COURSE CURRICULUM

OF

MASTER OF TECHNOLOGY (M.TECH.)

IN

AGRICULTURAL ENGINEERING (AE)

WITH

SPECIALIZATION IN

WATER RESOURCES DEVELOPMENT AND MANAGEMENT (WRM)

DEPARTMENT OF

AGRICULTURAL ENGINEERING,

TRIGUNA SEN SCHOOL OF TECHNOLOGY

ASSAM UNIVERSITY, SILCHAR-788011

W.E.F. ACADEMIC SESSION-2019-20

COURSE CURRICULUM FOR MASTER OF TECHNOLOGY IN AGRICULTURAL ENGINEERING (WATER RESOURCES DEVELOPMENT AND MANAGEMENT)

SUMMARY OF CONTACT HOURS AND CREDITS FOR THE COURSE OF MASTER OF TECHNOLOGY IN WATER RESOURCES DEVELOPMENT AND MANAGEMENT OF AGRICULTURAL ENGINEERING

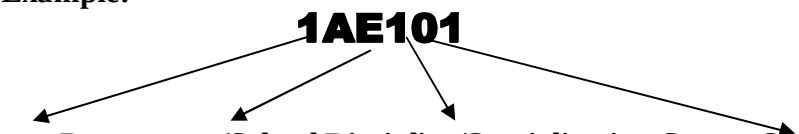
Year	Semester	Credits/ Contact Hour	Semester Wise Course Distribution					Semester Total
			Core Course	Elective (Discipline)	Elective (Open)	Audit Course	Dissertation	
I	1st	Credits	10	6	2	-	-	**18**
		Contact Hour	14	6	2	2	-	**24**
	2nd	Credits	10	6	2	-	-	**18**
		Contact Hour	14	6	2	2	-	**24**
II	3rd	Credits	-	3	3	-	10	**16**
		Contact Hour	-	3	3	-	20	**26**
	4th	Credits	-	-	-	-	16	**16**
		Contact Hour	-	-	-	-	32	**32**
Course Total		**Credits**	**20**	**15**	**7**	**-**	**26**	**68**
Course Total		**Contact Hour**	**28**	**15**	**7**	**4**	**52**	**106**

Coding System

All subjects have unique codes of alphanumeric values that follow the rules below.

- ✓ Code starts with number followed by two or three characters and three numbers.
- ✓ The first number after the characters denotes the semester of the discipline/specialization (viz. 1: 1st semester; 2: 2nd Semester, 3: 3rd Semester; 4: 4th Semester and so on).
- ✓ Two/Three characters after number defines the name of the Department or the School under which it is being undertaken (viz. (AE: Agricultural Engineering; ASH: Applied Science and Humanities; ECE: Electronics and Communication Engineering; CSE: Computer Science and Engineering; ST: School of Technology; and so on)
- ✓ Number at starting portion after characters defines the code for name of the Discipline/Specialization of the Department under which it is being undertaken (viz. 1: Water Resources Development and Management; 2: Food Process Engineering, 3: Farm Machinery and Power Engineering; and 4. Aquacultural Engineering and so on).
- ✓ The second and third number altogether after the 1st number denotes the status (Serial .No.) of the subjects in that discipline as (viz. 01: 1st Course; 02: 2nd Course; ad 03; 3rd course and so on).

Example:



Semester Department/School Discipline/Specialization Course Serial no. of the Discipline

COURSE CURRICULUM FOR MASTER OF TECHNOLOGY IN AGRICULTURAL ENGINEERING (WATER RESOURCES DEVELOPMENT AND MANAGEMENT)

A. COURSE STRUCTURE FOR M. TECH. IN WATER RESOURCES DEVELOPMENT AND MANAGEMENT OF AGRICULTURAL ENGINEERING

SEMESTER I

Sl. No	Course Code	Course Name	Teaching Scheme			Credits
			L	T	P	
1.	1AE101	Hydrology & Water Resources Engineering	3	0	0	3
2.	1AE102	On-Farm Irrigation and Drainage Engineering	3	0	0	3
3.	1AE1xx	Programme Elective – I	3	0	0	3
4.	1AE1xx	Programme Elective – II	3	0	0	3
5.	1ST101	Research Methodology and IPR	2	0	0	2
6.	1ST1xx	Audit Course – 1	2	0	0	0
7.	1AE103	Hydrology and Water Resources Engineering Lab	0	0	4	2
8.	1AE104	On-Farm Irrigation and Drainage Engineering Lab	0	0	4	2
		Total	**16**	**0**	**8**	**18**

SEMESTER II

Sl. No	Course Code	Course Name	Teaching Scheme			Credits
			L	T	P	
1.	2AE105	Water Well and Pump Engineering	3	0	0	3
2.	2AE106	Land Husbandry and Watershed Management	3	0	0	3
3.	2AE1xx	Programme Elective – III	3	0	0	3
4.	2AE1xx	Programme Elective – IV	3	0	0	3
5.	2ST1xx	Audit Course – 2	2	0	0	0
6.	2AE107	Water Well and Pump Engineering Lab	0	0	4	2
7.	2AE108	Land and Water Management Lab	0	0	4	2
8.	2AE109	Mini Project	0	0	4	2
		Total	**14**	**0**	**12**	**18**

SEMESTER III

Sl. No	Course Code	Course Name	Teaching Scheme			Credits
			L	T	P	
1.	3AE1xx	Programme Elective – V	3	0	0	3
2.	3ST2xx	Open Elective	3	0	0	3
3.	3AE110	Dissertation Phase – I	0	0	20	10
		Total	**6**	**0**	**20**	**16**

SEMESTER IV

Sl. No	Course Code	Course Name	Teaching Scheme			Credits
			L	T	P	
1.	4AE111	Dissertation Phase – II	0	0	32	16
		Total	**0**	**0**	**32**	**16**

SEMESTER I: Programme Elective – I

1AE112	Computational Methods
1AE113	Soil Water and Crop Environmental Engineering
1AE114	Advanced Groundwater Hydrology

SEMESTER I: Programe Elective – II

1AE115	Aquacultural Engineering
1AE116	Water Resources System Engineering
1AE117	Soil and Water Systems' Simulation and Modelling

SEMESTER II: Programme Elective – III

2AE118	Soil and Water Conservation Structural Engineering
2AE119	Open Channel Hydraulics and Coastal Engineering
2AE120	Environmental Engineering Fundamentals

SEMESTER I: Programme Elective – IV

2AE121	Modelling of Aquaculture and Fisheries Systems
2AE122	Water Quality Management
2AE123	Statistical Methods in Agriculture

SEMESTER I and SEMESTER II: Audit Courses 1 & 2

1ST102	English for Research Paper Writing
1ST103	Disaster Management
1ST104	Sanskrit for Technical Knowledge
1ST105	Value Education
2ST106	Constitution of India
2ST107	Pedagogy Studies
2ST108	Stress Management by Yoga
2ST109	Personality Development through Life Enlightenment Skills.

SEMESTER III: Programme Elective – V

3AE124	Water and Wastewater Treatment Engineering
3AE125	GIS and RS–Principles and Application in Land and Water Resources
3AE126	Design of Pumps for Irrigation and Drainage

SEMESTER III: Open Elective Courses

3ST201	Business Analytics
3ST202	Industrial Safety
3ST203	Operations Research
3ST204	Cost Management of Engineering Projects
3ST205	Composite Materials
3ST206	Waste to Energy

B. DETAILED COURSEWISE SYLLABUS FOR M. TECH IN WATER RESOURCES DEVELOPMENT AND MANAGEMENT OF AGRICULTURAL ENGINEERING

SEMESTER I : CORE COURSES

Course No. and Name: 1AE101, Hydrology and Water Resources Engineering

Teaching Scheme;
Lectures: 3 hours/week

Course Outcomes:
At the end of this course, students will be able to

- Familiarize with the global and regional water scenario and issues in water resources management.
- Conceptualize the different forms of water and hydrologic cycle.
- Analyze and interpret hydrological data though frequency distribution, probability and hydrological model application.
- Quantify the rainfall, runoff and base flow and analyse using models of runoff hydrograph.
- Estimate water yield from catchment and plan for design of water resources storage structures

Syllabus Contents

Unit I: Need for sustainable water management, hydrologic processes, global water scenario, water budget in India, irrigation development, major issues in land and water resources management

Unit II: Frequency analysis of hydrologic events, frequency distribution models, rainfall intensity-duration and frequency relationships.

Unit III: Model structure for time series, structural analysis, stationary series, non-stationary series analysis,

Unit IV: Hydrographs, flood routing, system models, conceptual and dynamic models of runoff hydrograph.

Unit V: Types of storage structures, water yield from catchments, runoff diversion, ponds and reservoirs, reservoirs and planning for dam reservoirs, earthen embankments and dams.

References

1. Subramanyam, K. Engineering Hydrology, Tata McGraw Hill Publication Co., New Delhi
2. Sharma, R. K. Hydrology and Water Resources Engineering, Dhanpat Rai and Sons,
3. Chow, V. T. Handbook of Applied Hydrology. McGraw Hill Book Co., USA
4. Garg, S.K. Hydrology and Water Resources Engineering, Khanna Publishers, ND.
5. Das, Ghanashyam. Hydrology and Soil Conservation Engineering, Prentice Hall of India, Pvt. Ltd, New Delhi

1AE102, On-Farm Irrigation and Drainage Engineering

Teaching Scheme

Lectures: 3 hours/week

Course Outcomes

At the end of this course, students will be able to

- Define irrigation and drainage terminology used for on farm water application and management.
- Identify the irrigation and drainage related issues of various agro-climatic regions.
- Outline the concept and methods of irrigation and drainage system for enhancing soil and crop environment.
- Design and evaluation of irrigation and drainage system to address the pertinent issues.
- Familiar with the automated and integrated irrigation and drainage system case studies.

Syllabus Contents

Unit I: Sources of irrigation distribution system, Irrigation water measurement, Plant-soil-water interaction: Scheduling of irrigation.

Unit II: Design and evaluation of surface and sub-surface systems-sprinkler and drip systems, Role of plastics in irrigation water management.

Unit III: Irrigation pumps, automation in irrigation, planning and economics of integrated irrigation system-case studies.

Unit IV: Drainage problems of various agro-climatic regions, determination of saturated hydraulic conductivity, steady and un-steady flow equations in sub-surface drainage system, sub-surface drainage systems design.

Unit V: Surface drainage systems design, drainage of rice fields, influence of irrigation on drainage, analysis of water balance, salinity control, agricultural drainage criteria, standard mathematical models used in agricultural drainage design.

