College of Agricultural Engineering and Technology
Anand Agricultural University
Godhra – 389001

Renaming of PG Degree nomenclature of "Soil and Water Engineering" to "Soil and Water Conservation Engineering"

Read : Resolution of 11th Special Meeting of the Board of Management held on 20-05-2017, vide item no. 11.18.

NOTIFICATION

It is notified to all concerned that the Board of Management of the Anand Agricultural University has resolved vide item No. 11.18 in its 11th special meeting held on 20-05-2017 as under;

"It is resolved to have the uniformity with other SAUs as per the recommendation of ICAR 5th Deans' committee, the Board of Management approves the renaming of the PG degree nomenclature of "Soil and Water Engineering" to "Soil and Water Conservation Engineering" in faculty of Agricultural Engineering and Technology for the students to be admitted from the academic year 2017-18 as recommended by Academic Council."

No:-AAU/CAET/Acad/ 2206-26 /2017
Date:- 01/ 05 /2017

(Dr. R. Subbaiah)
Principal & Dean
College of Agril. Engg. & Tech.

Copy F.w.cs. to:

1. All the members of the Board of management of this University
2. All the members of the Academic council of management of this University
3. All officers of this University
4. All Deans / Principals of this University
5. The Registrar, Anand Agricultural University, Anand
6. Unit/Sub Unit Officers of this University

Copy to:

7. P.S. to Hon. Vice Chancellor, Anand Agricultural University, Anand
8. P.A. to Registrar, Anand Agricultural University, Anand
9. All the HoDs of this college
10. Academic Branch of the university (20 Copies) / this college
11. Notification File

AGRICULTURAL ENGINEERING

Defining UG & PG degree for general market needs & for specialized jobs and uniformity in UG & PG degree nomenclature

Possibility of change in UG degree nomenclature such as B. Tech. (Agricultural and Bio-systems Engineering) as proposed by the "Committee on Minimum Standards of Higher Agricultural Education- Agricultural Engineering" were discussed in detail. It was pointed out that, at present in our country, B. Tech. (Agril. Engg.) or B.E. (Agril. Engg.) is the approved required qualification for different jobs in the government sector. Majority of the delegates were of the view that changing the degree nomenclature would have adverse impact on the job opportunities of agricultural engineering graduates in various central and state government departments where they have to compete with other disciplines like with civil engineering/agriculture graduates in soil conservation. Similarly the recommendations of the "Essential Qualification and Degree Nomenclature Review Committee" were discussed for possible change in the PG degree nomenclature. Majority of the delegates were of the view that the PG degree nomenclature should be as per the nomenclature of different departments reflecting the major disciplines of Agricultural Engineering. Delegates were of the view that more departments may have to be created in future as per the need for specialisation in different aspect of agricultural engineering and as such the PG degree nomenclature should suit needed specialisation to avoid recruitment problems. Finally the following decision was taken regarding the UG and PG degree nomenclature for the disciple of Agricultural Engineering:

i) **UG Degree:** B. Tech. (Agricultural Engineering)

ii) **PG Degree:** M. Tech. / P.hD (Agricultural Engineering) with specialisation in

- Soil and Water Conservation Engineering
- Irrigation and Drainage Engineering
- Farm Machinery and Power Engineering
- Processing and Food Engineering
- Renewable Energy Engineering

Restructuring of UG programme for increased practical contents

Names of Departments

1. Basic Engineering Applied Sciences
2. Soil and Water Conservation Engineering
3. Irrigation and Drainage Engineering
4. Farm Machinery and Power Engineering
5. Processing and Food Engineering
6. Renewable Energy Engineering

Taking fourth Deans Committee recommendations related to Agricultural Engineering as the base criteria, the issue was discussed at length. There was unanimous consensus on different aspects such as thorough restructuring of the distribution of different courses as per future challenges and recent developments, more emphasis on basic course of agricultural sciences for increased exposure of the student to the problems and practices of agricultural fields and inclusion of special courses on communication skills and personality development for increased employability of the graduating students. The delegates were also of the view that the total credit load as approved by fourth Deans Committee for B. Tech. Agricultural

ORGANIZATION OF COURSE CONTENTS & CREDIT REQUIREMENTS

Code Numbers

- All courses are divided into two series: 500-series courses pertain to Master's level, and 600-series to Doctoral level. A Ph. D. student must take a minimum of two 600-series courses, but may also take 500-series courses, if not studied during Master's programme.
- Credit seminar for Master's level is designated by code no. 591, and the two seminars for Doctoral level are coded as 691 and 692, respectively.
- Similarly, 599 and 699 codes have been given for Master's research and Doctoral research, respectively.

Course Contents

The contents of each course have been organized into:

Objective – to elucidate the basic purpose.

- Theory units – to facilitate uniform coverage of syllabus for paper setting.
- Suggested Readings – to recommend some standard books as reference material. This does not unequivocally exclude other such reference material that may be recommended according to the advancements and local requirements.
- A list of journals pertaining to the discipline is provided at the end which may be useful as study material for 600-series courses as well as research topics.
- E-Resources - for quick update on specific topics/events pertaining to the subject.
- Broad research topics provided at the end would facilitate the advisors for appropriate research directions to the PG students.

Minimum Credit Requirements

Subject	Master's programme	Doctoral programme
Major	20	15
Minor	09	08
Supporting	05	05
Seminar	01	02
Research	20	45
Total Credits	**55**	**75**
Compulsory Non Credit Courses	See relevant section	

Major subject: The subject (department) in which the students takes admission

Minor subject: The subject closely related to student's major subject (e.g., if the major subject is Entomology, the appropriate minor subjects should be Plant Pathology & Nematology).

Supporting subject: The subject not related to the major subject. It could be any subject considered relevant for student's research work.

Non-Credit Compulsory Courses: Please see the relevant section for details. Six courses (PGS 501-PGS 506) are of general nature and are compulsory for Master's programme. Ph.D. students may be exempted from these courses, if already studied during Master's degree.

SOIL AND WATER ENGINEERING

Course structure at a glance

CODE	COURSE TITLE	CREDITS
SWE 501*	WATERSHED HYDROLOGY	2+1
SWE 502*	DESIGN OF FARM IRRIGATION SYSTEMS	2+1
SWE 505*	SOIL AND WATER CONSERVATION ENGINEERING	2+1
SWE 504*	GROUND WATER ENGINEERING	2+1
SWE 503	AGRICULTURAL DRAINAGE SYSTEMS	2+1
SWE 506	CROP ENVIRONMENTAL ENGINEERING	2+0
SWE 507	DESIGN OF PUMPS FOR IRRIGATION AND DRAINAGE	2+0
SWE 508	OPEN CHANNEL FLOW	3+0
SWE 509	FLOW THROUGH POROUS MEDIA	2+0
SWE 510	WATER RESOURCES SYSTEM ENGINEERING	3+0
SWE 511	GIS AND REMOTE SENSING FOR LAND AND WATER RESOURCE MANAGEMENT	2+1
SWE 512	WATERSHED MANAGEMENT AND MODELING	2+1
SWE 513	LAND DEVELOPMENT AND EARTH MOVING MACHINERY	2+0
SWE 591	MASTER'S SEMINAR	1+0
SWE 592	SPECIAL PROBLEM	0+1
SWE 595#	INDUSTRY/ INSTITUTE TRAINING	NC
SWE 599	MASTER RESEARCH	20

SWE 601**	ADVANCED HYDROLOGY	3+0
SWE 602**	SOIL AND WATER SYSTEMS' SIMULATION AND MODELING	2+1
SWE 603	MODELING SOIL EROSION PROCESSES	2+1
SWE 604	ADVANCED HYDRO-MECHANICS IN SOIL AQUIFER SYSTEMS	3+0
SWE 605	HYDRO-CHEMICAL MODELING AND POLLUTANT MANAGEMENT	3+0
SWE 606	PLANT GROWTH MODELING AND SIMULATION	3+0
SWE 607	ADVANCES IN IRRIGATION AND DRAINAGE	2+0
SWE 691	DOCTORAL SEMINAR I	1+0
SWE 692	DOCTORAL SEMINAR II	1+0
SWE 693	SPECIAL PROBLEM	0+1
SWE 694	CASE STUDY	0+1
SWE 699	DOCTORAL RESEARCH	45

* Compulsory for Master's programme; ** Compulsory for Doctoral programme
# SWE 595 – Minimum of Three Weeks Training

Note:
Some of the identified Minor/Supporting fields are Mechanical Engineering, Processing & Food Engineering, Energy in Agriculture, Civil Engineering, Computer Science, Electrical Engineering, Mathematics and Statistics; the contents of some of the identified M /Supporting courses have been given.

