B.Sc. AGRICULTURAL ENGINEERING

FACULTY OF AGRICULTURAL ENGINEERING
AND TECHNOLOGY

UNIVERSITY OF AGRICULTURE, FAISALABAD

Approved in Syndicate on May 29, 2013
Pakistan’s economy is primarily an agrarian based as agriculture sector is contributing about 21% to its GDP, employing 45% of its work force, and providing livelihood to more than 67% of its population, which is residing mostly in the rural areas. But, contribution of this sector of economy is heavily dependent on adequate supply of irrigation water, state of the art modern as well as low cost farm equipment and structures and safe environment. At the same time, it is also needed to provide alternative energy sources and post harvest food preservation technologies to ensure food security as post harvest losses in fruits and vegetables could reduce production by 25-40%.

Keeping these issues in view, Faculty of Agricultural Engineering and Technology, University of Agriculture, Faisalabad was established in 1963 in collaboration with Colorado State University, USA. The Faculty is proud of its huge infrastructure, talented academia, well equipped laboratories, and well developed Engineering software laboratories. Faculty has also been recognized as a hub for academic professional and industry mechanization development. The faculty has opened its doors to the public to boost its professional and industrial dialogue through university industry linkage, outreach programs, internship for students and MOUs with public/private sectors.

The overall objective of the faculty is to train manpower through teaching and research in the field of irrigation and drainage, farm power and machinery, structures and environment, textile technology and food engineering. The faculty is very actively engaged in offering courses at undergraduate and postgraduate level to produce the skilled manpower specialized in managing water resources, farm equipment, environment, food and textile engineering and technologies. The faculty has recently launched new under and post graduate degree programs in Food Engineering and Water Resources Engineering, respectively to open new horizons in post harvest food and water resources management.

The specific objectives of the faculty include;

- Equipping the students with technical knowledge and skills required for the design, operation, maintenance and evaluation of irrigation, power and mechanical systems used in the industry and on agricultural farms;
- To abreast the students with mathematical, experimental and computational skills for solving real time on field problems;
- To develop skills in the students required to design, develop and modify indigenous farm and agro-industrial machines;
- To enhance students’ skills to design, develop and implement water saving irrigation techniques with special focus on high efficiency irrigation systems;
- To integrate academic learning with practice orientated experience through internship for career planning;
- To serve as hub between professionals, researchers, industry and farmers.

**Vision**

The Faculty of Agricultural Engineering and Technology would like to be recognized nationally and world over as a high seminary of learning pertinent to water and environment management, farm mechanization, agro-processing, textile, bio-energy systems engineering in the 21st century. The faculty is serving to bridge the gap between the researchers and farmers. The professionals (teachers/researchers) aimed to excel imparting education and training pertaining to water resources management and utilizing the water resources of the country in an efficient manner.

Faculty plans to impart professional education, training and produce skilled manpower at graduate and postgraduate level in the field of Agricultural Engineering, Water Resources Engineering and Textile Technology with special focus on resolving issues faced by the farming community. Faculty plans to improve communication skills of engineers through subject, project and thesis presentations, seminars and class discussions.
Faculty professionals are working hard to develop and maintain collaboration with other national and international institutions associated with Agricultural and Biological Engineering. A close interaction is being created with different government and private organizations. It is worth mentioning that most recently various MOUs have been signed with German and Chinese firms to enhance expertise on alternative energy sources and bio gas generation.

The Faculty of Agricultural Engineering and Technology has actively arranged national and international conferences and seminars to share knowledge among the professional of various countries and departments. This activity will be excelled in the future and more national and international seminars/conferences/workshops will be arranged. Outreach programs will be conducted for technology transfer to the farmers in collaboration with the private industry for promoting new technologies developed in the faculty.

The faculty has focused to develop energy center with the partnership of national and international organizations to formulate means to cop the current and forthcoming energy crises. Establishment of agro environmental research center to address the reclamation of environmental pollution from agriculture is also in planning phase. The development of centre of remote sensing is also a future plan of the faculty in order to use state of the art remote sensing techniques in agriculture and water resources management.

The up gradation of faculty laboratories to the standards that it can serve as certifying authority in the fields of material testing, fiber testing, food grading and environment protection is also a future vision of the Faculty of Agricultural Engineering and Technology.

Mission

The mission of the Faculty of Agricultural Engineering and Technology is to strengthen the academic programs of the university and to cater future needs of the trained manpower in the area of agricultural engineering specialized in water resources planning and management, farm machinery, agro processing, food engineering, textile technology and environment management.

The faculty is ready to serve the nation by providing trained manpower to plan and execute the public and private sectors projects pertaining to environment such as farm waste processing, water quality management, improved farm structures.

Eligibility Criteria for admission in B.Sc. Agri. Engineering

1. Entrance Test with 50% pass marks
2. FSc.(Pre-Engineering) with 60 percent pass marks
3. Three year Diploma in the relevant fields
# Revised Scheme of Studies of B.Sc. Agricultural Engineering

**Approved in Syndicate on May 29, 2013**

## First Semester

<table>
<thead>
<tr>
<th>Course No.</th>
<th>Title of the Course</th>
<th>Credit Hrs</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Major Courses</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>FMP-301</td>
<td>Metallurgy &amp; Workshop Practices</td>
<td>3(2-1)</td>
</tr>
<tr>
<td>ID-301</td>
<td>Fluid Mechanics</td>
<td>3(2-1)</td>
</tr>
<tr>
<td>SEE-301</td>
<td>Engineering Drawing &amp; Graphics</td>
<td>2(1-1)</td>
</tr>
<tr>
<td><strong>Minor Courses</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>IS-202 or</td>
<td>Islamic Studies or Ethics (for foreign student)</td>
<td>3(3-0)</td>
</tr>
<tr>
<td>SSH-202a</td>
<td></td>
<td></td>
</tr>
<tr>
<td>AGRON-319</td>
<td>Basic Agriculture for Engineers</td>
<td>3(2-1)</td>
</tr>
<tr>
<td>MATH-301</td>
<td>Linear Algebra &amp; Calculus</td>
<td>3(3-0)</td>
</tr>
<tr>
<td>PY-301</td>
<td>Applied Physics</td>
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<td><strong>Total Credit hours</strong></td>
<td>20(15-5)</td>
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## Second Semester

<table>
<thead>
<tr>
<th>Course No.</th>
<th>Title of the Course</th>
<th>Credit Hrs</th>
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</thead>
<tbody>
<tr>
<td><strong>Major Courses</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>FMP-302</td>
<td>Manufacturing Engineering</td>
<td>3(2-1)</td>
</tr>
<tr>
<td>ID-302</td>
<td>Engineering Numerical Analysis</td>
<td>3(2-1)</td>
</tr>
<tr>
<td>SEE-302</td>
<td>Engineering Mechanics</td>
<td>3(2-1)</td>
</tr>
<tr>
<td>SEE-304</td>
<td>Computer Aided Design</td>
<td>2(1-1)</td>
</tr>
<tr>
<td><strong>Minor Courses</strong></td>
<td></td>
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</tr>
<tr>
<td>ENG-101</td>
<td>English Composition and Comprehension</td>
<td>2(2-0)</td>
</tr>
<tr>
<td>AEE-302</td>
<td>Communication &amp; Presentation Skills</td>
<td>3(2-1)</td>
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## Third Semester

<table>
<thead>
<tr>
<th>Course No.</th>
<th>Title of the Course</th>
<th>Credit Hrs</th>
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</thead>
<tbody>
<tr>
<td><strong>Major Courses</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>FMP-401</td>
<td>Engineering Thermodynamics</td>
<td>3(2-1)</td>
</tr>
<tr>
<td>FMP-403</td>
<td>Agricultural Processing Engineering</td>
<td>3(2-1)</td>
</tr>
<tr>
<td><strong>Minor Courses</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>CHEM-401</td>
<td>Industrial Chemistry</td>
<td>3(2-1)</td>
</tr>
<tr>
<td>CS-401</td>
<td>Computer Programming and Applications in Engineering</td>
<td>3(2-1)</td>
</tr>
<tr>
<td>MATH-401</td>
<td>Differential Equations, Power Series, Laplace Transform</td>
<td>3(3-0)</td>
</tr>
<tr>
<td>RS-401</td>
<td>Sociology for Engineers</td>
<td>2(2-0)</td>
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<tr>
<td><strong>Total Credit hours</strong></td>
<td>17(13-4)</td>
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## Fourth Semester

<table>
<thead>
<tr>
<th>Course No.</th>
<th>Title of the Course</th>
<th>Credit Hrs</th>
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</thead>
<tbody>
<tr>
<td><strong>Major Courses</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>FMP-402</td>
<td>Instrumentation &amp; Measurements</td>
<td>3(2-1)</td>
</tr>
<tr>
<td>FMP-404</td>
<td>Engineering Economics &amp; Management</td>
<td>3(3-0)</td>
</tr>
<tr>
<td>ID-402</td>
<td>Fluid Flow Systems</td>
<td>3(2-1)</td>
</tr>
<tr>
<td>SEE-402</td>
<td>Mechanics of Materials</td>
<td>3(2-1)</td>
</tr>
<tr>
<td><strong>Minor Courses</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>SSH-102</td>
<td>Pakistan Studies</td>
<td>2(2-0)</td>
</tr>
<tr>
<td>STAT-402</td>
<td>Statistics and Probability</td>
<td>3(2-1)</td>
</tr>
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</table>
### Fifth Semester

<table>
<thead>
<tr>
<th>Course No.</th>
<th>Title of the Course</th>
<th>Credit Hrs</th>
</tr>
</thead>
<tbody>
<tr>
<td>ID-501</td>
<td>Open Channel Hydraulics</td>
<td>3(2-1)</td>
</tr>
<tr>
<td>ID-503</td>
<td>Engineering Hydrology</td>
<td>3(2-1)</td>
</tr>
<tr>
<td>SEE-501</td>
<td>Surveying &amp; Leveling</td>
<td>4(2-2)</td>
</tr>
<tr>
<td>SEE-503</td>
<td>Environmental Engineering</td>
<td>3(2-1)</td>
</tr>
</tbody>
</table>

**Minor Course**

<table>
<thead>
<tr>
<th>Course No.</th>
<th>Title of the Course</th>
<th>Credit Hrs</th>
</tr>
</thead>
<tbody>
<tr>
<td>SES-501</td>
<td>Soil Science</td>
<td>3(2-1)</td>
</tr>
</tbody>
</table>

**Electives**

<table>
<thead>
<tr>
<th>Course No.</th>
<th>Title of the Course</th>
<th>Credit Hrs</th>
</tr>
</thead>
<tbody>
<tr>
<td>FMP-503</td>
<td>Design of Agricultural Machinery</td>
<td>3(2-1)</td>
</tr>
<tr>
<td>FMP-505</td>
<td>Boiler Engineering and Power Plants</td>
<td>3(2-1)</td>
</tr>
<tr>
<td>ID-505</td>
<td>Water Management Engineering</td>
<td>3(2-1)</td>
</tr>
<tr>
<td>ID-507</td>
<td>Soil Dynamics</td>
<td>3(2-1)</td>
</tr>
<tr>
<td>SEE-505</td>
<td>Quantity Survey and Cost Estimation</td>
<td>3(2-1)</td>
</tr>
<tr>
<td>SEE-507</td>
<td>Environmental Management System in Industry</td>
<td>3(3-0)</td>
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</tbody>
</table>