References

1. Michael, A. M. Irrigation Theory and Practice, Vikas Publication. New Delhi
2. James, L. G. Principles of Farm Irrigation System Design, John Wiley and Sons, USA
3. Walker, W.R. and Skogerboe, Q. V. Surface Irrigation: Theory and Practice, Prentice Hall Inc. New Jersey, USA
4. FAO. Drainage Machinery. Irrigation and Drainage Paper No. 15. Food and Agricultural Organisation, Rome.
5. ISO. UPVC Pipes and fittings for use in subsoil drainage Specifications. Publication No. ISO/TC 138 WGIN431. ISO Din Deutsches Institut fur Normurig C.V. Ber-Jin 30.
6. Garg, S. K. Hydrology and Water Resources Engineering. Khana Publishers, New Delhi
7. Suresh, R. Watershed Hydrology. Standard Publishers, and Distributors, New Delhi

1AE103, Hydrology and Water Resources Engineering Lab

Teaching Scheme

Lectures: 4 hours/week

Course Outcomes

At the end of this course, students will be able to

- Identify and specify the hydrological instruments and their use for measurement of climatic parameters.
- Meticulous in handling and operation of hydrological instruments with highest accuracy level.
- Have comprehensive knowledge of theory and procedure for measurement, computation and analysis of hydrological data and events.
- Perceive the different mathematical equations and hydrological models used for analysis of hydrological events.

Syllabus Contents

The lab practice consists of the experiments and tutorials as decided by the course supervisor of the course, Hydrology and Water Resources Engineering Lab. It includes but not restricted to the following:

1. Study of hydrological instruments used for monitoring climatic parameters.
2. Study of different types of instrument and methods used for quantification of precipitation.
3. Study of different types of instrument and methods used for prediction of surface runoff.
4. Study of different methods and instrument used for measurement and analysis of evaporation and transpiration.
5. Standard procedure for planning and setting up of meteorological observatories.
6. Design of rainfall and stream gauging networks.
7. Study of different methods and instrument used for measurement and computation of stream flow and sediment transport.
8. Study of different methods and instrument used for water quality characteristics.
9. Study of mathematical equations and hydrological models used for analysis of hydrological events.
10. Study of water budgeting and frequency analysis of hydrologic events.

References

1. Subramanyam, K.. Engineering Hydrology, Tata McGraw Hill Publication Co., New Delhi
2. Sharma, R. K. Hydrology and Water Resources Engineering, Dhanpat Rai and Sons,
3. Chow, V. T. Handbook of Applied Hydrology. McGraw Hill Book Co., USA
4. Garg, S.K. Hydrology and Water Resources Engineering, Khanna Publishers, ND.
5. Das, Ghanashyam. Hydrology and Soil Conservation Engineering, Prentice Hall of India, Pvt. Ltd, New Delhi
6. Suresh, R. Watershed Hydrology. Standard Publishers, and Distributors, New Delhi

1AE104, On-Farm Irrigation and Drainage Engineering Lab

Teaching Scheme

Lectures: 4 hours/week

Course Outcomes

At the end of this course, students will be able to

- Identify and specify the hydrological instruments and their use for measurement of climatic parameters.
- Meticulous in handling and operation of hydrological instruments with highest accuracy level.
- Have comprehensive knowledge of theory and procedure for measurement, computation and analysis of hydrological data and events.
- Perceive the different mathematical equations and hydrological models used for analysis of hydrological events.

Syllabus Contents

The lab practice consists of the experiments and tutorials as decided by the course supervisor of the course, On-Farm Irrigation and Drainage Engineering Lab. It includes but not restricted to the following:

1. Identify and study the different irrigation instrument and setup used for application and distribution of water to the crop.
2. Study of different types of instrument and methods used for quantification of irrigation water.
3. Study of different types of instrument and methods used for determination of infiltration characteristics of soil.
4. Study of different types of instrument and methods used for estimation of irrigation water requirement.
5. Identify and quantify the sources of water used for different irrigation methods.
6. Study of standard procedure for planning and design of irrigation tanks and wells.
7. Study of different methods and instrument used for measurement and analysis of water quality parameters.
8. Study of standard procedure for design and evaluation of micro irrigation.
9. Study of standard procedure for land grading and land levelling for lay out irrigation system.
10. Study of standard procedure for design of surface and sub-surface drainage system.

References

1. Michael, A. M. Irrigation Theory and Practice, Vikas Publication. New Delhi
2. James, L. G. Principles of Farm Irrigation System Design, John Wiley and Sons, USA
3. Walker, W.R. and Skogerboe, Q. V. Surface Irrigation: Theory and Practice, Prentice Hall Inc. New Jersey, USA
4. FAO. Drainage Machinery. Irrigation and Drainage Paper No. 15. Food and Agricultural Organisation, Rome.

5. ISO. UPVC Pipes and fittings for use in subsoil drainage Specifications. Publication No. ISO/TC 138 WGIN431. ISO Din Deutsches Institut fur Normurig C.V. Ber-Jin 30.
6. Garg, S. K. Hydrology and Water Resources Engineering. Khana Publishers, New Delhi

2AE105, Water Well and Pump Engineering

Teaching Scheme

Lectures: 3 hours/week

Course Outcomes

At the end of this course, students will be able to

- Have comprehensive concept of water well and pump engineering.
- Methodical explanation of aquifers-well hydraulics in exploration and sustainability of groundwater.
- Have meticulous knowledge for the well design and groundwater recharge.
- Have exhaustive concept for analysis of flow into aquifer and different water resources boundaries.
- Perceive the different aquifer parameters and interference of water quality parameters
- Be competent to select, design and different water lifting devices (pumps) for different purposes.

Syllabus Contents

Unit I: Aquifers - hydraulic characteristics of aquifers. Basic principles of ground water flow, ground water investigation.

Unit II: Well hydraulics. Steady and unsteady flow through fully penetrating and partially penetrating wells in confined, semi-confined and unconfined aquifers. Flow through non-penetrating wells, determination of aquifer parameters by pumping test data analysis.

Unit III: Well design, groundwater recharge basins and injection wells, multiple well and interference between wells, flow into aquifer with different boundaries, groundwater quality management.

Unit IV: Study of indigenous water lifts. Operating principles of hydraulic ram. Principles of positive displacement, jet and air-lift pumps. Design of reciprocating pump. Design of centrifugal pump-impeller and casing.

Unit-V: Pump characteristics, selection of size and type of pump, optimization of pump efficiencies, pump testing and modification, pump installation, operation and maintenance, pump troubles and remedies. Pumps in series and parallel. Special operating conditions. Design of farm irrigation system network, installation and its optimization. Economics of alternative pumping plant design.

References

1. Michael, A. M. Irrigation Theory and Practice, Vikas Publication. New Delhi
2. Michael, A. M. and Khepar S.D. Water Well and Pump Engineering, Tata McGraw Hill

Publication Co., New Delhi
3. Church, A. H. and Jagdish Lal. Centrifugal Pumps and Blowers. Metropolitan Book Co. Pvt. Ltd. New Delhi
4. Bansal, R. K. A text book of Fluid Mechanics and Hydraulic Machine. Laxmi Publications, New Delhi.

2AE106, Land Husbandry and Watershed Management

Teaching Scheme

Lectures: 3 hours/week

Course Outcomes

At the end of this course, students will be able to

- Familiarize with the concept and issues of land husbandry and watershed management.
- Acquainted with the different watershed development plans and their objectives.
- Classify the land based on land capability classification and land use in different climatic regions.
- Strengthen the knowledge to identify the problem of soil erosion and conservation in watershed management.
- Identify the causes and effect of soil erosion and application of soil conservation techniques.
- Analyze and interpret soil fertility and role of different fertilizers and their management for sustainable farming system.

Syllabus Contents

Unit I: The concept of watershed, objectives, characteristics, delineation and coding of watershed, importance of land husbandry in watershed management.

Unit II: Watershed development plan, programmes in retrospect, NWDPRA, the hariayali progrrame, common guide lines.

Unit III: The problem of soil erosion and conservation, agronomic measures in watershed management, Land preparation and planting methods for conservation

Unit IV: Land capability classification and land use in the humid tropics, more crops per drop: importance of water management

Unit V: Maintenance of soil fertility, Organic Recycling: Role of manures, composts and bio fertilizers, fertilizers and their management, diversity farming system for sustainability.

References

1. Suresh, R. Soil and Water Conservation Engineering. Standard Publishers, and Distributors, New Delhi
2. Schwab, G. O., Fangeir, D. D., Edminister, W. T., and Frevert, R.K. Soil and Water Conservation Engineering, John Wiley and Sons.
3. Murty, V.V.N. and Jha, M. K. Land and Water Management Engineering. Kalyani Publisher, Ludhiana, India

4. Tideman, E.M. Watershed Management (Guidelines for Indian Conditions) Omega Scientific Publishers, New Delhi.
5. Sing, Rajvir. Watershed Planning and Management. Yash Publishing House, Bikaner.
6. Dhruvanarayan, V.V. Sastry, G., Patnaik, V. S. Watershed Management. Publ. And Inf. Div. ICAR, New Delhi.

2AE107, Water Well and Pump Engineering Lab

Teaching Scheme

Lectures: 4 hours/week

Course Outcomes

At the end of this course, students will be able to

- Have comprehensive concept of exploration of water resources and it's characteristics.
- Methodical explanation of design of different well and it's characteristics.
- Methodical explanation of design of different pumps and it's characteristics.
- Have meticulous knowledge for the well development and pumping test analysis.
- Be competent to select, design and different water lifting devices (pumps) for different purposes.

Syllabus Contents

The lab practice consists of the tutorials and experiments as decided by the course supervisor of the course, Water Well and Pump Engineering Lab. It includes but not restricted to the following:

1. Identify and study the different equipments and accessories and technique for construction of water wells.
2. Study of different types of equipments and accessories and methods for analysis of well logs.
3. Study of standard procedure for the design of different wells.
4. Study of standard procedure for the determination of well capacity by pumping test.
5. Study of different types of water lifts and pumps-calibration.
6. Study of standard procedure for the development of performance characteristic curves of a pump using a test rig.
7. Study of standard procedure for the design of design of centrifugal pump-impeller and casing.
8. Study of standard procedure for pumping test in an aquifer.

References

1. Michael, A. M. Irrigation Theory and Practice, Vikas Publication. New Delhi
2. Michael, A. M. and Khepar S.D. Water Well and Pump Engineering, Tata McGraw Hill Publication Co., New Delhi
3. Church, A. H. and Jagdish Lal. Centrifugal Pumps and Blowers. Metropolitan Book Co. Pvt. Ltd. New Delhi
4. Bansal, R. K. A text book of Fluid Mechanics and Hydraulic Machine. Laxmi

Publications, New Delhi.