SOIL AND WATER ENGINEERING

Course Contents

SWE 501 WATERSHED HYDROLOGY 2+1

Objective
To acquaint and equip the students about hydrological process and analysis of hydrological data required for design process

Theory
UNIT I
Hydrologic processes and systems; Hydrologic problems of small watersheds; Hydrologic characteristics of watersheds.
UNIT II
Measurement and analysis of hydrologic parameters, rainfall- runoff models, stream flow measurement and analysis of data.
UNIT III
Hydrograph analysis; Unit hydrograph theory; Synthetic and dimension less hydrograph, convolution of unit hydrograph.
UNIT IV
Concept of hydraulic flood routing, flood routing (reservoir and channel routing).
UNIT V
Definition and concept of different types of hydrologic models for simulation of hydrologic problems.

Practical
Rainfall analysis, runoff computation, construction of hydrographs, Delineation of watershed, hydrograph analysis, reservoir and channel routing, hydrologic models, visit to dam sites.

Suggested Readings
Chow VT, David, M & Mays LW. 1988. *Applied Hydrology*. McGraw Hill.
Ghanshyan Das 2000. *Hydrology and Soil Conservation Engineering*. Prentice Hall.
Tideman EM. 1996. *Watershed Management*. Omega Scientific Publ.

SWE 502 DESIGN OF FARM IRRIGATION SYSTEMS 2+1

Objective
To acquaint and equip with the irrigation principles, design consideration of surface irrigation and micro irrigation systems and their evaluation system.

Theory
UNIT I
Concepts of Irrigation; Irrigation principles, losses, conveyance, distribution; Application, scheduling parameters, water budgeting.
UNIT II
Surface irrigation, hydraulics of water advance and recession, hydraulic resistance to flow, gravity irrigation.
UNIT III
Design of Border irrigation, furrow irrigation, check basin irrigation; Sub Irrigation methods and concepts.

UNIT IV
Preliminary design criteria of sprinkler and micro irrigation systems, hydraulics of sprinkler and micro irrigation systems. Design of lateral, submain and main line of sprinkler and micro irrigation. Fertigation aspects.
UNIT V
Underground water conveyance system; Evaluation of irrigation systems and practices.

Practical
Design and evaluation of border, furrow, check basin, sprinkler and micro irrigation, computation of frictional losses, Design of underground water conveyance systems, economics of irrigation methods, visit to mechanized farms.

Suggested Readings

Finkel HJ. 1983.*Handbook of Irrigation Technology*. Vols. I-II. CRC Press.
Ivan E Henk. 1951. *Irrigation Engineering*. Vol. I. John Wiley & Sons.
Karmeli D, Peri G & Todes M. 1985.*Irrigation Systems: Design and Operation*. Oxford Univ. Press.
Pillsbury AF. 1972. *Sprinkler Irrigation*. FAO Agricultural Development Paper No. 88, FAO.
Rydzewski 1987. *Irrigation Development Planning*. John Wiley & Sons.
Sivanappan RK, Padmakumari O & Kumar V. 1987. *Drip Irrigation*. Keerthy Publ. House.
Sivanappan RK. 1987. *Sprinkler Irrigation*. Oxford & IBH.

SWE 503 AGRICULTURAL DRAINAGE SYSTEMS 2+1

Objective
To acquaint and equip with the importance and phenomenon of drainage system along with design consideration of surface and sub-surface drainage systems.

Theory
UNIT I
Theories and applications of surface and sub-surface drainage, steady state, unsteady state drainage equations for layered and non-layered soils, horizontal sub-surface drainage.
UNIT II
Principle and applications of Earnst, Glover Dumm, Kraijenhoff-van-de-leur equations.
UNIT III
Salt balance, leaching requirement and management practices under drained conditions.
UNIT IV
Design of different components of sub-surface drainage systems, theories of vertical drainage and multiple well point systems.
UNIT V
Disposal of drainage effluents, Management of drainage projects of water- logged and saline soils, case studies.

Practical
Measurement of in-situ hydraulic conductivity, estimation of drainage coefficient and leaching requirements, Delineation of waterlogged areas through isobar, isobath and topographic maps. Design of surface and sub- surface drainage systems, design of filter and envelop materials.

Suggested Readings

Battacharaya AK & Micheal AM. 2003. *Land Drainage*. Vikas Publ.
Clande Ayres & Daniel Scoates A.E. 1989.*Level Drainage and Reclamation*. McGraw Hill.
Luthin JN. 1978. *Drainage Engineering*. Wiley Eastern.
Ritzema HP. (Ed.). 1994. *Drainage Principles and Applications*. ILRI.
Roe CE 1966. *Engineering for Agricultural Drainage*. McGraw Hill.

SWE 504 GROUNDWATER ENGINEERING 2+1

Objective
To acquaint and equip with the occurrence, development and hydraulics of groundwater flow.

Theory
UNIT I
Properties affecting groundwater storage and movement, groundwater balance studies.
UNIT II
Well hydraulics, two dimensional flow, steady and unsteady state flow in confined, unconfined and semi-confined aquifers, steady flow in sloping aquifers, partial penetrating wells. Analysis of multi-aquifers.
UNIT III
Flow analysis in interfering wells. Pumping tests and determination of aquifer parameters.
UNIT IV
Groundwater modeling for water resources planning.
UNIT V
Techniques for groundwater recharge.

Practical
Water table contour maps and determination of groundwater flow, estimation of aquifer characteristics, problems on non leaky and leaky aquifers, analysis of pumping test data; Computation of interference of wells; groundwater computer simulation models.

Suggested Readings

Boonstra J & de Ridder NA. 1981. *Numerical Modeling of Groundwater Basins*. ILRI.
Domenico PA. 1972. *Concept and Models in Groundwater Hydrology*. McGraw Hill.
Hantush MS. (Ed.). 1964. *Advances in Hydro Sciences*. Vol. I. Academic Press.
Harr ME 1990. *Ground Water and Seepage*. Wiley Eastern.
Huisman L. 1972. *Groundwater Recovery*. MacMillan.
Polubarinova Kochina P Ya 1962.*Theory of Ground Water Movement*. Princeton Univ. Press.
Raghunath HM. 1992. *Ground Water*. Wiley Eastern.
Todd DK. 1997. *Ground Water Hydrology*. Wiley Eastern.

SWE 505 SOIL AND WATER CONSERVATION ENGINEERING 2+1

Objective
To acquaint and equip students with the process of degradation soil and water conservation and their remedial measures including design of structures.

Theory

UNIT I

Probability and continuous frequency distribution; Fitting empirical distributions.

UNIT II

Layout and planning of soil and water conservation measures; Design principles of soil and water structures including contour bunds and terraces; Gully control measures.

UNIT III

Hydraulic jump and energy dissipaters 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.

Practical

Design of Drop spillway, chute spillway, drop inlet spillway, hydraulic jump Calculation, design of bench terrace, contour bunds and contour trenches, Design and problems on earthen dam, silt detention tanks and check dams, visit to soil conservation structures sites.

Suggested Readings

Garde RJ & Ranga Raju KG. 1977. *Mechanics of Sediment Transport and Alluvial Stream Problems*. Willey Eastern.

Gurmel Singh *et al*. 1994. *Manual of Soil and Water Conservation Practices*. Oxford & IBH.

Hudson N.1971. *Soil Conservation*. B.T. Batsford Ltd.

Murthy VVN. 1998. *Land and Water Management Engineering*. Kalyani.

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

SWE 506 CROP ENVIRONMENTAL ENGINEERING 2+0

Objective

To acquaint and equip with the process of soil-water-plant relationship and their interaction for crop growth.

Theory

UNIT I

Aerial and edaphic environments for plant growth, energy and mass transfer in and above crop canopies.

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 behaviour.