**Total Credit hours** 17(13-4)

### Sixth Semester

<table>
<thead>
<tr>
<th>Course No.</th>
<th>Title of the Course</th>
<th>Credit Hrs</th>
</tr>
</thead>
<tbody>
<tr>
<td>FMP-502</td>
<td>Farm Machinery &amp; Earth Moving Equipment</td>
<td>4(3-1)</td>
</tr>
<tr>
<td>FMP-504</td>
<td>Professional Ethics</td>
<td>2(2-0)</td>
</tr>
<tr>
<td>ID-502</td>
<td>Soil Mechanics</td>
<td>3(2-1)</td>
</tr>
<tr>
<td>ID-504</td>
<td>Soil &amp; Water Conservation Engineering</td>
<td>3(2-1)</td>
</tr>
<tr>
<td>SEE-502</td>
<td>Farm Structures &amp; Materials</td>
<td>3(2-1)</td>
</tr>
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**Electives**

<table>
<thead>
<tr>
<th>Course No.</th>
<th>Title of the Course</th>
<th>Credit Hrs</th>
</tr>
</thead>
<tbody>
<tr>
<td>FMP-506</td>
<td>Energy Resources and Management</td>
<td>3(2-1)</td>
</tr>
<tr>
<td>FMP-508</td>
<td>Farm Machinery Management</td>
<td>3(2-1)</td>
</tr>
<tr>
<td>ID-506</td>
<td>Hydraulic Machinery</td>
<td>3(2-1)</td>
</tr>
<tr>
<td>ID-508</td>
<td>Ground Water Hydrology</td>
<td>3(2-1)</td>
</tr>
<tr>
<td>SEE-504</td>
<td>Water Supply and Sewerage</td>
<td>3(2-1)</td>
</tr>
<tr>
<td>SEE-506</td>
<td>Meteorology and Climate Change</td>
<td>3(2-1)</td>
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</table>

**Total Credit hours** 19

### Seventh Semester

<table>
<thead>
<tr>
<th>Course No.</th>
<th>Title of the Course</th>
<th>Credit Hrs</th>
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<tbody>
<tr>
<td>FMP-601</td>
<td>Farm Power</td>
<td>3(2-1)</td>
</tr>
<tr>
<td>ID-601</td>
<td>Irrigation Engineering</td>
<td>3(2-1)</td>
</tr>
<tr>
<td>SEE-601</td>
<td>Landscape Engineering</td>
<td>3(2-1)</td>
</tr>
<tr>
<td>AENG-601</td>
<td>Project &amp; Report I</td>
<td>3(0-3)</td>
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**Electives**

<table>
<thead>
<tr>
<th>Course No.</th>
<th>Title of the Course</th>
<th>Credit Hrs</th>
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</thead>
<tbody>
<tr>
<td>FMP-603</td>
<td>Post Harvest Engineering</td>
<td>3(2-1)</td>
</tr>
<tr>
<td>ID-603</td>
<td>Farm Irrigation Systems</td>
<td>3(2-1)</td>
</tr>
<tr>
<td>ID-605</td>
<td>Water Quality Management</td>
<td>3(2-1)</td>
</tr>
<tr>
<td>SEE-603</td>
<td>Solid and Wastewater Treatment</td>
<td>3(2-1)</td>
</tr>
<tr>
<td>SEE-605</td>
<td>Engineering Materials</td>
<td>3(2-1)</td>
</tr>
<tr>
<td>SEE-609</td>
<td>Environmental Impact Assessment</td>
<td>3(3-0)</td>
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**Total Credit hours** 18

### Eighth Semester

<table>
<thead>
<tr>
<th>Course No.</th>
<th>Title of the Course</th>
<th>Credit Hrs</th>
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<tbody>
<tr>
<td>FMP-602</td>
<td>Machine Design</td>
<td>3(3-0)</td>
</tr>
<tr>
<td>ID-602</td>
<td>Drainage Engineering</td>
<td>3(2-1)</td>
</tr>
<tr>
<td>ID-604</td>
<td>GIS &amp; Remote Sensing</td>
<td>3(2-1)</td>
</tr>
<tr>
<td>AENG-602</td>
<td>Project &amp; Report II</td>
<td>3(0-3)</td>
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**Total Credit hours** 15
<table>
<thead>
<tr>
<th>Electives</th>
<th>One Course is to be selected</th>
<th>Credit Hours</th>
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<tbody>
<tr>
<td>AE-602</td>
<td>Economics for Engineers</td>
<td>3(3-0)</td>
</tr>
<tr>
<td>FMP-604</td>
<td>Industrial Engineering and Management</td>
<td>3(2-1)</td>
</tr>
<tr>
<td>FMP-606</td>
<td>Reverse Engineering in Agricultural Engineering</td>
<td>3(2-1)</td>
</tr>
<tr>
<td>ID-606</td>
<td>Irrigation Water Management Techniques</td>
<td>3(2-1)</td>
</tr>
<tr>
<td>ID-608</td>
<td>Project Planning and Management</td>
<td>3(2-1)</td>
</tr>
<tr>
<td>SES-602</td>
<td>Land Reclamation</td>
<td>3(2-1)</td>
</tr>
<tr>
<td>SEE-602</td>
<td>Water Quality and Pollution</td>
<td>3(2-1)</td>
</tr>
<tr>
<td>SEE-604</td>
<td>Rural Electrification</td>
<td>3(2-1)</td>
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</table>

Total Credit hours: 15

Total Credit Hours: 137

Note:
1. A supervised internship training to be arranged by the institution after six semester as the requirement of the degree (Grades: Excellent, Good, Satisfactory)
2. Project and Report will be completed in two semesters i.e, 7th and 8th
Production and properties of common engineering materials: Ferrous metals, iron ores, properties and uses of pig iron, cast iron, wrought iron, steel, standard processes of manufacturing of Iron and steel, open hearth process, basic oxygen processes, production of ingots. Alloy steel and Irons: Effect of alloying elements, the AISI/SAE alloy steel and their identification, corrosion resistant steel, steel for high temperature services, alloy steel.


Practicals
1. Identification of tools and machines in the workshop.
2. Identification of different metals by spark tests and advance methods.
3. Demonstration of different heat treatment processes.
4. Practice of arc welding.
5. Practice of gas welding.
6. Safety and first aid in the workshop related to electrical, mechanical and other accidents.
7. Safety in the use of hand tools.
8. Visits to local foundries.

Suggested Readings
system. Automated assembly use of mechanical hands/Industrial Robots, concept of computer-integrated automation system (unmanned factory)

**Practicals**
1. Fabrication of various machine elements using lathe.
2. Making a slot on a shaft for a cotter pin using shaper and milling machines.
3. Cutting threads using milling and lathe machines.
6. Fabrication of a given agricultural machinery part.
7. Local visits to agricultural Machinery Manufacturing Industries.

**Suggested Readings**

**FMP-401 Engineering Thermodynamics 3(2-1)**

Heating and expansion of gases: Units of heat, gases and vapors, constant volume and constant pressure, P-V diagram, specific heat of gases, internal energy of gas, law of conservation of energy, methods of heating and expanding gases and vapors, work done by gas in expanding.


**Practicals**
1. Study of working principles of two stroke and four stroke engines using models.
2. Demonstration of Joule's law.
3. Study of rotary and reciprocating air compressors and their characteristic curves.
4. Study of PV diagram of diesel/gasoline engines.
5. Analysis of engine flue gases for CO, CO2, NO2, etc.
6. Determination of energy content of different fuels using calorimeter.
7. Study of heat transfer using refrigeration and air conditioning cycle.
9. Determination of flash point and fire point of different petroleum products.
Suggested Readings


FMP-402 Instrumentation and Measurements 3(2-1)

Basic terminology and concepts related to instruments, instrument behavior application of instrumentation, functional elements of instruments, basic terms related to instrumentation, such as threshold, resolution, accuracy, precision, sensitivity, response and error of instrument, uncertainty analysis, and least square techniques, static and dynamic characteristics of instrumentation, signal conditioning and recording devices. Principles and theory of electrical instruments: potentiometer, wheat stone bridge, strain analysis; strain measurement; strain gauges, types and their applications. Displacement, velocity and acceleration measurement: sensors and transducers, displacement measurement sensors; potentiometer, LVDT, capacitance sensors, piezoelectric sensors, velocity and acceleration sensors. Force and Torque Measurements: Force Measurements; Load cells. Torque measurements; torque cells. Pressure Measurement: Gauge, vacuum and abSolute pressure, pressure measuring devices. Measurement of Temperature: Resistance thermometers, thermocouples and radiation methods. Fundamentals of mechatronics: Introduction to electronics and sensors used in agricultural machinery, interfacing the machine and computers for response, controls and data logging, computer simulation of mechanical system.

Practicals
1. Measurement of Displacement by LVDT and Potentiometer;
3. Measurement of Force by Strain Gauges;
4. Calibration of pressure gauges with dead weight tester;
5. Measurement of Temperature by thermocouples;
6. Computer inter-facing for the depth and draft controls of tractors;
7. Visit to Mechatronics labs of different institutions;
8. Study of depth sensors in Agricultural Machinery

Suggested Readings
Introduction: industrial processes, value addition, structure and composition of food grains and fruits, engineering properties of agricultural materials - physical, mechanical and thermal properties. Pumps: types of pumps used in the industries, pump selection, pump laws and performance, viscosity effects. Fans: Classification as to type and design of fans, fan theory, fan performance, factors affecting fan selection, general performance and laws, fans in series and parallel, compression effect. Material handling and transportation equipment: Belt conveyors, chain conveyors, bucket elevators, pneumatic conveyors, gravity conveyors, augers, and trailer/trucks. Cleaning, Sorting and grading: Grade factors, washing types and methods of washing, sorting fruits and vegetables, types of sorters, cleaning and sorting, grading, nuts and seeds, types of grain cleaners/sorters, aerodynamics of small Practicals, types of separators, machine vision and its applications in grading. Size reduction: Size reduction and screen analysis of solid foods. Types of size reduction mills; fineness modulus, value of ground feed, size relationships, energy requirements, size reduction procedures, reducing devices, performance and characteristics of size reduction devices, mixing and types of mixers. Drying: Drying and dehydration, moisture content determinations; primary methods, equilibrium moisture content, drying processes, constant rate period, falling rate period, falling rate drying mechanism, dynamics of equilibrium moisture content, effect of temperature upon the rate of drying, effect of air rate upon the rate of drying, heat and mass balance limitation of the drying equipments, calculations, types of driers, psychometric chart.

Practicals
1. Determination of internal friction and angle of repose.
2. Measurement of bulk density of grains;
3. Measurement of grain moisture content by oven method and moisture meter;
4. Selection of fans for aeration of bin.
5. Calculation of Fineness modulus of wheat flour;
6. Demonstration of sieves used for cleaning/grading;
7. Carrying out screen analysis of milling/grinding equipment;
8. Study of Psychometric chart to calculate heat transfer during aeration/drying;
9. Study of dehydration characteristics of fruits/vegetable by moisture content vs. time curve and drying rate vs moisture content curve;
10. Visit to cold storage facilities;
11. Study tour to visit agricultural processing units and plants.

Suggested Readings


Suggested readings

FMP-502 Farm Machinery & Earth Moving Equipment 4(3-1)

Objective:
Teaching farm machines required for crop husbandry in addition to land leveling equipment.

Content:
Field Capacities and Cost Analysis: Implements Types, Factors affecting field capacity, Cost analysis
Tillage Implements:
(a). Primary tillage implements: Function & Types of Mold board plows, Components of a mold board plow, Reaction of soils to mold boards, Pulverizing action, Turning & inversion, Scouring, Forces acting upon a plow bottom, Effects of soil types, depth of plowing shape & design, attachments & rear furrow wheel and speed on draft & performance. Functions, components & types of Disk plows, Rotary plows, Chisel & subsurface plows.
Grain and Seed Harvesting: Harvesting and threshing methods, Types and development of Combines, functional elements of a combine, Flow path of material, Types and sources of seed loss, Types of threshing cylinders, Threshing effectiveness, Cylinder adjustment, Testing of Combines and its power requirements, Windrowing.
Earth Moving Equipments: Principles and working of Bulldozers, Soil scrapers and ditchers, Crawler, Parts of Crawler, Comparison of wheel type and Crawler tractors.

