction and uses
15. Harrows – types and uses
16. Bund former - ridger – leveller and basin lister
17. Mid Semester Examination
18. Wet land Implements – puddlers-direct seeder - mat nursery preparation- transplanters
19. Hitching systems and controls
20. Draft measurement of tillage equipment
21. Crop planting - methods - row crop planting systems
22. Seed drilling, hill dropping, check row planting - equipment
23. Transplanting, dibbling –equipment
24. Horizontal and Inclined plate planter
25. Devices for metering seeds in seed drills and planters
26. Furrow openers - covering and pressing devices
27. Grain drills - bulk flow metering mechanism
28. Drill calibration - procedure – problems
29. Application of fertilisers - metering devices
30. Seed cum fertiliser drill - application of liquid fertilisers
31. Liquid fertiliser application - methods - placement – equipment
32. Pneumatic planters – construction and principles of working
33. Problems on seed drills and planters
34. Farm Machinery Economics

Practical schedule

1. Operation of an animal drawn plough, measuring the draft
2. Hitching of mounted implements to the tractor
3. Operation of a tractor drawn mould board plough - adjustments - determination of field capacity
4. Operation of a tractor drawn disc plough - adjustments - determination of field capacity
5. Methods of ploughing with mounted implements
6. Operation of different types of disc harrows in the field and study of parts
7. Operation of tractor drawn cultivator - adjustments
8. Operation of a subsoiler - adjustments
9. Identification of parts in cup feed and fluted roller seed metering
10. Calibration of seed drill
11. Operation of seed planter in the field
12. Operation of centrifugal broadcasting device
13. Operation of paddy transplanter and drum seeder in the field
14. Study of wetland implements - puddlers and tramplers
15. Laboratory and field testing of primary and secondary tillage implements.
16. Cost economics of farm implements – determination of operational cost.
17. Final practical examination

Text Books

1. Jagdishwar Sahay. 2006. Elements of Agricultural Engineering. Standard Publishers Distributors, Delhi 6.
2. Michael and Ojha. 2005. Principles of Agricultural Engineering. Jain brothers, New Delhi.

Reference Books

1. Kepner, R.A., et al. 1997. Principles of farm machinery. CBS Publishers and Distributers, Delhi.

2. Harris Pearson Smith et al. 1996. Farm machinery and equipments. Tata McGraw-Hill pub., New Delhi.
3. Srivastava, A.C. 1990. Elements of Farm Machinery. Oxford and IBH Pub. Co., New Delhi

Journals

1. Journal of Agricultural Engineering (JAE). Indian Society of Agricultural Engineers. New Delhi -110012
2. Agricultural Engineering Today (AET). Indian Society of Agricultural Engineers. New Delhi -110012
3. Transactions of American Society of Agricultural and Biological Engineers. ISSN- 0001-2351
4. Soil and Tillage Research, ISSN-0167-1987

Web Resources

1. www.canharvesters.com
2. www.alibaba.com
3. www.angelfire.com

ERG 301 SOLAR AND WIND ENERGY ENGINEERING (2+1)

Theory

Unit I - Solar energy radiation and solar thermal collectors

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 dryers – agro industrial applications - liquid flat plate collectors - their performance.

Unit II - Solar concentrating collectors and PV technology

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

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 mill design and applications

Wind mill – classification– power curve. Upwind and downwind systems - 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

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.

Practical

Basic earth-sun angles and solar time - thermal efficiency of a flat plate collector and concentrator - solar still - solar dryers - solar water heaters - PV system - battery - standalone system - solar powered refrigeration system - SPV water pumping system. Wind measurements and instrumentation – wind monitor - wind data and prediction – rotor blade design. Ocean thermal energy conversion cycles – problems on tidal power plants - geothermal energy generation – energy storage.

Lecture schedule

1. Solar energy and its prospects - solar constant and radiation on earth surface
2. Reflectivity, transmissivity, absorptivity and transmission absorption coefficient
3. Basic earth sun angles - concept of solar time
4. Solar radiation measuring instruments - heat transfer principles
5. Solar collectors - types and configuration - flat plate collector – heat transfer correlations - collector efficiency - heat balance
6. Absorber plate – types - selective surfaces- Thermal losses and efficiency of flat plate collectors
7. Solar driers – types – heat transfer - performance of solar dryers
8. Agro industrial applications - liquid flat plate collectors - their performance.
9. Optically concentrating collectors – types – reflectors
10. Solar thermal power stations – principle and applications
11. Solar pond – types - performance – characteristics – applications
12. Solar stills – types - solar refrigeration.
13. Photovoltaics - types – characteristics – load estimation
14. Batteries – invertors – operation - system controls.
15. PV system installations – standalone systems - PV powered water pumping - system sizing and optimization
16. Hybrid system - solar technologies in green buildings.
17. Mid Semester Examination
18. Nature of wind – wind structure and measurement – site consideration
19. Wind power laws - velocity and power duration curves
20. Aero foil - lift and drag Characteristics - tip speed ratio
21. Torque and power characteristics - power coefficients - Betz coefficient.
22. Wind mill – classification – transmission rotors – pumps - generators
23. WECS components and schemes
24. Standalone system - grid system – batteries.
25. Wind energy storage - wind farms - wheeling and banking - testing and certification procedures.
26. Ocean energy- off shore and on shore ocean energy conversion technologies
27. OTEC principles- open and closed cycles.
28. Tidal energy – high and low tides – tidal power- tidal energy conversion schemes.
29. Geothermal energy – resources – classification and types of geothermal power plants.
30. Nuclear energy – reactions – fusion fission hybrid.
31. Fuel cell – principal and operation
32. Fuel cell classification - applications
33. Energy storage – pumped hydro and underground pumped hydro
34. Compressed air - battery - flywheel – thermal storage.

Practical schedule

1. Problems on solar time – basic earth sun angles
2. Study of radiation measuring instruments – Visit to meteorology section
3. Thermal losses and efficiency of flat plate collectors problems
4. Testing of solar water heater
5. Testing of natural convection dryer
6. Testing of solar still
7. Study of photovoltaic cell characteristics
8. Study on SPV water pumping system
9. Wind Energy conversion calculations for power relating parameter and velocity
10. Design of rotor blade for horizontal axis wind mill
11. Study of wind measuring instruments
12. Visit to solar / wind energy installations
13. Study on ocean thermal energy conversion cycles
14. Problems on Tidal plants
15. Study on Geothermal energy generation
16. Study on energy storage.
17. Final Practical Examination.

Text books

1. Rai., G.D. 2002 "Solar Energy Utilization" Khanna publishers, New Delhi.
2. More, H.S and R.C. Maheshwari, 1982 " Wind Energy Utilization in India" CIAE Publication - Bhopal.
3. Rao. S and B.B. Parulekar. 2000. Energy Technology – Non conventional, Renewable and Conventional. Khanna Publishers, Delhi.

Reference books

1. Mathew Buresch, 1986. Photovoltaics Energy Systems. McGraw-Hill Book Company, London.
2. Jui Sheng Hsieh. 1986. Solar Energy Engineering, Prentice Hall, London.
3. Tany Burtar, 2001, Hand book of wind energy. Jhon Wiley and Sons.
4. Manwell, J.F.,J.G.McGswan and A.L.Rogers. 2004. Wind Energy Explained – Theory Design and Application, John Wiley and Sonsilid.
5. John Twidell. 1987. A guide to small wind energy conversion system, Cambridge University press. UK.
6. Rai. G.D. 2002 "Non Conventional Sources of Energy", Khanna Publishers, New Delhi.

Journals

1. Solar Energy – Science direct
2. Solar Energy materials and Solar Cell– Science direct
3. Journal of Solar Energy Engineering - Transactions of American
4. Society of Mechanical Engineers
5. Solar Energy Journal – International Solar Energy Society
6. Journal of Wind Engineering and Industrial Aerodynamics – Elsevier
7. Sun and Wind Energy Journal – Pergamon Press

Web resources

1. www.freesolaronline.com
2. www.rsnz.org
3. www.finwea.org
4. www.mnre.gov.in

SWE 301 HYDROLOGY (2+1)

THEORY:

Unit I – Hydrologic cycle and initial losses

Hydrologic cycle - Precipitation - Forms and measurement of precipitation - Water losses - interception loss, evaporation, transpiration - Infiltration - infiltration capacity - mechanics of infiltration. Factors influencing the rate of infiltration - measurement of infiltration - infiltration equations - Infiltration indices - ϕ-index - W index - problems

Unit II – Runoff and hydrograph

Stream types - run off process - phases of runoff process - Factors affecting run off - Different methods of Estimation of runoff – Intensity, duration, frequency relationship - Estimation of runoff by empirical formulae - Stream flow and stream gauging - Hydrograph - Hydrograph components - base flow separation - Unit hydrograph - unit hydrograph theory - purposes of unit hydrograph - Derivation of unit hydrograph for multiple durations from unit hydrograph of a specified duration - super position technique and 'S' curve method

Unit III - Aquifers

Groundwater development in India - occurrence of groundwater - Types of aquifer - confined - unconfined -perched - artesian - aquifuge - aquitard -aquiclude - Movement of ground water

Unit IV – Hydraulics of wells

Hydraulics of wells - static water levels - piezometric level - pumping water level - drawdown - cone of depression - Radius of influence - well yield - specific capacity- transmissibility - Coefficient of storage - specific yield - specific retention - selection of well sites - Steady state radial flow into the wells - derivation of Dupit's equation -Derivation of Theims equation - partially penetrating wells - Unsteady state flow into the wells- Theis methods - Jacobs method - derivation - Hydraulics of open wells - recuperation test - well losses - Geophysical investigation of ground water - surface methods - Subsurface methods of investigation - uses

Unit V - Wells

Wells - classification - advantages of open well and bore wells - Construction of dug well - sunk wells, Increasing the yield of open well - well logging - Types of well screen - Design of well screens - Casing – Curb- Well development - yield testing - Sanitary protection – Well drilling – Techniques for different formations – hand boring –

PRACTICAL

Estimation of mean rainfall over a basin - Estimation of missing data of rainfall, double mass curve techniques and optimum number of rain gauges for a watershed - Determination of infiltration with double ring infiltrometers - Computation of runoff by rational method & estimation of peak runoff - Problems on unit hydrograph - Multiple duration unit hydrograph – S-curve and superposition technique.

Problems in steady state flow towards wells - Determination of Transmissibility storage coefficient by Theis method - Jacob method - modified Jacob method - partially penetrated well - Determination of aquifer properties by recuperation test - Study of electrical resistively surveying - Design of open well casing and curb - Visit to well drilling site - Design of well screen - Bore well - Yield testing.

LECTURE SCHEDULE:

Unit I – Hydrologic cycle and initial losses

1. Hydrology, hydrologic cycle.
2. Precipitation - forms and measurement of precipitation.
3. Water losses - interception loss, evaporation, transpiration, Evapotranspiration.

4. Infiltration - infiltration capacity - mechanics of infiltration - Factors influencing the rate of infiltration.
5. Infiltration indices - index - W index - problems - measurement of infiltration - infiltration equations.

Unit II – Runoff and hydrograph

6. Stream types - Stream flow measurement – stage – automatic recorders
7. Velocity measurement – current meters – area-velocity method - dilution technique – electromagnetic method – ultrasonic method.
8. Run off process - phases of runoff process.
9. Factors affecting run off.
10. Rational method of Estimation of peak rate of runoff – Intensity-duration- frequency relationship.
11. Estimation of runoff by Cook's method, Curve number method, unit hydrograph method.
12. Estimation of runoff by empirical formulae.
13. Hydrograph - Hydrograph components - base flow separation.
14. Unit hydrograph - unit hydrograph theory - purposes of unit hydrograph.
15. Derivation of unit hydrograph – Unit hydrographs of multiple durations from unit hydrograph of a specified duration - super position technique and 'S' curve method.

Unit III - Aquifers

16. Types of aquifer - confined - unconfined -perched - artesian - aquifuge - aquitard - aquiclude.
17. Mid semester examination
18. Profile zoning of soil water – occurrence of ground water.
19. Movement of ground water.

Unit IV – Hydraulics of wells

20. Hydraulics of wells - static water levels - pumping water level - piezometric level -drawdown - cone of depression.
21. Radius of influence - well yield - specific capacity- transmissibility.
22. Coefficient of storage - specific yield - specific retention - selection of well sites.
23. Steady state radial flow into the wells - derivation of Dupuit's equation / Theim equation.
24. Partially penetrating wells.
25. Unsteady state flow into the wells- Theis method - Jacobs's method - derivation.
26. Hydraulics of open wells - recuperation test
27. Well losses – estimation of well losses.
28. Geophysical investigation of ground water - surface methods
29. Subsurface methods of investigation - uses.

Unit V - Wells

30. Wells - classification - advantages of open well and bore wells - Construction of dug well - sunk wells.
31. Increasing the yield of open well - well logging.
32. Types of well screen - perforated pipes - bamboo screens - slotted screens - Design of well screens – Casing- Curb
33. Well development - yield testing - Sanitary protection.
34. Well drilling techniques for different formation – hand boring

PRACTICAL

1. Estimation of mean rainfall over a basin.
2. Estimation of missing data of rainfall and optimum number of rain gauges for a watershed.
3. Analysis of intensity and duration curves for different frequencies and double mass curve techniques.
4. Determination of infiltration with double ring infiltrometers & curve fitting.
5. Computation of runoff by rational method & estimation of peak runoff.
6. Problems on unit hydrograph.
7. Multiple duration unit hydrograph curve and superposition technique.