UNIT V

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

Suggested Readings

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

Slatyor OP. 1967. *Plant Water Relationship*. Academic Press.

SWE 507 DESIGN OF PUMPS FOR IRRIGATION AND DRAINAGE 2+0

Objective

To acquaint and equip with requirement of pumps for irrigation and drainage system and their design features.

Theory

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 and their design.

UNIT III

Non-conventional energy sources for pumping, wind mills, micro turbines, solar pumps, hydraulic ram- their selection and design criteria.

UNIT IV

Design of pumping station, techno-economic evaluation. Energy conservation measures for pumping systems.

Suggested Readings

Church AH & Jagdish Lal 1973 *Centrifugal Pumps and Blowers*. Metropolitan Book Co.

Michael AM & Khepar SD. 1989. *Water Well and Pump Engineering*. Tata McGraw Hill.

Michael AM. 1990. *Irrigation Theory and Practice*. Vikas Publ. House.

Modi PN & Seth SM. 2000 *Hydraulic and Fluid Mechanics*. Standard Book House.

SWE 508 OPEN CHANNEL FLOW 3+0

Objective

To acquaint and equip with the hydraulics of surface water flow phenomenon in open channels

Theory

UNIT I

Open channel and their properties, energy and momentum, critical flow computation and application.

UNIT II

Uniform flow; gradually varied flow theory and analysis, methods of computation.

UNIT III

Practical problems such as design of transitions, flow passing Islands etc. spatially varied flow, rapidly varied flow.

UNIT IV

Hydraulic jump and its use as energy dissipator, flow through channel of non-linear alignment and flow through non-prismatic channel sections.

UNIT V

Unsteady flow, gradually varied unsteady flow and rapidly varied unsteady flow.

UNIT IV
Watershed management research instrumentation and measurement, problem identification, simulation and synthesis.
UNIT V
Modelling of flood and drought phenomenon, drought management and dry farming.

Practical
Preparation of watershed development proposal, preparation of water shed evaluation report. Application of Models of flood and drought phenomenon. Application of watershed models.

Suggested Readings

Isobel W Heathcote. 1998. *Integrated Watershed Management: Principles and Practice*. Wiley Publ.
Kenneth N Brooks, Peter F Ffolliott, Hans M Gregersen, Leonard F DeBano. 1991. *Hydrology and the Management of Watersheds*.Wiley-Blackwell.

SWE 513 LAND DEVELOPMENT AND EARTH MOVING MACHINERY 2+0

Objective
To acquaint and equip the students with the Land Development and Earth Moving Machinery modeling and modeling systems

Theory
UNIT I
Objectives, methods and equipment for land clearing and development. Machinery selection, mechanics of operation and vegetation types.
UNIT II
Earth moving machinery and earthmoving mechanics. Grading of sloppy lands. Principles of mechanisms used in crawler mounted tractors.
UNIT III
Earth diggers and ditchers. Bull dozers and scrapers. Elevating and self powered graders. Automation of earth moving and grading machines. Lazer guided leveler with global positioning system.
UNIT IV
Boring machines. Different methods of boring.

Suggested Readings

Dutta SK. 1987. *Soil Conservation and Land Management*. International Distributors, Dehradun.
Eric C Orlem.1997. *Earth-Moving Machines*. Motorbooks International.
Kuhar JE. 1977. *The Precision Farming Guide for Agriculturalist*. Lori J. Dhabalt, USA.
Nichols HL & Day DH.1998. *Moving the Earth. The Work Book of Excavation*. McGraw Hill.
Peurifoy RL. 1956. *Construction, Planning, Equipment and Methods*.McGraw Hill.
Roger V Amato & Donald J Heimburger 2003. *Classic Vintage Crawlers and Dozers*. B Heimburger House Publ.
Singh G.1991. *Manual of Soil and Water Conservation Engineering*. Oxford & IBH.

SWE 601 ADVANCED HYDROLOGY 3+0

Objective
To acquaint and equip the students with advanced hydrological process, analysis of hydrological data and their application for modeling.

Theory
UNIT I
Hydrologic models, processes and systems. Uncertainty in hydrological event. Statistical homogeneity.
UNIT II
Probabilistic concept Frequency analysis. Co-relation and regression analysis. Probability distribution of hydrological variables.
UNIT III
Time series analysis. Markov processes.
UNIT IV
Formulation of various steps of statistical models and their application in hydrology.

Suggested Readings

Garg SK.1987. *Hydrology and Water Resources Engineering*. Khanna Publ.
Hann CT. *Advanced Hydrology*. Oxford Publ. House.
Linseley RK Jr., Kohler MA & Paulhus JLH. 1975. *Applied Hydrology*. McGraw Hill.
Mutreja KN.1986. *Applied Hydrology*. Tata McGraw Hill.

SWE 602 SOIL AND WATER SYSTEMS' SIMULATION AND MODELING 2+1

Objective
To acquaint and equip the students with the simulation of soil water systems and modeling techniques.

Theory
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 flow simulation - parameters and calibration - Streamflow 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.

Practical
Rainfall - Runoff models - Infiltration models - Stanford watershed model (SWM) - channel flow simulation problems - stream flow statistics – model parameters and input data requirements of various softwares of surface hydrology and groundwater – Hydrologic Modelling System – Soil Water Management Model – Soil Water Assessment Tool – Catchments, Simulation Hydrology Model – Stream flow model and use of dimensionless unit hydrograph – Generalized groundwater models.

Suggested Readings

Chaudhry MH. 1993. *Open Channel Flow*. Prentice Hall.
Chow VT. 1959. *Open Channel Hydraulics*. Mc-Graw Hill.
Henederson FM. 1966. *Open Channel Flow*. MacMillan.

SWE 509 FLOW THROUGH POROUS MEDIA 2+0

Objective

To acquaint and equip with the hydraulics and process of water flow in the water bearing formation under saturated as well as unsaturated conditions.

Theory

UNIT I

Aquifer and fluid properties, forces holding water in soils, hydrodynamics in porous media and limitations of governing laws.

UNIT II

Differential equations of saturated flow, initial and boundary conditions. Dupuit and Business approximations and linearization techniques.

UNIT III

Stream functions, potential functions and flow net theory. Analysis of seepage from canals and ditches.

UNIT IV

Unsaturated flow theory, Infiltration and capillary rise flux dynamics. Hydro-dynamic dispersion in soil-aquifer system.

Suggested Readings

Harr Milton E. 1962. *Groundwater and Seepage*. McGraw-Hill.
Jacob Beer 1972. *Dynamics of Fluid Flow in Porous Media*. Elsevier.
Muskat M & Wyckoff RD. 1946. *The Flow of Homogeneous Fluids through Porous Media*. JW Edwards.
Patrick A Domenico & Schwartz FW. 1998. *Physical and Chemical Hydrogeology*. John Wiley & Sons.
Remson I, Hornberger GM & Moiz Fred J. 1971. *Numerical Methods in Subsurface Hydrology*. Wiley Interscience.

SWE 510 WATER RESOURCES SYSTEM ENGINEERING 3+0

Objective

To acquaint and equip with the techniques for optimization of water resources for achieving maximum output.

Theory

UNIT I

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

UNIT II

Mathematical programming techniques, linear programming and its extension: gradient method, simplex method, non-linear programming classical optimization.

UNIT III

Geometric programming and dynamic programming, application of optimization techniques for water resources.

UNIT IV

Development and management including conjunctive use, crop production functions and irrigation optimization.

Suggested Readings

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

SWE 511 GIS AND REMOTE SENSING FOR LAND AND WATER RESOURCE MANAGEMENT 2+1

Objective

To acquaint and equip with the techniques of Remote Sensing and application of GIS for land and water resources management.

Theory

UNIT I

Basic principles of remote sensing and sensors. Elements of photogrametry.

UNIT II

Electromagnetic spectrum. Energy interaction with surface features, Aerial photo and satellite imagery. Photo and image interpretation.

UNIT III

Principles of Geographical Information System tools, their types and capabilities, Advantages of GIS over conventional methods.

UNIT IV

Importance of ground truth establishment, 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.

Practical

Familiarization with remote sensing and GIS hardware, software and their principle of working, Methods of establishing ground truth, Comparison between ground truth and remotely sensed data, Application of GIS packages.