Practicals:
Identification of Primary Tillage Implements.
1. Identification of Secondary Tillage Implements.
2. Determination of Field Capacity of Agricultural Field Implements under actual field condition.
3. Determination of Field Efficiency of Agricultural Field Implements.
5. Calibration of grain drills in Laboratory.
6. Calibration of grain drills in Field.
7. Study and operation of Tractor Hydraulic System.
8. Mini Project.

**Suggested Readings:**

**FMP-503 Design of Agricultural Machinery 3(2-1)**

Philosophy of Design: Formulating of procedure, importance of machine design in Agricultural Machinery, Reliability, Engineering Standards, User economics.
Stresses: Stress failure theory, Designing for deflection, Strain determinations, Stresses caused by impact.
Power Transmissions: V-Belt forces, kinematics and design procedure, Chain drive, Forces, selection and design procedure. Universal Joints, description and functioning in Agricultural Machinery.
Linkages in Farm Machinery: Velocity and acceleration determination, Four bar mechanism, Machinery mechanism, Forces on plows and discs.
Design of Surfaces of Plow Bottoms: Design of moldboard plow and disk plow.

**Practical**
1. Chain and belt drives design and installation.
2. Determine the angular relation between the input and output of universal joints.
3. Analysis of thresher.
4. Calculate the forces in three-point hitch of tractor.
5. Visit to Farm Machinery Institute for Implement evaluation.
6. Assembling and disassembly of seed planter, sprayer and engine.
7. Analysis and construction of agricultural machines.
8. Design methods of a mould board plow.

**Suggested readings**

**FMP-504 Professional Ethics 2(2-0)**

**Objectives:**
The objective of the course is to improve the ethical standards of students in engineering.
**Contents:**
Controversy – Professions and Professionalism – Professional ideals and virtues – Theories about right action – Self-interest – Customs and religion – Use of Ethical Theories

Engineering as social experimentation: Engineering as experimentation – Engineers as responsible experimenters – Codes of Ethics – A Balanced Outlook on Law – The Challenger Case Study.

Engineer’s responsibility for safety: Safety and risk – Assessment of safety and risk – Risk
Benefit Analysis – Reducing risk – The Three Mile Island and Chernobyl Case Studies


Suggested Readings:
2. Charles D Fledderman, Engineering Ethics, Prentice Hall, New Mexico, 1999

FMP-505 Boiler Engineering and Power Plants 3(2-1)

Boiler Engineering: Introduction, types, construction, mounting, accessories steam cycle, steam nozzles, supersaturated expansion in nozzles, heat drop in saturated and supersaturated expansion, steam injector, steam turbine, work done, velocity diagram, work done in blading, velocity compounding, pressure compounding, impulse turbine, heat account for boiler and turbine, amount of fuel burnt, acceptance tests, analysis and calorific value of fuel, analysis of flue gases, amount of steam produced, pressure and quality of steam, design of boiler and pressure control system devices. Properties of steam, enthalpy of water, dryness fraction, enthalpy of wet steam, use of steam tables, super heated steam, internal energy of steam.

Power Plants: Steam Plants: Introduction, general layout of modern steam plants, steam generators, engines and auxiliary components, back pressure and pass out turbines, deviation of actual cycle from ideal, turbine pump and condenser.

Gas Turbine and Power Plants: Introduction, the gas turbine cycle, modification in basic cycle, isentropic efficiency of compressors and turbines, intercooling and reheating, explosion type gas turbine with solar heating, development and improvement in gas turbine. Jet propulsion plant, comparison of steam and gas power plants.

Practical
1. Demonstration and inspection of different types of boilers.
2. Determination of calorific value of fuel
3. Analysis of flue gases using gas analyzer
4. Quality analysis of steam
5. Measurement of impulse force on vane of turbine
6. Assessment of power generation at output shaft
7. Visit to different power plants
8. Visit to sugar and textile industries to study boilers and steam power.
9. Visit to nuclear and steam power plants.

Suggested Readings:

FMP-506 Energy Resources and Management 3(2-1)


Practicals
1. Estimation of energy requirements for major crops.
2. Performance/ evaluation of biogas plants
3. Estimation of solar and wind energies
4. Study of different types of solar dryers
7. Measurement of energy contents in diesel, biomass, and vegetable oil with calorimeter.

Suggested Readings:

FMP-508 Farm Machinery Management 3 (2-1)

Machine performance: Machines capacities; time efficiency; machine manoeuvrability; field patterns, factors effecting machine performance.
Power performance: Tractor power; draw bar power; PTO power, hydraulic power, power measurement; tractor tests, Nebraska Tractor Tests.
Ergonomics: Introduction, operator skill, operator aids for control, machine sensors, GPS role in machine control, operator safety and environment Machinery Management: Machinery costs – ownership costs, operating costs, and timeliness costs; machinery selection and replacement.
Optimization: optimum use of machine, estimation of power for a machine, part load operation, break even point, linear programming.
Hay and Forage harvesting: Mechanics of cutting plants; mowers; mover conditioners, balers; impact cutting; curing and preservation of forage; wind rowing.
Grain harvesting: Introduction, methods and equipment, reaper and windrowing; types of threshers, threshing cylinders, threshing losses, combine harvesting; types of cutting heads and tracks for different crops (wheat, rice, maize, sunflower), functional processes – gathering, cutting, pickup, feeding, threshing, separation, cleaning; combine losses and adjustments, performance evaluations.

Special crop machines: Cotton harvester; maize harvester; sugarcane harvester; potato harvester.

Precision Farming: Introduction, precision farming methods, precision equipment- laser land levelling, sensors, variable rate application, role of GIS and GPS in precision farming

Practicals:
1. Measurement of Drawbar and PTO power of a tractor.
2. Calculation of field capacity of selected farm machinery.
3. Demonstration of reaper and thresher.
4. Demonstration of combine harvester.
7. Thresher and Combine adjustments to solve grain breakage problem.
8. Study of cost analysis of combine harvesting.

Suggested Readings:

FMP-601 Farm Power 3(2-1)

Objective: Providing instructions relating components of I.C. engine, tractor components and its mechanics

Contents:
Introduction: History of engine development, engine cycles, principles of operation, types of engines.
Principal parts of engine: Functions, construction, cylinder, cylinder heads, liner, crank case, piston, connecting rod, crank shaft, clutch, flywheel, valves and their operation, valve mechanism.
Fuels and combustion: Types of engine fuels, fuel tests and their significance, gasoline tests, antiknock test, octane number, volatility, Reid vapour pressure, sulphur content, gun content, heat values, gasoline additives. Engine emissions and their analysis.
Ignition system: Types of engine fuels, fuel tests and their significance, gasoline tests, antiknock test, octane number, volatility, Reid vapour pressure, sulphur content, gun content, heat values, gasoline additives. Engine emissions and their analysis.
Ignition system: Types of ignition, spark, magneto and compression ignition, induction coils, distributor, spark plug, contact-breaker points, condenser, trouble shooting.
Cooling system: Types, principle of operation, parts of air/water cooling system, line diagram, radiator, thermostat, water pump, fan, engine heating, repair and maintenance, types of coolants.
Lubrication system: Types, principle of operation, components of lubrication systems, line diagram, types of lubricants, trouble shooting.
Electrical System: A.C. and D.C. voltage, alternator/dynamo, battery, battery charging and maintenance, self starter, electrical gauges and controls, line diagram, repair and maintenance.

Practicals:
1. Study of main components of engine and engine types.
2. Study of valve system and its adjustments.
3. Demonstration of fuel system, cooling system and electrical system of tractor.
5. Fuel injector, pump adjustment and calibration.
6. Demonstration of engine lubrication system.
7. Servicing of a single cylinder diesel engine.
9. Battery testing for charging-discharging.
10. Engine diagnostics-analysis of engine emissions using gas analyzer, multi-scan, etc.
11. Tour to tractor industry (Millat Tractors Limited, Al-Ghazi Tractors, Ltd)

Suggested Readings:

FMP-602 Machine Design 3(3-0)

Objectives:
Discussion of design and loading of Power Transformers and Induction motors is introduced and electrical equipment installation; commissioning, testing and troubleshooting practices are discussed.

Contents:

Suggested Readings:
USA

FMP-603 Post Harvest Engineering 3(2-1)

Introduction: Importance of cereal grains and other food products, food preservation, the 
food cycle, important factors of food production. 

Properties of Cereals: Cereal grains and their structure, physical properties, biochemical 
properties. 

Factors Affecting Grain Stability: Physical factors, biological factors, chemical factors, thermal 
factors. 

Post harvest Losses: Forms and measurement of post harvest losses, measures to 
control losses. 

Pre-storage handling of Food Products: Physiological maturity, harvesting, threshing, 
collection, transportation, and receiving system. 

Drying and Aeration: principle of drying, solar drying, artificial drying, types of dryers, 
components of dryers, factors affecting drying rate, natural aeration, artificial 
aeration, methods of aeration, air conditioning/refrigeration. 

Storage: Basic requirements for a storage structure, classification of storage structure, types 
of Public storage structures, storage structure design, temporary and permanent storage 
facilities, Non-conventional storage facilities, considerations in selecting type of storage 
structure, problems in grain storage, stored grain pests, control methods. 

Grades and Standards: Importance of grades and standards, food quality, establishing 
grades and standards, assessing the grade, grade factors and their importance, grading 
equipment, representative sampling, WTO and its regulation regarding quality control. 

Practicals 
1. Measurement of moisture content of grain, fibre, and other food products 
2. Measurement of size, shape, density, specific gravity, porosity, angle of repose, 
coefficient of friction, hardness test. 
3. Thermal properties of biological materials; specific heat, 
thermal conductivity. 
4. Study of air conditioning and refrigeration plants. 
5. Study of storage structures and their specifications. 
6. Visits to public / private storage structures. 

Suggested Readings: 
2nd ed. Vikas Publishing House, New Delhi, India. 
Experiments in food process engineering. CBS Publishers and distributers, New 
Delhi, India. 
Westport Connecticut. 
Gordon and Breach, N.Y., USA. 
Wharfedale Road, Ipswich, Suffolk

FMP-604 Industrial Engineering and Management 3(2-1)

Introduction: Industrialization and industrial policies of Pakistan; Classification of agro-based 
industries, management, operations research, system engineering, statistics, ergonomics, 
manufacturing engineering, ISO and WTO regulations. Production System Design: Mill and 
Plant Layout; Line Diagrams; Flow Diagrams, Work measurement. General 
Terminologies used in physical measurements. Product System control: Inventory control, 
production control, production planning, quality control, statistical process control charts, 
sampling plan, total quality management. Industrial Management: Definition of Management; 
Functions of Management: Personal Management; human resource development, Policy

Practicals
1. Study of organizational structures of selected industries.
2. Study of plant/factory layout principles.
3. Estimation of air, water, and soil pollutants of selected industries.
4. Study of different types of cleaners and conveyors.
5. Evaluation of different storage techniques.
6. Visit to local vendor Industries.
7. Student projects

Suggested Readings

FMP-606 Reverse Engineering in Agricultural Engineering 3(2-1)

Objective:
- Optimization of mechanical inputs
- Providing ingenious and indigenization solutions to problems
- Economization / cost reduction

Content:
Overview: Definition and scope
Steps Involved in Various Stages of Reverse Engineering: Analysis of functionality of the design: a) List of functional attributes of the machine/part. b) Attributes to be added/Modified by re-engineering; Exploding/Disassembling the Sub-assembly and Making the BOM (Bill of Materials); Materials Scanning for each Component: Physical Properties, Hardness and Tensile testing, Chemical testing- Materials Spectrometry, Functional validation of materials selection and performance, Recommended Improvement and/or modification in Materials etc; Metrological Probing in Reverse Engineering: Scanning of the parts, 3-D drawings with various design softwares Creating the Computer Aided Dimensional Parameter: Creating the Manufacturing processes by closely analyzing the manufacturing requirements of each part;

Practicals:
1. Drafting the Modified Parts: Create 2D drafts or 3D models of the parts in the BOM. (Depending on the Criticality or the Manufacturability of the parts) in BOM. (use Solid-works).
2. Create the complete Drawing folder for the BOM
4. Create Request for quote (RFQ) package for local vendors
5. Test of Modified Functional Paramters.