8. Problems in steady state flow towards wells - partially penetrated well.
9. Determination of Transmissibility by Theis method.
10. Determination of Transmissibility and storage coefficient by Jacob method.
11. Determination of aquifer properties by recuperation test.
12. Study of electrical resistivity surveying.
13. Design of open well casing and curb
14. Visit to well drilling site.
15. Design of well screen.
16. Bore well - Yield testing.
17. Final practical exam.

TEXT BOOK

1. Gunshyam das 2005, Hydrology and soil conservation engineering, Prentice-Hall of India Pvt. Ltd., New Delhi

REFERENCE BOOKS:

1. Subramanya, K. 2004. Engineering Hydrology, Tata McGraw Hill pub Co. New Delhi.
2. Raghunath, H.M.. 2003. Groundwater, wiley Eastern Ltd. Madras.
3. Gurmel Singh et al. 2005. Manual of soil and water conservation practices. Oxford & IBH publishing Co. New Delhi.
4. Michael, A.M. and Ojha, T.P. 2006. Principles of Agricultural Engineering Vol II Jain Brothers, New Delhi.
5. Suresh, R. 2005. Soil and Water Conservation Engineering, Standard Publishers & Distributors, New Delhi.
6. Suresh, R. 2008. Land and water management principles, Standard Publishers & Distributors, New Delhi.

SWE 302 SOIL CONSERVATION AND WATER HARVESTING (2+1)

Theory:

Unit I – Soil erosion

Problems of soil erosion - Geological and Accelerated erosion, Factors affecting water erosion, Types of water erosion - Splash, sheet and rill, Gully, stream bank and road erosion and ravines, 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', Measurement of runoff and soil loss - Multislot divisor unit - Coshocton rotating wheel sampler - Rainfall simulation and simulator - Sediment yield and sedimentation, Wind erosion mechanics - Methods of estimation of wind erosion - Desertification, deforestation and shifting cultivation

Unit II – Erosion control

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 – Gully Control Structures

Gully control and control of landslides, Temporary gully control measures, Permanent Gully Control Structures - Wind erosion control - wind breaks and shelter belts

Unit IV – Watershed management

Watershed - concept - planning, Principles - Components of watershed development - Watershed management plan - Biological. Watershed management plan – Engineering.

Unit V – Water harvesting

Water harvesting methods, Farm pond - lined and unlined - Computation of capacity, Percolation pond - Selection of site - components, Dry farming techniques for improving crop production,

PRACTICAL:

Identification of different types of water erosion on the field - Computation of erosivity index and preparation of iso-erodent maps - Estimation of soil erosion from run- off plots - Computation of erodibility factor in USLE - Computation of topographical factor in USLE - Computation of crop management and conservation practice - factor in USLE - Estimation of soil erosion with multislot divisor and coshocton wheel sampler - Control measure for hills and rolling topography - vegetative water ways - design - Rainfall simulation experiment - Design and drawing of contour bunds and graded bunds - Design and drawing of bench terraces - Design and drawing of contour trenches and stone walls - Design of spillways - Drop spillway - Design of Drop inlet & chute spillway - Design of farmpond and earthern embankment - Field visit and observation of R.V.P - percolation ponds, farm ponds and checkdams.

LECTURE SCHEDULE:

1. Problems of soil erosion - Geological and Accelerated erosion, adverse effects of water and wind erosion. Factors affecting water erosion.
2. Different types of water erosion - Splash, sheet and rill gully, stream bank and road erosion and ravines.
3. Universal Soil Loss Equation (USLE) & soil loss tolerance. Rainfall Erosion Index - erosivity factor
4. Soil erodibility Index - erodibility nature of soils. Slope, slope length and topographical factors.
5. Crop management for soil erosion 'C' factor. Conservation practice factor 'P'
6. Measurement of runoff and soil loss
7. Erosion measurement by multislot divisor unit
8. Coshocton rotating wheel sampler
9. Rainfall simulation and simulator.
10. Sediment yield and sedimentation.
11. Wind erosion mechanics and factors affecting wind erosion.
12. Methods of estimation of wind erosion
13. Desertification, deforestation and shifting cultivation.
14. Types of erosion control measures.
15. Contour bunds and Graded bunds
16. Broad beds and furrows, wide based terraces and dykes. Random tie riding, basin listing and mulching.
17. Mid semester examination.
18. Bench terraces, stonewalls and contour trenches.
19. Gully control and control of land slides
20. Temporary gully control measures.
21. Permanent Gully Control Structures - Drop spillway.
22. Drop inlet and chute spillways.
23. Contour cultivation; strip cropping, mixed cropping, mixed farming, crop rotation for erosion control.

24. Afforestation - conservation measures for light and heavy soils.
25. Diversion drains and vegetative water ways
26. Wind erosion control - wind breaks and shelter belts
27. Watershed - concept - planning
28. Principles - Components of watershed development
29. Water harvesting methods.
30. Farm pond - lined and unlined - Computation of capacity.
31. Percolation Pond - Selection of site - components.
32. Dry farming techniques for improving crop production
33. Watershed management plan - Biological.
34. Watershed management plan - Engineering.

PRACTICAL SCHEDULE:

1. Identification of different types of water erosion on the field.
2. Computation of erosivity index and preparation of iso-erodent maps.
3. Estimation of soil erosion from run- off plots.
4. Computation of erodibility factor in USLE.
5. Computation of topographical factor in USLE.
6. Computation of crop management and conservation practice - factor in USLE.
7. Estimation of soil erosion with multislot divisor and coshocton wheel sampler.
8. Control measure for hills and rolling topography - vegetative waterways - design.
9. Rainfall simulation experiment.
10. Design and drawing of contour bunds and graded bunds.
11. Design and drawing of bench terraces.
12. Design and drawing of contour trenches and stonewalls.
13. Design of spillways - Drop spillway
14. Design of Drop inlet & chute spillway.
15. Design of farmpond and earthern embankment.
16. Field visit and observation of R.V.P - percolation ponds, farm ponds & checkdams.
17. Final Practical Examination.

REFERNCE BOOKS:

1. Gurmel Singh et al. 1996. Manual of soil and water conservation practices. Oxford & IBH publishing Co. New Delhi.
2. Michael, A.M. and Ojha, T.P. 1980. Principles of Agricultural Engineering Vol II Jain Brothers, New Delhi.
3. Suresh, R. 1997. Soil and Water Conservation Engineering, Standard Publishers & Distributors, New Delhi.

FPE 301 PROCESS ENGINEERING OF SPICES AND PLANTATION CROPS 2+1

THEORY

Unit I: Importance and processing of spices

Spices – production and importance – stage of harvesting and harvesting methods - processing of major and minor spices – pepper, cardamom, chilli, turmeric, ginger, clove, nutmeg, vanilla – unit operations involved – equipments – principle and construction

Unit II: Packaging, grading and quality analysis of spices

Cleaning and grading of spices - packaging and storage of spices – grading specifications – Agmark, ASTA, ESA specifications - processes involved in the manufacture of oleoresins and essential oils – quality analysis of spices and their derivatives

Unit III : Processing of coffee, tea and cocoa

Processing of coffee, tea, cocoa and rubber – methods, process and equipment – value added products – grading and types - packaging and storage

Unit IV: Processing of coconut, oilpalm, arecanut and cashew

Processing of plantation crops – production and importance – processing of coconut, oilpalm, arecanut, cashew– harvesting and stages of harvest – drying, cleaning and grading – production of value added products – packaging and storage of produces.

Unit V : Processing of medicinal crops

Importance of medicinal crops – production and export status - processing of medicinal crops - equipments used - principles and operations – active principles in various medicinal plants – application and uses - extraction methods

PRACTICAL

Performance evaluation of pepper threshers, inclined belt separator, spiral separator, vibratory type grader, rotary type grader, white pepper peeler cum washer, abrasive type white pepper polisher, turmeric boiler, turmeric polisher, coffee pulper cum washer, arecanut dehuskers and coconut dehusker – drying characteristics of spices in thin layer dryer, cabinet dryer, fluidized bed dryer, spouted bed dryer and rotary dryer.

Lecture schedule

1. Importance for spices – cardamom, pepper, turmeric – importance - production and export status
2. Stages and methods of harvest of major and minor spices – equipments used – principles and operations
3. Threshing, shelling, decortication of spices – construction and operation details
4. Drying of spices – traditional methods – improved methods - mechanical drying – advantages – quality of drying –moisture content of spices – determination – toluene displacement method
5. Processing of cardamom – stage of harvest, curing in kilns, modern kilns/ dryers, garbling, grading, grade specifications and packaging
6. Processing of pepper – harvesting, collection, threshing and threshers – construction and working, drying, cleaning and grading, standards, packaging
7. Processing of white pepper – wet and dry pulping and retting methods – drying – quality of white pepper
8. Processing of turmeric – traditional and improved methods -
9. Turmeric processing – turmeric boiler and polisher – construction and working – drying and polishing - grade specifications and packaging of turmeric and their products
10. Processing of chilli – harvesting, drying - dryers – construction and operation.
11. Grading, storage and packaging of chilli and their products – types and standards
12. Low temperature grinding / cryogenic grinding – advantages – refrigerant used – construction and working
13. Processing of ginger – harvesting, washing, drying, packaging – quality aspects
14. Processing of clove, nutmeg and other minor spices
15. Processing of vanilla – harvesting, drying, seasoning and packaging – methods of processing

16. Grading for spices – construction and operation – AGMARK, ASTA and ESA specifications for spices and spice derivatives.
17. Mid semester examination
18. Packaging and storage of spices – requirements – gunny bags, poly lined gunny bags, handling for shipment
19. Quality analysis of spices and spice derivatives – effects of contaminants – methods of analysis
20. Spices - extraction of oleoresins and essential oils – solvent extraction process – equipment, solvents used, process and principles.
21. Importance for plantation crops – economic importance - production and export status – need for processing
22. Processing of coffee – wet and dry method, estate level processing, pulping, washing and drying – equipment – construction and operation
23. Curing of coffee – drying, hulling, grading, colour sorting, separation and packaging
24. Tea – types – green tea, black tea, oolong tea – constituents of tea.
25. Unit operations involved in tea processing – methods and equipments - grading of tea – methods – grades of tea- packaging of tea
26. Processing of cocoa – flow chart and important unit operations – cocoa products – methods of preparation
27. Processing of cashewnut – flow chart –important unit operations roasting, shelling and grading – equipments – types – working principles.
28. Coconut processing – products – flow charts – extraction of oil – methods – wet and dry process – equipments – construction and operation.
29. Products of coconut – coconut milk, coconut milk powder, copra, desiccated coconut powder, skimmed milk powder – process and equipment.
30. Processing of oil palm – flow chart – important unit operations – equipment – types – construction and working.
31. Processing of areca nut – flow chart, important unit operations, dehusking, slicing, boiling, drying, colouring and packaging, equipments for dehusking – types, construction and working
32. Extraction of aromatic and colouring components from spices and plantation crops.
33. Importance of medicinal crops – production and export status - processing of medicinal crops – equipments used- principles and operation
34. Active principles in various medicinal plants – application and uses - extraction methods

Practical schedule

1. Performance evaluation of pepper thresher
2. Performance evaluation of white pepper peeler cum washer
3. Evaluation of inclined belt separator for pepper
4. Evaluation of spiral separator for pepper
5. Evaluation of rotary type grader for pepper and cardamom
6. Performance evaluation of cardamom garbling unit
7. Evaluation of turmeric boiler and polisher
8. Determination of drying characteristics of spices in thin layer dryer
9. Determination of drying characteristics of spices in cabinet dryer
10. Determination of drying characteristics of cardamom in fluidized bed dryer
11. Evaluation of coffee pulper cum washer

12. Evaluation of arecanut dehuskers
13. Evaluation of coconut dehuskers
14. Evaluation of gloriosa thresher
15. Visit to spice processing industry
16. Visit to tea/coffee processing industry
17. Final practical examination.

Text books

1. Pandey, P. H. 2002. Post Harvest Engineering of Horticultural Crops through Objectives. Saroj Prakasam, Allahabad.
2. Pruthi, J.S. 1998. Major Spices of India – Crop Management and Post Harvest Technology. Indian Council of Agricultural Research, Krishi Anusandhan Bhavan, Pusa, New Delhi. PP. 514.

Reference books

1. ASTA, 1997. Official analytical methods of the American Spice Trade Association, Fourth Edition.
2. Purseglove, J.W., E.G.Brown, G.L.Green and S.R.J.Robbins. 1981. Cardamom – Chemistry. Spices, Vol. I, Tropical Agricultural Series, Longman, London, 1: 605.
3. Pruthi, J.S. 1980. Spices and Condiments: Chemistry, Microbiology and Technology. First Edition. Academic Press Inc., New York, USA. pp. 1-450.