2AE108, Land and Water Management Lab.

Teaching Scheme

Lectures: 4 hours/week

Course Outcomes

At the end of this course, students will be able to

- Identify and specify the equipments and accessories and their use for land topographical survey, soil, water and crop parameters analysis.
- Have Meticulous in handling and operation of instruments with highest accuracy level.
- Have proficiency in design of soil and water conservation structure.
- Have comprehensive knowledge of theory and procedure for measurement, computation, analysis and management of land and water.

Syllabus Contents

The lab practice consists of the tutorials and experiments as decided by the course supervisor of the course, Land and Water Management Lab. It includes but not restricted to the following:

1. Identify and study the different equipments and accessories and methods for topographical survey and delineation of watershed.
2. Study of different types of equipments and accessories and methods for analysis of soil physic-chemical parameter analysis.
3. Study of different types of equipments and accessories and methods for analysis of crop physic-chemical parameter analysis.
4. Study of different types of equipments and accessories and methods for analysis of water quality parameter analysis.
5. Study of standard procedure for planning and design of soil conservation structures.
6. Study of standard procedure for planning and design of water harvesting structures.
7. Study of standard procedure for planning and design of irrigation tanks and wells.
8. Study of standard procedure for design of protective and precision farming structure.

References

1. Suresh, R. Soil and Water Conservation Engineering. Standard Publishers, and Distributors, New Delhi
2. Schwab, G. O., Fangeir, D. D., Edminister, W. T., and Frevert, R.K. Soil and Water Conservation Engineering, John Wiley and Sons.
3. Murty, V.V.N. and Jha, M. K. Land and Water Management Engineering. Kalyani Publisher, Ludhiana, India
4. Tideman, E.M. Watershed Management (Guidelines for Indian Conditions) Omega Scientific Publishers, New Delhi.
5. Sing, Rajvir. Watershed Planning and Management. Yash Publishing House, Bikaner.
6. Dhruvanarayan, V.V. Sastry, G., Patnaik, V. S. Watershed Management. Publ. And Inf. Div. ICAR, New Delhi.

7. T.P. Kanetkar & S.V. Kulkarni. Surveying and Levelling. (Part I & II). Griha Prakashan.

2AE109: Mini Project

Teaching Scheme
Lectures: 4 hours/week

Course Outcomes
At the end of this course, students will be able to

- Solve a live problem using software/analytical/computational tools.
- Learn to write technical reports.
- Develop skills to present and defend their work in front of technically qualified audience.

Syllabus Contents
Students can take up small problems in the field of design and development or design refinement of farm machines or computer application in tractor and farm machinery design as mini project. It can be related to solution to an engineering problem, verification and analysis of experimental data available, comparative performance of various farm equipment, conducting experiments on various engineering subjects, studying a software tool for the solution of an engineering problem etc.

3AE110, Dissertation Phase – I

Teaching Scheme
Lectures: 20 hours/week

Course Outcomes
At the end of this course, students will be able to

- Expose to self-learning various topics.
- Survey the literature such as books, national/international refereed journals and contact resource persons for the selected topic of research.
- Learn to write technical reports.
- Develop oral and written communication skills to present and defend their work in front of technically qualified audience.

Guidelines
The Project Work will start in semester III and should preferably be a problem with research potential and should involve scientific research, design, generation/collection and analysis of data, determining solution and must preferably bring out the individual contribution. Seminar should be based on the area in which the candidate has undertaken the dissertation work as per the common instructions for all branches of M. Tech. The examination shall consist of the preparation of report consisting of a detailed problem statement and a literature review. The preliminary results (if available) of the problem may also be discussed in the report. The work has to be presented in front of the examiners panel set by Head and PG coordinator. The candidate has to be in regular contact with his guide and the topic of dissertation must be mutually decided by the guide and student.

4AE111, Dissertation Phase – II

Teaching Scheme
Lectures: 32 hours/week

Course Outcomes

At the end of this course, students will be able to

- Use different experimental techniques.
- Use different software/ computational/analytical tools.
- Design and develop an experimental set up/ equipment/test rig.
- Conduct tests on existing set ups/equipments and draw logical conclusions from the results after analyzing them.
- Work in a research environment or in an industrial environment.
- Conversant with technical report writing.
- Present and convince their topic of study to the engineering community.

Guidelines

It is a continuation of Project work started in semester III. He has to submit the report in prescribed format and also present a seminar. The dissertation should be presented in standard format as provided by the department. The candidate has to prepare a detailed project report consisting of introduction of the problem, problem statement, literature review, objectives of the work, methodology (experimental set up or numerical details as the case may be) of solution and results and discussion. The report must bring out the conclusions of the work and future scope for the study. The work has to be presented in front of the examiners panel consisting of an approved external examiner, an internal examiner and a guide, co-guide etc. as decided by the Head and PG coordinator. The candidate has to be in regular contact with his guide.

PROGRAMME ELECTIVES – I

1AE112, Computational Methods

Teaching Scheme

Lectures: 3 hours/week

Course Outcomes

At the end of this course, students will be able to

- Acquaint with comprehensive concept of differentiation and standard integration.
- Methodical explanation of Numerical integration, Area under and between the curves, volume of solids, centroids of simple shapes.
- Have meticulous knowledge for the presentation of statistical data and presentation into arguments from scale, graphical methods and stochastic models.

Syllabus Contents

Unit I: Introduction to differentiation, Functional notation, Gradient of a curve, Differentiation from first principles, Methods of differentiation, Some applications of differentiation, , Integration using algebraic substitutions, trigonometric substitutions and partial fractions.

Unit II: Numerical integration, Area under and between the curves, Mean and root square values, Volume of solids, Centroids of simple shapes.

Unit III: First order differential equations, First-order linear differential equations, Linear equations of second order with constant coefficients, First-order separable equations, Euler's method, Systems and equations of higher order, Comparison of the methods.

Unit IV: Presentation of statistical data, Measures of central tendency and dispersion, Probability, Binomial and Poisson distribution, Normal distribution, Linear Correlation, Linear regression, Sampling and estimation theories.

Unit V: Introduction, Arguments from scale, Graphical methods, Approaches to differential equations, Quantitative differential equations, Stochastic models.

References

1. Edward A. Bender. An Introduction to Mathematical Modeling. John Wiley & Sons. Fourth edition
2. Steven C. Chapra. Applied Numerical Methods with MATLAB for Engineering and Science. 2nd Ed.
3. John Bird. Engineering Mathematics. Newnes Publication. Fourth Edition.
4. Joe D. Hoffman. Numerical Methods for Engineers and Scientists. Marcel Dekker, Inc. New York. Second Edition.

1AE113, Soil Water and Crop Environmental Engineering

Teaching Scheme

Lectures: 3 hours/week

Course Outcomes

At the end of this course, students will be able to

- Acquaint and equip with the process of soil-water plant relationship and their interaction for crop growth.
- Acquaint and equip with the hydraulics and process of water flow in the water bearing formation under saturated as well as unsaturated condition.

Syllabus Contents

Unit I: Aerial and edaphic environments for plant growth, energy and mass transfer in and above crop growth.

Unit II: Climatic changes and plant response to environmental stresses, evapo-transpiration models. Instrumentation and techniques for monitoring plant environments.

Unit III: Processes and aspects of growth and development, soil-root interface, root sink functions.

Unit IV: Water movement in soil-plant atmosphere continuum, artificial environments and plant behavior. Unsaturated flow theory, Infiltration and capillary rise flux dynamics. Hydro-dynamic dispersion in soil-aquifer system.

UnitV: Design and operation of controlled environment facilities and their instrumentation. Crop growth and yield modeling.

References:

1. Ghildyal BP & Tripathy RP. 1987. Fundamental of Soil Physics. Wiley Eastern.

2. Slatyor OP. 1967. Plant Water Relationship. Academic Press.
3. Harr Milton E. 1962. Groundwater and Seepage. McGraw-Hill
4. Jacob Beer 1972. Dynamics of Fluid Flow in Parous Media. Elsevier
5. Muskat M & Wyckoff RD. 1946. The Flow of Homogeneous Fluids through parous Media. JW Edwards.
6. Patrick A Domeniico & Schwartz FW. 1998. Physical and Chemical Hydrology. John Willey & Sons.
7. Remson I, Hornberger GM & Moiz Fred J. 1971. Numerical Methods in Subsurface Hydrology. Wiley Interscience.

1AE114, Advanced Groundwater Hydrology

Teaching Scheme

Lectures: 3 hours/week

Course Outcomes

At the end of this course, students will be able to

- Have comprehensive definition of Aquifers and hydraulic characteristics of aquifers.
- Methodical explanation of aquifers-well hydraulics.
- Have meticulous knowledge for the well interference, pumping tests and determination of aquifer parameters.
- Acquaint and equip with the safe yield and basin-wide ground water development.

Syllabus Contents

Unit I: Basic principles of ground water flow. Ground water investigation. Properties affecting groundwater storage and movement, Groundwater balance studies.

Unit II: Well hydraulics. Two dimensional flow, Steady state flow in confined, unconfined and semi-confined aquifers, Partial penetrating wells. Steady and unsteady flow through fully penetrating and partially penetrating wells in confined, semi-confined and unconfined aquifers.

Unit III: Well interference, Pumping tests and determination of aquifer parameters. Flow through non-penetrating wells. Determination of aquifer parameters by pumping test data analysis.

Unit IV: Well design. Groundwater recharges basins and injection wells. Construction and Development of tube wells.

Unit V: Safe yield and basin-wide ground water development, Techniques for groundwater recharge**.** Groundwater quality management. Ground water models

References

1. Boonstra, J. and de Ridder, N.A. 1981. Numerical Modelling of Groundwater Basins. ILRI.
2. Domenico, P.A. 1972. Concept and Models in Groundwater Hydrology. Mc Graw Hill.

3. Garg, S.K.1999. *Irrigation Engineering and Hydraulic Structures*. Khanna Publishers.
4. Hantush, M.S. (Ed.). 1964. Advances in Hydro Sciences. Vol. 1, Academic Press.
5. Harr, M.E. 1990. Ground Water and Seepage. Wiley Eastern.
6. Huisman, L. 1972. *Groundwater Recovery*. Mc Millan.
7. Michael, A.M., Khepar, S.D. and Sondhi, S.K. 2008. *Water Wells and Pumps*. Tata McGraw-Hill Publishing Co. Ltd.
8. Nagabhushaniah, H.S. 2001. *Groundwater in Hydrosphere*. CBS Publishers and Distributors.
9. Polubarinova Kochina, P. Y. 1962. *Theory of Ground Water Movement*. Princeton University Press.
10. Raghunath, H.M. 1992. *Ground Water*. Wiley Eastern.
11. Todd, D.K. 1997. *Ground Water Hydrology*. Wiley Eastern.