Suggested Readings

ID-301 Fluid Mechanics 3(2-1)

Objective: To study the fundamentals of fluid mechanics including statics and kinematic, concept of energy, momentum, forces and flow measurement.

Fundamentals of Fluid Mechanics: Definition and branches of fluid mechanics, distinction between solid and fluids, Properties of fluids: density, viscosity, surface tension, specific weight, specific gravity, etc., bulk modules of elasticity, compressibility of fluids. Fluid statics: Pressure variations in a fluid, pressure measuring devices, gauges and manometers, buoyancy and stability of submerged and floating bodies, forces on plane and curved surfaces, center of pressure. Fluid kinematics: Types of flow, dimensions of flow, streamlines, path lines, flow patterns for different references, continuity equation, source flow, sink flow, flow nets, uses and limitations of flow net. Pipe flow: pipe flow equations, head losses in pipes flow; friction losses due to ends, elbows, reducers, etc; pressure distribution along pipe line; laminar and turbulent flow in pipes, major and minor energy losses in pipes, branching pipes, flow distribution in pipes place in series and in parallel; pipe network analysis. Energy Consideration in Steady flow: General equations of steady flow, heads, Bernoulli’s equation and its Practical applications, hydraulic and energy grade lines, power consideration in fluid flow, cavitations, head losses, solution of flow problems. Momentum and forces in fluid flow: Impulse-momentum principle and application, force exerted on a stationary and moving bodies (flat and curved), relation between absolute and relative velocities, reaction of a jet, jet propulsion, torque in rotating machines. Fluid Flow Measurements: Orifices, weirs, notches and venture meter, pitot tube, coefficient of contraction, velocity and discharge, derivation of their discharge formulae and their applications.

Practicals
1. Demonstration of various parts of hydraulic bench.
2. Experimental study of laminar and turbulent flow.
3. Experimental study of tube gauges and dead weight pressure gauges.
4. Calibration of orifices by various methods.
5. Calibration of Venturimeter.
7. Verification of Bernoulli’s theorem.
8. Determination of meta-centric height.
10. Drag on a small sphere.

Suggested Readings

ID-302  Engineering Numerical Analysis  3(2-1)

Finite difference, Forward, backward and central difference and its operators form, Interpolation and extrapolation, Linear and higher order interpolating polynomials, Newton’s Gregory forward and backward difference interpolation formulas and its utilization as extrapolation, Lagrange interpolation and extrapolation, Numerical differentiation based on differences, Numerical integration; Trapezoidal and Simpson’ approximations, Trapezoidal and Simpson’s extrapolations by Romberg integration process, Numerical Solution of non-linear equations; Bracketing and iteration methods and its applications as multiple root methods, Direct solution of the system of linear equations; Gauss-elimination, Direct and indirect factorization, symmetric factorization, tridiagonal factorization, Iterative methods like Jacob’s iteration and Gauss-Seidel iteration, Numerical solution of initial value problems; Single-Step methods like Euler’s method, Euler’s modified method, Runge-Kutta method and its comparison with Taylor’s series expansion, Multi-steps methods like Adams Bashforth and Modulation two and three step methods, Higher order differential equations, system of differential equations, Numerical solution of linear and nonlinear boundary value problems.

Practicals
Numerical solution techniques will be elaborated and demonstrated.

Suggested Readings

ID-402  Fluid flow systems  3(2-1)

Pumps: Purposes, pump components, pump classification centrifugal, jet, positive displacement, turbine pumps, submersible pumps, propeller and mixed flow pumps and gas or air lift pumps; types of impellers (open, semi-closed, closed), terminology in pumping systems-specific speed, priming, pumping energy, total dynamic head pump problems and their remedies. Characteristic curves: TDH-Q curve, cavitations; net positive suction head; umps location, affinity laws, pump testing, maintenance of pumps, system head curves and its components for pumps selection, pumps in parallel, pumps in series. Pumping system head and power requirements; Suction lift, well draw down, friction head loss, operating head seasonal variation in system head curve, pumps selection, prime mover electric, diesel and their selection, feasibility of prime mover selection, determining pumping head, brake horsepower; water horse power; input horse power; pumping plant efficiency.

Practicals
1. Study of components of various pumps;
2. study of pump characteristics;
3. determination of pumps efficiency;
4. determining operating conditions and input horse power for pumps installed in parallel;
5. determining operating condition and input horse power for pumps installed in series;
6. laboratory study of losses in pipe flow;
7. visit to study the pumping system and pipe flow of a selected industry.
Suggested Readings

ID-501 Open Channel Hydraulics 3(2-1)

Objective:
To study the basic concepts of fluid flow, principles of energy and momentum, and characteristics of different hydraulic structures used in open channel.

Contents:
Basic Concepts of Fluid Flow: Types, state and regimes of flow, channel flow types, channel geometry, measurement of velocity in channel, velocity distribution in channel and its coefficients, pressure distribution in channel, effect of slope on pressure distribution.
Uniform Flow: Establishment of uniform flow. The Chezy’s and Manning’s equations, resistance coefficient estimation, normal depth and velocity, normal and critical slopes, free board, best hydraulic section, determination of section dimensions.
Rapidly Varied Flow: Characteristics of varied flow, sharp crested weir, aeration of the nappe crest shape and discharge over spillway, type and characteristics of the hydraulic jump, jump as energy dissipater, flow through sudden transitions.

Practicals:
1. Determination of discharging in open channel through different methods.
2. Development of stage-discharge curve (Y-Q Relationship)
3. Development of hydraulic jump
4. Flow through/over different hydraulic structures
5. Determination of critical flow, critical depth, alternative depth
6. Determination of Chezy and Manning n for a rectangular prismatic channel
7. Plotting flow profile of an open channel

Suggested Readings:

ID-502 Soil Mechanics 3(2-1)

Objective:
Developing an understanding about the physical properties of soils and their application in agricultural engineering.

Contents:
Physical Properties: Water Content, Void Ratio, Porosity, Degree of Saturation, Specific Gravity, Unit Weight and their determination, Atterberg limits, Sieve Analysis, Hydrometer and Pipette Analysis, Stoke’s Law, Grain Size distribution

Classification of Soils: Grain Size Classification; Bureau of Soils, M.I.T. Unified, AASHTO and ASTM Classification systems, Textural Classification by Triangular Chart, Unified Soil Classification, AASHTO Soil Classifications.

Permeability and Seepage: Definition, Hydraulic Gradient, Darcy’s Law, Factors affecting Permeability, Permeability of stratified soils, Laboratory and Field determination of coefficient of Permeability, Seepage Force, Quick Sand Condition, Flow nets, Boundary Conditions, Graphical Method of Flow net construction, Determination of Quantity of Seepage, Two Dimensional Flow, Laplace Equation, seepage through Earth Dams, Design of Filters

Compaction: Purpose and theory of Compaction, Moisture Content and Dry Density relationship, Standard Proctor Compaction Test, Modified Proctor compaction Test, Degree of Compaction and its determination in the Field. Methods of compaction in the field; Factors affecting compaction of soils.

Vertical Stresses in Soils: Definition, Stresses caused by self weight of soil, Geostatic stresses, stresses caused by Point Loads and Uniformly distributed Loads: Boussinesq and Westergard theories, Pressure bulb, Stress distribution diagram on horizontal and vertical, Stress at a point outside loaded area, Newmark’s charts and 2:1 Method

Soil Exploration: Importance of Soil Exploration, Soil Exploration methods, Probing, Test Trenches and Pits, Auger boring, wash boring, rotary boring, Percussion drilling and Geophysical methods, Sol Samples, Disturbed and Un-disturbed samples, In-situ Tests (SPT, CPT and PLT).

Practicals
1. Identification of Soil (Visual and Manual)
2. Determination of Moisture Content of Soil
3. Determination of Specific Gravity of Soil
4. Determination of Liquid Limit of Soil
5. Grain Analysis of Soil (including both Mechanical and Hydrometer Analysis)
6. Determination of Plastic Limit and Plasticity Index of Soil
7. Determination of Shrinkage Limit of Soil
8. Classification of Soil according to AASHTO and USCS
9. Modified/Proctor Compaction Test
10. Constant Head Permeability Test (Granular Soil)
11. Falling Head Permeability Test (Granular and Fine Grained Soils)

Suggested Readings:

ID-503 Engineering Hydrology 3(2-1)

Objective:
- To acquaint the students with the basic components hydrologic cycle and their analysis.
- Introduce a stream flow components, flood routing, and hydrology model.

Contents:
Hydrologic processes: Introduction, Hydrologic cycle and its components, importance of hydrology, climatic factors, estimation of precipitable water, snowcover and snow fall, stream flow, water stage, discharge, interpretation of stream flow data evaporation and transpiration, Evapotranspiration and its estimate using different methods.

Hydrologic Analysis: Hydrograph and its characteristics, run off and its components, recessions, hydrograph separation, rainfall-runoff relations, phenomenon of runoff estimating the volume of storm runoff, estimating snow melt runoff, seasonal and annual runoff relations, hydrograph of runoff unit hydrograph its derivation and application, overland flow.

Hydrologic Models: definition, classification of models, development, calibration, verification and application of models.

Practicals:
1. Demonstration of weather recording instruments and practice in taking actual data from weather stations including a visit to weather station.
2. Measuring runoff in the field by different techniques.
3. Development of unit hydrograph and its use.
4. Frequency analysis of rainfall data.
5. Measuring infiltration rate in the field.

Suggested Readings:

ID-504 Soil & Water Conservation Engineering 3(2-1)

Objective:
Understanding the process of soil degradation and its protection affectivity soil moisture and agriculture productivity.

Contents:
Conservation Structures: Drops Spillways, Chutes and Pipes Spillways; their requirements, components and limitations.

Practicals:
1. Measurements of soil loss from splash erosion by rainfall simulator.
3. Demonstration of moisture conservation techniques.
4. Field visit to areas with water and wind erosion prevailing.

Suggested Readings:

ID-505 Water Management Engineering 3 (2-1)


Water Storage Tanks: Sizing a water storage tanks. Considerations in sizing water storage tanks. General criteria. Design of storage tanks, construction of water storage tank, Preparatory works, Materials and procedures, Concrete base, Brick or stone walls, Concrete walls, Back filling. Stone pitching, Quantities.


Conjunctive Use of Water: Conjunctive use of saline groundwater. Effects of sediment and salinity on conjunctive use of water.

Practicals:
Flow measurements, water course survey, water course design,

Suggested Readings:
1. On Farm Water Management Field Manuals, (Revised 1996-97)
   c. Vol.VI Irrigation Agronomy.
   e. Vol. X Water Harvesting and Spate Irrigation

Ministry of Food, Agriculture and Livestock (Federal Water Management cell) Government of Pakistan, Islamabad.

ID-506 Hydraulic Machinery 3 (2-1)

Introduction: Definition. types and uses of hydraulic machinery. Steady incompressible flow in pressure conduits: Laminar and turbulent flow in circular pipes. major and minor energy losses in pipes. branching pipes. pipes in series. pipes in parallel and pipe network analysis.