Journals

1. Journal of spices and plantation crops
2. Indian J. Arecanut, Spices & Medicinal Plants
3. Journal of spices and aromatic crops

e- Reference

1. www.indianspices.com
2. www.coconutboard.gov.in
3. www.tide-india.org/projects/06diffusion-arecanut-processing.html

VI Semester			
1.	MAT 302	Operations Research	1+1
2.	ENG 301	Soft Skills for Employability	0+1
3.	AEX 301	Extension Methodologies and Transfer of Agricultural Technology	1+1
4.	ERG 302	Bio and Thermo-chemical Conversion of Biomass	2+1
5.	FPE 302	Food and Dairy Engineering	2+1
6.	SWE 303	Irrigation and Drainage Engineering	2+1
7.	AGE 301	Project Work	0+2
8.	AGE 302	Study Tour	0+1
9.	FMP 303/ ERG 303	Operation and Maintenance of Farm Equipment / Biomass Power Generation Technologies	0+5
Total			**8+14=22**

MAT 302 OPERATIONS RESEARCH (1+1)

THEORY

Unit-I: Linear Programming techniques

Linear programming –Introduction- Problem Formulation - Graphical method –Limitations- General Linear programming problem-Canonical and Standard forms of LPP-Simplex Method- Computational Procedure –Artificial variable technique - Big M- Method.

Unit-II: Transportation and Assignment Models

Transportation Problem –Mathematical form of TPP-Methods of finding initial basic feasible solutions- North West - Corner Rule. Row Minimum - Column Minimum- Matrix Minimum - Vogel's Approximation Method (VAM)- Optimal Solution – Modified distribution Method (MODI Method). Assignment Problem –Mathematical form- Hungarian Method.

Unit-III: Integer Programming

Integer Programming Problems-definitions –General form- Gomory's Algorithm –All Integer Cutting Plane Algorithm- Gomory's mixed integer method.

Unit-IV: Network Scheduling by PERT /CPM

Introduction –Network and basic components –construction and time calculation in network. Critical path method (CPM). Programme Evaluation and Review Technique (PERT) calculation – advantages in network

Unit-V: Inventory model

Inventory control - selective control techniques – economic lot size problems – problem of EOQ with and without shortage- EOQ problems with price Breaks. Inventory control techniques – uncertain demand and stochastic problems.

PRACTICAL

Problems in Formulation of Linear programming Problem - Graphical method –Simplex Method- Big M- Method. Transportation Problem - North West - Corner Rule. Row Minimum - Column

Minimum- Matrix Minimum - Vogel's Approximation Method (VAM)- Optimal Solution – Modified distribution Method (MODI Method). Assignment Problem –Hungarian Method. Integer Programming Problems-Gomory's Algorithm –All Integer Cutting Plane Algorithm- Gomory's mixed integer method. Construction of Network and time calculation in network. Critical Path Method (CPM). Programme Evaluation and Review Technique (PERT) calculation. Problems in Inventory model - selective control techniques – economic lot size problems – problem of EOQ with and without shortage- EOQ problems with price Breaks- Inventory control techniques – uncertain demand and stochastic problems.

Lecture Schedule:

1. Linear programming –Introduction- Problem Formulation
2. Solution of LPP using Graphical method
3. Limitations- General Linear programming problem-Canonical and Standard forms of LPP
4. Simplex Method-Computational Procedure
5. Artificial variable technique - Big M Method.
6. Transportation Problem –Mathematical form of TPP-Methods of finding initial basic feasible solutions- North West - Corner Rule. Row Minimum Column Minimum- Matrix Minimum
7. Vogel's Approximation Method (VAM)- Optimal Solution – Modified distribution Method (MODI Method).
8. Assignment Problem –Mathematical form- Hungarian Method.
9. **MID SEMESTER EXAMINATION**
10. Integer Programming Problems-definitions –general form- Gomory's Algorithm
11. All Integer Cutting Plane Algorithm -Gomory's mixed integer method.
12. Network and basic components –construction and time calculation
13. Critical path method (CPM).
14. Programme Evaluation and Review Technique (PERT) calculation – advantages in network
15. Inventory control-concepts - economic lot size problems- Problem of EOQ with and without shortage.
16. EOQ problems with price Breaks.
17. Uncertain demand and stochastic problems.

PRACTICAL SCHEDULE

1. Problem in Formulation of Linear programming
2. Problems in Graphical method
3. Problems in Simplex Method
4. Problems in Big M Method
5. Transportation Problem -Methods of finding initial basic feasible solutions- North West - Corner Rule. Row Minimum Column Minimum- Matrix Minimum
6. Vogel's Approximation Method (VAM)- Optimal Solution – Modified distribution Method (MODI Method).
7. Assignment Problem –Hungarian Method.
8. Problems in Integer Programming Problems- Gomory's Algorithm
9. Problems in all Integer Cutting Plane Algorithm -Gomory's mixed integer method.
10. Problems in construction of Network and time calculation
11. Problems in Critical path method (CPM).
12. Problems in Programme Evaluation and Review Technique (PERT)

13. Inventory control-concepts - economic lot size problems-
14. Problem of EOQ with and without shortage.
15. EOQ problems with price Breaks.
16. Uncertain demand and stochastic problems.
17. **Final Practical Examination**

TEXT BOOKS

1. Kanti Swarup, P.K Gupta, Man Mohan (2005)-Operations Research - Sultan Chand and Sons educational publisher, New Delhi.
2. G.V. Shenoy, U.K.Srivastava & S.C. Sharma(2002)-Operations Research for Management-New Age International (P) Ltd., publishers, New Delhi.

REFERENCE BOOKS

1. V.K.Kapoor and Sumant Kapoor(2003)- Operations Research Technique for Management-S. Chand and Sons, New Delhi.
2. Hamdy A. Taha (2000) -Operations Research -Prentice Hall of India Publisher, New Delhi.
3. Ravindran, Don.T.Phillips and James .J.Solberg(2001)-Operations Research-John Willey and Sons, Singapore.
4. S.J.Venkatesan(1999)-Operations Research- JS Publishers,Cheyyar.
5. Prem Kumar Gupta & D.S. Hira (2001)-Operations Research- Sultan Chand and Sons educational publisher, New Delhi.

E-REFERENCES

www.mathworld.com
http://www.statistics.com/resources/glossary/
http://www.tutorvista.com/content/math/statistics-and-probability/linear-programming/linear-programmingindex.php
http://mat.gsia.cmu.edu/QUANT/NOTES/chap11/node8.html

E-JOURNAL

http://www.math.neu.edu/~Suciu/journals.html

ENG 301 SOFT SKILLS FOR EMPLOYABILITY (0+1)

UNIT I –Overview

Soft skills and hard skills – career skills and corporate skills – lateral thinking - ego styles – different types – on being a professional.

UNIT II – Life Skills

1. Attitude

Psychological and Sociological definitions – types of attitude (positive and negative) and consequences – suggestions to keep a good attitude.

2. Emotional Intelligence (EI)

Introduction and Definitions – four branch model of EQ and its detailed explanation - five point scale to measure EI – suggestions to improve EI

3. Interpersonal skills

Study of character traits - discussion of formal interpersonal skills like greeting, enquiring, answering, complimenting and acknowledging.

4. **Self Development/Empowerment**

Self awareness and motivation – Maslow's theory of hierarchy and needs - Self analysis through SWOC and Johari Window – Elements and seven rules of motivation – Goal setting based on principle of SMART – Strategies of self motivation – Knowledge enhancing through reading of Newspapers, magazines and journals.

UNIT III Communication Skills

5. Process of communication

Objectives of communication – Types of communication – Formal Vs informal communication – LSRW components of communication – Barriers to communication

6. Listening skills

Purpose and significance of listening – Process of listening –Different types of listening - How to be a good listener – Guidelines for effective listening – Barriers to listening – Tips to overcome the barriers

7. Reading skills

Purpose and significance of Reading – Benefits of reading – Process/Types of reading – Understanding/Inferring/Note making – SQ3R technique –How to be a good reader – Barriers/Distractions to good reading – Tips to overcome the barriers

8. Speaking Skills

Purpose and significance of speaking clearly –Verbal code and visual code - Benefits of good speaking - Process/ components of good speech – Informative speaking & its types – persuasive speaking & its types –Presentation skills – Barriers of speaking - Tips to overcome the barriers

9. Writing skills

Purpose and significance of writing – features of good writing – How to develop writing skills – choice construction, paragraph design, etc. – letter writing skills – formal & informal – parts of a good letter – layout & format of a letter –preparing a curriculum vitae – report writing – preparing a conference paper – writing a book review - editing – punctuation,spelling, grammar and vocabulary.

10. Telephone skills

The right environment – formal greetings - telephone courtesies – effective listening skills – interpersonal skills – concluding formality.

11. Mid Semester

UNIT IV – Employability Skills

12. Interview skills - I

Definitions of interview – two types of group interview – preliminary requirements for success – telephone interview – specially designed interviews.

13. Interview skills - II

Five stages of interview – how to answer the questions

14. Group discussion

Definition – contexts – why and how? – techniques for successful participation – skills required – simulation – based - group discussion.

UNIT V – Corporate Skills

15. Leadership qualities

Definition - basic requirements – (responsibility - self – knowledge - knowledge of, and rapport with subordinates- knowledge of the assignment- goal setting- decision making – team work) leadership with primates – leadership and vision.

16. Negotiation skills

Select definitions – functions of negotiation – two kinds of negotiation – phases of the process – rules – steps to improve negotiation skills.

17. Time management

Basic skills of time management – relationship between stress management and time management – time management techniques for prudent time management – tips for time management.

17. Stress management

Definition of stress –kinds - stress at work – causes, effects and solution - stress and stroke – different kinds of stroke – stress in interview.

PRACTICAL SESSIONS

Session No.	**Title**	**Activity**
1.	Soft Skills- an overview	Brainstorming session
2.	Life skills/ Attitude	Interactive software and discussion pm [positive thinking
3.	Interpersonal skills	Demonstration
4.	Self Development/Empowerment role-play	Role-play
5.	Process of communication	Interactive software Effective Communication
6.	Listening and speaking	Audio listening and close tasks
7.	Reading and writing Skills	Reading an unfamiliar text writing simulation
8.	Presentation Skills.	Listening to a software and demonstration by students and peer group evaluation
9.	Professional writing strategies	Discussion on article scientific and conference paper by means of handouts
10.	Writing a rejoinder	Divergent simulation
11.	Group discussion	Audio listening on group discussion and structured, timed Group Discussion.
12.	Interview skills – I	Listening to software on being interviewed and preparing a resume
13.	Interview skills - II	Interview simulation by subject experts and the course teacher
14.	Leadership qualities	Brainstorming session and convergent simulations
15.	Negotiation skills	Role Play
16.	Stress management and time management listening	To a software on stress and role play

TEXT BOOK:

Hariharan,S. , S. N.Sundararajan, and S.P.Shanmugapriya.(2010). **Soft Skills**. MJP Publishers, Chennai.

REFERENCE:

1. Alex. (2009). Soft skills: Know yourself and know the world. S. Chand & Co. Publishing House, New Delhi.
2. Beverly Jaeger. (2004). Making Work Work for the Highly Sensitive Person. Tata McGraw – Hill, USA.
3. Dipali Biswas. (2009). Enhancing Soft Skills. Shoraff Publishers and Distributors.
4. Gloria. J. Galanes, Kathreine Adams, John. K. and Brilhart. (2004). Effective Group Discussion. Tata McGraw – Hill, New Delhi.
5. Jagadeesan. G. and Santhanakrishnan, R. (2007). Soft Skills Development. ICFAI University Press. New Delhi.
6. Martin Avis. (2010). Effective Time Management Skills for Everyone. Avis Consultancy, London, U.K.
7. Mayer, J.D., Salovey, P and Caruso, D.R. (2000). Models of Emotional Intelligence. R.J. Shernberg (Ed.). Handbook of Intelligence. Cambridge University Press, Cambridge.
8. Patsy McCarthy and Caroline Hatcher. (2002). Presentation Skill: The Essential Guide for Students. Sage Publications, CA.
9. Peggy Claus. (2007): The Hard Truth about Soft Skills. Harper Collins Publishers, New York, USA.
10. Peter. J. Gosling. (2002), Scientists Guide to Poster Presentations, Kluwar Academic Pub, N.Y, USA.
11. Richard Ellis. (2009). Communication Skills; Step ladders to success for professionals. Intellect Books, Chicago, USA.
12. Robert, A. Day. (2000). How to Write a Scientific Paper. ELBS, U.K.
13. Sarvesh Gulati. (2006). Corporate Soft Skills. Rupa Publishers, New Delhi.
14. Soleman. D. (1998). Working with Emotional Inteligence. Bloomsbury Publishing, London.

WEBSITES

- www.softskills.com
- www.reportingskills.com
- www.writing-skills.com
- www.negotiation.com
- www.businessballs.com
- www.study-habits.com
- www.timethoughts.com

AEX 301 EXTENSION METHODOLOGIES AND TRANSFER OF AGRICULTURAL TECHNOLOGY (1+1)

Theory

Unit I Communication and Programme Planning

Communication – meaning – definition – models – elements and their characteristics – types and barriers in communication. Programme planning – meaning, definition, principles, steps in programme development process, monitoring and evaluation of extension programmes.

Unit II Extension Teaching Methods

Extension teaching methods - Audio-Visual aids – definition – classification – purpose, planning and selection, combination and use – individual, group and mass contact methods – merits and demerits.

Unit III Modern Communication Gadgets

Modern communication sources – internet, video and teleconferencing, Interactive Multimedia Compact Disk (IMCD), village kiosks, Kissan Call Centre (KCC), mobile phone

Unit IV Diffusion and Adoption

Diffusion – meaning and elements. Adoption – meaning –adopter categories and factors influencing adoption, stages of adoption, Innovation decision process and attributes of innovation consequences of adoption.

Unit V Capacity building

Capacity building of extension personnel and farmers – meaning – definition, types of training, training to farmers, farm women and rural youth, FTC & KVK.