Suggested Reading

De Mess MN. 2004. *Fundamental of Geographic Information System*. John Wiley & Sons.
Lille Sand T & Kaiffer R.1987. *Remote Sensing and Image Interpretation*. John Wiley & Sons.
Sabbins F.1987. *Remote Sensing Principle and Interpretation*. Freeman.

SWE 512 WATERSHED MANAGEMENT AND MODELING 2+1

Objective

To acquaint and equip the students with the watershed management modeling and modeling systems.

Theory

UNIT I

Problems of desertification and degradation. Models of sediment yield.

UNIT II

Survey, monitoring, reclamation and conservation of agricultural and forest lands, hill slopes and ravines.

UNIT III

Concept of operational watershed. National land use policy, legal and social aspects.

UNIT III
Input environment and techniques of monitoring plant environment, process and aspect of growth and development. Input yield models.
UNIT IV
Quantitative analysis of plant processes light photo-syntheses, respiration, growth, water uptake etc. and their mathematical modeling.

Suggested Readings

Loomis RS, Connor DJ.1992. *Crop Ecology: Productivity and Management in Agricultural System*. Cambridge Univ. Press.
Spedding CRW. 1979. *An Introduction to Agricultural Systems*. Applied Science Publ.
Thornley JHM & Johnson IR. 1990. *Plant and Crop Modelling. A Mathematical Approach to Plant and Crop Physiology*. Clarendon Press. Oxford Science Publ.

SWE 607 ADVANCES IN IRRIGATION AND DRAINAGE 2+0

Objective
To acquaint and equip the students with the advance application of irrigation and drainage system along with applicability of various models.

Theory
UNIT I
Advances in surface irrigation systems- surge irrigation: effect of surging on surface flow hydraulics, cablegation: water supply management.
UNIT II
Atomization in sprinkler and micro irrigation system; multipurpose and special uses of micro irrigation.
UNIT III
Synthetic materials for drainage systems. Environmental issues related to drainage. Socio-economic impacts of drainage systems.
UNIT IV
Controlled drainage for reducing agricultural non point pollution. Application of simulation models for drainage systems.

Suggested Readings

FAO. 1982. *Mechanized Sprinkler Irrigation*. FAO Irrigation & Drainage Paper 35.
FAO. 1989. *Guidelines for Designing and Evaluating Surface Irrigation System*. FAO Irrigation & Drainage Paper 45.
Keller J & Bliesner RD. 1990. *Sprinkler and Trickle Irrigation*. Chapman & Hall.
Ritzema HP. (Ed.). 1994. *Drainage Principles and Applications*. ILRI.
Walker WR & Skogerboe GV. 1987. *Surface Irrigation: Theory and Practice*. Prentice Hall.

List of Journals

- Ground Water
- Journal of Hydrology
- Journal of Soil Conservation
- Journal of Water Management
- Transactions of ASAE
- Transactions of ASCE
- Water Resource Research

Suggested Broad Topics for Master's and Doctoral Research

- Groundwater Modeling
- Hydrologic Modeling of Watersheds
- Conjunctive use of surface and groundwater
- Design and evaluation of irrigation and drainage systems and soil conservation measures
- Rainfall runoff modeling
- Evaluation of canal command area
- Water productivity analysis
- Water and energy saving technologies
- Application of modern tools such as Remote Sensing, GIS and simulation modeling for soil and water management strategies

Suggested Readings

Biswas AK. 1976. *Systems Approach to Water Management*. McGrawHill.
Cox DR & Mille HD. 1965.*The Theory of Stochastic Processes*. John Wiley & Sons.
Eagleson PS. 1970. *Dynamic Hydrology*. McGraw Hill.
Himmel Blau DM & Bischoff KB. 1968. *Process Analysis and Simulation Deterministic Systems*. John Wiley & Sons.
Linsley RK, Kohler MA & Paulhus JLH. 1949. *Applied Hydrology*.McGraw Hill.
Schwar RS & Friedland B. 1965. *Linear Systems*. McGraw Hill.
Ven Te Chow, David R Maidment & Mays LW. 1998. *Applied Hydrology*. McGraw Hill.

SWE 603 MODELING SOIL EROSION PROCESSES 2+1

Objective

To acquaint and equip the students with the advance erosion process along with tools required and application of soil erosion models.

Theory

UNIT I

Overland flow, basic theory of particle movement and sediment transport; sediment deposition process.

UNIT II

Estimation of sediment load; mechanics of soil erosion by water and wind.

UNIT III

Water and wind erosion control measures.

UNIT IV

Universal soil loss equation; stochastic models and dynamic models.

Practical

Computation of soil erosion index; Estimation of soil erodibility factor; Design of erosion control structures. Computation of suspended load and sediment load using empirical formulae; Application of sediment yield models, prediction of sediment loss – computation of reservoir sedimentation – sounding method.

Suggested Readings

Garde RJ & Ranga Raju KG. 1977. *Mechanics of Sediment Transport and Alluvial Stream Problems*. Wiley Eastern Ltd.
Morgan RPC. (Ed. D. A. Davidson). 1986. *Soil Erosion and Conservation*. ELBS,Longman.
USDA. 1969. *A Manual on Conservation of Soil and Water*. Oxford & IBH.

SWE 604 ADVANCED HYDO-MECHANICS IN SOIL AQUIFER SYSTEMS 3+0

Objective

To acquaint and equip the students with the advance soil-aquifer-water mechanics and various techniques for the analysis of the system.

Theory

UNIT I

Soil aquifer system. Flow of water in partially saturated soils. Partial differential equation of flow.

UNIT II

Determination of unsaturated hydraulic conductivity and models for its estimation.

UNIT III

Infiltration and exfiltration from soils in absence and presence of water table. Movement of groundwater in fractured and swelling porous media.

UNIT IV

Spatial variability. Theory of krigging. Statistical approaches in soil water dynamics.

Suggested Readings

Kirkham & Powers.1972. *Advanced Soil Physics*. John Wiley & Sons.
Muskut M.1937. *The Flow of Homogeneous Fluid through Porous Media*. McGraw Hill.

SWE 605 HYDRO-CHEMICAL MODELING AND POLLUTANT MANAGEMENT 3+0

Objective

To acquaint and equip the students with the hydrodynamics of fluid and pollutant flow and the impact analysis of contaminant transport through modeling.

Theory

UNIT I

Hydrodynamics in flow through porous media, Hydrodynamic dispersion, diffusion, convection equation.

UNIT II

Analytical and numerical models of contaminant transport in unsaturated soil profile and ground water.

UNIT III

Water quality management in lakes and reservoirs; physical characteristics; hydrologic and chemical budgets; bio-geochemical processes of pollutants; assessment methods.

UNIT IV

Classical wastewater problems; Water reclamation, reuse, water quality constraints and considerations for reuse in irrigation and industry; Biological wastewater treatment.

UNIT V

Modern stream pollution problem. Quality of groundwater and sources of contaminants. Cost economics – environment impact assessment.

Suggested Readings

Larry W Mays 1996. *Water Resources Handbook*. McGraw Hill.
Metcalf and Eddey 1994. *Wastewater Treatment Engineering and Reuse*. John Wiley.
Soli J Arceivala 1998. *Wastewater Treatment for Pollution Control*. Tata McGraw-Hill.

SWE 606 PLANT GROWTH MODELING AND SIMULATION 3+0

Objective

To acquaint and equip the students with the simulation and modeling techniques in the soil, plant and water environment for crop growth.

Theory

UNIT I

Introduction to crop growth modeling. Simulation and simulation techniques. Types of models and modeling approaches.

UNIT II

Relational diagram for principal process, structures of a generalized agricultural simulator.

UNIT III

Concept and connotations of rural development, rural development policies and strategies. Rural development programmes: Community Development Programme, Intensive Agricultural District Programme, Special group – Area Specific Programme, Integrated Rural Development Programme (IRDP) Panchayati Raj Institutions, Co-operatives, Voluntary Agencies /Non-Governmental Organizations. Critical evaluation of rural development policies and programmes. Constraints in implementation of rural policies and programmes

Suggested Readings

Bhalla GS & Singh G. 2001.*Indian Agriculture - Four Decades of Development*. Sage Publ.