PROGRAMME ELECTIVES – II

1AE115, Aquacultural Engineering

Teaching Scheme
Lectures: 3 hours/week

Course Outcomes
At the end of this course, students will be able to

- Outline the concept and flow types, properties and phenomenon in aquacultural system and quality management.
- Acquaint and equip with the selection, planning and process for design of farm, aquacultural system and quality management.

Syllabus Contents

Unit I: Open channel flow, pipe flow, type of open channel flows, open channel and their properties, velocity distribution in open channels, local phenomenon in open channel flow, Critical flow,

Unit II : Chemical equilibrium, important water quality parameter; pH, carbon dioxide, nitrogenous compounds, nitrogen cycle, phosphorous cycle, BOD, COD, DO, C:N ratio, fertilization and liming of pond.

Unit III : Selection of suitable site for aquacultural project, topography, type of soil and its quality, water supply, drainage, environmental considerations, process of farm design, computations for water requirement, seepage and evaporation, types of ponds and their designs, dykes, pump fed farm, tide fed farm.

Unit IV: Aerator, need of aeration, type of aerators: Diffuser aerators, Propeller-aspirator pump aerator, paddle wheel aerator and cascade aerator, design of surface water aeration system,

recirculating aquaculture systems, component of recirculating aquaculture system, advantages and disadvantages of RAS.

Unit V: Type of hatchery, component of hatchery, design and construction of carp hatchery, design of commercial freshwater prawn hatchery.

References

1. Chow, Ven TE, Open Channel Hydraulics, McGraw-Hill International BOOK Company.
2. Lawson, Thomas B., Fundamental of Aquacultural Engineering, Springer
3. Boyad, C.E. and Tuker C.S. Pond Aquaculture Water Quality Management, Springer.
4. Timmons. B. Michal, Recirculating Aquacultural System. Ithaca Publishing Company.

1AE116: Water Resources System Engineering

Teaching Scheme

Lectures: 3 hours/week

Course Outcomes

At the end of this course, students will be able to

- Familiarize with the nature, concepts and significance of optimization of water resources systems.
- Acquaint and equip with techniques for optimization of water resources for achieving maximum output.

Syllabus Contents

Unit I: The nature of water resources systems: Systems analysis - the jargon used. The methods of systems analysis.

Unit II: Concepts and significance of optimization in water resources, objective functions, deterministic and stochastic inputs.

Unit III: Mathematical programming techniques, Linear programming models - concept of simplex tableau, its working principles - the two phases of simplex method - revised simplex method - duality, decomposition principle - post optimality analysis. Transportation problem.

Unit IV: Non-linear programming of simple cases. Dynamic programming - multi stage decision process - computational procedure in Dynamic programming – Stochastic linear and Dynamic programming

Unit V: Development and management including conjunctive use, crop production functions

and irrigation optimization.basic concepts of probability - application of systems analysis to water resources systems in particular.

References

1. Larry WM. 1996. Water Resources Handbook. McGraw-Hill.
2. Loucks DP et al. 1981. Water Resources System Planning and Analysis. Prentice Hall.
3. Rao SS. 1978. Optimization Theory and Applications. Wiley Eastern.

1AE117, Soil and Water Systems' Simulation and Modelling

Teaching Scheme

Lectures: 3 hours/week

Course Outcomes

At the end of this course, students will be able to

- Familiarize with the complexity of resources management process and systems analysis.
- Methodical explanation of flow parameters and capacity simulation in water management system.
- Acquaint and equip the students with the simulation of soil water systems and modeling techniques.

Syllabus Contents

Unit I: Systems engineering for water management; Complexity of resources management process, systems analysis.

Unit II: Rainfall-runoff models - Infiltration models, Simulation methods, structure of a water balance model.

Unit III: Channel and calibration – Stream flow statistics, surface water storage requirements.

Unit IV: Flood control storage capacity; total reservoir capacity - surface water allocations. Ground water models.

Unit V: Design of nodal network, General systems frame work – Description of the model; Irregular boundaries, General –Numerical approaches.

References

1. Ramesh, K. 2009. E-book on Experimental Stress Analysis. IIT Madras. http://apm.iitm.ac.in/smlab/kramesh/book_5.htm
2. Dally, J.W. and Riley, W.F. 1991. Experimental Stress Analysis, McGraw-Hill, New York.
3. Sharpe, W.N. 2008. Handbook of Experimental Solid Mechanics. Springer, Netherlands.
4. Pant, B., Gargesha, G., Lingaiah, K., Ramachandra, K., Srinath, L.S. and Raghavan, M.R. 1984. Experimental Stress Analysis. Tata McGraw Hill, New Delhi.

PROGRAMME ELECTIVES – III

2AE118, Soil and Water Conservation Structural Engineering

Teaching Scheme
Lectures: 3 hours/week

Course Outcomes
At the end of this course, students will be able to

- Acquaint and equip students with the process of degradation soil and water conservation and their remedial measures including design of structures.
- Have comprehensive knowledge of theory and procedure for hydrologic, hydraulic and structural design of soil and water conservation structures.

Syllabus Contents

Unit I: Layout and planning of soil and water conservation measures; Probability and continuous frequency distribution; Fitting empirical distributions.

Unit II: Design principles of soil and water structures including contour bunds and terraces; Gully control measures.

Unit III: Hydraulic jump and energy dissipators for soil conservation structures; hydrologic, hydraulic and structural design of drop structures.

Unit IV: Sediment deposition process. Estimation of sediment load, earthen dams, seepage through dams and stability analysis.

Unit V: Rainwater harvesting, Flood control and stream bank protection measures.

References

1. Suresh, R. Soil and Water Conservation Engineering. Standard Publishers, and Distributors, New Delhi
2. Schwab, G. O., Fangeir, D. D., Edminister, W. T., and Frevert, R.K. Soil and Water Conservation Engineering, John Wiley and Sons.
3. Murty, V.V.N. and Jha, M. K. Land and Water Management Engineering. Kalyani Publisher, Ludhiana, India
4. Tideman, E.M. Watershed Management (Guidelines for Indian Conditions) Omega Scientific Publishers, New Delhi.
5. Sing, Rajvir. Watershed Planning and Management. Yash Publishing House, Bikaner.
6. Dhruvanarayan, V.V. Sastry, G., Patnaik, V. S. Watershed Management. Publ. And Inf. Div. ICAR, New Delhi.
7. Grade RJ & Ranga Raju KG 1977. Mechanics of Sediment Transport and Alluvial Stream Problems. Weilley Eastern.
8. Gurmel Singh et al. 1994. Manual of Soil and Water Conservation Practices. Oxzford & IBH.
9. Hundson N. 1971. Soil Conservation. B.T.Batsford Ltd.

10. USDA .1969. A Manual on Conservation of Soil and Water. Oxford & IBH.

2AE119: Open Channel Hydraulics and Coastal Engineering

Teaching Scheme

Lectures: 3 hours/week

Course Outcomes

At the end of this course, students will be able to

- Acquire insight about the open channel and their properties.
- Acquaint and equip with the hydraulics of surface water flow phenomenon in open channels.
- Capable to analyze flow profile analysis.
- Generate scenarios of protection of coastline- structure and forces acting on them.
- Address the pertinent coastal protection planning for design of aquacultural farm.

Syllabus Contents

Unit I: Open Channel and their Properties, Energy and Momentum Principle, Critical Flow, Uniform Flow, Design of Channels for Uniform flow.

Unit II: Gradually Varied Flow, Flow Profile Analysis, Flow Over Spillway, Hydraulic Jump, Flow Through Non-prismatic Channel, Gradually Varied Unsteady Flow.

Unit III: Equilibrium and Dynamic Theory of Tides, Types of Tides and Tidal Theory, Tidal Propagation in the Channel, Estuaries and Coastal Inlets, Tidal Mixing.

Unit IV: Properties of Ocean Water, Provinces of Ocean, Generation and Prediction of waves, Propagation and Transformation of Waves, Longshore Currents, Rip Current, Littoral Transport,

Unit V: Artificial Protection of Coastline- Structure and forces acting on them, Coastal Protection Planning for Design of Aquacultural Farm.

References

1. Chaudhry MH. 1993. Open Channel Flow. Prentice Hall.
2. Chow VT.1959. Open Channel Hydraulics. Mc-Grew Hill.
3. Henederson FM. 1966. Open Channel Flow. Macmillan.
4. Modi, P.N. and S.M.seth. 2000. Hydraulics and Fluid Mechanics, Standard Book House.

2AE120: Environmental Engineering Fundamentals

Teaching Scheme

Lectures: 3 hours/week

Course Outcomes

At the end of this course, students will be able to

- Perceive the different issues, domains and management of environmental engineering
- Have meticulous knowledge for the environmental quality (water and air pollution) and control.

Syllabus Contents

Unit I: Introduction to environmental engineering, Domains of environmental engineering, History of environmental engineering, Environmental issues of emerging concern, laws and regulations, Environmental engineering management, Development of environmental regulations, environmental legislation in India, environmental ethics**.**

Unit II: Ecology and the environment, Ecosystems, Nutrient cycles, Biodiversity, Ecology and the environment, Limnology, Water budget, Population growth.

Unit III: Overview of chemistry, Mass relationships, Units of measurement, Equilibrium, Acid-base reactions, Solubility reactions, Redox reactions, Chemical reaction rates; Mass balance.

Unit IV: Overview of microbiology, Microbes in the environment, Microbes in engineering systems, Microbial energetic, Microbial growth kinetics, Microbial genetics; Microbial diseases.

Unit V: Environmental quality, Water pollution (Organic pollutants, Inorganic pollutants, Physical pollutants), Water pollution (Oxygen sag curve), Air pollution (Greenhouse gases; Hazardous gases), Pollution control (Wastewater treatment), Pollution control (Water treatment; Desalination & Membranes; Land-based treatment)

References

1. Davis M.L., Cornwell D.A., “Introduction to Environmental Engineering”, Tata McGraw Hill Education (P) Ltd., New Delhi
2. De A.K., “Environmental Chemistry ", New Age International (P) Ltd., New Delhi.
3. Khopkar S.M., “Environmental Pollution Analysis”, New Age International (P) Ltd., New Delhi.
4. Cunningham W.P., Cunningham M.A., “Principles of Environmental Science”, Tata McGraw Hill
5. Krishnamoorthy B., “Environmental Management, Text Book and Cases”, PHI Learning (P) Ltd.
6. Chandrappa R., Das D.B., “Solid Waste Management: Principals and Practice”
7. Pelczar, M., J.Chan E.C.S. and Krieg, N. R. Microbiology, Tata McGraw Hill, New Delhi.
8. Droste R.L., “Theory and Practice of Water and Wastewater Treatment”, Wiley India (P) Ltd.
9. Dara S.S., “A Textbook of Environmental Chemistry and Pollution Control”, S. Chand and Company Ltd., New Delhi.