Practicals

Communication pattern in TOT organizations – ongoing agricultural and rural development/TOT programmes, ATMA and SHGs – preparation of visual aids – extension literature – news stories, feature stories – interview articles – photo journalism – activities of Directorate of ODL / Educational Media Centre – activities of Community Radio Centre – writing script for radio and television – spread and acceptance of farm technologies at village level.

Theory

Lecture Schedule

1. Communication-meaning, definition, functions, elements and their characteristics.
2. Types and barriers of communication and models of communication.
3. Programme planning-definition, scope, principles, importance, steps, evaluation, keys for evaluation.
4. Extension teaching methods-definition, meaning, functions, selection and classification.
5. Individual contact methods-farm and home visit, office call, telephone call and personal letter-observation and result demonstration.
6. Group contact methods-method demonstration, meeting, lecture, debate, workshop, seminar, forum and conference
7. Group contact methods-symposium, panel, brainstorming, buzz session, role playing and simulation games.
8. Mass contact methods-campaign, exhibition, farmers day and field trips - purpose, procedures, advantages and limitations.
9. Mid Semester Examination.
10. Mass contact methods-written communication-circular letter, leaflet, folder, pamphlet-purpose, procedures, advantages and limitations.
11. Audio visual aids-definition, scope and importance, classification-merits and demerits-factors influencing planning and selection.
12. Modern communication gadgets-computer networks, internet, video and teleconferencing.
13. Modern communication sources (e-extension)-multimedia devices-mobile phone, Kisan Call Centre, Village Knowledge Centre/information kiosks, portal, websites.
14. Diffusion-meaning, definition, elements. Innovation-adoption, meaning, definition, attributes of innovation and stages of adoption
15. Innovation-decision process, functions, adopter categories-factors influencing adoption-impact and constraints in technology transfer programmes.
16. Capacity building of extension personnel and farmers-meaning, definition and importance
17. Training-types, institutions training for farmers, farm women and rural youths and importance

Practicals

1. Understanding the communication pattern in State Department of Agriculture/Horticulture.
2. Study on communication pattern in University TOT Centres.
3. Study of on going agricultural development programmes.
4. Preparation and practicing of posters, charts, graphs, circular letter, folders and leaflets
5. Visit to the State Department of Agricultural Engineering to study the transfer of technology efforts in farm mechanization.
6. Visit to village and fixing the priorities and selecting a most important problem for preparation of a project.
7. Visit to ATMA implemented village.

8. Studying the role of print media communication in publishing the activities of agriculture and allied fields.
9. Visit to Educational Media Centre.
10. Practicing skill on photo journalism
11. Studying the distance learning efforts of Directorate of ODL/Educational Media Centre
12. Studying the role of Community Radio Centre in TOT
13. Script writing for Radio and Television
14. Preparation of interview schedule to study the spread and acceptance of farm technologies at village level.
15. Data collection and tabulation
16. Presentation of reports.
17. Final Practical Examination

Reference

Text Books

1. Ray, G.L., 1999. Extension Communication and Management, Naya Prokash, 206, Bidhan Sarani, Calcutta.
2. Rogers, E.M. 1995. Diffusion of Innovations, The Free Press, Newyork
3. Sandhu, A.S. 1996. Extension Programme Planning, Oxford & IBH Publishing Co. pvt. Ltd, New Delhi
4. Sandhu, A.S. 1996. Agricultural Communication: Process and Methods, Oxford & IBH Publishing Co. Pvt. Ltd, New Delhi.

Journals

1. Indian Journal of Social Sciences, Serials Publications, New Delhi
2. Agricultural Extension Review, Department of Agriculture and Co-operation, Ministry of Agriculture, New Delhi
3. Journal of Rural Development, NIRD, Rajendra Nagar, Hyderabad
4. MANAGE, NAARM, Hyderabad
5. Yojana, Ministry of Rural Development, New Delhi

Web Resources

- www.i4d.com
- www.panasia.org
- www.joe.org

ERG 302 BIO AND THERMO-CHEMICAL CONVERSION OF BIOMASS **(2+1)**

Theory

Unit I - Biomass characterization

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

Unit II - Biochemical Conversion

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 – bioethanol – feedstock – process – utilization - composting - methods – machinery.

Unit III - Thermo chemical conversion by combustion

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

Unit IV -Thermochemical conversion by gasification and pyrolysis

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 - Cogeneration and waste heat recovery

Cogeneration technologies – cycles – topping – bottoming – problems – applications – selection. Waste heat recovery - plate heat exchangers - waste heat boilers - heat pumps - thermic fluid heaters - selection of waste heat recovery.

Practical

Biomass characterization – measurement of BOD and COD– design of KVIC and Deenabandhu biogas plant - purification of biogas – bio digested slurry - design of UASB reactor. Briquetting – stoichiometric calculations – performance of wood burning stoves - producer gas generators - evaluation of agro residue gasifier – dual fuel engine - pyrolysis plant - charcoal making – waste heat recovery calculation.

Lecture schedule

1. Biomass – types – fuels from biomass. Terms and units used in biomass production.
2. Biomass fuel characterization – physical, chemical and thermal - energy release.
3. Supply chain – harvesting / collection – transportation and processing.
4. Briquetting – types – pelletizing.
5. Anaerobic digestion – biogas – types of biogas plants
6. Construction details - operation and maintenance of biogas plants
7. Factors affecting biogas production – pipe line layout- Water removal devices
8. Biogas utilization – biogas appliances
9. Bio digested slurry handling, utilization and enrichment
10. High rate biomethanation process – anaerobic contact process – anaerobic filter
11. UASB – expanded bed reactor – fluidized bed reactor
12. Wastewater characteristics – biological treatment – aerobic trickling filters
13. Composting – process parameter- composting technology- compost stability - machinery
14. Landfilling and its principal- construction - different phases- landfill gas recovery
15. Bioethanol – feedstock – process – utilization
16. Thermochemical degradation – Stoichiometric air requirement - combustion process
17. Mid-semester examination
18. Chemistry of combustion - combustion zones – emissions.
19. Cofiring of biomass – characteristics – options – conversion
20. Incinerators - layout. Combustion of wastes and MSW – properties.
21. Wood burning stoves - types- construction and operation.
22. Biomass gasification – chemistry of gasification Updraft gasifier – principles
23. Down draft, cross draft and Fluidized bed gasifier - principles - application
24. Gas cleaning and conditioning - thermal application
25. Performance evaluation of gasifier - emissions – commercial gasifies plants.
26. Pyrolysis – product recovery – types - biochar – bio oil- operation – recovery.
27. Biomass based power generation – concept – stand alone and grid based – policies
28. Cogeneration - topping and bottoming cycles- Advantages of cogeneration technology
29. Cogeneration - Application in various industries like Cement, Sugar Mill, Paper Mill etc.
30. Steam turbines – steam engines – stirling engines.
31. Indirect fired gas turbines and direct fired pressurized gas turbines
32. Waste heat recovery - recuperators - regenerators - economizers - plate heat exchangers - waste heat boilers
33. Heat pumps - thermic fluid heaters - selection of waste heat recovery.
34. Environmental impact on biomass energy conversion technologies – cost economics.

Practical schedule

1. Characterisation of biomass
2. Design of KVIC model biogas plant
3. Design of Deenbandhu model biogas plant
4. Purification of biogas – CO_2 and H_2S removal
5. Study on biogas appliances
6. Study on utilization of biogas for engine running.
7. Estimation of manurial value of biodigested slurry
8. Estimation of BOD and COD
9. Design of UASB reactor
10. Study on briquiting and Stoichiometric calculations
11. Study on performance of wood burning stoves
12. Performance evaluation of agro residue gasifier
13. Study on utilization of producer gas for engine running
14. Study on pyrolysis plant
15. Waste heat recovery calculation.
16. Visit to biomass power plant
17. Final Practical Examination.

Text books

1. Chawla, O.P.1986. "Advances in Biogas Technology". ICAR Publication, New Delhi.
2. Rao. S and B.B. Parulekar. 2000. Energy Technology – Non conventional, Renewable and Conventional. Khanna Publishers, New Delhi.
3. Horlock JH, 1987. Cogeneration - Heat and Power, Thermodynamics and Economics, Oxford Press.

Reference books

1. Khandelwal K.C. and Mahdi, S.S. 1986. Biogas Technology. Tata Mc Graw Hill Pub. Co. Ltd., New Delhi.
2. Srivastava, P.K., Shukla, B.D. and Ojha, T.P. 1993. Technology and application of biogas. Jain Brothers, New Delhi.
3. Mathur,A.N.and Rathore,N.S.1993.,Biogas production Management and Utilisation. Himanshu Publication. New Delhi.
4. Chakraverty, A. 1993. Biotechnology and other alternate technologies for utilisation of biomass. Oxford and IBH Publising Co., New Delhi.

Journals

1. Bioresource Technology – Science direct
2. Biomass and Bioenergy – Science direct
3. Renewable Energy – Science direct
4. Fuel – Science direct

Web resources

1. www.sciencedirect.com
2. http://en.wikipedia.org/wiki/anaerobic_digestion
3. www.mnre.gov.in
4. www.gasification.org
5. www.cogeneration.net
6. www.bee-india.nic.in

SWE 303 IRRIGATION AND DRAINAGE ENGINEERING **(2+1)**

THEORY:

Unit I-Water Resource

Water Resources- River basins-Development and Utilization in India and Tamil Nadu-Irrigation - duty and delta - Rooting characteristics-Moisture use of crop, Evapotranspiration - ET – plot.

Unit II- Irrigation Requirement

Crop water requirement - Effective rainfall - Scheduling - Irrigation requirement - Irrigation frequency, Irrigation efficiencies.

Unit –III Methods of Irrigation

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

Unit IV –Command Area Development

Command area - Concept, Components of CADA - CADA programmes in Tamil Nadu - On Farm Development works, Execution - maintenance and economics of OFD WORKS, Farmer's committee and its role for water distribution and system operation, Strategic outlet command - stream size for efficient warabandhi and rotational irrigation system.

Unit V-Agricultural drainage and system

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.

PRACTICAL:

River basins, irrigation projects, irrigation tanks and water resources in TN - Determination of soil moisture by different methods (gravimetric, tensiometer, gypsum block and neutron probe method) - Duty and delta relationship – Problems Estimation of water requirement by different methods - Estimation of Evapotranspiration - Land levelling - plane method from climatalogical data - Determination of irrigation efficiencies - Problems on Border irrigation and Design of Basin irrigation. - Design of Furrow irrigation - problems - Problems on Kennedy's and Lacey's theory - Design of under ground pipeline system - Problems on Irrigation scheduling - OFD works in command areas - Design of surface drainage system - Design of Sub-surface drainage system - Field visit to command areas and observation of OFD works.

LECTURE SCHEDULE:

Unit I-Water Resource

1. Water Resources - River basins - Development and Utilization in India and Tamil Nadu
2. Irrigation - definition - necessity -advantage - disadvantages.
3. Duty of water - expression - relationship between duty and delta, Rooting characteristics and Moisture use of crop.
4. Evapotranspiration - measurement of ET - Lysimeter, Field experiment plot – soil moisture depletion study, Water balance method - evaporation methods.
5. Estimating ET by climatological data - Blaney Criddle - modified Penman method.

Unit II- Irrigation Requirement

6. Crop water requirement - Crop coefficients for various crops. Estimation of Crop water requirement - field water balance.
7. Effective rainfall - factors affecting effective rainfall - Scheduling – Irrigation requirement- Irrigation frequency.
8. Irrigation efficiencies - conveyance - application - storage - water use - distribution.

Unit –III Methods of Irrigation

9. Methods of irrigation - Border irrigation, types, stream size requirement - Hydraulics and design
10. Basin irrigation, hydraulics and design.
11. Furrow irrigation - types, hydraulics and evaluation.
12. Design of furrow irrigation - sub irrigation.
13. Design of erodible and non-erodible, alluvial channels- Kennedy's and Lacey's theories.
14. Materials for lining watercourses and field channel.
15. Water control and diversion structure - Check gates, diversions, turnouts, siphon tubes.
16. Underground pipeline irrigation system - structures for underground pipelines.
17. Mid Semester Examination.
18. Design of underground pipeline irrigation system.
19. Land grading - Land levelling design methods - plane method.
20. Profile method - plan inspection method - contour adjustment method.

Unit IV –Command Area Development

21. Command area - Concept. Components of CADA - CAD programmes in TamilNadu.
22. Land consolidation and infra structure required , organization and maintenance - on farm development works.
23. Execution -maintenance and economics of OFD WORKS.
24. Farmer's committee and its role for water distribution and system operation. Strategic outlet command - stream size for efficient warabandhi and rotational irrigation system.

Unit V-Agricultural drainage and system

25. Agricultural drainage - problems of drainage - concept and factors affecting drainage.
26. Drainage coefficient; principles of flow through soils - Darcy's law - infiltration theory.
27. Surface drainage systems - various methods.
28. Design of open drains - problems.
29. Subsurface drainge - Investigations.
30. Hooghoudt's steady state equation.
31. Design of subsurface drainage - tube diameter, perforation, outlet.
32. Random drainage - herringbone - grid iron types.
33. Pipe materials - tile, plastics cement - Envelope materials.Load factors - blind inlet - filters - mole drains, drainage wells.
34. Leaching requirements - irrigation and drainage water quality recycling of drainage water for irrigation.