Similitude and dimensional analysis: Geometric. kinematic. and dynamic similarity. dimensionless numbers like Reynolds number. Froude number etc. and their application. application of similitude and dimensional analysis in hydraulic model studies.
Similarity laws and factors for turbo-machines: Efficiency, similarities, restriction on use of similarity laws, peripheral-velocity factor, specific speed.

Hydraulic turbines: Definition, types of turbines, suitability of turbines, components of turbines, inlet and outlet velocity diagrams, guide blade angle, inlet and outlet vane angles WHP and BHP of turbine, hydraulic, mechanical and overall efficiency of turbines, factors influencing the performance of turbines.

Practicals:
1. Impact of jet on stationary flat and curved vanes.
2. Measurement of various losses through pipes and pipe fittings.
3. Verification of Reynolds number.
4. Components and operational characteristics of various pumps.

Suggested Readings:
4. Khana Publishers, New Delhi, India.

ID-507 Soil Dynamics 3 (2-1)


Practical
1. Determination of consolidation under given load.
2. Determination of shear strength of soil.
3. Coulomb’s earth pressure theory.

Suggested Readings:

ID-508 Ground Water Hydrology 3 (2-1)

Introduction: Basic concepts of Ground Water and Soil water, Types of subsurface water, Water Potential, Aquifer types, Soil water movement and Ground water movement, Forms and origins of Ground water, Aquifer functions, Porosity, Storage coefficient, Hydraulic conductivity, transmissivity.
Ground Water Movement: Darcy’s Law and its applications, Observation wells, Peizometers, Flow nets, Streamlines, Equipotential lines, Steady and non-steady flow.
Contamination in Ground Water (The teacher will elaborate this topic to the students)
Well Hydraulics: Steady flow in confined and un-confined aquifers, Steady flow in confined with uniform recharge, Unsteady flow in un-confined aquifer, Wells near aquifer boundaries, Multiple well system, Specific capacity, Well losses, Well efficiency and aquifer testing.
Construction of Tube Wells: Well drilling methods, selecting and setting of screens, design and placing of gravel pack, methods of well development, Tube well performance tests.

Practicals:
1. Water level measurements by electrical sounding.
2. Determination of groundwater flow rates and direction.
3. Determination of well losses and well efficiency.
4. Design of gravel packing for specific conditions.
5. Determination of hydraulic properties of aquifers.
6. Demonstration of an available groundwater computer model.

Suggested Readings:
4. Ahmad, N. 1985. “Ground water Resources of Pakistan” Shahzad Nazir Publisher, Gulberg-III, Lahore

ID-601 Irrigation Engineering 3(2-1)

Objectives:
- To enrich the students with the importance, development and management issues of irrigation network of Pakistan
- Application of various field application methods, design of irrigation channels through different approaches.

Contents:
Introduction: Definition, necessity of irrigation, water resource and irrigation system of Pakistan, Indus Basin Treaty, water budget of Pakistan
Water Requirement of Crops: Functions of irrigation, preparation land for irrigation, crop period, base period, duty and delta, relationship between duty and delta, factors affecting duty, depth and frequencies of irrigation, Kharif-Rabi ratio, optimization of irrigation water, irrigation efficiency, uniformity coefficient, consumptive use of water, effective rainfall, net irrigation requirements, gross irrigation requirement, estimation of consumption use, Blaney Criddle, Hargreaves Methods, assessment of irrigation water wharges
Methods of Irrigation: Classification of irrigation methods, factors affecting the choice of irrigation methods, surface methods, sub-surface irrigation methods
Hydraulic Structures: Introduction: Dams, weirs, and barrages. Classification of dams, Gravity dams, Forces acting on a gravity dam, Modes of failure, Principal and shear stresses, Stability analysis, Elementary profile of a gravity dam, Practical profile of a gravity dam, Limiting height of a gravity dam, Profile of high masonry gravity dam.
Water conveyance structures: Introduction: Canals, distributaries, minors, and water courses. , Basic definitions, alignment of canal, water distribution system, required canal capacity, seepage losses, empirical formula for channel Losses, channel section for minimum seepage losses.
Design of irrigation channels: Design of stable channel, regime channels, Kennedy’s theory, Lacey’s theory, estimation of transported sediment, bed load equations, design procedure for unlined non-erodible irrigation channel, maintenance of irrigation channels

Practicals:
1. Study of characteristics of various irrigation structures in the near by area.
2. Design and layout of a canal for a given command.
3. A field visit to canal irrigation system and structures.
4. Design of outlets.
5. Computer aided design of a watercourse for a command area.
6. Sampling and measurement of sediments in canal water.

Suggested Readings:
1. Irrigation Engineering & Hydraulic Structures by Santosh Kumar, Garg, 10th revised Edition, 1993
2. Irrigation & Water Power Engineering by Dr. B.C. Punmia, Dr. Pande B.B. Lal

ID-602 Drainage Engineering 3(2-1)

Objectives:
Providing knowledge and skills required on drainage systems, types, requirements and design of drainage systems, operation & maintenance.

Contents:
Introduction: Definition of agricultural drainage, drainage system terms, scope and benefits. Elements of drainage design, types of drainage problems, differences in drainage in humid and arid areas, crop requirements. Surface and Subsurface drainage principles, theories of open drain/ditch and subsurface drainage systems, design criteria.
Drainage Requirements: Plant processes. Raw materials, Plant structure, Factors controlling production. The soil environment and aeration requirement. Diagnosis and improvement of salt affected soils, Plant response to salinity, Soil response to excess water and salinity, Situation in which drainage problems exist.
Drainage System: Investigation procedure, Moisture holding capacity in the root zone, annual irrigation schedule, deep percolation from irrigation, sources causing high water table conditions, determination of barrier zone and drain locations.
Surface Drainage: Surface drainage system, type and functions of surface drainage ditches, land forming, joint surface and subsurface drainage system.
Sub-Surface Drainage: Planning subsurface drainage system, Use of vertical drainage system. Design, installation, and construction of subsurface drains, Maintenance of buried drains. Open ditches for drainage. Interceptor and mole drains; Design and construction.
Operation and Maintenance of Drainage System: Buried Pipe drainage system, open drainage system, drainage water disposal ponds, drainage observation well, policy and basic requirements, weed control and embankment stability.

Practicals:
1. Verification of Darcy’s Law by laboratory methods
3. Determination of water table,
4. Saturated hydraulic conductivity by piezometers,
5. Auger hole, planning of a subsurface drainage system and outlet with design of a sump;
7. Computation of leaching requirement and drainage coefficient of a drainage basin.
8. Total coliform test in drinking water by multiple fermentation tube method.

Suggested Readings:

ID-603  Farm Irrigation Systems  3 (2-1)

Farm Irrigation Systems and Systems Design Fundamentals: Functions of farm irrigation systems, Types of farm irrigation systems such as diversion methods, conveyance methods, and application methods, Design of farm irrigation systems, Data for design, Water source evaluation and determination of daily design requirements.
Crop Water Requirements: Plant soil relationship, Evapotranspiration, Determination of evapotranspiration and irrigation scheduling.
Surface Irrigation: Different methods of surface irrigation, furrow irrigation, border irrigation and basin irrigation, Surface irrigation process, Effectiveness of surface irrigation i.e. uniformity, application efficiency etc. Design of surface irrigation system, Infiltration data for surface irrigation, Design of furrow, border and basin irrigation systems.
Sprinkle Irrigation System: Advantages and disadvantages of the system, Types of sprinkle system, Components of sprinkle system, Design of set-move including its layout, number of lateral operated per irrigation set and sprinkle selection.
Trickle Irrigation: Advantages and disadvantages of trickle irrigation, Problems associated with trickle irrigation, Trickle irrigation methods, Trickle irrigation system components, Trickle irrigation laterals, Mainlines and manifolds, Control heads and control of trickle irrigation clogging.

Practicals:
1. Design and layout of surface irrigation methods for a given field.
2. Field evaluation of surface irrigation system.
3. Design and evaluation of sprinkler irrigation system for a given field.
4. Design and evaluation of drip irrigation system.
5. Evaluation of surface irrigation system using appropriate computer software (BASCAD etc.)
6. Preparing irrigation schedule of cropped field.

Suggested Readings:
ID-604 GIS & Remote Sensing 3(2-1)

Objective:
Understanding basic principles of Global Information System (GIS) & Remote Sensing (RS), and their applications in the field of agricultural engineering.

Contents:
Displaying Data: Creating map, Adding tabular data to a map, Symbolizing data. Labeling, Charting and Map projection. Layout.
Querying Data: Getting attributes of features. Attribute of particular feature, Feature near other, Fall inside polygon, Intersect other feature. Aggregation of data.
Data Creation: Creating and editing spatial data. Registration and digitization. Working with images and aerial photographs. Working with CAD in GIS environment.
Analyzing Data for Specific Purposes: Creating suitability map for various purposes. Soil, rainfall and water pollution map for various parameters. Use of GRID data for groundwater sources.

Practicals:
1. Land use/Land cover,
2. water quality monitoring,
3. land degradation,
4. monitoring of environmental pollution,
5. crop production,
6. water resources,
7. weather analysis and forecasting.

Suggested Readings:
1. Arc View 3.x, Arc GIS 9.3 and Map Info
2. ERDAS Imagine 9.1 and Differential GPS set.

ID-605 Water Quality Management 3(2-1)

Introduction: Definition and concepts, irrigation and drainage water quality, water quality terminolgy, water quality objectives, quality criteria and standards for irrigation water carcinogenic/non carcinogenic substances, water quality status in Pakistan.
Water treatment: Water pollution and their sources, water treatment techniques i.e. coagulation, softening, mixing and flocculation, sedimentation, filtration etc.
Drainage Effluents and Management Techniques: Sources of drainage water, characteristics, quality of drainage water, alternates for disposal of drainage water drainage water reuse techniques, crop management, soil management techniques, chemical management techniques, drainage and leaching fractions, concepts of preferential flow.
Agricultural chemicals and Groundwater Contamination: Agricultural chemical, their uses, trends and properties concept of nitrate nitrogen and pesticides transport; through the soils, behavior of agricultural chemicals in flooded/water logged soils, management practices to avoid groundwater contamination.

Practicals:
1. Analysis of drainage water for irrigation purposes.
2. Waste water analysis for BOP, COD and other chemicals.
3. Visit to waste water treatment plants, drainage system and drainage reuse sites
4. Use of computer software to assess non-point source pollution.

**Suggested Readings:**

**ID-606 Irrigation Water Management Techniques 3(2-1)**

Introduction: Concept of water management and its developments in Pakistan, components of water management. Water distribution: Irrigation system management, warabandi-types, rotation system advantages and disadvantages, constraints of warabandi. Soil-water plant Relationship: Soil moisture and its types, soil moisture characteristics, field capacity, wilting point, total available water, management allowed deficit, infiltration rate, hydraulic conductivity.


**Practicals:**
1. Determination of field capacity and wilting points of a soil sample.
2. Land leveling of a given field and cost estimate.
3. Field visits of earthen and lined water courses.
4. Flow measurement in a watercourse and interpretation of data.

**Suggested Readings:**
3. Jensen, M.E, 1981, Design and Operation of Farm Irrigation System. ASAE, Monograph, USA.

**ID-608 Project Planning and Management 3(2-1)**

Project Planning, Scheduling and Controlling by Deterministic Models: project planning activities, Rectangular bar chart, CPM, developing a critical path schedule, determining the minimum total cost of a project. Manual versus computer analysis of critical path methods, preparing a execution schedule, scheduling resources, delivering Materials, scheduling laborers, Financing the project, Job layout, Project control during construction, keeping equipment records, Project supervision. construction cost control, cost control records. Project Planning, Scheduling and Controlling by Probabilistic Models: PERT project Evaluation & Review Technique, Statistical tools as mean variance. Standard Deviation. Probability distribution, beta courses, center limit, Use of computer software in project management and planning. claims and arbitration: claims, escalation, indexation, arbitration and litigation. Factors Affecting the Selection of Equipment and Tools: standard types of equipment, special equipment, the cost of owning and operating equipment, depreciation cost, straight line depreciation, decline balance method, sum of the year, digit method. Investment costs, operating costs, economical life of construction equipment, cost of depreciation and replacement, Maintenance and repair costs,
down time costs, economical cost of equipment, sources of construction equipment, labour problems, labour organization, prevention and settlement of disputes.