PROGRAMME ELECTIVES – IV

2AE121, Modelling of Aquaculture & Fisheries Systems

Teaching Scheme
Lectures: 3 hours/week

Course Outcomes
At the end of this course, students will be able to

- Acquire insight about the importance of Modelling of Aquaculture and Fisheries System
- Acquaint and equip with model parameters and calibration of model – testing and validating of model – simulation and forecasting
- Suggest fish growth model – pond ecosystem model.

Syllabus Contents

Unit I: Modelling –Modelling terminology - systems and models – constraints to modelling aquaculture systems.

Unit II: Modelling aquaculture systems – need – tools for theoretical analysis study of interactions, use of mathematics and computers.

Unit III: Empirical modelling – collection and organizing data and calculations, Theoretical models – developing a frame of reference, defining model objectives, determination of model components – relationship between model components –

Unit IV: Estimation of model parameters and calibration of model – testing and validating of model – simulation and forecasting.

Unit V: Application of modelling in Aquaculture – fish growth model – pond ecosystem model – dissolved oxygen model, ammonia model, water temperature model, salinity model, recirculating aquaculture model.

References

1. Fikret Berkes, Robin Mahon, Patrick mcconney, Richard Pollnac, and Robert Pomeroy. Managing Small-scale Fisheries. International development research centre. New Delhi.
2. Bernard A. Megrey l Erlend Moksness Editors. Computers in Fisheries Research. Second Edition. Springer.
3. Robert R. Stickney. Aquaculture: An introductory text. CABI Publishers.

2AE122, Water Quality Management

Teaching Scheme
Lectures: 3 hours/week

Course Outcomes
At the end of the course, students will be

- Aware of the importance and the scope of water quality monitoring and management.
- Able to select water and its characteristics for treatment.
- Acquaint with mathematical interpretation and fundamental expression of pollution transport.

Syllabus Contents

Unit I: Need for water quality data, Water quality monitoring, The most frequent pollutants in a river, Drinking water standards, Regulations and goals, Chemical principles, Sources water composition and watershed protection, Water quality regulations and policy development, Surface water quality sampling and canals, Groundwater sampling, Economic quantity of water: Demand, Prices, Rate structures, Water supply economics.

Unit II: Equalisation, Screening, Shredding, Grit removal, Sedimentation, Floatation, Filtration, Membrane filtration, Temperature control, Mixing, Evaporative treatment, Pumping systems.

Unit III: Chemical oxidation/reduction, pH control, Metal precipitation, Coagulation and flocculation, Disinfection, Air stripping, Adsorption of aqueous compounds, Ion exchange.

Unit IV: The theory of biological treatment, Aerobic biological treatment, Anaerobic biological treatment, Anoxic biological treatment, Constructed wetlands for wastewater treatment, Wastewater microbiology.

Unit V: Mathematical interpretation of pollution transport, Fundamental expressions, Dispersion in rivers and streams, The biochemical pollution, Application of the general differential equations, Interpretation in the finite terms, Progress in numerical modeling: The finite difference method, The finite element method.

References

1. A. P. Sincero and G. A. Sincero. Physical–chemical treatment of water and wastewater. CRC Press.
2. M. L. Davis. Water and Wastewater Engineering: Design Principles and Practice. The McGraw-Hill Companies, Inc.
3. S. D. Lin. Water and Wastewater Calculations Manual. The McGraw-Hill Companies, Inc.
4. Y. Li and K. Migliaccio. Water Quality Concepts, Sampling, and Analyses. CRC Press.
5. F. R. Spellman. Water Treatment Operations: Math Concepts and Calculations. CRC Press.
6. R. S. Ramalho. Introduction to Wastewater Treatment Processes. Academic Press Inc.

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2AE123, Statistical Methods in Agriculture

Teaching Scheme

Lectures: 3 hours/week

Course Outcomes

- Acquaint with comprehensive concept of probability distributions.
- Methodical explanation of tests of hypothesis.
- Have meticulous knowledge for the Design and analysis of experiments
- Outline the concept and methods of experimental data analysis using SPSS, Systat and Statistica etc.

Syllabus Contents

Unit I: Probability, discrete random variables and probability distributions. Continuous random variables and probability distributions.

Unit II: Tests of hypothesis for a single sample, statistical influence for two samples.

Unit III: Simple linear regression and correlation, multiple linear regression, hypothesis tests.

Unit IV: Design and analysis of experiments with single factor and several factors. Analysis of variance, statistical quality controls.

Unit V: Introduction to SPSS, Systat and Statistica.

References

1. Jaggi, S., Varghese, C.V., Batra, P.K. and Sharma, V.K. 2015. Statistical Methods for Agricultural Research. IASRI, New Delhi. http://www.iasri.res.in/ebook/EB_SMAR/
2. Bayo, L. 2014. Applied Statistical Methods in Agriculture, Health and Life Sciences. Springer International Publishing Switzerland.
3. Mead, R. Curnow, R.N. and Hasted, A.M. 2002. Statistical Methods in Agriculture and Experimental Biology, 3rd Edition. CRC Press, Taylor and Francis Group, New York.
4. Welham, S.J., Gezan, S.A., Clark, S.J. and Mead, A. 2014. Statistical Methods in Biology: Design and Analysis of Experiments and Regression. CRC Press, New York.

PROGRAMME ELECTIVES – V

3AE124, Water and Wastewater Treatment Engineering

Teaching Scheme

Lectures: 3 hours/week

Course Outcomes

- Aware of the importance and the scope of waste water treatment and management.
- Outline the concept and methods of waste water treatment processes.
- Acquaint and equip with techniques of water and wastewater treatment and management.

Syllabus Contents

Unit I: Total Water Management - Hydrologic Cycle, Supply and Demand, Regulations, Watershed Management, Ground and Surface Water, Hydrology, Overview of Water Treatment -

Supply Water Characteristics, Water Quality, Drinking Water Standards, Water Chemistry, Chemical Reaction and Kinetics, Water Conveyance and Distribution, Hydraulics

Unit II: Conventional Water Treatment Processes - Aeration, Sedimentation, Rapid Mixing, Flocculation, Coagulation, Filtration, Disinfection, Flouridation, Water Softening, Turbidity Removal, Taste and Odor Control, Advanced Water Treatment Processes - Ion Exchange, Ozonation, Adsorption, Ultra Filtration, Membrane Processes, UV Disinfection

Unit III: Overview of Wastewater Management - Wastewater Characteristics, Flows and Pollutant Loads, Biochemistry and Microbiology, Sanitary and Stormwater Collection Systems, Effluent Quality Standards, Receiving Stream Quality, Design Standards, Economic Analysis

Unit IV: Wastewater Preliminary and Primary Treatment Processes - Screening, Grit Removal, Sedimentation, Secondary Wastewater Treatment Processes - Activated Sludge, Trickling Filters, Rotating Biological Contactors, Stabilization Ponds, Lagoons, Aeration, Clarification, Filtration, Chlorination-Dechlorination

Unit V: Advanced Wastewater Treatment Processes - Chemical Coagulation, Carbon Adsorption, Phosphorus Removal, Nitrogen Removal (Nitrification/Denitrification), Media Filtration, UV Disinfection, Solids Handling Processes - Gravity Thickening, Flotation Thickening, Dewatering, Pressure Filtration, Stabilization, Aerobic and Anaerobic Digestion, Composting, Drying, Incineration, Land filling, Land Application

References

1. Water, waste water and storm water infrastructure management by Neil S Grigg
2. Water, sanitary and waste services for buildings by a F E Wise and J A Swaffield
3. Handbook of water treatment by Kurita water industries limited, Japan
4. Standard handbook of environmental engineering by Robert A Corbitt
5. Sanitation and water supply handbook by Tony Gage
6. Handbook of water and wastewater treatment technologies by Nicholas P. Cheremisinoff

3AE125, GIS and RS–Principles and Application in Land and Water Resources

Teaching Scheme

Lectures: 3 hours/week

Course Outcomes

- Have comprehensive knowledge of Principles of GIS and Remote Sensing tools, their

types and capabilities.

- Have exhaustive concept and approach to identify and quantitative estimates of hydro-meteorological parameters.
- Acquaint and equip with techniques of remote sensing and application of GIS for land and water resources management.

Syllabus Contents

Unit-I

Principles of Geographical Information System tools, their types and capabilities, Advantages of GIS over conventional methods. Basic principle of remote sensing, sensor, platforms, data analysis,

Unit-II

Principal remote sensing approach for quantitative estimates of precipitation, runoff, evapotranspiration. visible and infrared techniques, space borne radar, ground based radar, cloud indexing methods, thresh holding methods, life history methods microwave radiometry

Unit-III

General approach for measuring soil moisture, Gamma radiation techniques, visible/near-infrared techniques, thermal, microwave techniques.

Unit-IV

Importance of ground truth establishment, exploration of groundwater with satellite imagery, principles of image analysis, imagery selection, water quality.

Unit-V

GIS and remote sensing for land and water resources data collection, analysis and interpretation, Application of GIS in water and land resource development and management.

References

1. Sabins, J.R. Remote Sensing Principles and Interpretations. W. H. Freeman & Co.
2. Burrough, P. A. Principles of GIS for Land Resources Assessment
3. Shultz, G. A. and Engman, E. T. Remote Sensing in Hydrology and Water Management, Springer, New York.
4. Crisman Nicholas. Exploring GIS. John Wiley and Sons.
5. Heywood, Ian., Cornelius Sarah and Carver Steve. An Introduction to GIS, Addission-Wesley-Longman.
6. Dew Mess MN. 2004. Fundamental of Geographic Information System. John Wiley & Sons.
7. Lille Sand T & Kaiffer R. 1987. Remote Sensing and Image Interpretation. John Wiley & Sons.
8. Sabbins F. 1987. Remote Sensing Principle and Interpretation. Freeman.

3AE126, Design of Pumps for Irrigation and Drainage

Teaching Scheme

Lectures: 3 hours/week

Course Outcomes

- Acquire insight about the basic hydraulic design of pump.
- Acquaint and equip with requirement of pumps for irrigation and drainage system and their design features.
- Capable to select pertinent parameters and design criteria for pumping systems.
- Analyze techno-economic feasibility of designed pumping system.

Syllabus Contents

Unit I: Basic hydraulic design of centrifugal pump, water hammering problem in centrifugal pump.

Unit II: Principle and performance characteristics of vertical turbine pump, submersible pump and axial flow pump.