PRACTICAL SCHEDULE:

1. River basins, irrigation projects, irrigation tanks and water resources in TN.
2. Determination of soil moisture by different methods (gravimetric, tensiometer, gypsum block and neutron probe method).
3. Problems on duty of water - Duty and delta relationship.
4. Estimation of water requirement by different methods.
5. Estimation of Evapotranspiration.
6. Land levelling - plane method from climatologically data.
7. Determination of irrigation efficiencies.
8. Problems on Border irrigation and Design of Basin irrigation.

9. Design of Furrow irrigation - problems.
10. Problems on Kennedy's and Lacey's theory
11. Design of under ground pipeline system.
12. Problems on Irrigation scheduling.
13. OFD works in command areas.
14. Design of surface drainage system.
15. Design of Sub-surface drainage system.
16. Field visit to command areas and observation of OFD works.
17. Final Practical Examination.

REFERENCE BOOKS:

1. Luthin. J.N. 1966, Drainage Engineering, John Wiley and Sons, New York.
2. Michael, A.M. 1990. Irrigation -Theory and Practice, Vikas publishing house, New Delhi.
3. Murthy, V.V.N. 1998, Land and water management, Kalyani publishing, New Delhi.

FPE 302 FOOD AND DAIRY ENGINEERING (2+1)

Theory

Unit I Properties of foods and methods of food concentration

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

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

Food spoilage – causes for 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

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

Homogenisation - theory and working of homogenisers - 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.

Practical

Determination of cooking properties - microbial load estimation - decimal reduction time - experiment on water activity - thermal conductivity - re-hydration ratio -osmotic dehydration - experiment on tray drying - extruder - visit to industries.

Determination of engineering properties of milk - experiments on LTLT, HTST pasteurizers - efficiency of cream separator-study of homogenizer and butter churn - drum and spray driers - problems - ice cream mix calculation and freezing of ice-cream - visit to dairy unit

Lecture Schedule

1. Introduction – constituents of food – energy values of food
2. Thermal, electrical and rheological properties of foods
3. Texture of food materials, definition, terminologies – measurements
4. Viscometry – basic concepts – types of viscometers – construction and comparision
5. Concentration of foods – freeze concentration – concepts
6. membrane concentration of foods
7. Thermal processing of foods – thermal processes – cooking, blanching, pasteurization, sterilization and canning.
8. Interaction of heat energy and food components – reaction kinetics – decimal reduction time – temperature dependence of kinetics – Arrhenius equation.
9. Thermal death time curves – D value – determination – importance - canning
10. Irradiation preservation – direct and indirect effects – dose determining factors – applications
11. Retort processing – principles and applications
12. Food Spoilage – causes for food spoilage – need for preservation of foods
13. Moisture content – free and bound water – water activity– monolayer value – BET isotherms
14. Roult's law, Salwin – Slawson equation for water activity of mixture.
15. Dehydration of foods – tunnel drying, belt drying and vacuum drying- principles – equipments – construction and operation
16. Freeze drying – principles – heat and mass transfer – calculation of drying time – changes – types – application
17. Mid –semester examination
18. Osmotic dehydration – principles and concepts -Foam mat drying – principles and concepts.
19. Physical, chemical and thermal properties of milk.
20. Classification of milk – market and special milk – selection of material for milk handling, effects of metals on milk – straining – filtering – clarification of milk.
21. Milk storage tanks – materials, construction and design.
22. Pasteurization of milk – temperature parameters – importance and requirements – methods and equipments – plate heat exchanger.
23. Sterilization of milk – time – temperature parameters – importance and equipments.
24. Homogenization – principles – equipments – advantages – importance and requirements
25. Processing of milk – cream separation – methods and equipments
26. Manufacture of butter – theories of butter churning – process and equipments
27. Whey production – principles - equipments.
28. Ice cream – types – constituents – manufacturing – equipments
29. Ghee processing – methods and equipments
30. Production of milk powder – properties – composition, types – drum and spray dryers – types of atomizers and flow patterns – droplet trajectory of milk
31. Processing of condensed milk – skim milk – butter milk – flavoured milk, casein, yoghurt and Paneer properties – equipments involved.
32. Probiotic dairy products – manufacture.
33. Cleaning and sanitation – importance – detergents – properties – cleaning procedures
34. Cleaning – in – place – sanitation – effluent treatment and disposal.

Practical Schedule

1. Determination of cooking properties of parboiled and raw rice.
2. Estimation of microbial load in food materials.
3. Problems on decimal reduction time.
4. Problem on water activity of food and salwin – slawson equation.

5. Determination of rehydration ratio of dehydrated foods.
6. Determination of thermal conductivity of food materials
7. Experiment on osmotic dehydration of foods
8. Experiment on tray drying
9. Experiment of food extruder
10. Experiment on microwave oven heating of food.
10. Determination of properties of milk
11. Solving problems on pasteurization of milk
12. Experiments on cream separator to determine the separation efficiency
13. Experiments on construction and operation of butter churn and butter working accessories
14. Experiment on homogenizer
15. Solving problems on ice-cream mix calculation and freezing of ice-cream
16. Visit to food processing and dairy industry
17. Final practical examination.

Text books

1. Singh, R.Paul. and Heldman, R.Dennis.2004. Introduction to Food Engineering. 3rd Edition. Academic Press, London.
2. Kessler, H.G.1981. Food engineering and dairy technology. Verlag A.Kessler, Freising.

Reference Books

1. Walstra, P. T.J. Geurts, A. Nooman, A. Jellema and M.A. J.S Van Boekel. 2005. Dairy Technology. Marcel Dekker Inc. New york.
2. Clunie Harvey, W.M and Harry Hill. 2009 Milk Products. IV Edition Biotech Books, New Delhi.
3. Robinson, R.K.1986. Modern dairy technology Vol.I Advances in Milk processing. Elsevier Applied Science Publishes, London.
4. Charm, S.E.1971. The fundamentals of Food engineering, AVI pub.Co.,Inc,
5. Karel Marcus, Fennama, R.Owen and Lund, B.Dayal. 1975. Principles of food science, Part II - Physical principles of food preservation, Marcel Dakker, Inc.
6. Hall,C.W and T.J. Hedrick. 1971. Drying of milk and milk products. AVI Publishing Co., West Port, Connecticut.

Journals

1. Indian Food Industry, AFSTI, India
2. Food Technology Abstracts, CFTRI, India.
3. Times Food Processing Journal, World Wide
4. Media Limited, Mumbai.

Web resources

1. http://www.ndri.res.in
2. http://www.blackwell_synergy.com
3. http://www.post-gazette.com/

http://www.patentstrom.us/patents/6586036.htm

AGE 301	PROJECT WORK	(0+2)

Identification problem – literature collection – fabrication of equipments – land preparation – preliminary testing of equipments / layout of irrigation trails – parametric data collection.

AGE 302	STUDY TOUR	(0+1)

Visit to places of interest in Tamil Nadu & Pondicherry States related to the subjects taught in Farm Machinery and Power, soil and Water Conservation Engineering, Food and Agricultural Process Engineering, Bio Energy and Agricultural Structures, Viz.,

Visit to sugar mill – building construction material production units – paddy processing research centre, Tanjore – earth moving equipments – open mines and briquetting plants at Neyveli lignite corporation – food industries – biscuit manufacturing, macroni, vermicelli plants at Pondicherry – packaging units – power blending units – cold beverages manufacturing and bottling units at Madras – dairy milk processing units – pelletizing and granual coating plants, plastics for agriculture at CIPET. Centre for water resources, Anna University Chennai.

Visit to water harvesting water sheds – improved water conveyance, distribution structures and erosion control structures at institute of hydrology, Poondi. – Structural engg. Research centre, CSIR complex and farm equipment-manufacturing units – institute of remote sensing.

FMP 303 OPERATION AND MAINTENANCE OF FARM EQUIPMENT (0+5)

Practical

Tractors - identification of major systems - components and their uses. Types of hitch systems and adjustments. Preliminary checkups and safety aspects before starting a tractor and power tiller - procedure for starting, running and stopping the tractor and power tiller. Practice in driving tractor and power tiller on road and field - practice in hitching the implements with tractor and power tiller - practice in tractor and power tiller with implements for land preparation. Operational adjustments, maintenance and safety aspects for various tillage implements, sowing equipment and weeding equipment - operation, maintenance and safety aspects of plant protection equipment. Study on periodical maintenance of tractor, power tiller, plant protection, harvester and threshing equipment.

Land development equipment-Bulldozer -track assembly – track tension and alignment – components – reconditioning and assembling. Bulldozer controls – operation – leveling exercises. Bulldozer hydraulics and shovel assembly – shovel exercises. Maintenance – exercises in cleaning air filter, oil filter and fuel filter. Backhoe loader cum excavator - identification of parts - Operation and maintenance. Leveling equipment – operation of terracer blade and laser leveller.

Well drilling equipment-Percussion drill – identification of parts – tracing power train. Identification and operation of controls.

Manufacturing of farm implements – estimation and costing- Cost economics of farm equipment – determination of operational cost.

Lecture Schedule

1. Identification of major systems of a tractor and general guidelines,
2. Study on preliminary check measures before starting a tractor - procedure for starting, running and stopping the tractor.
3. Practice of driving the tractor on the road.
4. Practice of driving the tractor on the road with trailer.
5. Practice of driving the tractor off the road
6. Practice in hitching the implements with tractor.
7. Practice in operating the mould board plough with the tractor - operational adjustments, maintenance and safety aspects.
8. Practice in operating the disc plough with the tractor - operational adjustments, maintenance and safety aspects.
9. Practice in operating the chisel plough with the tractor - operational adjustments, maintenance and safety aspects.

10. Practice in operating the rotavator plough with the tractor - operational adjustments, maintenance and safety aspects.
11. Practice in operating the spading machine with the tractor - operational adjustments, maintenance and safety aspects.
12. Practice in operating cultivator with tractor - operational adjustments, maintenance and safety aspects.
13. Operation of different types of disc harrows in the field and study of parts
14. Practice in operating bund former with tractor - operational adjustments, maintenance and safety aspects.
15. Practice in operating seed drill with tractor - operational adjustments, maintenance and safety aspects.
16. Practice in operating trailer with tractor - operational adjustments, maintenance and safety aspects.
17. Practice in operating cage wheel with tractor - operational adjustments, maintenance and safety aspects.
18. Practice in post hole digger with tractor - 0operational adjustments, maintenance and safety aspects.
19. Practice in sugarcane planter with tractor - operational adjustments, maintenance and safety aspects.
20. Study on the trouble shooting and remedies in tractor
21. Study on periodical maintenance aspects of tractor including tyre and battery
22. Study on periodical maintenance aspects of tillage implements and trailer
23. Identification of components of power tiller and their maintenance
24. Study on preliminary check measures and safety aspects before starting a power tiller - procedure for starting, running and stopping the power tiller.
25. Practice of driving the power tiller on the road.
26. Practice of driving the power tiller off the road.
27. Practice of driving the power tiller off the road
28. Practice on hitching matching implements with power tiller
29. Practice in operating power tiller with rotary tiller for dry rototilling, operational adjustments, maintenance and safety aspects.
30. Practice in operating power tiller with rotary tiller for puddling, operational adjustments, maintenance and safety aspects.
31. Practice in operating power tiller with auger digger, terracer - operational adjustments, maintenance and safety aspects.
32. Practice in operating power tiller with trailer and boom sprayer - operational adjustments, maintenance and safety aspects
33. Study on the trouble shooting and remedies in power tiller
34. Study on periodical maintenance aspects of power tiller
35. Operation of centrifugal broadcasting device
36. Operation of riding paddy transplanter in the field
37. Operation of walk behind type paddy transplanter in the field
38. Operation and evaluation of dry land weeders
39. Operation and evaluation of wetland weeders
40. Mid-semester examination
41. Operation and evaluation of cono weeder
42. Operation and evaluation of power operated garden land weeder.
43. Operation and evaluation of power operated SRI weeder.
44. Identification of components of manually operated sprayers- operational adjustments, maintenance and safety aspects.

45. Practice in operating power operated sprayers - operational adjustments, maintenance and safety aspects.
46. Trouble shooting and remedies in power knapsack sprayer.
47. Study on the periodical maintenance aspects of sprayers.
48. Practice in reaper - operational adjustments, maintenance and safety aspects
49. Practice in paddy harvester and thresher - operational adjustments, maintenance and safety aspects
50. Practice in ground harvester - operational adjustments, maintenance and safety aspects
51. Practice in mini combine harvester - operational adjustments, maintenance and safety aspects
52. Bulldozer - identification of parts
53. Bulldozer tracks – measurement of slackness and adjustment track maintenance and repair.
54. Bulldozer controls – practice in road marching.
55. Bulldozer shovel and hydraulics – exercise in earthing.
56. Bulldozer transmission – transmission sub-assemblies – maintenance and adjustment.
57. Bulldozer – leveling practices
58. Measurement of work output of Bulldozer – cost of earth – work – calculations.
59. Backhoe loader with excavator - identification of different systems.
60. Backhoe loader with excavator controls – practice in road marching.
61. Backhoe loader with excavator – excavation practices
62. Leveling practice using tractor drawn terracer blade and cost of operation.
63. Earth work practice with tractor operated laser leveller
64. Earthwork calculation – Estimation of machine output and cost of operation.
65. Exercise in identification of components of calyx drill and percussion drilling rig.
66. Tracing out the power train of a percussion drilling rig.
67. Identification of control levers and their functions in a percussion drilling rig.
68. Visit to well excavation site
69. Study of rock blasting unit
70. Study of down the hole hammer drill.
71. Identification of percussion drilling tools and their repair and maintenance.
72. Pneumatic compressor – components – repair and maintenance.
73. Manufacturing of coconut dehusker and workout their cost.
74. Manufacturing of sugarcane detrasher and workout their cost.
75. Manufacturing of star weeder and workout their cost.
76. Manufacturing of cono weeder and workout their cost.
77. Manufacturing of SRI marker and workout their cost.
78. Cost economics of farm implements
79. Determination of operational cost of implement by manual methods.
80. Determination of operational cost of implement by using computer programme.
81. Workout the cost economics for different paddy transplanter
82. Workout the cost economics for paddy combine harvester
83. Workout the cost economics for sugarcane combine harvester
84. Workout the cost economics for multi crop thresher
85. Practical examination.