Punia MS. *Manual on International Research and Research Ethics*. CCS, Haryana Agricultural University, Hisar.

Rao BSV. 2007. *Rural Development Strategies and Role of Institutions - Issues, Innovations and Initiatives*. Mittal Publ.

Singh K. 1998.*Rural Development - Principles, Policies and Management*. Sage Publ

PGS 506 (e-Course) DISASTER MANAGEMENT. 1+0

Objective

To introduce learners to the key concepts and practices of natural disaster management; to equip them to conduct thorough assessment of hazards, and risks vulnerability; and capacity building

Theory

UNIT I

Natural Disasters- Meaning and nature of natural disasters, their types and effects. Floods, Drought, Cyclone, Earthquakes, Landslides, Avalanches, Volcanic eruptions, Heat and cold Waves, Climatic Change: Global warming, Sea Level rise, Ozone Depletion

UNIT II

Man Made Disasters- Nuclear disasters, chemical disasters, biological disasters, building fire, coal fire, forest fire. Oil fire, air pollution, water pollution, deforestation, Industrial wastewater pollution, road accidents, rail accidents, air accidents, sea accidents.

UNIT III

Disaster Management- Efforts to mitigate natural disasters at national and global levels. International Strategy for Disaster reduction. Concept of disaster management, national disaster management framework; financial arrangements; role of NGOs, Community-based organizations, and media. Central, State, District and local Administration; Armed forces in Disaster response; Disaster response: Police and other organizations

Suggested Readings

Gupta HK. 2003.*Disaster Management*. Indian National Science Academy. Orient Blackswan.

Hodgkinson PE & Stewart M. 1991.*Coping with Catastrophe: A Handbook of Disaster Management*. Routledge.

Sharma VK. 2001.*Disaster Management*. National Centre for Disaster Management, India.

ANNEXURE - III

Item No. 15.3 **અનુસ્નાતક કક્ષાએ લેખિત પ્રવેશ પરીક્ષાના માર્કસ (કટ ઓફ સિવાય) તેમજ અનુસ્નાતક કક્ષાએ મેળવેલ માર્કસ મેળવી મેરીટ બનાવવા બાબત**

આ અંગે ચર્ચાને અંતે નીચે મુજબ ઠરાવવામાં આવ્યું

"આથી ઠરાવવામાં આવે છે કે, અનુસ્નાતક કક્ષાએ પ્રવેશ પરીક્ષામાં અગાઉ કટ ઓફ તરીકે ૫૦% માર્કસએ પાસીંગની અમલવારી હતી તે રદ્દ કરી લેખિત પ્રવેશ પરીક્ષામાં મેળવેલ માર્કસના ૫૦% (કટ ઓફ માર્કસ ધ્યાને લીધા સિવાય) તથા સ્નાતક અભ્યાસક્રમમાં મેળવેલ ગુણના ૫૦% (O.G.P.A.) આધારે મેરીટ તૈયાર કરવાનું ઠરાવવામાં આવ્યું જેનો અમલ નવા શૈક્ષણિક વર્ષ (૨૦૧૭–૧૮)થી કરવાનો રહેશે. તે મુજબ વિદ્યાપરિષદને ભલામણ કરવામાં આવે છે."

(અમલ: કુલસચિવ)

Item No. 15.4 **Starting P.G. programme in 'Irrigation and Drainage Engineering' discipline in Faculty of Agricultural Engineering**

The matter was discussed and it was resolved as under

"It is hereby resolved to initiate PG programme in the discipline of 'Irrigation and Drainage Engineering' in Faculty of Agricultural Engineering as per **(Annexure-I)** from the academic year 2017-18. The resolution is recommended to the Academic Council for its approval."

(Action: Principal & Dean, Agri. Engg. & Tech., Godhra)

Item No. 15.5 **Approval of the syllabus of PG Programmes in Food Technology**

The matter was discussed and it was resolved as under

"It is resolved that the syllabus of PG Programmes in Food Technology as per **Annexure-I** is hereby approved and recommended to the Academic Council for its approval."

(Action: Principal & Dean, F.P.T. & B.E.)

Item No. 15.6 **Renaming of PG Degree nomenclature of 'Soil and Water Engineering' to 'Soil and Water Conservation Engineering'**

The matter was discussed and it was resolved as under

"It is hereby resolved to rename the PG Degree nomenclature of 'Soil and Water Engineering' to 'Soil and Water Conservation Engineering' in Faculty of Agricultural Engineering from the academic year 2017-18. The resolution is recommended to the Academic Council for its approval."

(Action: Principal & Dean, Agri. Engg. & Tech., Godhra)

Communication Skills -Grammar (Tenses, parts of speech, clauses, punctuation marks); Error analysis (Common errors); Concord; Collocation; Phonetic symbols and transcription; Accentual pattern: Weak forms in connected speech: participation in group discussion: Facing an interview; presentation of scientific papers.

Suggested Readings

Chicago Manual of Style. 14th Ed. 1996. Prentice Hall of India.
Collins' Cobuild English Dictionary. 1995. Harper Collins.
Gordon HM & Walter JA. 1970. *Technical Writing*. 3rd Ed. Holt, Rinehart & Winston.
Hornby AS. 2000.*Comp. Oxford Advanced Learner's Dictionary of Current English*. 6th Ed. Oxford University Press.
James HS. 1994. *Handbook for Technical Writing*. NTC Business Books.
Joseph G. 2000. *MLA Handbook for Writers of Research Papers*. 5th Ed. Affiliated East-West Press.
Mohan K. 2005. *Speaking English Effectively*. MacMillan India.
Richard WS. 1969. *Technical Writing*. Barnes & Noble.
Robert C. (Ed.). 2005. *Spoken English: Flourish Your Language*. Abhishek.
Sethi J & Dhamija PV. 2004. *Course in Phonetics and Spoken English*. 2nd Ed. Prentice Hall of India.
Wren PC & Martin H. 2006.*High School English Grammar and Composition*. S. Chand & Co

PGS 503 (e-Course) INTELLECTUAL PROPERTY AND ITS MANAGEMENT IN AGRICULTURE 1+0

Objective

The main objective of this course is to equip students and stakeholders with nowledge of intellectual property rights (IPR) related protection systems, their significance and use of IPR as a tool for wealth and value creation in a knowledge-based economy

Theory

Historical perspectives and need for the introduction of Intellectual Property Right regime; TRIPs and various provisions in TRIPS Agreement; Intellectual Property and Intellectual Property Rights (IPR), benefits of securing IPRs; Indian Legislations for the protection of various types of Intellectual Properties; Fundamentals of patents, copyrights, geographical indications, designs and layout, trade secrets and traditional knowledge, trademarks, protection of plant varieties and farmers' rights and bio-diversity protection; Protectable subject matters, protection in biotechnology, protection of other biological materials, ownership and period of protection; National Biodiversity protection initiatives; Convention on Biological Diversity; International Treaty on Plant Genetic Resources for Food and Agriculture; Licensing of technologies, Material transfer agreements, Research collaboration Agreement, License Agreement

Suggested Readings

Erbisch FH & Maredia K.1998. *Intellectual Property Rights in Agricultural Biotechnology*. CABI.
Ganguli P. 2001.*Intellectual Property Rights: Unleashing Knowledge Economy*. McGraw-Hill.
Intellectual Property Rights: Key to New Wealth Generation. 2001. NRDC & Aesthetic Technologies.
Ministry of Agriculture, Government of India. 2004. *State of Indian Farmer*. Vol. V. *Technology Generation and IPR Issues*. Academic Foundation.