Unit III: Non-conventional energy sources for pumping, wind mills, micro turbines, solar pumps, hydraulic ram – their

Unit IV: Selection and design criteria. Energy conservation measures for pumping systems.

Unit V: Power requirements in pumping, techno-economic evaluation.

References

1. Church AH & Jagadish Lal. 1973. *Centrifugal Pumps and Blowers*. Metropolitan Book Co.
2. Michael AM, SD Khepar & SK Sondhi. 2008. *Water Wells and Pumps*. Tata McGraw-Hill Publishing Co. Ltd.
3. Michael AM. 1990. *Irrigation Theory and Practice*. Vikas Publ. House.
4. Modi PN & Seth SM. 2000. *Hydraulics and Fluid Mechinics*. Standard Book House.

AUDIT COURSES

1ST101, Research Methodology and IPR

Teaching Scheme

Lectures: 2 hours/week

Course Outcomes

At the end of this course, students will be able to

- Understand research problem formulation.
- Analyze research related information.
- Follow research ethics
- Understand that today's world is controlled by Computer, Information Technology, but tomorrow world will be ruled by ideas, concept, and creativity.
- Understanding that when IPR would take such important place in growth of individuals & nation, it is needless to emphasis the need of information about Intellectual Property Right to be promoted among students in general & engineering in particular.
- Understand that IPR protection provides an incentive to inventors for further research work

and investment in R & D, which leads to creation of new and better products, and in turn brings about, economic growth and social benefits.

Syllabus Contents

Unit I: Meaning of research problem, Sources of research problem, Criteria Characteristics of a good research problem, Errors in selecting a research problem, Scope and objectives of research problem. Approaches of investigation of solutions for research problem, data collection, analysis, interpretation, Necessary instrumentations.

Unit II: Effective literature studies approaches, analysis. Plagiarism, Research ethics.

Unit III: Effective technical writing, how to write report, Paper. Developing a Research Proposal, Format of research proposal, a presentation and assessment by a review committee

Unit IV: Nature of Intellectual Property: Patents, Designs, Trade and Copyright. Process of Patenting and Development: technological research, innovation, patenting, development. International Scenario: International cooperation on Intellectual Property. Procedure for grants of patents, Patenting under PCT.

Unit V: Patent Rights: Scope of Patent Rights. Licensing and transfer of technology. Patent information and databases. Geographical Indications.

Unit 6: New Developments in IPR: Administration of Patent System. New developments in IPR; IPR of Biological Systems, Computer Software etc. Traditional knowledge Case Studies, IPR and other institutes.

References

1. Stuart Melville and Wayne Goddard, "Research methodology: An introduction for science & engineering students'"
2. Wayne Goddard and Stuart Melville, "Research Methodology: An Introduction"
3. Ranjit Kumar, 2nd Edition, "Research Methodology: A Step by Step Guide for beginners"
4. Halbert, "Resisting Intellectual Property", Taylor & Francis Ltd, 2007.
5. Mayall, "Industrial Design", McGraw Hill, 1992.
6. Niebel, "Product Design", McGraw Hill, 1974.
7. Asimov, "Introduction to Design", Prentice Hall, 1962.
8. Robert P. Merges, Peter S. Menell, Mark A. Lemley, " Intellectual Property in New Technological Age", 2016.
9. T. Ramappa, "Intellectual Property Rights Under WTO", S. Chand, 2008.

1ST102, English for Research Paper Writing

Teaching Scheme

Lectures: 2 hours/week

Course Objectives

Students will be able to:

- Understand that how to improve your writing skills and level of readability
- Learn about what to write in each section

- Understand the skills needed when writing a Title
- Ensure the good quality of paper at very first-time submission

Syllabus Contents

Unit I: Planning and Preparation, Word Order, Breaking up long sentences, Structuring Paragraphs and Sentences, Being Concise and Removing Redundancy, Avoiding Ambiguity and Vagueness

Unit II: Clarifying Who Did What, Highlighting Your Findings, Hedging and Criticising, Paraphrasing and Plagiarism, Sections of a Paper, Abstracts.Introduction

Unit III: Review of the Literature, Methods, Results, Discussion, Conclusions, The Final Check.

Unit IV: Key skills are needed when writing a Title, key skills are needed when writing an Abstract, key skills are needed when writing an Introduction, skills needed when writing a Review of the Literature.

Unit V: Skills are needed when writing the Methods, skills needed when writing the Results, skills are needed when writing the Discussion, skills are needed when writing the Conclusions

Unit 6: Useful phrases, how to ensure paper is as good as it could possibly be the first- time submission

Suggested Studies

1. Goldbort R (2006) Writing for Science, Yale University Press (available on Google Books)
2. Day R (2006) How to Write and Publish a Scientific Paper, Cambridge University Press
3. Highman N (1998), Handbook of Writing for the Mathematical Sciences, SIAM. Highman's book.
4. Adrian Wallwork , English for Writing Research Papers, Springer New York Dordrecht Heidelberg London, 2011.

1ST103, Disaster Management

Teaching Scheme

Lectures: 2 hours/week

Course Objectives

Students will be able to:

- Learn to demonstrate a critical understanding of key concepts in disaster risk reduction and humanitarian response.
- Critically evaluate disaster risk reduction and humanitarian response policy and practice from multiple perspectives.
- Develop an understanding of standards of humanitarian response and practical relevance in specific types of disasters and conflict situations.
- Critically understand the strengths and weaknesses of disaster management approaches, planning and programming in different countries, particularly their home country or the

countries they work in

Syllabus Contents

Unit I: Introduction Disaster: Definition, Factors and significance; Difference between hazard and disaster; Natural and manmade disasters: Difference, Nature, Types and magnitude.

Unit II: Repercussions of Disasters and Hazards: Economic damage, Loss of human and animal life, Destruction of Ecosystem. Natural Disasters: Earthquakes, Volcanisms, Cyclones, Tsunamis, Floods, Droughts and famines, Landslides and avalanches, Man-made disaster: Nuclear reactor meltdown, Industrial accidents, Oil slicks and spills, Outbreaks of disease and epidemics, War and conflicts.

Unit III: Disaster Prone Areas in India Study of seismic zones; Areas prone to floods and droughts, Landslides and avalanches; Areas prone to cyclonic and coastal hazards with special reference to tsunami; Post-disaster diseases and epidemics

Unit IV: Disaster Preparedness and Management Preparedness: Monitoring of phenomena triggering a disaster or hazard; Evaluation of risk: Application of remote sensing, Data from meteorological and other agencies, Media reports: Governmental and community preparedness.

Unit V: Risk Assessment Disaster risk: Concept and elements, Disaster risk reduction, Global and national disaster risk situation. Techniques of risk assessment, Global Co-operation in risk assessment and warning, People's participation in risk assessment. Strategies for survival.

Unit 6: Disaster Mitigation Meaning, Concept and strategies of disaster mitigation, Emerging trends in mitigation. Structural mitigation and non-structural mitigation, Programs of disaster mitigation in India.

Suggested Readings

1. R. Nishith, Singh AK, "Disaster Management in India: Perspectives, issues and strategies", New Royal Book Company.
2. Sahni, Pardeep et al. (Eds.), "Disaster Mitigation Experiences And Reflections", Prentice Hall of India, New Delhi.
3. Goel S. L. "Disaster Administration And Management Text And Case Studies", Deep & Deep Publication Pvt. Ltd., New Delhi.

1ST104, Sanskrit for Technical Knowledge

Teaching Scheme

Lectures: 2 hours/week

Course Objectives

- To get a working knowledge in illustrious Sanskrit, the scientific language in the world
- Learning of Sanskrit to improve brain functioning
- Learning of Sanskrit to develop the logic in mathematics, science & other subjects enhancing the memory power
- The engineering scholars equipped with Sanskrit will be able to explore the huge knowledge from ancient literature

Syllabus Contents

Unit I: Alphabets in Sanskrit, Past/Present/Future Tense, Simple Sentences
Unit II: Order, Introduction of roots, Technical information about Sanskrit Literature
Unit III: Technical concepts of Engineering-Electrical, Mechanical, Architecture, Mathematics

Suggested Readings

1. "Abhyaspustakam" – Dr.Vishwas, Samskrita-Bharti Publication, New Delhi
2. "Teach Yourself Sanskrit" Prathama Deeksha-Vempati Kutumbshastri, Rashtriya Sanskrit Sansthanam, New Delhi Publication
3. "India's Glorious Scientific Tradition" Suresh Soni, Ocean books (P) Ltd., New Delhi

Course Outcomes

Students will be able to

- Understanding basic Sanskrit language
- Ancient Sanskrit literature about science & technology can be understood
- Being a logical language will help to develop logic in students

1ST105, Value Education

Teaching Scheme

Lectures: 2 hours/week

Course Objectives

Students will be able to

- Understand value of education and self- development
- Imbibe good values in students
- Let the should know about the importance of character

Syllabus Contents

Unit I: Values and self-development –Social values and individual attitudes. Work ethics, Indian vision of humanism.
Moral and non- moral valuation. Standards and principles.
Value judgments

Unit II: Importance of cultivation of values.
Sense of duty. Devotion, Self-reliance. Confidence, Concentration. Truthfulness, Cleanliness.
Honesty, Humanity. Power of faith, National unity.
Patriotism. Love for nature, Discipline

Unit III: Personality and Behavior Development - Soul and scientific attitude. Positive thinking. Integrity and discipline.
Punctuality, Love and kindness.
Avoid fault Thinking.
Free from anger, Dignity of labour.
Universal brotherhood and religious tolerance.
True friendship.
Happiness Vs suffering, love for truth.
Aware of self-destructive habits.
Association and Cooperation.
Doing best for saving nature

Unit IV: Character and Competence –Holy books Vs Blind faith.
Self-management and Good health.
Science of reincarnation.
Equality, Nonviolence, Humility, Role of Women.

All religions and same message.
Mind your Mind, Self-control.
Honesty, Studying effectively

Suggested Readings

Chakroborty, S.K. "Values and Ethics for organizations Theory and practice", Oxford University Press, New Delhi

Course Outcomes

Students will be able to

- Knowledge of self-development
- Learn the importance of Human values
- Developing the overall personality

2ST106, Constitution of India

Teaching Scheme

Lectures: 2 hours/week

Course Objectives

Students will be able to

- Understand the premises informing the twin themes of liberty and freedom from a civil rights perspective.
- To address the growth of Indian opinion regarding modern Indian intellectuals' constitutional role and entitlement to civil and economic rights as well as the emergence of nationhood in the early years of Indian nationalism.
- To address the role of socialism in India after the commencement of the Bolshevik Revolution in 1917 and its impact on the initial drafting of the Indian Constitution.