Text book

1. Jain, S.C. and C.R. Rai. 1999. Farm tractor maintenance and repair. Standard publishers and distributors, New Delhi.

2. Moving the Earth, Herbert L.Nichols Sr.1959, D. Vannostrand company Inc. Princetion.

Reference books

1. Percussion Drilling rigs and tools for shallow water wells W.N.Jennings, 1934. The Technical Press Limited, London.
2. Hand book of Heavy Construction, Havers and Stubb, 1971. Mc graw – Hill book Company, New York.
3. Barger, E.L., J.B. Liljedahl and E.C. McKibben, 1997. Tractors and their Power Units. Wiley Eastern Pvt. Ltd., New Delhi.

Journals

1. International Journal of Automotive Technology, ISSN-1229-9138
2. Review of automotive engineering published by the Japanese Society of Automotive Engineers
3. Journal of Agricultural Engineering (JAE) . Indian Society of Agricultural Engineers. New Delhi -110012

Web references

1. www.idavette.net
2. www.autorepair.about.com
3. www.sciencedirect.com

ERG 303 BIOMASS POWER GENERATION TECHNOLOGIES (0+5)

1. Biomass characteristics
2. Supply chain – harvesting, transport and preprocessing of Biomass
3. Combustion Power Generation Technologies
4. Gasification and pyrolysis
5. Biochemical conversion
6. Transport biofuels production and utilization
7. Small scale decentralized power generation system.

VII Semester			
1.	AGE 401	Industry and Institutional Educational Tour (15 days)	0+1
2.	AGE 402	Rural Agricultural Engineering Work Experience (10 days)	0+1
3.	AGE 403	Industrial Internship Programme (80 days)	0+5
Total			**0+7**

AGE 401	Industry and Institutional Educational Tour (15 days)	0+1

AGE 401 Industry and Institutional Educational tour (0+1)

Visit to places of interest in other states (other than Tamil Nadu, Pondicherry) related to the subjects taught in Farm machinery and Power, Soil and Water Conservation Engineering, Agricultural process Engineering, Bio Energy and Agricultural Structures, viz.,

Visit to dairy plant – National seed processing plant, IARI, New Delhi – energy division of IIT – tractor and allied farm equipment manufacturing industries – Tata energy research institute, - National physical laboratory – appraisal of environmental pollution problem in Agra – architectural splendor of Tajmahal – Environmental research institute at Jaipur. Technical museums at Bangalore and New Delhi.

Parametric data analysis at forest research institute, soil and water conservation research and training institute, Remote sensing centre, Dehradun – WALMI (water and land management institute). – Dhun valley project – observation of soil erosion and control measures – appraisal of drainage NDRI Karnal –food and fruit processing industries, solar, photo, voltaic production system at EC (Electronic corporation of India) – sea and coastal erosion studies at Bombay – BARC, observation of dry land technology at ICRISAT and central dry land research institute at Hyderabad. HMT – Indian telephone industrials BEL Viswesharya industrial museum – Bharath earthmovers – BHEL (PV models) at Bangalore, CFTRI, Mysore.

AGE 402 Rural Agricultural Engineering Work Experience (0+1)

Inventory survey – land, water, machinery, equipments and cropping pattern – availability of power – animal, mechanical and electrical, pump – selection and maintenance.

Observation of existing cultural practices – improvement – cost benefits – observation of erosion spots – remedial measures – observation of land preparation – tools used – suggestion of improved tools, machinery and post harvest equipments – use of non conventional energy sources – biogas plant, smokeless choola, solar cooker, water heater – preparation of report.

AGE 403 Industrial Internship Programme (0+5)

Students allotted to various industries as below to get on hand, in plant training in the industrial environment – farm Machinery and Implements Tractors / Power Tillers / earth moving Machinery – Manufacture and Testing Crop/Seed/Food /Dairy-Processing/Machinery manufacture and testing – soil /

Water conservation techniques/Design and implementation-pumping industry-Equipment-manufacture and Testing – Renewable energy gadgets – manufacture and Testing – Renewable energy installations – maintenance and management – Farm structures – materials – manufacture and Testing – Govt. Testing and Training Institute etc., like Soil conservation – design, layout and execution – water management – measurement of flow – equity distribution in the field – efficiency computation – assessment of consumptive use ratio – irrigation – design and layout of drip, and sprinkler. Operation and maintenance of farm equipments – tractors, bulldozers rigs, power tillers and plant protection equipment's – land cultivation tools – design – manufacture – testing and marketing – bore wells – prospecting ground water – sinking of bore wells – yield testing, hiring – tractor, bulldozer and rigs – energy consumption – a real coverage – bill preparation, tie up with Encofed and TAI – interection and appraisal of marketing strategy.

Industries-modern rice mills – operation and maintenance – quality control – extraction of byproducts – bran, oil, briquetting of husk – solvent extraction plants – operation – extraction of oil-quality control – pump manufacture – design – fabrication – selection and testing, preparation of report.

VIII Semester			
1.	TAM 401 / ENG 401	,yf;fpa';fspy; ntshz;ika[k; mwptpay; jkpH; gadhf;fKk; / Development Education- for non Tamil students	0+1
2.	FMP 401	Field Crop Machinery	2+1
3.	SWE 401	Application of GIS in Water Resource Management	2+1
4.	SWE 402	Irrigation Equipment, Drip and Sprinkler Technology	2+1
5.	FPE 401	Storage and Packaging Technology	1+1
6.	AGE 404	Project Work	0+2
7.	AGE 405	Study Tour	0+1
8.	SWE 403/ FPE 402	Watershed Management Technologies/ Processing of Agricultural Produces and their Products	0+5
Total			**7+13=20**

TAM 401 / ENG 401 ,yf;fpa';fspy; ntshz;ika[k; mwptpay; jkpH; gadhf;fKk;/ DEVELOPMENT EDUCATION- FOR NON TAMIL STUDENTS (0+1)

bra;Kiwg; gapw;rp ml;;ltiz

1. ntshz;ik – brhy; bghUs; tpsf;fk; - bjhy;fhg;gpak; fhl;Lk; epyg;ghFghL kw;Wk; kz;zwptpay;.
2. r';f ,yf;fpa';fspy; ntshz;ikj; bjhHpy; El;g';fs;
3. gjpbdz; fPH;f;fzf;F E}y;fspy; ntshz;ik mwptpay; - jpUf;Fws; - ehd;kzpf;foif - ,dpait ehw;gJ – ,d;dh ehw;gJ – Ie;jpizbaGgJ – jpizkhiy E}w;iwk;gJ
4. r';f ,yf;fpa';fspy; bey; tiffs; - gs;S E}y;fspy; bey; tiffs;
5. ntshz;ikg; gHbkhHpfs; - cHt[/ tpij/ ehw;W eLjy;/ vU/ ePh;g;ghrdk;/ fis/ gaph;g; ghJfhg;g[/ mWtil/ fsh; epyr; rPh;jpUj;jk;/ thdpay;/ kiH/ gUt';fs; gw;wpa Fwpg;g[fs;
6. ehl;Lg;g[w ghly;fs; tHp ntshz;ikr; bra;jpfis mwpjy;
7. mwptpay; jkpHpd; tsh;r;rp epiyfs; - jkpHpy; ntshz;ik ,jH;fs;/ fl;Liur; RUf;fk; (Abstract) vGJ jy;.
8. fUj;Jg; ghpkhw;wj; jpwd;fs; (Communication skills) nkilg; ngr;R – nfl;ly;/ ngRjy;/ goj;jy;/ vGJjiy - nkk;gLj;Jtjw;fhd tHp Kiwfisg; gapw;Wtpj;jy;.
9. ,ilg;gUtj; njh;t[
10. bkd; jpwd;fis (Soft skills) nkk;gLj;Jjy;.
11. bkhHpbgah;g;g[- Xh; mwpKfk;. bkhHpbgah;g;g[tiffis mwpjy; - ntshz; bra;jpfis jkpHhf;fk; bra;jy;
12. fiyr;brhy;yhf;fk; - fiyr; brhw;fis cUthf;Fk; Kiw – fiyr; brhw;fisj; jug;gLj;Jjy; - tl;lhu tHf;Fr; brhw;fisj; bjhFj;jy;
13. mwptpay; jkpH; tsh;r;rpapy; fzpdpapd; g';F
14. E}y; Kd;Diu/ mzpe;Jiu/ E}y; kjpg;gPL bra;jy; (kjpg;g[iu)
15. bra;jp tiffs; - bra;jpj;jhs; - thbdhyp – bjhiyf;fhl;rp Mfpa jfty; bjhlh;g[rhjd';fSf;F ntshz;ikr; bra;jpfis vGjg; gapw;rp mspj;jy;.

16. ntshz; bjhHpy;El;g';fs; bjhlh;ghd tpsk;guk;/ Jz;Lg; gpuRuk;/ kog;gpjH;fs;/ g[JbkhHpfs;/ ifnaLfs; jahhpj;jy;.
17. fye;Jiuahly;/ neh;fhzy;/ ehlfk;/ ftpij/ tpy;Yg;ghl;L \yk; ntshz;ikr; bra;jpfisg; gug;g[jy;.

ghh;it E}y;fs;

- fe;jrhkp/ ,y. br. 1974. ntshz;ika[k; gz;ghLk; - jkpH;ehL ntshz;ikg; gy;fiyf;fHfk;/ nfhaKj;J}h;.
- fe;jrhkp/ ,y. br. 1981. ,yf;fpaj;jpy; ntshz;ik - jkpH;ehL ntshz;ikg; gy;fiyf;fHfk;/ nfhaKj;J}h;.
- fe;jrhkp/ ,y. br. 1983. ntshz;ik gHbkhHpfs;. fiyr;bry;tk; gjpg;gfk; - nfhaKj;J}h;.
- FHe;ijrhkp/ th. br. mwptpay; jkpH;.
- brhkby. jkpH; ,jH;fs;
- kPdhl;rp Re;juk;/ kh kw;Wk; V. ,y. tprayl;Rkp. 2002. jfty; bjhlh;g[jkpH; bkhHpg;gad;ghL. nf. Mh;. v!;. Mg;brl; gphpz;lh;/ nfhit -3.
- kzpnkfiy/ k. 2002. jkpH; bkhHpj; jlj;jpy; ntshz; mwptpaypd; RtLfs;. njtp gjpg;gfk;/ jpUr;rpuhg;gs;sp.
- kzit K!;jgh. ,izaj; jkpH;.
- mide;jpe;jpa mwptpay; jkpH; fHfk; - fy;tp El;gtpay;.
- cyfj; jkpHhuha;r;rp epWtdk; - jkpHhpd; kug[r; bry;t';fs;.
- ,uh. re;jpunrfud;. bkhHpg; ghlk; - gilg;ghf;fj;jpwd; tsh;j;jy;.

DEVELOPMENT EDUCATION
(Equivalent course for non-Tamil students)

PRACTICAL

Basic principles of learning- Taxonomy of educational objectives- Transferable skills -Multiple intelligence-Career development-Success story of entrepreneurs-Group learning-Brainstorming, Simulation, Role play, Ice breakers- Transactional communication- Types of ego- Interpersonal communication- Writing- Fax and e-mail, applying for a job, interviews, project report- Strategies and skills- Basic principles of scientific article editing.

LECTURE SCHEDULE

1. Basic principles of learning. Binary terms viz – growth and development, education – for – life and life – long education, motivation and morale – occupation and profession, training and education, lateral thinking and conventional thinking, teaching and learning – discussion.
2. Bloom's classification of educational objectives – Cognitive, Affective, Psychomotor domain(s) – discussion
3. Career development – opportunity for graduates of agriculture and allied sciences – discussion
4. Success story of a farmer – factors involved – role – play
5. Brainstorming – Demonstration
6. Simulation – Convergent task – demonstration
7. Simulation – Divergent task – demonstration
8. Role – pay – interpersonal communication – Fax, email – Transactional communication – ice breaker
9. Mid Semester Examination
10. Verbal and analytical skills – interactive CD-ROM
11. Writing and Editing – demonstration
12. Writing popular articles
13. Project Report – discussion on a mutilated cloze text
14. Project Report – Role play

15. Scientific articles – Selection, organization and presentation – a discussion
16. Writing a scientific article
17. Practical Examination

REFERENCES:

Anderson, L. W. and David R. Krathwohl, D. R., et al (Eds..) (2001) *A Taxonomy for Learning, Teaching, and Assessing: A Revision of Bloom's Taxonomy of Educational Objectives*. Allyn & Bacon. Boston, MA (Pearson Education Group)

David H.Janessen(2009)Learning to solve problems: A handbool for solvogng learning EnvironmentsRoutledge. USA

Gay Lumsden , Donald Lymsaden,Carolyn Wieytstoff (2009) Communicating in Groups and Teams: Sharing Leadership: Wadswoth Cengage Learning. Boston.USA

Michael, Michalko .Thinkertoys: A Handbook of Creative-Thinking Techniques (2nd Edition) (June 8, 2006) Ten Speed Press. Canada

Sudarsanam. R (1985) Development Education: Vibhuvan publishers. Coimabatore.