Rothschild M & Scott N. (Ed.). 2003. *Intellectual Property Rights in Animal Breeding and Genetics*. CABI.
Saha R. (Ed.). 2006. *Intellectual Property Rights in NAM and Other Developing Countries: A Compendium on Law and Policies*. Daya Publ. House.
The Indian Acts - Patents Act, 1970 and amendments; Design Act, 2000; Trademarks Act, 1999; The Copyright Act, 1957 and amendments; Layout Design Act, 2000; PPV and FR Act 2001, and Rules 2003; National Biological Diversity Act, 2003

PGS 504 BASICCONCEPTS IN LABORATORYTECHNIQUES 0+1

Objective

To acquaint the students about the basics of commonly used techniques in laboratory

Practical

Safety measures while in Lab; Handling of chemical substances; Use of burettes, pipettes, measuring cylinders, flasks, separatory funnel, condensers, micropipettes and vaccupets; washing, drying and sterilization of glassware; Drying of solvents/chemicals. Weighing and preparation of solutions of different strengths and their dilution; Handling techniques of solutions; Preparation of different agro-chemical doses in field and pot applications; Preparation of solutions of acids; Neutralisation of acid and bases; Preparation of buffers of different strengths and pH values. Use and handling of microscope, laminar flow, vacuum pumps, viscometer, thermometer, magnetic stirrer, micro-ovens, incubators, sandbath, waterbath, oilbath; Electric wiring and earthing. Preparation of media and methods of sterilization; Seed viability testing, testing of pollen viability; Tissue culture of crop plants; Description of flowering plants in botanical terms in relation to taxonomy

Suggested Readings

Furr AK. 2000. *CRC Hand Book of Laboratory Safety*. CRC Press.
Gabb MH & Latchem WE. 1968. *A Handbook of Laboratory Solutions*. Chemical Publ. Co

PGS 505 (e-Course) AGRICULTURAL RESEARCH, RESEARCH ETHICS AND RURAL DEVELOPMENT PROGRAMMES 1+0

Objective

To enlighten the students about the organization and functioning of agricultural research systems at national and international levels, research ethics, and rural development programmes and policies of Government

Theory

UNIT I

History of agriculture in brief; Global agricultural research system: need, scope, opportunities; Role in promoting food security, reducing poverty and protecting the environment; National Agricultural Research Systems (NARS) and Regional Agricultural Research Institutions; Consultative Group on International Agricultural Research (CGIAR): International Agricultural Research Centres (IARC), partnership with NARS, role as a partner in the global agricultural research system, strengthening capacities at national and regional levels; International fellowships for scientific mobility.

UNIT II

Research ethics: research integrity, research safety in laboratories, welfare of animals used in research, computer ethics, standards and problems in research ethics.

UNIT III
3D Graphics, 3D transformation rotation about an arbitrary axis. Curved surface generation, Hidden surface removal.
UNIT IV
Orthogonal Projection and multiple views, Isometric projection, Perspective projection, 3D Clipping
UNIT V
Generation of solids, Sweep method, Interpolation, Graphic Standards, CGS Modeling, Applications of Computer Graphics

Practical
Practical problems on above topics

Suggested Readings
Hearn Donald.1996. *Computer Graphics*. PHI.
Schaum. Series. 2004. *Computer Graphics*. TMH

CSE 502 NEURAL NETWORK AND ITS APPLICATIONS 2+1

Objective
To acquaint and equip the students about the concepts of neural network for solving engineering problems

Theory
UNIT I
Introduction to neural network and its comparison with biological system. Perceptron and linear separable functions, multi-layers perceptrons.
UNIT II
Back propagation, one basic learning algorithm for feed-forward neural network, variation and improvement for back-propagation algorithm, Generalisation of learning algorithm.
UNIT III
Recurrent Networks: Hopefield networks and Boltzmann Machine.
UNIT IV
Unsupervised learning and self organized features maps
UNIT V
Application of neural network in function approximation, time series predictions, pattern recognition, control systems and optimization in engineering problems

Practical
Development of neural network by back-propagation learning algorithm using MATLAB for function approximation, time series predictions, pattern recognition, control systems and optimization in engineering problems.

Suggested Readings
Haykins S.1999. *Neural Network- Comprehensive Study*. PHI.
Hertz J, Krogh A & Palmer RG. 1991. *Introduction to Theory of Neural Computation*. Addison-Wesley

COMPULSORY NON-CREDIT COURSES

(Compulsory for Master's programme in all disciplines; Optional for Ph.D. scholars)

Course code	Course Title	Credits
PGS 501	LIBRARY AND INFORMATION SERVICES	0+1
PGS 502	TECHNICAL WRITING AND COMMUNICATIONS SKILLS	0+1
PGS 503 (e-Course)	INTELLECTUAL PROPERTY AND ITS MANAGEMENT IN AGRICULTURE	1+0
PGS 504	BASIC CONCEPTS IN LABORATORY TECHNIQUES	0+1
PGS 505 (e-Course)	AGRICULTURAL RESEARCH, RESEARCH ETHICS AND RURAL DEVELOPMENT PROGRAMMES	1+0
PGS 506 (e-Course)	DISASTER MANAGEMENT	1+0

Course Contents

PGS 501 LIBRARY AND INFORMATION SERVICES 0+1

Objective
To equip the library users with skills to trace information from libraries efficiently, to apprise them of information and knowledge resources, to carry out literature survey, to formulate information search strategies, and to use modern tools (Internet, OPAC, search engines etc.) of information search.

Practical
Introduction to library and its services; Role of libraries in education, research and technology transfer; Classification systems and organization of library; Sources of information- Primary Sources, Secondary Sources and Tertiary Sources; Intricacies of abstracting and indexing services (Science Citation Index, Biological Abstracts, Chemical Abstracts, CABI
Abstracts, etc.); Tracing information from reference sources; Literature survey; Citation techniques/Preparation of bibliography; Use of CD-ROM Databases, Online Public Access Catalogue and other computerized library services; Use of Internet including search engines and its resources; e- resources access methods.

PGS 502 TECHNICAL WRITING AND COMMUNICATIONS SKILLS 0+1

Objective
To equip the students/scholars with skills to write dissertations, research papers, etc.
To equip the students/scholars with skills to communicate and articulate in English (verbal as well as writing).

Practical
Technical Writing - Various forms of scientific writings- theses, technical papers, reviews, manuals, etc; Various parts of thesis and research communications (title page, authorship contents page, preface, introduction review of literature, material and methods, experimental results and discussion); Writing of abstracts, summaries, précis, citations etc.; commonly used abbreviations in the theses and research communications; illustrations, photographs and drawings with suitable captions; pagination, numbering of tables and illustrations; Writing of numbers and dates in scientific write-ups; Editing and proof-reading; Writing of a review article.

Suggested Readings

Grover GK.1996. *Mechanical Vibrations*. New Chand & Bros., Roorkee.
Rao SS. 2005. *Mechanical Vibration*. John Wiley.
William T Thomson.2004. *Theory of Vibration with Application*. 5th Ed. Marie Dillon Dahleh Amazon Co

Computer Science & Electrical Engineering

EE 501 APPLIED INSTRUMENTATION **2+1**

Objective

To acquaint and equip the students with various types of transducers for study and analysis of various variables

Theory

UNIT I

Basic instrumentation systems and transducer principles. Displacement Transducers: Potentiometer,LVDT, Piezoelectric and capacitive transducers. Digital Transducers. Velocity transducers – Analog and Digital

UNIT II

Acceleration and absolute motion measurement. Force transducer -Strain Gauge, Hydraulic load cell, Cantilever type and Probing ring. Method of separation of force – Torque, Power and Energy measuring techniques.

UNIT III

Temperature measurement using Bi-metals, PTRs, Thermistors, Thermocouples, Electronic IC sensors and Pyrometers. Heat flux measurement. Humidity measurement – Dry and Wet bulb, Hair hygrometer and Humister. Soil and Grain moisture transducers, pressure measurement – Manometers, Bourdon Tube, Diaphragm type transducer. High pressure and vacuum sensing techniques.

UNIT IV

Flow transducers, Positive displacement, venturimeter, Rotameter, Drag force, Ultrasonic, Electromagnetic, Hot wire anemometers. Time and frequency measurement.