Syllabus Contents

Unit I: History of Making of the Indian Constitution: History, Drafting Committee (Composition & Working)

Unit II: Philosophy of the Indian Constitution: Preamble, Salient Features

Unit III: Contours of Constitutional Rights & Duties:

- Fundamental Rights
- Right to Equality
- Right to Freedom
- Right against Exploitation
- Right to Freedom of Religion
- Cultural and Educational Rights
- Right to Constitutional Remedies
- Directive Principles of State Policy
- Fundamental Duties.

Unit IV: Organs of Governance:

- Parliament
- Composition
- Qualifications and Disqualifications
- Powers and Functions
- Executive
- President

- Governor
- Council of Ministers
- Judiciary, Appointment and Transfer of Judges, Qualifications
- Powers and Functions

Unit V: Local Administration:

- District's Administration head: Role and Importance,
- Municipalities: Introduction, Mayor and role of Elected Representative
- CEO of Municipal Corporation.
- Pachayati raj: Introduction, PRI: Zila Pachayat.
- Elected officials and their roles, CEO Zila Pachayat: Position and role.
- Block level: Organizational Hierarchy (Different departments),
- Village level: Role of Elected and Appointed officials.
- Importance of grass root democracy

Unit 6: Election Commission:

- Election Commission: Role and Functioning.
- Chief Election Commissioner and Election Commissioners.
- State Election Commission: Role and Functioning.
- Institute and Bodies for the welfare of SC/ST/OBC and women.

Suggested Readings

1. The Constitution of India, 1950 (Bare Act), Government Publication.
2. Dr. S. N. Busi, Dr. B. R. Ambedkar framing of Indian Constitution, 1st Edition, 2015.
3. M. P. Jain, Indian Constitution Law, 7th Edn., Lexis Nexis, 2014.
4. D.D. Basu, Introduction to the Constitution of India, Lexis Nexis, 2015.

Course Outcomes

Students will be able to

- Discuss the growth of the demand for civil rights in India for the bulk of Indians before the arrival of Gandhi in Indian politics.
- Discuss the intellectual origins of the framework of argument that informed the conceptualization of social reforms leading to revolution in India.
- Discuss the circumstances surrounding the foundation of the Congress Socialist Party [CSP] under the leadership of Jawaharlal Nehru and the eventual failure of the proposal of direct elections through adult suffrage in the Indian Constitution.
- Discuss the passage of the Hindu Code Bill of 1956.

2ST107, Pedagogy Studies

Teaching Scheme

Lectures: 2 hours/week

Course Objectives

Students will be able to

- Review existing evidence on the review topic to inform programme design and policy making undertaken by the DfID, other agencies and researchers.
- Identify critical evidence gaps to guide the development.

Syllabus Contents

Unit I: Introduction and Methodology:

- Aims and rationale, Policy background, Conceptual framework and terminology

- Theories of learning, Curriculum, Teacher education.
- Conceptual framework, Research questions**.**
- Overview of methodology and Searching.

Unit II: Thematic overview:

- Pedagogical practices are being used by teachers in formal and informal classrooms in developing countries.
- Curriculum, Teacher education.

Unit III: Evidence on the effectiveness of pedagogical practices

- Methodology for the in depth stage: quality assessment of included studies.
- How can teacher education (curriculum and practicum) and the school curriculum and guidance materials best support effective pedagogy?
- Theory of change.
- Strength and nature of the body of evidence for effective pedagogical practices.
- Pedagogic theory and pedagogical approaches.
- Teachers' attitudes and beliefs and Pedagogic strategies.

Unit IV: Professional development: alignment with classroom practices and follow up support

- Peer support
- Support from the head teacher and the community.
- Curriculum and assessment
- Barriers to learning: limited resources and large class sizes

Unit V: Research gaps and future directions

- Research design
- Contexts
- Pedagogy
- Teacher education
- Curriculum and assessment
- Dissemination and research impact.

Suggested Readings

1. Ackers J, Hardman F (2001) Classroom interaction in Kenyan primary schools, Compare, 31 (2): 245-261.
2. Agrawal M (2004) Curricular reform in schools: The importance of evaluation, Journal of Curriculum Studies, 36 (3): 361-379.
3. Akyeampong K (2003) Teacher training in Ghana - does it count? Multi-site teacher education research project (MUSTER) country report 1. London: DFID.
4. Akyeampong K, Lussier K, Pryor J, Westbrook J (2013) Improving teaching and learning of basic maths and reading in Africa: Does teacher preparation count? International Journal Educational Development, 33 (3): 272–282.
5. Alexander RJ (2001) Culture and pedagogy: International comparisons in primary education. Oxford and Boston: Blackwell.
6. Chavan M (2003) Read India: A mass scale, rapid, 'learning to read' campaign.
7. www.pratham.org/images/resource%20working%20paper%202.pdf.

Course Outcomes

Students will be able to understand:

- What pedagogical practices are being used by teachers in formal and informal classrooms

in developing countries?
- What is the evidence on the effectiveness of these pedagogical practices, in what conditions, and with what population of learners?
- How can teacher education (curriculum and practicum) and the school curriculum and guidance materials best support effective pedagogy?

2ST108, Stress Management By Yoga

Teaching Scheme
Lectures: 2 hours/week

Course Objectives
- To achieve overall health of body and mind
- To overcome stress

Syllabus Contents

Unit I: Definitions of Eight parts of yog. (Ashtanga)

Unit II: Yam and Niyam.
- Do`s and Don't's in life.
- Ahinsa, satya, astheya, bramhacharya and aparigraha
  Shaucha, santosh, tapa, swadhyay, ishwarpranidhan

Unit III: Asan and Pranayam
- Various yog poses and their benefits for mind & body
  Regularization of breathing techniques and its effects-Types of pranayam

Suggested Readings
1. "Yogic Asanas for Group Tarining-Part-I" : Janardan Swami Yogabhyasi Mandal, Nagpur
2. "Rajayoga or conquering the Internal Nature" by Swami Vivekananda, Advaita Ashrama (Publication Department), Kolkata

Course Outcomes
Students will be able to
- Develop healthy mind in a healthy body thus improving social health also
- Improve efficiency

2ST109, Personality Development Through Life Enlightenment Skills

Teaching Scheme
Lectures: 2 hours/week

Course Objectives
- To learn to achieve the highest goal happily
- To become a person with stable mind, pleasing personality and determination
- To awaken wisdom in students

Syllabus Contents	**Hours**
Unit I: Neetisatakam-Holistic development of personality • Verses- 19,20,21,22 (wisdom) • Verses- 29,31,32 (pride & heroism) • Verses- 26,28,63,65 (virtue) • Verses- 52,53,59 (dont's) • Verses- 71,73,75,78 (do's)	8
Unit II: Approach to day to day work and duties.	8

• Shrimad Bhagwad Geeta : Chapter 2-Verses 41, 47,48, • Chapter 3-Verses 13, 21, 27, 35, Chapter 6-Verses 5,13,17, 23, 35, • Chapter 18-Verses 45, 46, 48.	
Unit III: Statements of basic knowledge. • Shrimad Bhagwad Geeta: Chapter2-Verses 56, 62, 68 • Chapter 12 -Verses 13, 14, 15, 16,17, 18 • Personality of Role model. Shrimad Bhagwad Geeta: Chapter2-Verses 17, Chapter 3-Verses 36,37,42, • Chapter 4-Verses 18, 38,39 • Chapter18 – Verses 37, 38, 63	8
Suggested Readings 1. "Srimad Bhagavad Gita" by Swami Swarupananda Advaita Ashram (Publication Department), Kolkata 2. "Bhartrihari's Three Satakam (Niti-sringar-vairagya)" by P.Gopinath, Rashtriya Sanskrit Sansthanam, New Delhi.	
Course Outcomes Students will be able to • Study of Shrimad-Bhagwad-Geeta will help the student in developing his personality and achieve the highest goal in life • The person who has studied Geeta will lead the nation and mankind to peace and prosperity • Study of Neetishatakam will help in developing versatile personality of students.	

OPEN ELECTIVES

3ST201, Business Analytics	
Teaching Scheme Lectures: 3 hours/week, Total Number of Lectures: 48	
Course Objectives • Understand the role of business analytics within an organization. • Analyze data using statistical and data mining techniques and understand relationships between the underlying business processes of an organization. • To gain an understanding of how managers use business analytics to formulate and solve business problems and to support managerial decision making. • To become familiar with processes needed to develop, report, and analyze business data. • Use decision-making tools/Operations research techniques. • Manage business process using analytical and management tools. • Analyze and solve problems from different industries such as manufacturing, service, retail, software, banking and finance, sports, pharmaceutical, aerospace etc.	
Syllabus Contents	**No. of lectures**
Unit I: Business analytics: Overview of Business analytics, Scope of Business analytics, Business Analytics Process, Relationship of Business Analytics Process and organisation, competitive advantages of Business Analytics. Statistical Tools: Statistical Notation, Descriptive Statistical methods, Review of	9

probability distribution and data modelling, sampling and estimation methods overview.	
Unit II: Trendiness and Regression Analysis: Modelling Relationships and Trends in Data, simple Linear Regression. Important Resources, Business Analytics Personnel, Data and models for Business analytics, problem solving, Visualizing and Exploring Data, Business Analytics Technology.	8
Unit III: Organization Structures of Business analytics, Team management, Management Issues, Designing Information Policy, Outsourcing, Ensuring Data Quality, Measuring contribution of Business analytics, Managing Changes. Descriptive Analytics, predictive analytics, predicative Modelling, Predictive analytics analysis, Data Mining, Data Mining Methodologies, Prescriptive analytics and its step in the business analytics Process, Prescriptive Modelling, nonlinear Optimization.	9
Unit IV: Forecasting Techniques: Qualitative and Judgmental Forecasting, Statistical Forecasting Models, Forecasting Models for Stationary Time Series, Forecasting Models for Time Series with a Linear Trend, Forecasting Time Series with Seasonality, Regression Forecasting with Casual Variables, Selecting Appropriate Forecasting Models. Monte Carlo Simulation and Risk Analysis: Monte Carle Simulation Using Analytic Solver Platform, New-Product Development Model, Newsvendor Model, Overbooking Model, Cash Budget Model.	10
Unit V: Decision Analysis: Formulating Decision Problems, Decision Strategies with the without Outcome Probabilities, Decision Trees, The Value of Information, Utility and Decision Making.	8
Unit 6: Recent Trends in : Embedded and collaborative business intelligence, Visual data recovery, Data Storytelling and Data journalism.	4

Course Outcomes

- Students will demonstrate knowledge of data analytics.
- Students will demonstrate the ability of think critically in making decisions based on data and deep analytics.
- Students will demonstrate the ability to use technical skills in predicative and prescriptive modeling to support business decision-making.
- Students will demonstrate the ability to translate data into clear, actionable insights.