Practical
Preparing a PC-I project proposal for a small irrigation project

Suggested Readings:
1. Guidelines of the Planning Commission on Project Planning Execution and monitoring

SEE-301 Engineering Drawing & Graphics 2(1-1)

Objective:
- To enable the students to prepare agricultural and structural drawings manually as well as using computer.

Introduction:
Introduction to engineering drawing, various types of lines, basic geometrical constructions, conic sections, theory of orthographic projection, dimensioning & lettering, Introduction to tolerance, projections on points, projections of straight lines, Projections of planes and solids in simple position, sectioning of solids, Isometric projections, development of surfaces.

Practicals:
1. Introduction to drawing instruments and their use, various scales,
2. practice of orthographic projection missing lines in orthographic projection,
3. Drawing three views of different objects,
4. Practice of Dimensioning and Lettering,
5. Practice of Sectioning,
6. Conversion of orthographic projection into isometric view,
7. Creating drawings of Engineering Fasteners like Rivets, Cotters Joints, threads etc.

Suggested Readings:

SEE-302 Engineering Mechanics 3(2-1)

Concept of measurement of mass, force, time and space, Systems of units, Fundamentals & Derived units, Conversion of units, required Accuracy of results, General Principles of Statics, Vector addition, Subtraction and Products, Resultant of Distributed (Linear & Non-linear) force Systems, General conditions of equilibrium of Co-planer forces, Laws of Triangle, Parallelogram and Polygon of forces, Types of beams, Supports and Loads, Simple cases of Axial forces, Shear forces and Bending Moment diagrams, Problem involving friction on Flat surfaces, Geometrical Properties of Plane Areas, Work, Energy, Power, Impulse, Momentum, Conservation of Momentum and Energy, Rectilinear and Curvilinear motions, Tangential and Normal Components of Acceleration, Simple Harmonic motion

Practicals:
1. To verify the law of polygon of forces,
2. the law of parallelogram of forces,
3. the principles of moments,
4. the co-efficient of friction between surfaces.
5. Special numerical problems and assignments.
6. Moment of inertia of fly wheel mounted on wall and a wooden block by suspension.
7. Efficiency of various models of machines.
8. Modulus of rigidity of metal bar by static and dynamic methods.
9. Special numerical problems and assignments.

Suggested Readings:

SEE-304 Computer Aided Design 2(1-1)


Practicals
Drawing and working problems on AutoCAD Mechanical Power Pack Package

Suggested Readings:

SEE-402 Mechanics of Materials 3(2-1)


Practicals:
1. Practical exercises related to axial loaded,
2. bending torsions and deflection of beams.
3. Buckling curved bars, strain gauges and fatigue loading,
4. special numerical problems and assignments.

Suggested Readings:

SEE-501 Surveying & Leveling 4(2-2)

Objectives:
• To enable students to understand theory and practice of land surveying and leveling.
• To develop skills to use modern survey instruments for above objective.

Contents:
Introduction: Surveying instruments; Chains, Tapes, Steel Bands, their Types and Uses
Chain Surveying: Ranging and chaining of survey Lines. Fieldwork and plotting of chain survey.
Compass Surveying : Prismatic Compass and Surveyor Compass, Uses, Bearing, Local Attraction, Fieldwork and Plotting
Plane Table Surveying: Parts and Accessories, Methods of Surveying, Two Point and Three Point Problems
Leveling :General Principle, Types of Levels and their temporary and Permanent Adjustments, Methods of Leveling, Reduction of Level, Precise Leveling and Trignometric Leveling
Theodolite: Types and uses of Theodolites, Temporary and Permanent Adjustments, Measurement of Horizontal and Vertical angles
Tachometrical Surveying: Methods of Tachometric Surveying, Fieldwork and computations.
Traversing; Traversing with Prismatic Compass, Theodolite and Plane Table, Computations and Adjustments of Traverse, Transformation of Co-ordinates
Omitted Measurements: Calculation of Areas and Volume, Earth work calculation, D.M.D method, Simpson rule and Trapezoidal rule

Practicals:
1. Practice on measurement of distances and introduction to measuring instruments
2. Chain Surveying and plotting
3. Compass Traversing
4. Plane Table by methods of radiations and intersections
5. Two Points Problem
6. Three Points Problem
7. Level adjustments by Two-Peg method
8. Profile and Cross-Sectioning
9. Theodolite Traversing

Suggested Readings:

SEE-502 Farm Structures & Materials 3(2-1)

Objectives:
• To develop ability of students to understand and carry out specified farm structure
• To familiarize about the characteristics of material used in agricultural engineering related structured

Contents:
Heat flow through Walls Insulation: Rate of heat transmission through building materials, conductance, combined conductance coefficient. Equation for heat flow through non-homogenous walls, combined ceiling and roof coefficient.


Dairy Building: Functional planning, Environment, Sanitation, Space requirements for animals and traffic, arrangement of space. Other considerations, Milking Parlors, Pen vs Stall Barns, Storage or feed, Milk and manure etc. Insulation and ventilation.

Poultry Housing: Functional planning, Production practices, Environment, Space requirements, Arrangement or space. Insulation and ventilation, other considerations.


Practicals:
1. To draw the layout plan of old and new agricultural engineering workshop.
2. Different materials used in farm structure their properties and their requirement.
3. To draw the layout plan of dairy farm and its requirements.
4. To draw the layout plan of horse farm and its requirement.
5. To draw the layout plan of poultry farm and its requirement.
6. Design problems of farm structures and godowns.
7. Numerical problems related to capacity of farms, size of farm.
9. Design problems of grain storage structures.
10. Storage of milk and its processing at dairy farm and numerical problems related to it.
11. Animal shelters in farm their types and size according to the size of animal.

Suggested Readings:
1. French T.E. 2010. Agricultural Drawing and design of farm structures. Nabu Publisher, USA

SEE-503 Environmental Engineering 3(2-1)

Objectives:
- Teaching various aspects of environmental science and engineering.
- To familiarize students with the basic principles of environmental engineering.

Contents:
Basic definitions. Importance of environmental control in agriculture. Pollution and their classification. Environmental monitoring and control.

Water Pollution: Irrigation water quality, criteria and standard. Sources and types of pollution, agricultural practices and water pollution, solute transport phenomenon, judicious use of water to avoid leaching, land and water management techniques for controlling water pollution, subsoil contamination.

Air Pollution: Types of air pollutants, sources of air pollution, global warming, ozone depletion, hazardous substances, World's carbon pollution. Horizontal and vertical dispersion of pollutants, cleaning the atmosphere, measurements of particulates, gases and their control.

Noise Pollution: Sound pressure level, frequency and propagation, Acoustic environment and health effects of noise, measuring noise, noise control.
Practicals:
1. Measurements of pH, colour, odour, BOD, COD, solids, nitrate of water and waste water etc.
2. Design of Green House and Plant Environment Control System.
3. Measurement of dust and fume in the air.
5. Case studies exercises and assignments.
6. Total coliform test in drinking water by multiple fermentation tube method.

Suggested Readings:
5. Kumar, A. 2004. Industrial Pollution and Management

SEE-504 Water Supply and Sewerage 3(2-1)

Introduction: overview of water supply and sanitation in Pakistan; Health Aspects of Water Supply and Sanitation; Water availability standards. Water Supply: sources of water, Choices of water sources (spring, wells etc) and their protection. Design and construction of Tubewells, Dug wells and handpumps.
Forecasting population, Consumption for various purposes, Factor effecting consumption, Analysis Impurities in water, Physical tests, chemical tests, Bacteriological tests. Economics of community water supply, Planning and design of low cost water supply schemes. Water Treatment and Distribution : sedimentation tank, Coagulation, Flocculation, Usual coagulants, Mixing devices, Filtration, Filter sand, Classification of filters, disinfections, Chlorination. Sanitation: purpose of sanitation, Site for sewage treatment work, Water borne and helminth diseases and their control, Health and water chemistry, Planning and design of low cost sanitation. Composting and biogas, sanitation and irrigation, Agriculture and aqua cultural reuse.

Practicals:
1. Assessment of water supply demand of a community
2. Design of a water supply project Determination of physical, and chemical characteristics of drinking water
3. Determination of Bacteriological characteristics (Coliform count) of water and waste water
4. Visit to a drinking water treatment plant.

Suggested Readings:

SEE-505 Quantity Survey and Cost Estimation 3(2-1)

Scope: Scope of civil engineering works; General practice in government departments for schedule of rates and specifications; Rate analysis; Specifications for various items of construction.
Bill of Quantities (B.O.Q) & Measurement Book (M.B): Types and methods of estimates, Working out quantities, rates and cost analysis of construction materials; Valuation, depreciation and sinking fund.

Contents and preparation of bills of quantities for different projects like irrigation, roads, sanitary, building etc. and maintaining of Measurement Books. Measurement, specification and costing of excavation and back filling, mass concrete retaining walls, beams, concrete piles, steel or wooden truss or steel framed gantry, estate road, sewer and water main pipe works. Priced bill of quantity.

Tendering: Preparation of civil engineering contracts and tender documents. Introduction to claims and conflicts resolution e.g. escalation, indexation, arbitration and litigation.

Practical:
Evaluation of proposals and contracts.

Suggested Readings:
1. E.W. Steel and Terence J. Mc GHEE, Estimating & Costing,

SEE-506 Meteorology and Climate Change 3(2-1)


Practicals:
Determination of Pressure, Temperature, Humidity, Sunshine hours, Precipitation, Wet and Dry bulb thermometer and other weather parameters in a weather station.

Suggested Readings:

SEE-507 Environmental Management System in Industry 3(3-0)


Suggested Readings:
3. ISO 14000 Standards Manual
4. Pak EPA Act, 1997

**SEE-601 Landscape Engineering 3(2-1)**

**Theory:**
Introduction, importance of landscaping, gardening and its design, principles and elements of landscape design, landscape design materials, types of designs; formal and informal garden designs, Chinese and Japanese gardening, rockeries, terrace, roof and water gardens, plants suitable for various designs, landscape designs for public and private buildings, parks and playgrounds etc., highway and roadside plantations, developmental cost estimates for landscape.

**Practicals:**
1. Visits to different parks and gardens,
2. landscape designs for private and community houses, schools, colleges, universities, municipal and national parks, industrial areas and roadsides;
3. establishing various types of gardens.

**Suggested Readings:**
2. William M.M. 2010. Landscape Planning Environmental Applications Wiley publisher, USA

**SEE-602 Water Quality and Pollution 3(2-1)**

**Introduction:** Definition and concepts, irrigation and drainage water quality, water quality terminology, water quality objectives, quality criteria and standards for irrigation water carcinogenic/non carcinogenic substances, water quality status in Pakistan.

**Water treatment:** Water pollution and their sources, water treatment techniques i.e. coagulation, softening, mixing and flocculation, sedimentation, filtration etc.

**Drainage Effluents and Management Techniques:** Sources of drainage water, characteristics, quality of drainage water, alternates for disposal of drainage water drainage water reuse techniques, crop management, soil management techniques, chemical management techniques, drainage and leaching fractions, concepts of preferential flow.

**Agricultural chemicals and Groundwater Contamination:** Agricultural chemical, their uses, trends and properties concept of nitrate nitrogen and pesticides transport ;through the soils, behavior of agricultural chemicals in flooded/water logged soils, management practices to avoid groundwater contamination.