UNIT V

Level measurement, OD and pH measurement, PCO2 and grain quality measurement. Biomedical measurement – BP, ECG etc., Ultrasonic flaw detection, Spectroscopy

Practical

Study the characteristics of various transducers : Potentiometer, LVDT, Proximity sensors and Photo pickups, Load cell, Thermistor and Thermocouple, LM 335/AD 590se of various Analog interfacing blocks: Attenuators, Amplifiers, A/D converters, Filters, digital interfaces using Wave shapers and level shifters. Practice of using interfaces and developing suitable software for data acquisition through PC/Microcomputer: Use of Microcomputer kit, Study the use of 8255 I/O IC, Study the use of printer port in a PC. Data acquisition through PC/Kit

Suggested Readings

Doebelin EO.1990. *Measurement Systems Applications and Design*. Tata McGraw Hill.
Nakra BC &Chaudhary KK. 2004. *Instrumentation Measurement and Analysis*. Tata McGraw Hill.
Sawhney AK. 2008. *Electrical and Electronics Measurement and Instrumentation*. Dhanpat Rai & Sons

EE 502 PROCESS CONTROL SYSTEM **2+1**

Objective

To acquaint and equip the students about the concepts involved in process control system to control variables at the desired level

Theory

UNIT I

Introduction to Process Control - Controlled Variable, Control strategy, Single Variable and multi variable control systems, Process Control loop, Open loop and closed loop control system, Linear and non linear control system, Transfer function and procedure for determining the Transfer function of Complex Control System, Representation of a Control System by block diagram and its Reduction

UNIT II

Characteristics of real Process - Process Equation, Controlling & Controlled Variable, Transient & steady state response, Self Regulation Property, Control System Parameters, Evaluation of Control System.

UNIT III

Improved Control through Complex Control of process - Controller Modes or actions, On/OFF Mode, Proportional Mode, Integral Mode, Derivative Mode, Composite Control Mode (PD, PI, PID, Modes).

UNIT IV

Analysis of Common loop, involving - Flow control (Solid, liquid and gaseous flow), Pressure regulation (Pressure Transducers), Liquid level (Mechanical & Electrical Systems), Temperature Control (Thermistor and thermocouple).

UNIT V

Introduction to Computer Control of Process Application and design - Signal Conditioning, Design of OP AMPS circuits used to implement Proportional Integral, Derivative and Composite Modes. Study of various computer Controlled Electrical and Mechanical Systems.

Practical

Study of various controllers by using Op-Amps, Use of microprocessors in process control.

Suggested Readings

Johnson CD.1977. *Process Control Instrumentation Technology*. PPH.
Manke BS.2006. *Linear Control System*. Khanna Publishers

CSE 501 COMPUTER GRAPHICS **2+1**

Objective

To acquaint and equip the students with the under lined concepts for generating various geometrical shapes and processing them

Theory

UNIT I

Graphic display devices, Interactive devices, Line and circle plotting techniques by using Bresenham's algorithm, Windowing and clipping, Sutherland Cophen algorithm, Cyrus and Beck method.

UNIT II

Curve drawing using Hermite Polynomial, Bezier curve, B Splines, Picture Transformation, translation, rotation, Scaling and Mirroring

Suggested Readings

Benjamin JR & Allen C. 1975. *Probability Statistics and Decision for Civil Engineers.* MGH New York.
Lipson C & Shets NJ. 1973. *Statistical Design and Analysis of Engineering Experiments.* McGraw Hill.
Subra Suresh. 1998. *Fatigue of Materials.* Cambridge Univ. Press

CE 603 DESIGN OF BINS AND SILOS 2+1

Objective

To acquaint and equip the students with Design practices for optimum design of grains storage structures

Theory

UNIT I

Computer aided design manuals. Rankine's and Coloumb's theories of active and passive pressures.

UNIT II

Janssen's and Airy's theories grain pressure theories for design of deep and shallow silos. Reimbert's theory of silo design.

UNIT III

Comparison of Australian (AS) and Indian (BIS) design criteria for bins and silos.

UNIT IV

Computer aided design of grain silos by developing flowcharts and programs for underground and over ground silos

Practical

Analysis and design of silos of various capacities using available software. Use of different standard codes and theories in the development of flowcharts and design program for various capacity silos

Suggested Readings

AS-3774.1990. *Loads on Bulk Solid Containers.*
BS-5061.1974. Specifications for Cylindrical Storage Tower Silos and Recommendations for their use. BIS Relevant Standards.
Rajgopalan K. 1989. *Storage Structure.* Oxford & IBH.
Reimbert M & Reimbert A.1956. *Design of Bins*

Mechanical Engineering

ME 501 MECHANISM ANALYSIS AND SYNTHESIS 3+0

Objective

To acquaint and equip the students with important area for analysis and design of Farm Machinery Mechanism

Theory

UNIT I

Introduction to kinematics of mechanisms, kinematic analysis and synthesis, mobility and degree of freedom of a mechanism, systematic of mechanisms deriving other mechanisms from linkages.

UNIT II

Relative motion, instantaneous center method, Kennedy's theorem. Graphical and analytical methods of displacement, velocity and acceleration analysis, Computer – Aided analysis of mechanisms.

UNIT III

Dimensional synthesis of linkages for path generation, function generation and rigid-body guidance problems. Graphical techniques. Relative pole method and method of inversion etc. Analytical kinematics synthesis of linkages, Freudenstein's method, Loop closure equations based on complex variable approach

UNIT IV

Kinematics of gears-Analysis of epicyclic gear trains. Synthesis of gear trainscompound and epicyclic. Cam – follower system; standard follower motions and combinations, importance of follower acceleration in cam system dynamics, terms related to cam deisgn- their importance. Cam synthesis – graphical cam profile layout for a desired follower motion. Analytical determination of cam profile co-ordinates for disc cam operating common types of follower.

Suggested Readings

George N Sandor & Arthur G Erdman.1984. *Advanced Mechanism Design - Analysis and Synthesis.* Vols. I; II. Prentice Hall.
Norton. 2003. *Design of Machinery - An Introduction to the Synthesis and Analysis of Mechanisms and Machines.* McGraw Hill.
Shigley Vicker. 2007. *Theory of Machines and Mechanisms.* McGraw Hill.
Soni AH. 1974. *Mechanism Synthesis and Analysis.* McGraw Hill.

ME 502 VIBRATIONS 3+0

Objective

To acquaint and equip the students with Significant field in the study and Analysis of farm machinery dynamics

Theory

UNIT I

Vibration motion and its terminology. Undamped free vibrations, equations of motion-natural frequency. Energy method, Rayleigh method; effective mass Principle of Virtual work. Equivalent spring stiffness in parallel and in series. Harmonic analysis and Fourier Series. Damping – viscous, solid, coulomb equivalent dampers. Viscosity damped free vibrations, Logarithmic decrement. Forced vibrations with harmonic excitation and rotating unbalance, Energy dissipated by damping. Forced vibration with damping, Vibration isolation and force and motion transmissibility.

UNIT II

Two degree of freedom systems. Principal modes of vibration, co-ordinate coupling. Vibration absorbers, Free vibration equation of motion for multi- degree of freedom systems. Influence coefficients and Maxwell's reciprocal theorem, stiffness coefficients. Numerical methods for finding natural frequencies for multi degree of freedom systems.

UNIT III

Vibration of lumped parameter systems and continuous systems. Lagrange equations. Vibration measuring instruments: Vibrometers, velocity pickups, Accelerometer and frequency measuring instruments. Applications of vibrations.

Practical
Measurement of strain with strain gauge. Photo elastic methods and Moire's apparatus

Suggested Readings
Srinath LS.1984. *Experimental Stress Analysis*. Tata McGraw Hill.
Singh Sadhu. 1982. *Experimental Stress Analysis*. Khanna Publ.
Dally J.W. & W.F. Riley, 1990. *Experimental Stress Analysis*. Tata McGraw Hill

CE 506 SIMILITUDE IN ENGINEERING 2+1

Objective
To acquaint and equip the students with different aspects of similitude in Engineering and its importance in engineering

Theory
UNIT I
Dimensions and units.
UNIT II
Dimensional and similarity analysis. Theory of models.
UNIT III
True, distorted and dissimilar models.
UNIT IV
Application to different systems with special reference to Structural and fluid flow systems, Analogues.

Practical
Equations for the period of simple pendulum. Uniform rectangular cantilever beam. Spring mass level system. Investigation of extrapolation. Deflection of a cantilever beam. Prediction of the deflection of a beam using a model. Analogue model experiments

Suggested Readings
Green Murphy.1950. *Similitude in Engineering*. Ronald Press.
Huntley HE. 1974. *Dimensional Analysis*. Dover Publ.
Stephen J Klin.1965. *Similitude and Approximation Theory*. McGraw Hill

CE 507 CONTROL OF POLLUTION FROM SOLID WASTES 2+0

Objective
To acquaint and equip the students with different methods for management of solid wastes and their importance

Theory
UNIT I
Definition. Sources. Quality, Classification and characteristics of solid waste collection, Transport and reduction at source.
UNIT II
Handling, Collection , Storage, transport of Solid wastes.
UNIT III
Disposal methods and their merits and demerits.
UNIT IV
Processing of solid wastes. Fertilizers, fuel and food values.