WEB SOURCE:

www.mindstools.com
www.nwlink.com
www.evancarmichael.com
www.richland.edu
www.aaps-journal.org

FMP 401 FIELD CROP MACHINERY (2+1)

THEORY

Unit I- Weeding equipment

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.

Unit II – Sprayers

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

Unit III – Dusters

Dusters - types - mist blower cum duster - other plant protection devices, care and maintenance.

Unit IV- Harvesters

Principles and types of cutting mechanisms. Harvesters - types - mower mechanism – construction and adjustments - registration and alignment. Mowers, windrowers, reapers, reaper binders and forage harvesters. Combine harvester – types - parts - construction and working. Diggers for potato, groundnut and other tubers. Sugarcane harvesters - cotton pickers - corn harvesters.

Unit V- Threshers and other machineries

Thresher – construction and working of multi crop thresher. Fruit pluckers - tree shakers - fruit harvesting machinery. Forest machinery - shrub cutters - tree cutting machines – post hole diggers – Chaff cutter

Practical

Familiarisation with different types of weeding and inter culture equipment- Operation . Study and operation with different types of sprayers and dusters - care and maintenance. Experimental determination of spray pattern, particle size. Mower – Vertical conveyor reaper - combine harvester. Study of various types of fruit harvesting equipment - Study of various types of threshers - groundnut diggers - horticultural machinery - forest machinery – post hole digger.

Lecture schedule

1. Interculture operation - importance - weeding tools - manually operated.
2. Animal drawn and tractor drawn intercultural implements - hoe - harrow – sweep.
3. Earthing up - row crop weeders – operating principles.
4. Tractor mounted intercultivators, sweeps – types.
5. Basics of pesticide application.
6. Sprayers - classification – principles - manually operated hydraulic sprayers.
7. Descriptions of manually operated sprayers such as knapsack, pedal, rocker
8. Hydraulic energy sprayers - pumps and circuits.
9. Orchard sprayers- Boom sprayer - components - construction - operation.
10. Hydraulic energy sprayer nozzles - description and types.
11. Gaseous energy sprayers - description, working, adjustments, maintenance and accessories.
12. NMD and VMD determination - Determination of particle size and distribution.
13. Pesticide formulation for spraying - Drift and factors affecting drift – drift minimising techniques
14. Special types of sprayers - Spinning disc sprayers - CDA – Electrostatic sprayers - aerial spraying.
15. Care and maintenance of sprayers and dusters.
16. Dusters - types - description - orchard dusters - other pest control devices.
17. Mid - semester examination.
18. Harvesting – hand tools - operation.
19. Harvesting machinery - mower mechanisms – construction.
20. Cutter bar - components - construction – registration and alignment.
21. Grain combine – study of different types
22. VCR –study and operation
23. Groundnut digger - study and operation
24. Thresher – study and operation of multi crop threshers
25. Sugarcane harvesters.
26. Cotton pickers.
27. Cotton strippers.
28. Corn harvesters.
29. Horticultural machinery - fruit pluckers - Tree shakers
30. Forest machinery - chain saws.
31. Post hole digger – study and operation.
32. Cost economics of field crop machinery
33. Flail type mower – study and operation
34. Chaff cutter - construction - operation.

Practical schedule

1. Operation and evaluation of dry land weeders and
2. Operation and evaluation of cono weeder
3. Operation and evaluation of power operated weeders.
4. Dismantling, parts identification and assembly of knapsack sprayer - types.
5. Field-testing of rocker arm sprayer

6. Working with different types of nozzles and spray pattern study
7. Study and testing of different types of dusters.
8. Dismantling, parts identification and assembly of different components of knapsack power sprayer cum duster.
9. Lab and field calibration of boom sprayer and row crop sprayer.
10. Starting, trouble shooting, minor repairs and maintenance of power sprayer.
11. Calibration, field testing and handling techniques of power sprayer.
12. Field-testing of tall- tree sprayer
13. Digging holes with power tiller operated digger.
14. Field-testing of groundnut digger.
15. Side mounted mower - adjustment and operation.
16. Vertical conveyor reaper - operation - performance evaluation
17. Final Practical Examination.

Text Books

1. Jagdishwar Sahay. 2006. Elements of Agricultural Engineering. Standard Publishers Distributors, Delhi 6.
2. Michael and Ojha. 2005. Principles of Agricultural Engineering. Jain brothers, New Delhi.

Reference Books

1. Kepner, R.A., et al. 1997. Principles of farm machinery. CBS Publishers and Distributers, Delhi.
4. Harris Pearson Smith et al. 1996. Farm machinery and equipments. Tata McGraw-Hill pub., New Delhi.
5. Srivastava, A.C. 1990. Elements of Farm Machinery. Oxford and IBH Pub. Co., New Delhi

Journals

1. Journal of Agricultural Engineering (JAE). Indian Society of Agricultural Engineers. New Delhi -110012
5. Agricultural Engineering Today (AET). Indian Society of Agricultural Engineers. New Delhi -110012
6. Transactions of American Society of Agricultural and Biological Engineers. ISSN- 0001-2351
7. Soil and Tillage Research, ISSN-0167-1987

Web Resources

1. www.canharvesters.com
2. www.alibaba.com
3. www.angelfire.com

SWE 401 APPLICATION OF GIS IN WATER RESOURCE MANAGENENT (2 + 1)

Theory

Unit I – Aerial Photography

Aerial Photography- Relief displacement. Photogrammetry – Stereoscopy - principal points - parallax and its measurement. Colours - Composite colour images.

Unit II – Remote sensing

Remote Sensing- Electromagnetic Spectrum-Radiation laws- Interaction with atmosphere and surfaces, spectral reflectance of earth materials and vegetation. Satellite Remote Sensing - Resolution – Scanning – Sensors, Land Observation Satellites - Visual image interpretation.

Unit III – Image processing

Digital image processing, Image rectification and Image enhancement - Filtering - band ratioing, Image classification – supervised & unsupervised classification, Remote sensing application in soil & water conservation

Unit IV – Geographical Information System

GIS – types – raster- vector, Data base management systems – RDBMS, Data types- spatial-non-spatial, Spatial data models, Spatial referencing, Map projections, Data input, Editing, Encoding, Raster data analysis, Vector data analysis

Unit V – GIS applications

Digital Elevation model, Cost and path analysis, Types of output & Presentation, Types of errors – elimination and accuracies, GIS applications in DEM and its analysis, watershed analysis, runoff modelling, soil erosion modelling.

Lecture Schedule

Unit I – Aerial Photography

1. Photgrammetry- Aerial Photography- types of aerial photographs – Relief displacement, vertical exaggeration
2. Stereoscopy : Principal points- Parallax – measurement – Height determination- Ground control Points
3. Colors – basics – Composite colour images – RGB and IHS – transformation
4. Image Interpretation, Elements of Image Interpretation, Interpretation Keys, Image Interpretation Strategies, Visual interpretation, Collateral Information

Unit II – Remote sensing

5. Fundamentals of Remote Sensing: Definition, Electromagnetic Spectrum, Radiation laws
6. Radiation and its interaction with atmosphere and surfaces, spectral reflectance of earth materials and vegetation.
7. Satellite Remote Sensing geostationary and sun-synchronous satellites, Path and rows, Resolution – Spatial, spectral, temporal and radiometric.
8. Scanning – Along track and Across track, Sensors –Optical, Thermal and Microwave
9. Platforms and sensors - Land observation satellites - orbits, - Landsat, IRS, Thematic Mapper, RBV, MSS, LISS, WiFS, AWiFS, SPOT satellites.

Unit III – Image processing

10. Digital image processing : Image rectification and restoration
11. Geometric and radiometric correction – noise removal
12. Image enhancement – contrast manipulation - Level slicing – Contrast stretching.
13. Spatial filtering – convolution - edge enhancement –
14. Band ratioing - principal component analysis – vegetation components.
15. Image classification – supervised – Training fields
16. Mid-semester examination
17. Minimum distance- Parallelepiped, Maximum likelihood method
18. Unsupervised classification – histogram method
19. Sequential, Isodata method.
20. Remote sensing application in soil & water conservation

Unit IV – Geographical Information System

21. GIS – Basic components- types –raster- vector
22. Data types- spatial - non-spatial, Spatial data models
23. Data base management systems –RDBMS-query –normalization.
24. Spatial referencing, Map projections,
25. Data input, Editing, Encoding
26. Raster data analysis
27. Vector data analysis

Unit V – GIS applications

28. Digital Elevation model and its analysis
29. Cost and path analysis
30. Types of output & Presentation
31. Types of errors – elimination and accuracies.
32. GIS applications in watershed analysis
33. GIS applications in rainfall –runoff modelling
34. GIS applications in soil erosion modelling

PRACTICAL SCHEDULE:

1. Measurement of relief displacement using parallax bar
2. Stereoscopic vision test
3. Aerial photo interpretation - visual
4. Satellite images interpretation – visual
5. Introduction to ILWIS
6. Geo-referencing of images
7. Image enhancement practice
8. Supervised classification practice
9. Unsupervised classification practice
10. Database Management Systems
11. Spatial data input and editing - Digitising
12. Raster analysis problems – Database query
13. GIS applications in DEM and its analysis
14. GIS application in watershed analysis
15. GIS application in rainfall-runoff modelling
16. GIS application in soil erosion modelling
17. Practical Examination

TEXT BOOK

1. Lillesand, T.M. and Kiefer, R.W. 2005. "*Remote Sensing and Image Interpretation* ", II edition. John Wiley & sons.
2. Heywood, I., Cornelius. S., Carver. S 2002. An Introduction to Geographical Information Systems. Addison Wesley Longman, New York.

Reference Books

1. Floyd F.Sabins. 2005. "*Remote Sensing: Principles and Interpretation*", III edition. Freeman and Company New York.
2. Jensen, J.R., 2004. "Introductory Digital Image Processing: A Remote Sensing Perspective". Prentice – Hall. New Jersey.
3. Duggal. S.K., 2006, Surveying Vol.I, Tata McGraw-Hill pub. Co, New Delhi,

SWE 402 IRRIGATION EQUIPMENT, DRIP AND SPRINKLER TECHNOLOGY (2+1)

THEORY:

Unit I – Water Lifts

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 – Pumps and their types

Centrifugal pump- principle and working -Work done by centrifugal pump – Pump characteristics and efficiencies - Multistage, Submersible, Turbine pumps Mixed flow, Axial flow, jet and Airlift pumps. Pump selection and installation - pump Troubles and Remedies.

Unit III – Drip Irrigation

Drip irrigation -components. Dripper-types and equations governing flow through drippers. Wetting pattern - Filters and Fertigation tanks -Derivation of equation for flow through pipes with uniform spaced outlets. Design of laterals – paired - tapered, Submain – paired - tapered, Main lines - pump capacity. Operation and maintenance of Drip irrigation system – automation.

Unit IV –Sprinkler Irrigation

Sprinkler irrigation – components performance - 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

Surge and Cablegation. 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

PRACTICAL:

Performance Evaluation of Reciprocating pump - Performance Evaluation of Centrifugal pump - Performance Evaluation of Multistage pump - Performance Evaluation of jet pump - Performance Evaluation of Air lift pump - Wetting pattern study of drippers - Design of drip lateral - Design of drip submain - Design of drip main and pump capacity - Evaluation of uniformity of Drip system - Sample design of drip system for a field and preparation of estimate - Wetting pattern of sprinklers - Sprinkler main design - Evaluation of sprinkler uniformity .

LECTURE SCHEDULE:

1. Indigenous water lifts - types and their working
2. Types of pumps - Positive displacement and variable displacement pumps
3. Reciprocating pump - principle - components - single acting and double acting
4. Reciprocating pump- Work done - coefficient of discharge – slip
5. Centrifugal pump- principle and working
6. Work done by centrifugal pump
7. Pump characteristics and efficiencies
8. Multistage, Submersible, Turbine pumps Mixed flow, Axial flow,
9. Jet and Airlift pumps
10. Pump selection and installation - pump Troubles and Remedies.
11. Drip irrigation, advantages-components.
12. Dripper-types and equations governing flow through drippers,
13. Wetting pattern
14. Filters and Fertigation tanks
15. Derivation of equation for flow through pipes with uniform spaced outlets
16. Design of laterals – paired - tapered
17. Mid-Semester Examination
18. Submain – paired - tapered
19. Main lines - pump capacity
20. Operation and maintenance of Drip irrigation system
21. Drip irrigation - automation
22. Sprinkler irrigation – components
23. Sprinkler performance - sprinkler discharge - Distance of throw
24. Distribution pattern - Application rate - Droplet size,
25. sprinkler selection and spacing - capacity of sprinkler system

26. Design of laterals - tapered
27. Design of Main lines - pump capacity
28. Operation and maintenance of sprinkler irrigation system
29. Surge and Cablegation
30. Greenhouse irrigation system design.
31. Types of valves - pressure relief valve - Gate valve
32. Non-return valve – butterfly valve, Solenoid valves.
33. Underground pipeline irrigation system
34. structures for underground pipelines

PRACTICAL SCHEDULE:

1. Performance Evaluation of Reciprocating pump
2. Performance Evaluation of Centrifugal pump
3. Performance Evaluation of Multistage pump
4. Performance Evaluation of jet pump
5. Performance Evaluation of Airlift pump
6. Wetting pattern study of drippers
7. Design of drip laterals
8. Design of drip submains
9. Design of drip main and pump capacity
10. Evaluation of uniformity of Drip system
11. Wetting pattern of sprinklers
12. Sprinkler lateral design
13. Sprinkler main design
14. Evaluation of sprinkler uniformity
15. Design of Sprinkler System for a typical field.
16. Greenhouse irrigation system design.
17. Final Practical Examination

REFERENCE BOOKS:

1. A.M.Michael, 2010. Irrigation - theory and practice, Vikas publishers, New Delhi**.**
2. Jack Keller and Rond. Belisher 1990. Sprinkler and Trickle irrigation, Van Nostrand Reinhold, New York.
3. Modi, P.N. and Seth, S.M. 2010, Hydraulics and fluid mechanics, Standard book house, New Delhi.