**Practicals:**
1. Analysis of drainage water for irrigation purposes.
2. Waste water analysis for BOP, COD and other chemicals.
3. Visit to waste water treatment plants, drainage system and drainage reuse sites Use of computer software to assess non-point source pollution.

**Suggested Readings:**

Practicals:
1. Visit of small, medium and large water treatment plants and writing of a report on the functioning and maintenance of the plants.
2. Visit of wastewater treatment plants in urban areas and writing a report of the visit of plants.

Suggested Readings:

Objective:
- To develop understanding regarding the concept / design of rural electrification project and its usage in various agro based activates, farm structure and house etc.

Content:
Benefits of electricity in agriculture, elementary transmissions and distribution, transformation voltage; basic principles, ratio of transformation, iron and copper losses; regulation, auto-transformers, 3-phase transformers, delta star connections, scot connection, constructional features and cooling of transformers; Electrical wiring practices: farmstead and farm houses; Radiation: types of radiation and application in agriculture; Resistance heating: units advantages and applications; Sensing elements and fundamentals of control: response to environmental factor like temperature, pressure, humidity, radiation etc. Selection of motors: single and three phase; Selection of electrical wires and distribution types; Electrical wiring, electrical distribution systems, electrical panel boards, one-way and two-way wirings/connections, single phase and three phase connections.

Electricity Fundamentals: Nature of electric current, resistance and voltage, effect of temperature on resistance, specific resistance, Ohm’s Law, units of power, arrangements of resister in series and parallel, Kirchoff’s Laws.
Electric Machines: DC Machines, AC Machines, Transformers,
Electric Instruments: Introduction to electric instruments, types & application of different electric instruments (Potentio-meter, strain gauges, electric transducers)
Farmstead Distribution System: Electric load, types of distribution centers, locating the distribution center, selection of wire for feeder lines.
Electricity for Water Supply and Cooling: Horsepower required for pumping, wiring devices and control, energy cost of water system, refrigeration cycle and refrigeration Control, calculating the product load and space load.
Electricity for Heating: Advantages & disadvantages of electric heating, electric heating elements, electric heating equipment, under heat brooders, infrared brooders, electric hot bed.
Electrical Control and Special Equipments: Switches, relays, push buttons, thermostats, time switches, floating switches, pressure switches, milk cooler, electric fences & feed processing equipments.
Practicals:
1. Safety and precautionary measures of use of electrical appliances in the machinery workshop and field.
2. Study of construction of panels of wiring systems.
3. Study of transformer types.
4. Use of motors for different operations in the machinery workshop at farm buildings.
5. Practice on repair and adjustment of electrical alliances. (motors, switches, fuses etc)
6. Electrical power tools and their application in agriculture and village homes.
7. Verification of Ohm’s Law
8. Verification of Kirchhoff’s Law
9. Verification of Kirchhoff’s Voltage Law
10. To study the construction of a transformer
11. To study the construction of D.C/A.C machine
12. Demonstration of an A.C Series and Parallel circuit
13. Study of the different types of wiring system

Suggested Readings:

SEE-605 Engineering Materials 3(2-1)

Metals: Composition and properties of ferrous and non-ferrous metals. Effect of various heat treatments on the properties of steel and its alloys. Methods of corrosion control.
Paints, Plasters and Varnishes: Composition, preparation, properties, tests and uses of paints, plasters, varnishes and distemper.
Miscellaneous Materials: Composition, varieties, properties and uses of glass, plastics, Laminates and adhesive. Properties and uses of asphalt, rubber and asbestos.

Practicals:
1. Measurement of angle of twist by using torque measuring apparatus
2. Universal testing machine
3. Torsion testing machine
4. Beam testing rig
5. Compression test by using hydraulic press
6. Cement testing machine
7. Measurement of deflection by Helical spring apparatus
8. Measurement of extension by Leaf spring apparatus
9. Charpay impact tester
10. Los angles abrasion testing machine
11. 7-Ton Hydraulic strut tester
12. To determine compressive strength of concrete
13. Brenile hardness tester

Suggested Readings:

SEE-609 Environmental Impact Assessment 3(3-0)


Suggested Readings:

AENG-601 Project & Report I 3(0-3)

Introduction to technical report writing, important components of technical writing, selection/preparation of research topic, objectives, review of literature, methodology, data processing, results, conclusions, summery, abstract, presentation of (data collected in the field/laboratory) results in the form of graphs, tables, figures, and photographs, references and appendices, report writing, presentation methods and skills.

Suggested Readings:

AENG-602 Project & Report II 3(0-3)

Introduction to technical report writing, important components of technical writing, selection/preparation of research topic, objectives, review of literature, methodology, data processing, results, conclusions, summery, abstract, presentation of (data collected in the field/laboratory) results in the form of graphs, tables, figures, and photographs, references and appendices, report writing, presentation methods and skills.

Suggested Readings:
# LIST OF MINOR COURSES
For BSc AGRICULTURAL ENGINEERING

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<th>Course No.</th>
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<td>ENG-101</td>
<td>English Composition and Comprehension</td>
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<td>MATH-301</td>
<td>Linear Algebra &amp; Calculus</td>
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<td>AGRON-319</td>
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<td>SES-602</td>
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**IS-202 or SSH-202a**  Islamic Studies or Ethics for Non-Muslims  
(Attached at the end)

**ENG-101**  English Composition and Comprehension  
2(2-0)

Composition: Adverb and Adjectives; their forms and use; Articles and their use, prepositions; Relative pronouns, clauses; Conditional sentences; Correction of sentences.  
Comprehension: Getting the essential information; Effective communication; Comprehension writing, rules, practice; Order of importance: Application for job; Technical Report writing; Essay writing; Critical Reading and Thinking: The Damned Human Race (Article); How to live to be 200 (Article)

**Suggested Readings**
2. Ahmad, A. 2009, To The Point (English Grammar & composition for degree), To the point publishers, 5-A. Yousaf Market, Ghazni Street, Urdu Bazar, Lahore.

**MATH-301**  Linear Algebra & Calculus  
3(3-0)

Objective:  
To learn fundamentals of algebra & calculus.

Contents:  
Basic set theory: Complex numbers: Cartesian and polar form, De Moivre’s theorem, roots, exponential, trigonometric, hyperbolic and logarithmic functions’, complex powers.  
Matrices: square matrices, determinants, reduced echelon form, rank, eigen-values, eigenvectors, Markov processes, mass transient problem, forecasting of weather and develop the
solution of system of differential equations for mechanical systems/electrical systems/agricultural/civil engineering especially in public health engineering problem, linear transformation, modeling and solution of system of linear equations. Vector spaces: group, subgroup, ring, field, vector space, subspace, linear independent and linearly dependent set of vectors, spanning set, basis for a vector space and its applications in engineering.

Differential calculus: limit, continuity, derivative, total differential, higher order differentiation, tangent and normal, Taylor series, Maclaurin series, extreme values, 1st and 2nd derivative test, point of inflection and its applications in business and engineering.

Integral calculus: limit of sum, Riemann integration, evaluating integrals, definite integrals, area under a curve and other applications of integration.

Suggested Readings:

PY-301 Applied Physics 3(2-1)


Practicals:
1. Construction of wiring systems, fuses, switches of various types insulators.
2. Circuits design and drawing of a typical farm electrical system.
3. Selection of motor for various farm equipment such as forage cutter, feed-grinders, and shop tools.
4. Practice on repair and adjustment of electric motors, switches, fuses, transmission wiring controls.
5. Study of 3 phase induction motor.
6. Study of star and delta connections.
7. Study of semi conductor, triode, diode valve and transistors.
8. Use of AVO meter, CRO, plani meter.
9. Fabrication of full wave rectifier and inductance study of its wave-shape.

Suggested Readings

AGRON-319 Basic Agriculture for Engineers 3(2-1)

systems and crop rotations, Irrigation systems. Production technology of major and minor crops. Classification of field crops w.r.t. their food value. Techniques and practices for enhancing crop productivity.

Practicals
1. Land measuring units (Conventional and metric systems).
2. Identification of various soil types;
3. Demonstration of various irrigation methods;
4. Identification of various crops and their seeds w.r.t food value;
5. Demonstration of improved sowing methods;
6. Visits to grain storage facilities and progressive farms;
7. Raising nursery for transplanting seedlings of non-traditional / regional crops;
8. Study of medicinal crops and organic farming.

Suggested Readings

AEE-302 Communication & Presentation Skills 3(2-1)
Definition, types and functions of communication; effective communication and its barriers; verbal communication skills; speaking, speech making, listening, reading and writing. Preparing and delivering a speech, development of effective reading skills, art of effective writing, writing scientific and popular articles. Listening: the process, types, barriers and strategies for effective listening; non-verbal communications; characteristics, functions and types; leadership; concept, techniques, functions and characteristics; development of effective leadership skills.

Practicals
Communication & Presentation Skills labs related to speaking, speech making, listening, reading and writing.

Suggested Readings
Impurities in natural water, hardwater, water softening, boiler scales and deposits, industrial, irrigation and municipal water, metallic corrosion and its inhibition, paints and varnishes, fats and oils, extraction, refining and hydro- genation of oils, sugar industry and its by-products, nitrogenous, phosphatic and potassic fertilizers. Aerobic & non aerobic fermentation.

Practicals
1. Determination of carbonates and bicarbonates in industrial water
2. Determination of chlorides and sulphates in industrial water
3. Determination of pH and TSS in water
4. Estimation of nitrogen, phosphorus and potassium in fertilizers
5. Analysis of an oil for acid, saponification and iodine value.

Suggested Readings

CS-401 Computer Programming and Applications in Engineering 3(2-1)

Introduction: Computer components, operating system, software & applications, Programming: Introduction, programming languages, flowchart, programming structure, introduction to C++, application of C++ to solve engineering problems, modeling and simulation.

Practicals
1. Demonstration of computer components and Windows installation.
2. Exercise on the use of word processing, spreadsheet and engineering graphics.
3. Programming of engineering problems with C++.

Suggested Readings

MATH-401 Differential Equations, Power Series, Laplace Transform 3(3-0)

Ordinary Differential Equation: Basic concepts of ordinary differential equation, General and particular solution, Initial and boundary condition, Linear and nonlinear differential equations, Solution of first order differential equation by separable variables and its application in our daily life situations, Techniques like change in variables homogeneous, non-homogeneous, exact, non-exact, linear and non-linear Bernoulli could be used in case of complications. Solution of second order differential equations by theory of operators and its application as forced and free oscillations, the extension of second order solution criteria to high order differential equations, solution of the system of differential equations by theory of operators and its application in daily life situations, Partial Differential Equations: Basic Concepts, linear and non-linear P.D equations, Quasi linear and Quasi non-linear P.D equations, homogenous and non-homogenous P.D equations, solutions of P.D equations, boundary and initial conditions as dirichlet conditions, Neumann’s condition, Robin’s/mixed condition, classification of P.D equations as Elliptic conditions, Parabolic and hyperbolic. Analytic Solution by separation of Variables of the Steady State, two dimensional heat equation/Laplace equation and un-steady one dimensional heat equation/Diffusion equation with homogenous and non-homogenous boundary conditions.
D’Alembert’s solution of two dimensional wave equation homogenous and non-homogenous boundary conditions. Fourier Series: Periodic waveforms and their Fourier representations, calculating a Fourier series, Fourier series of odd and even functions, Half range Fourier series, Fourier series solution for the above P.D equations.

Suggested Readings

RS-401 Sociology for Engineers 2(2-0)

Studying the Group Dynamics; Types of Social Groups, Primary and Secondary groups, In-groups and Out-groups, Reference Group; Group Dynamics; Group Size, Leadership, Social Loafing, Social Dilemmas, Groupthink, Conformity. Types of Disputes: Dispute Resolution Techniques; Participatory Irrigation Management; Organizational Techniques for Sustainable Social Organizations: A Case Study; Community Development: A Case Study of AKRSP.