UNIT V
Recycling and reuse materials and energy recovery operations

Suggested Readings
Kreith F & Tchobanoglous G. 2002.*Handbook of Solid Waste Management*. McGraw Hill.
Ramachandra TV. 2006. *Management of Municipal Solid Waste*. Capital Publ. Co

CE 601 PROBABILISTIC APPROACH IN DESIGN 2+0

Objective
To acquaint and equip the students with different probabilistic methods for dynamic loading design

Theory
UNIT I
Review of various approaches in engineering design and introduction of probabilistic approach.
UNIT II
Random variables. Probability distribution and density functions. Expected values, Mean. Variance, Conditional probability. Characteristic functions.
UNIT III
Function of random variable. Concepts of stationary, ergodic and non- stationary processes.
UNIT IV
Auto correlation. Cross-correlation. Covariance functions. Power spectral and cross spectral density functions and their determination from experimental data.
UNIT V
Broad-band and Narrow band random processes., White noise. Application in various disciplines of engineering

Suggested Readings
Benjamin JR & Allen C. 1975. *Probability Statistics and Decision for Civil Engineers*. MGH New York.
Evan DH.1992. *Probability and its Applications for Engineers*. ASQC Press & Marcel Dekker

CE 602 RANDOM VIBRATIONS 2+0

Objective
To acquaint and equip the students with design by linear and nonlinear random loading analysis

Theory
UNIT I
Response to linear single and multi-degree of freedom system to stationary and non-stationary random excitation.

UNIT II
Response of continuous systems. Normal mode method.
UNIT III
Non-linear random vibration. Level crossing. Peak and envelope statistics. First excursion land fatigue failures
UNIT IV
Applications to mechanical, aero, civil, ocean and agricultural engineering systems

CE 502 DAMS & RESERVOIR OPERATIONS 3+1

Objective
To acquaint and equip with different types of dams, their design philosophies and use.

Theory
UNIT I
Dams classification. Suitable site selection for dams & reservoirs. Survey & planning of storage projects.
UNIT II
Type of concrete dams. Forces acting on concrete dams. Stability analysis. Methods of design of gravity dams. Temperature control for dams.
UNIT III
Earth dams and their types. Methods of construction. Causes of failure & remedial measures. Seepage and stability analysis of earth dams.
UNIT IV
Foundation treatment. Abutment grunting. Instrumentation in dams.
UNIT V
Spill way and spillway capacities and spillway gates.
UNIT VI
Reservoir planning, Storage, sedimentation, Losses, Economics. Flood routing.

Practical
Exercises on above topics

Suggested Readings
Bharat Singh. 2002. Earthen Dams. New Chand & Bros., Roorkee.
Creager WP, Justin JD, Hinds J. 1945. *Engineering for Dams*. Vols. I-III. John Wiley & Sons.
Sharma HD. 1981. *Concrete Dams*. Metropolitan

CE 503 WATER QUALITY AND POLLUTION CONTROL 3+1

Objective
To acquaint and equip with different aspects of wastes and waste water quality, treatment and their importance

Theory
UNIT I
Impurities in water. Water analysis (Physical, Chemical and Bacteriological).
UNIT II
Indices of water quality for domestic and industrial uses. Monitoring of water quality from various sources of water pollution.
UNIT III
Purification of water supplies.
UNIT IV
Waste water characteristics and disposal methods.
UNIT V
Waste water treatment.
UNIT VI
Mathematical modeling on pollution control. Environmental legislation on water pollution in India and abroad

Practical
Determination of pH, dissolved and suspended solids, Chlorides, Sulphates, turbidity, dissolved oxygen hardness, BOD, COD, Nitrogen (Ammonical, nitrate, nitrite), MPN, Total count of bacteria in water/sewage samples

Suggested readings
Garg SK. 2004. *Environmental Engineering*. Vol. II. Khanna Publ.
Garg SK. 2004. *Environmental Engineering*. Vol. I. Khanna Publ.
Howard S Peavey, Donald R Rod & Tchobanglous G. 1985. *Environmental Engineering*. McGraw Hill.
Manual of Water Supply and Treatment. 1999 Ministry of Urban Development, New Delhi.
Metcalf and Eddy. 2003. *Waste Water Engineering Treatment and Reuse. Tata McGraw* Hill

CE 504 FLUVIAL HYDRAULICS 2+1

Objective
To acquaint and equip the students with different aspects of Fluvial Hydraulics and their importance in the engineering

Theory
UNIT I
Sediment properties, Sediment problems. Incipient motion of sediment particles.
UNIT II
Regimes of flow. Resistance to flow.
UNIT III
Bed load. Suspended load. Total load transport.
UNIT IV
Alluvial streams and their hydraulic geometry. Bed level variations in alluvial streams.
UNIT V
Sediment samples and sampling. Alluvial river models. Sediment transport through pipes. Bed level variations in alluvial streams. River

Practical
Problems on determination of sediment properties, regimes of flow, resistance to flow, incipient motion, bed load, suspended load, total load transport and sediment transport

Suggested Readings
Garde RJ & Ranga Rajan KG. 2001. *Mechanics of Sediment Transport and Alluvial Stream Problems*.
Howard H Chang. 1988. *Fluvial Process in River Engineering*. John Wiley & Sons.
Raudkivi AJ. 1990. *Loose Boundary Hydraulics*. Pergamon Press

CE 505 EXPERIMENTAL STRESS ANALYSIS 2+1

Objective
To acquaint and equip students with different techniques/methods of stress analysis and its importance in Engineering

Theory
UNIT I
Strain and stress, Strain relationship, Strain gauges mechanical, optical, electrical, acoustical and pneumatic etc and their use. Different types of electric strain gauges, Semiconductor gauges.

SUGGESTED

MINOR/SUPPORTING COURSES

Some identified Minor/Supporting courses

Course code	Course Title	Credits
CE 501	OPEN CHANNEL FLOW	3+0
CE 502	DAMS & RESERVOIR OPERATIONS	3+1
CE 503	WATER QUALITY AND POLLUTION CONTROL	3+1
CE 504	FLUVIAL HYDRAULICS	2+1
CE 505	EXPERIMENTAL STRESS ANALYSIS	2+1
CE 506	SIMILITUDE IN ENGINEERING	2+1
CE 507	CONTROL OF POLLUTION FROM SOLID WASTES	2+0
CE 601	PROBABILISTIC APPROACH IN DESIGN	2+0
CE 602	RANDOM VIBRATIONS	2+0
CE 603	DESIGN OF BINS AND SILOS	2+1
CSE 501	COMPUTER GRAPHICS	2+1
CSE 502	NEURAL NETWORK AND ITS APPLICATIONS	2+1
EE 501	APPLIED INSTRUMENTATION	2+1
EE 502	PROCESS CONTROL SYSTEMS	2+1
ME 501	MECHANISM ANALYSIS AND SYNTHESES	3+0
ME 502	VIBRATIONS	3+0

Civil Engineering

CE 501 OPEN CHANNEL FLOW **3+0**

Objective

To acquaint and equip with different techniques of Open Channel Flow and its importance in the engineering

Theory

UNIT I

Open channel and their properties. Energy and momentum principles. Critical flow computations and applications.

UNIT II

Uniform flow. Its development. Formula and design computation.

UNIT III

Boundary layer concept. Surface roughness. Velocity distribution and instability of uniform flow.

UNIT IV

Gradually varied flow theory and analysis. Method of computations.

UNIT V

Hydraulic jump and its use as levelling energy dissipation.

UNIT VI

Spatially varied flow. Unsteady flow. Rapidly varied flow.

Suggested Readings

Henderson FM.1966. *Open Channel Flow*. Macmillan.
Subramaninum 1960. *Open Channel Flow*. McGraw Hill.
Ven T Chow. 1959. *Open Channel Flow*. McGraw Hill