References

1. Business analytics Principles, Concepts, and Applications by Marc J. Schniederjans, Dara G. Schniederjans, Christopher M. Starkey, Pearson FT Press.
2. Business Analytics by James Evans, Pearson Education.

3ST202, Industrial Safety

Teaching Scheme

Lectures: 3 hours/week

Syllabus Contents

Unit-I: Industrial safety: Accident, causes, types, results and control, mechanical and electrical hazards, types, causes and preventive steps/procedure, describe salient points of factories act 1948 for health and safety, wash rooms, drinking water layouts, light, cleanliness, fire, guarding,

pressure vessels, etc, Safety color codes. Fire prevention and firefighting, equipment and methods.

Unit-II: Fundamentals of maintenance engineering: Definition and aim of maintenance engineering, Primary and secondary functions and responsibility of maintenance department, Types of maintenance, Types and applications of tools used for maintenance, Maintenance cost & its relation with replacement economy, Service life of equipment.

Unit-III: Wear and Corrosion and their prevention: Wear- types, causes, effects, wear reduction methods, lubricants-types and applications, Lubrication methods, general sketch, working and applications, i. Screw down grease cup, ii. Pressure grease gun, iii. Splash lubrication, iv. Gravity lubrication, v. Wick feed lubrication vi. Side feed lubrication, vii. Ring lubrication, Definition, principle and factors affecting the corrosion. Types of corrosion, corrosion prevention methods.

Unit-IV: Fault tracing: Fault tracing-concept and importance, decision tree concept, need and applications, sequence of fault finding activities, show as decision tree, draw decision tree for problems in machine tools, hydraulic, pneumatic, automotive, thermal and electrical equipment's like, I. Any one machine tool, ii. Pump iii. Air compressor, iv. Internal combustion engine, v. Boiler, vi. Electrical motors, Types of faults in machine tools and their general causes.

Unit-V: Periodic and preventive maintenance: Periodic inspection-concept and need, degreasing, cleaning and repairing schemes, overhauling of mechanical components, overhauling of electrical motor, common troubles and remedies of electric motor, repair complexities and its use, definition, need, steps and advantages of preventive maintenance. Steps/procedure for periodic and preventive maintenance of: I. Machine tools, ii. Pumps, iii. Air compressors, iv. Diesel generating (DG) sets, Program and schedule of preventive maintenance of mechanical and electrical equipment, advantages of preventive maintenance. Repair cycle concept and importance.

References

1. Maintenance Engineering Handbook, Higgins & Morrow, Da Information Services.
2. Maintenance Engineering, H. P. Garg, S. Chand and Company.
3. Pump-hydraulic Compressors, Audels, McGraw Hill Publication.
4. Foundation Engineering Handbook, Winterkorn, Hans, Chapman & Hall London.

3ST203, Operations Research

Teaching Scheme

Lectures: 3 hours/week

Course Outcomes

At the end of this course, students will be able to

- Apply the dynamic programming to solve problems of discreet and continuous variables.
- Apply the concept of non-linear programming.
- Carry out sensitivity analysis.
- Model the real world problem and simulate it.

Syllabus Contents

Unit I: Optimization Techniques, Model Formulation, models, General L.R Formulation, Simplex Techniques, Sensitivity Analysis, Inventory Control Models

Unit II: Formulation of a LPP - Graphical solution revised simplex method - duality theory - dual simplex method - sensitivity analysis - parametric programming

Unit III: Nonlinear programming problem - Kuhn-Tucker conditions min cost flow problem - max flow problem - CPM/PERT

Unit IV: Scheduling and sequencing - single server and multiple server models - deterministic inventory models - Probabilistic inventory control models - Geometric Programming.
Unit V: Competitive Models,Single and Multi-channel Problems, Sequencing Models, Dynamic Programming, Flow in Networks, Elementary Graph Theory, Game Theory Simulation.

References

1. H.A. Taha, Operations Research, An Introduction, PHI, 2008
2. H.M. Wagner, Principles of Operations Research, PHI, Delhi, 1982.
3. J.C. Pant, Introduction to Optimisation: Operations Research, Jain Brothers, Delhi, 2008
4. Hitler Libermann Operations Research: McGraw Hill Pub., 2009
5. Pannerselvam, Operations Research: Prentice Hall of India, 2010
6. Harvey M Wagner, Principles of Operations Research: Prentice Hall of India, 2010

3ST204, Cost Management of Engineering Projects

Teaching Scheme

Lectures: 3 hours/week

Syllabus Contents

Introduction and Overview of the Strategic Cost Management Process
Cost concepts in decision-making; Relevant cost, Differential cost, Incremental cost and Opportunity cost. Objectives of a Costing System; Inventory valuation; Creation of a Database for operational control; Provision of data for Decision-Making.
Project: meaning, Different types, why to manage, cost overruns centres, various stages of project execution: conception to commissioning. Project execution as conglomeration of technical and nontechnical activities. Detailed Engineering activities. Pre project execution main clearances and documents Project team: Role of each member. Importance Project site: Data required with significance. Project contracts. Types and contents. Project execution Project cost control. Bar charts and Network diagram. Project commissioning: mechanical and process
Cost Behavior and Profit Planning Marginal Costing; Distinction between Marginal Costing and Absorption Costing; Break-even Analysis, Cost-Volume-Profit Analysis. Various decision-making problems. Standard Costing and Variance Analysis. Pricing strategies: Pareto Analysis. Target costing, Life Cycle Costing. Costing of service sector. Just-in-time approach, Material Requirement Planning, Enterprise Resource Planning, Total Quality Management and Theory of constraints. Activity-Based Cost Management, Bench Marking; Balanced Score Card and Value-Chain Analysis. Budgetary Control; Flexible Budgets; Performance budgets; Zero-based budgets. Measurement of Divisional profitability pricing decisions including transfer pricing.
Quantitative techniques for cost management, Linear Programming, PERT/CPM, Transportation problems, Assignment problems, Simulation, Learning Curve Theory.

References

1. Cost Accounting A Managerial Emphasis, Prentice Hall of India, New Delhi
2. Charles T. Horngren and George Foster, Advanced Management Accounting
3. Robert S Kaplan Anthony A. Alkinson, Management & Cost Accounting
4. Ashish K. Bhattacharya, Principles & Practices of Cost Accounting A.H. Wheeler publisher
5. N.D. Vohra, Quantitative Techniques in Management, Tata McGraw Hill Book Co. Ltd.

3ST205, Composite Materials

Teaching Scheme

Lectures: 3 hours/week

Syllabus Contents

Unit I: Introduction: Definition – Classification and characteristics of Composite materials. Advantages and application of composites. Functional requirements of reinforcement and matrix. Effect of reinforcement (size, shape, distribution, volume fraction) on overall composite performance.

Unit II: Reinforcements: Preparation-layup, curing, properties and applications of glass fibers, carbon fibers, Kevlar fibers and Boron fibers. Properties and applications of whiskers, particle reinforcements. Mechanical Behavior of composites: Rule of mixtures, Inverse rule of mixtures. Isostrain and Isostress conditions.

Unit III: Manufacturing of Metal Matrix Composites: Casting – Solid State diffusion technique, Cladding – Hot isostatic pressing. Properties and applications. Manufacturing of Ceramic Matrix Composites: Liquid Metal Infiltration – Liquid phase sintering. Manufacturing of Carbon – Carbon composites: Knitting, Braiding, Weaving. Properties and applications.

Unit IV: Manufacturing of Polymer Matrix Composites: Preparation of Moulding compounds and prepregs – hand layup method – Autoclave method – Filament winding method – Compression moulding – Reaction injection moulding. Properties and applications.

Unit V: Strength: Laminar Failure Criteria-strength ratio, maximum stress criteria, maximum strain criteria, interacting failure criteria, hygrothermal failure. Laminate first play failure-insight strength; Laminate strength-ply discount truncated maximum strain criterion; strength design using caplet plots; stress concentrations.

Text Books

1. Material Science and Technology – Vol 13 – Composites by R.W.Cahn – VCH, West Germany.
2. Materials Science and Engineering, An introduction. WD Callister, Jr., Adapted by R. Balasubramaniam, John Wiley & Sons, NY, Indian edition, 2007.

References

1. Hand Book of Composite Materials-ed-Lubin.
2. Composite Materials – K.K.Chawla.
3. Composite Materials Science and Applications – Deborah D.L. Chung.
4. Composite Materials Design and Applications – Danial Gay, Suong V. Hoa, and Stephen W. Tasi.

3ST206, Waste to Energy

Teaching Scheme

Lectures: 3 hours/week

Syllabus Contents

Unit I: Introduction to Energy from Waste: Classification of waste as fuel – Agro based, Forest residue, Industrial waste - MSW – Conversion devices – Incinerators, gasifiers, digestors.

Unit II: Biomass Pyrolysis: Pyrolysis – Types, slow fast – Manufacture of charcoal – Methods – Yields and application – Manufacture of pyrolytic oils and gases, yields and applications.

Unit III: Biomass Gasification: Gasifiers – Fixed bed system – Downdraft and updraft gasifiers –

Fluidized bed gasifiers – Design, construction and operation – Gasifier burner arrangement for thermal heating – Gasifier engine arrangement and electrical power – Equilibrium and kinetic consideration in gasifier operation.

Unit IV: Biomass Combustion: Biomass stoves – Improved chullahs, types, some exotic designs, Fixed bed combustors, Types, inclined grate combustors, Fluidized bed combustors, Design, construction and operation - Operation of all the above biomass combustors.- Design and constructional features - Biomass resources and their classification - Biomass

Unit V: Biogas: Properties of biogas (Calorific value and composition) - Biogas plant technology and status - Bio energy system conversion processes - Thermo chemical conversion - Direct combustion - biomass gasification - pyrolysis and liquefaction - biochemical conversion - anaerobic digestion – Types of biogas Plants – Applications - Alcohol production from biomass - Bio diesel production - Urban waste to energy conversion - Biomass energy programme in India.

References

1. Non Conventional Energy, Desai, Ashok V., Wiley Eastern Ltd., 1990.
2. Biogas Technology - A Practical Hand Book - Khandelwal, K. C. and Mahdi, S. S., Vol. I & II, Tata McGraw Hill Publishing Co. Ltd., 1983.
3. Food, Feed and Fuel from Biomass, Challal, D. S., IBH Publishing Co. Pvt. Ltd., 1991.
4. Biomass Conversion and Technology, C. Y. WereKo-Brobby and E. B. Hagan, John Wiley & Sons, 1996.