FPE 401 STORAGE AND PACKAGING TECHNOLOGY (1+1)

Theory

Unit I Spoilage and storage

Direct damages, Indirect damages of perishable and durable commodities – control measures - factors affecting storage – types of storage – Losses in storage and estimation of losses.

Unit II Storage methods

Improved storage methods for grain-modern storage structures-infestation-temperature and moisture changes in storage structures-CAP storage-CA storage of grains and perishables- construction operation and maintenance of CA storage facilities

Unit III Functions of packaging materials

Introduction – packaging stragtegies for various environment – functions of package – packaging materials – cushioning materials – bio degradable packaging materials – shrink and stretch packaging materials.

Unit IV Food Packaging Materials and Testing

Introduction – paper and paper boards - flexible - plastics - glass containers – cans - aluminium foils - package material testing-tensile, bursting and tear strength.

Unit V Special Packaging Techniques

Vacuum and gas packaging - aseptic packaging - retort pouching – edible film packaging – tetra packaging – antimicrobial packaging – shrink and stretch packaging.

Practical

Design of grain bins-experiments with evaporative cold storage structure-cold stores design - CA storage of fruits. Testing of packaging material- MAP of fruits and vegetables-experiments on vacuum packaging - experiments on bottling of fruit products-visit to cold storage and packaging industry.

Lecture schedule

1. Spoilage mechanisms – direct and indirect damages of perishable and durable commodities and Spoilage control measures in storage.
2. Storage importance, requirements and types for food grains and foods – factors affecting storage – storage loss estimation.
3. Modern storage structures – shed – vertical silos
4. Temperature and moisture changes in storage structures-control measures
5. Design of Shallow bin
6. Design of deep bin
7. CAP storage – concept requirements – advantages – CA storage of grains and perishables – selection of gases – control
8. Construction operation and maintenance of CA storage facilities - MA storage of grains.
9. Mid semester examination.
10. Introduction, packaging strategies and requirement for various environments- functions of food packaging and packaging terminology.
11. Basis for selection of packaging material - Definition of cushioning materials – requirements of cushioning – selection – types.
12. Paper- Paper boards- types – properties , Required for packaging - Flexible Plastics (films) in food packaging and their requirements
13. Glass containers – Can - Aluminum foils, - its requirements - Testing of packaging Materials – compression – tensile strength - other strength characters.
14. Principle and operation of Vaccum and gas packaging machine - Principles and importance of Aseptic Packaging –requirements.
15. Retort pouching – requirements - Edible film packaging – requirements - advantages in food industry
16. Tetra Packaging – principle and operation - Anti microbial packaging
17. Principle uses of Shrink and stretch Packaging and its applications in food industry

Practical Schedule

1. Design of shallow bins
2. Design of deep bins
3. Study of insect control measures in storage structures
4. Experiments with evaporative cold storage structure
5. Design of Cold Storage unit
6. Experiment on CA Storage for fruits
7. Experiment on CA Storage for grains
8. Testing of tensile Strength of packaging materials
9. MAP storage of fruits and vegetables
10. Experiment on Vaccum packaging of fruits and vegetables
11. Experiment on canning of fruits
12. Experiment on bottling of fruit products
13. Experiment on Form Fill Seal Machine for Liquids

14. Experiment on Form Fill Seal Machine for Powder foods
15. Visit to FCI godown
16. Visit to packaging Industry
17. Final Practical Examination

Text Books

1. Sahay, K.M. and K.K.Singh. 1996. unit operations of agricultural processing. Vikas publishing house Pvt.ltd., New Delhi.
2. Food Packaging Technology, Hand book, 2004. NIIR Board, New Delhi.
3. Pandey, P.H.2002. post harvest engineering of horticultural crops through objectives. Saroj Prakasam. Allahabad.

Reference Books

1. Himangshu Barman. 2008, Post Harvest Food grain storage. Agrobios (India), Jodhpur.
2. Chakaraverty, A. 2000. third edition. Post harvest technology of cereals, pulses and oil seeds. Oxford & IBH publishing & Co.Pvt.Ltd. New Delhi.

Journals

Packaging India, Indian Institute of Packaging
Processed Food Industry , Gurgoan

Web resources

http://www.post-gazette.com/
http://www.patentstrom.us/patents/6586036.htm

AEG 404 PROJECT WORK (0+2)

Experimentation – data collection – compilation – analysis – report submission.

AEG 405 STUDY TOUR (0+1)

Visit to places of soil-erosion control measures – contour bound, contour trenching,. Bench terraces at Yercaud, Ooty, Kodaikkanal – wind erosion and control measures at Bodi-hydropower system, tunnels and water conveying system at Periyar and Aliyar hydal projects. Tea, coffee and cardamom processing plants at Valparai, Coonoor and Gudalur – Bio energy centres at Kuttralam, Madurai Kamaraj University. Rural technology centre at Gandhigram – Wind farm at Muppandal, PV cell / PV aided gadgets – manufacturing units Coimbatore, Solar Thermal / biomass gadgets – manufacturing at Coimbatore, Madras, - drip irrigation systems – areas of contour ploughing.

SWE 403 WATERSHED MANAGEMENT TECHNOLOGIES (0+5)

Watershed Management - Site selection for water harvesting structures-Design of farm pond, percolation pond, check dams and drop spillway. Practice in laying out contour lines in the field-Design of vegetated waterway. Study of moisture conservation techniques-Collection of data for land and water use planning of watersheds. Study of vegetative control measures -Design of silt detention tanks - Preparation of model watershed plan -Estimating cost benefit ratio- Observation of runoff control and silt monitoring station – Study of Afforestation programme-Visit to NGO developed / NWDPRA watershed

Micro irrigation - Modern methods of irrigation-Pressure irrigation-soil moisture plant relationship. Drip irrigation- Design of main, sub main, and lateral-Selection of material for pipes and emitters - Problems on drip irrigation design-Layout planning for agricultural and horticultural crops-Types of pumps and their selection- subsurface drip irrigation- Automation- Cost economics of drip irrigation- Installation of drip system- field survey of drip irrigation systems. Sprinkler irrigation -Factors governing efficiency, pipe friction-Design of lateral, main and sprinkler head. Selection of pumps for

sprinklers-Operation and maintenance of sprinklers-Installation of sprinkler system-field survey for sprinkler systems and data analysis.

Farm structures- Grain storage structures – Bins, Rat proof godown, silage storage-Poultry housing – Poultry laying house -Battery brooders and laying-Functional requirements. Animal houses – types – Pen barns – Feeding shed. Design and drawing of a poultry house, stanchion barn, pit silo and trench silo. Design and estimation of pump house, threshing and drying floor.

Green houses - Types- Site selection and layout-Load calculations –design, drawing and construction. Greenhouse Instruments -Measurement of radiation and RH -Estimation of water requirement -Evaluation of fan-pad systems- study of physical properties of soil less media - Design of irrigation and drainage systems. Greenhouse covering materials - Types – Properties. Pad material –properties – Pad area and Fan to Pad distance – Fans – Airflow rate -Water flow rate – Bleed off ratio.

FPE 402 PROCESSING OF AGRICULTURAL PRODUCES AND THEIR PRODUCTS 0+5

Experiential learning on machinery, product formulation and product preparation from dairy, fruits and vegetables. Hands on training on biochemical and microbial analysis of various products prepared from dairy, fruits and vegetables.

EQUIVALENT COURSES

FARM MACHINERY & POWER

Sl.No.	2007 - syllabus	2011 - syllabus
1.	FMP 221 Manufacturing Practices (2+1)	FMP 101 Manufacturing Practices (2+1)
2.	FMP 121 Thermal Engineering (2+1)	FMP 103 Thermodynamics (2+1)
3.	FMP 122 Electrical Engineering (2+1)	FMP 102 Electrical Engineering (2+1)
4.	FMP 222 Electronics and Instrumentation (2+1)	FMP 203 Electronics and Instrumentation (2+1)
5.	FMP 321 Design of Machine Elements and Computer Aided Machine Drawing (2+1)	FMP 204 Machine Design and Computer Aided
6.	FMP 421 Tractor and other power units (2+1)	FMP 301 Farm Tractors (2+1)
7.	FMP 223 Farm Implements and Machinery –I (2+1)	FMP 302 Tillage and Sowing Equipment (2+1)
8.	FMP 322 Farm Implements and Machinery –II (2+1)	FMP 401 Field Crop Machinery (2+1)

9.	FMP C21 Operation and Maintenance of Tractors and allied equipment (1+2)	FMP 303 Operation and maintenances of Farm Equipment (0+5)
10.	FMP C23 Ergonomics and Farm safety (2+1)	No course
11.	FMP C22 Land development and well drilling Equipment (2+1)	FMP 324 Operation and maintenances of Farm Equipment (0+5)

BIOENERGY

Sl. No.	2007 - SYLLABUS	2011 - SYLLABUS
1	ERG 321 Renewable Energy Resource Technology (2+1)	ERG 322 Bio and Thermochemical Conversion of Biomass (2+1)
2	ERG C81 Hydrogen Production and	No course
3	ERG C82 Energy from solid and liquid	No course
4	ERG C83 Bio fuel production	No course

SOIL &WATER CONSERVATION ENGINEERING

Sl. No.	2007 – SYLLABUS	2011 – SYLLABUS
1.	SWC 222 Surface Hydrology and Soil Conservation (2+1)	SWE 301 Hydrology (2+1)
2.	AST 222 Building materials and farm structures (2+1)	AST 202 Engineering Materials, Constr and Costing (2+1)
3.	SWC C22 Theodolite Surveying Remote Sensing & Geographic Information System (2+1)	SWE 401 Applications of GIS in Water Management (2+1)
4.	SWC C23 Watershed Management (2+1)	SWE 403 Watershed Management Te
5.	SWC 321 Ground water hydrology and Drainage Engineering (2+1)	SWE 303 Irrigation and Drainage Engir
6.	SWC 421 Design of surface and pressurized irrigation systems (2+1)	SWE 402 Irrigation Equipment, Drip ar Technology (2+1)

7.	SWC 401 Geographic Information System for Watershed Management (2+1)	SWE 401 Applications of GIS in Water

AGRICULTURAL STRUCTURES

Sl. No.	2007 – SYLLABUS	2011 – SYLLA
1.	AST 121 Engineering Drawing (0+1)	AST 121 Engineering Drawing 0+
2.	AST 221 Strength of Materials (2+1)	AST 201 Strength of Materials 2+
3.	AST 222 Building Materials and Farm Structures (2+1)	AST 202 Engineering Materials, C Estimation and Costing (2+1)

DEPARTMENT OF PROCESSING

Sl. No	**2007 Syllabus**	**2011 Sylla**
1	FPE 221Heat Transfer, Refrigeration and Air conditioning (2+1)	FPE 201 Heat and Mass Transfer
		FPE 203 Refrigeration and Air co (1+1)
2	FPE 222 Crop and Seed Processing (2+1)	FPE 221Post Harvest Engineering (1+1)
3	FPE 201Unit Operations in Food Process Engineering (2+1)	FPE 202 Unit Operations in Food
4	FPE 321 Food and Dairy Engineering (2+1)	FPE 321 Food and Dairy Engine
5	FPE 322 Food Plant Design, Food Safety and Management (2+1)	Not available

AGRICULTURAL SCIENCES (EQUIVALENT COURSES)

Sl. No	2007 Syllabus	2011 Syllabus
1	AGR 121Principle of Crop Production (2+1)	AGR 121 Production Technology of Field Cr
2	SAC 221 Fundamental of Soil Science (2+1)	SAC 201 Fundamental of Soil Science (2+1)
4	AEX 321 Extension methods and Transfer of Technology (1+1)	AEX 301 Extension Methodologies and Trans Technology (1+1)
5	ABM 301Agribusiness Management I (2+1)	AEC 101 Principle of Agriculture Economics
6	- -	HOR 121 Basic Horticulture (1+1)
7	FPE C 21 Food Science, Storage and Packaging Technology (2+1)	FSN 101 Principle of Food Science (2+1)
9	ABM 301 Agribusiness Management I (2+1)	ARM 201 Fundamentals of Agribusiness Mar
10	-	FOR 211 Forest Resource Management (1+1
11	-	NST 301 Fundamentals and Applications of (1+0)
12	-	SAC 101 Principles of Analytical Chemistry (