Suggested Readings

SSH-102 Pakistan Studies 2(2-0)

Historical Perspective: Two nation Theory; Ideology of Pakistan; Objectives for the creation of Pakistan; Important personalities in the creation of Pakistan; Sir Syed Ahmad Khan; Allama Iqbal; Quaid-e-Azam. Constitutional Development in Pakistan: Objectives Resolution and its constitutional importance; Ulma’s 22 points; Islamic provisions of 1956 constitution; Islamic provisions of 1962; Constitution; Islamic provisions of 1973 constitution. Contemporary Pakistan: Objectives of Pakistan’s foreign policy; An overview of Pakistan’s foreign Policy; Pakistan’s foreign policy towards her neighboring countries; Regional organizations.

Suggested Readings
1. Amin, Shahid. 2010, Pakistan’s Foreign Policy, Oxford University Press, Karachi.

STAT-402 Statistics and Probability 3(2-1)

Complementary events, Concepts from communication theory, Problems related to engineering, Conditional probability, The multiplication law, Independent events, Baye’s formula, Permutations and combinations, Multiplication principle, Problems related to engineering, science and management, Applications of counting, Bernoulli trials, Binomial probability, Markov chains, Probability distribution, Expected value, Decision making, Problems related to engineering and management.

**Practicals**
1. Simple, Multiple and Component bar diagram.
2. Histogram, Frequency polygon,
3. Frequency curve, c.f. curve, cumulative percentage curve and locate Quantiles.
4. Problem assignments relating probability.
5. Fitting a Binomial distribution.
6. Fitting a Poisson distribution.
7. Fitting a Normal distribution.
8. Sampling distribution of difference between two means.
10. Test of significance of association of attributes by $x^2$-test (chi-square test).
12. Calculating a simple, partial and a multiple correlation and their tests of significance.
   Fitting a simple linear regression equation and its test of significance by Analysis of Variance (F-test) and t-test.

**Suggested Readings**

**SES-501 Soil Science 3(2-1)**

**Objective:**
Developing understanding of basics of soils in agricultural engineering perspective.

**Contents:**
Soil Colloids: General constitution of Silicate clays, Adsorbed cations, Silicate clay structure, Classification of Silicate clays, Chemical Composition of silicate clays, Cation exchange capacity of soils, Plasticity, Cohesion, Swelling, Shrinkage, Dispersion and Flocculation.
Plant Nutrients and Fertilizers: Factors controlling the growth of higher plants, The essential elements from air, water and soil, Soil solution, Soil and plant interrelations, fertilizer elements, Nitrogen Fertilizers, Phosphates Fertilizers, Potassium Fertilizers, Mixed Fertilizers, Methods of applying solid fertilizers, Application of liquid Fertilizers.
Saline and Sodic Soils: Climate and salinity, Some basic terms, Saline, Saline alkali and Sodic Soils, Diagnosis of Saline and Sodic Soils, Reclamation Steps of Salt-affected soils, Leaching Requirements, Crop tolerance to Salinity.

Suggested Readings:

SES-602 Land Reclamation 3(2-1)

Practical Measurement of infiltration rate of saline, sodic and waterlogged soils, movement of solutes, preparation of soil paste and soil saturation extract, chemical analysis for pH, EC, SAR, ESP, and cations and anions, quality of irrigation water, water table depth measurements.

Suggested Readings:

AE-602 Economics for Engineers 3(3-0)
Definition and scope of economics, significance of economics for engineers, basic concepts; theory of production; supply and demand; determination of price, output revenue, costs and profit under perfect and imperfect competition. Cost comparisons of the use of conventional and
modern method/technologies in agriculture; replacement analysis, estimation of breakeven point of farm machinery, estimation of depression and cost analysis. Project identification, appraisal and feasibility (technical vs. economics); various aspects of project preparation, analysis and evaluation, identification of cost and benefits (tangible, non-tangible, private, social) of projects and their pricing. Discounting/compounding procedure, benefit/cost analysis, net present worth of the project and its practical implications, accounting techniques and their application in project evaluation.

**Suggested Readings:**
APPENDIX

شروع سپری گری کی روشنی، میلی و دال

یاد شناختی از میلی فرستاران با کمک فرستاران لیتنا

پاکستان کمپین، کمیته پاکستان، اسلام آباد

کی سازنده کی روشنی، مریم گرد و

لصوب

Islamic Studies (Compulsory)
for B.A./B.Sc.

مطالعه اسلامیات (لازم)

پایان

لی ایران کی
اصابت برآینده مطالعه اجتماعات (لازی)

لی این؟ بنی سام کی

مطالعه اجتماعات (لازی) کے لئے (1) اکثر پروپ گے ہے

مطالعہ اجتماعات (لازی) کا کئی سرفيز تعلیمی کے میں جماعت کے گروپ کی کامیابی کا سالہ بصفی کا

اک مرحلہ کے لئے اک اپنی ثابت ہوئی تحقیق کے کئی جائزے کے لئے مطالعاتی اپنی کامیابی کا مکمل مکمل کرونا دیکھی گئی ہے تاکہ بغاوت کے ایجاد سازگاری کے Agreggate

کے کر

1. متفقہ اہتمامات

(سمتیاں نیاں اثرات کے لئے اسکریپٹ کے جوہر کے)

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في حق السموات والأرض وأعمال البشر والحيوان. لا إله إلا الله، لاتوا إلى الألقاب التي يذكرون الله

(القرآن 58:2)

(القرآن 6:15)

(القرآن 19:191)

(القرآن 4:173)

(القرآن 10:14)

(القرآن 3:3)

(القرآن 20:40)

(القرآن 10:31)

(القرآن 16:12)

(القرآن 17:100)

(القرآن 14:9)

(القرآن 12:109)

(مrene) ناطق

(القرآن 12:109)

(القرآن 14:9)

(القرآن 17:100)

(القرآن 16:12)

(القرآن 20:40)

(القرآن 19:191)

(القرآن 6:15)

(القرآن 58:2)

(القرآن 19:191)

(القرآن 6:15)

(القرآن 58:2)

(القرآن 19:191)

(القرآن 6:15)

(القرآن 58:2)

(القرآن 19:191)

(القرآن 6:15)

(القرآن 58:2)

(القرآن 19:191)
عن عليّ قال: قال رسول الله ﷺ: من ملك زاداً و راحلاً تلبسه إلى بيت الله ﷺ ولم يجد فلا عليه أن يروت
هديًا أو تصرفاً وذلك إن جارك، و تعالى يقول ﷺ: يا من أنت الجليل ﷺ جعل الله ﷺ الهدى من استطاع إليه
سميًا (جامع ترمي).

عن إبراهيم ﷺ أن النبي ﷺ قال: أربعة من أعظمهن أحق في جهر الدنيا والآخرة ثواباً كبيراً وسناءً
ذاكرًا و بيدًا على اللسان صادقًا و زوجه لا ترهح حياً في نفسها و بالله ﷺ (سنن نسائي).

عن أبي هريرة رضي الله عنه أن رسول الله ﷺ قال: أو صورون ما المظلم؟ قالوا: المظلم فينا من
لادهم الله ولا منا، فقال: إن المظلم من أهلك عن يأبى يوم القيامة بالصلاة وبسما، و يأبى قد
ضل هم، و قد فهدنا، وأكمل الله هذا دعمه، فبعد الله هذا، فعفى، هذا من حسناتنا، وهذا من
حسناتنا، فإن قلته حسناتنا، فإن يقضى ما عليه عندنا من خطاياهم فقررت عليهم ثم طرح في النار.
عن أبي هريرة ﷺ قال: قال رسول الله ﷺ: من أكل الحلال يأكله، فليأكله من يأكله ﷺ يوم القيامة شجاعًا
أجزوه لزبيدات يطوفون يوم القيامة يوم يأخذ يطوفونه (يعتني شفته)، ثم يقول أن مالك وأنك أدرك ثم فلا
ولا يحسن الذين يخولون بما أهل الله من فضيلة هو خيراً لهم بل هو شر ما لهم سيطروا مابخلوا به.
(صومح بخاري).

عن شعبة بن معمك ﷺ قال: قال رسول الله ﷺ: إنا نحن الصوم السليم إلا بسب سبيع سنين و زاداً ببلغ عشر
سنين، فأعطوه عليها، أخرجه أبو داود الترمي و وقفه عطوه الصوم السليم، إن بسب سنين
(صنعوه بخاري) وأطروته عليه إبراهيم ﷺ.

قال رسول الله ﷺ: قل شبر الناس يوم القيامة إذا الرجل الذي يأتي مغشى، يوجد و يعود: بوجه.
(مقول عليه: أبي هريرة).

قال رسول الله ﷺ بعده بالزم روز يوم القيامة في خلق الناس وقد قبضت قبعة في النار فيستلم فيها كتمن
المجرم برحاء، ف يصنع أهل النار عليه يقولون: أين ملكنا مشاكل؟ أين كنت دارماً بالمعروف
ويهتدوا من المكر، قال: كذب مكرك ولا أدمع وأنا ك من المكر، والله
عن أبي هريرة ﷺ قال: نikal شركاء في عينهم، فعلمت أن الله ﷺ قد طرقاً إلى
المجنون، وما إجتمعت قوم في بيت من بيوت الله ﷺ بئس الله ﷺ و يضربون، ينابعهم، إنك تعلوا
السكنة و يختلف الروحاء و يهملوا الملكة و يكرههم الله ﷺ فين عينه، ومن بطبه عمله لم يمسه به
(مسلمة).

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قال رسول الله ﷺ إن أقتل من يوضع في ميزان من يزن يوم القيامة خلق حسبه: وإن الله بيض النافذة التذبي (ورضو عن النوران)

عن عمر بن الخطاب قال: قال رسول الله ﷺ حين سأل عن الإمام أن تزعم بالله ومبادئه ورسوله وأولي الأئمة وأولهم بن عفان ومهما ولبس. (ثقة عليه)

عن النجاشي بن عبد الملك قال: قال رسول الله ﷺ: دفاع الإمام من رحمة بالله رأياً وبالإسلام دينياً وجميل رسول لا.

عن أشجاع قال: قال رسول الله ﷺ: والذي نفسك بعده لا يؤمن عبد حتى يحب. لا خير في منه (ثقة عليه)

عن النجاشي بن عبد الملك قال: قال رسول الله ﷺ: فيؤذى المؤمنين في مراحمهم وتوعدهم، وتعاطفهم كمثل الجسد إذا اشتدت عليه حمى له سائر الجسم باللهوس البيني. (ثقة عليه)

عن إبراهيم بن عبد الله عن النبي ﷺ: قال رسول الله ﷺ: 가ني الإسلام على خمس: تآباد أبداً أن لا إله إلا الله وأنا محمد عبد الله ورسوله وإقام الصلاة وأجزاء النزول والصلاة وصوم رمضان. (ثقة عليه)

عن أبي سعيد الخدري عن رسول الله ﷺ: قال من رأى منكراً فلم يظهر، فما أنتمًا (ثقة عليه)

قلت أنا لم يعط فينجه وذلك أضرع الإمام. (رواية مسلم)

عن عبد الله بن عمر قال: قال رسول الله ﷺ: إن كرمت رأياً وكتك أنتم مستسلمون عن رعبه، فإمام الذي على الناس رأياً هو مستسلم عن رعبه ورجل راع على أمل بيه وهو مستسلم عن رعبه والرجال راع على مال سيدنه وهو مستسلم عنه ألا فلك رأياً وكتك أنتم مستسلمون عن رعبه (ثقة عليه)

(1) (2) (3) (4) (5) (6) (7) (8)
1. Introduction to Islam

Hameed ullah