RAJIV GANDHI PROUDYOGIKI VISHWAVIDYALAYA, BHOPAL

New Scheme Based On AICTE Flexible Curricula

Agriculture Engineering, V-Semester

AN501- Unit Operation in Post Harvest Management

Course Objective: Describe psychrometry, drying, cleaning, grading and paddy processing

Unit I Introduction

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

Unit II Psychrometry and Drying

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

Unit III Cleaning and grading

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

Unit IV Shelling and handling

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

Unit V Paddy and crop processing

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

Practicals:

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

Course Outcome: Students understand different post harvest losses of agricultural and horticultural crops, their prevention and different unit operations involved after harvest for value addition to the produce.

References:

1. Chakraverty, A.2000.Third Edition, Post harvest technology for Cereals, Pulses and oilseeds. Oxford &IBH publication Pvt Ltd, New Delhi
2. Sahay, K.M., and Singh, K.K. 1994. Unit operations of Agricultural Processing. Vikas publishing house Pvt. Ltd., New Delhi.
3. Pande, P.H. 1994. Principles of Agriculture Processing. Kalyani Publishers, Ludhiana
4. Mohsenin, N.N.1970. Physical properties of plant and animal materials Grodon and Breach

publishers, Ludhiana
5. Chakraborty, S.K. 2013. Fundamental Food Engineering, Narosa Publishing House Pvt. Ltd., New Delhi, ISBN:978-81-8487-334-4.

RAJIV GANDHI PROUDYOGIKI VISHWAVIDYALAYA, BHOPAL

New Scheme Based On AICTE Flexible Curricula

Agriculture Engineering, V-Semester

AN502- Farm Machinery & Equipment -II

Course Objective: To impart knowledge about machines / implements for plant protection, intercultural operation, harvesting and threshing.

Unit I

Introduction to harvesting - Principles and types of cutting mechanisms. Study of harvesting operation-harvesting methods, harvesting terminology. Study of mowers – types, constructional details, working and adjustments. Study of shear type harvesting devices – cutter bar, inertial forces, counter balancing, terminology, cutting pattern. Study of reapers, binders and windrowers – principle of operation and constructional details. Importance of hay conditioning, methods of hay conditioning, and calculation of moisture content of hay.

Unit II

Introduction to threshing systems – manual and mechanical systems. Types of threshing drums and their applications. Types of threshers- tangential and axial, their constructional details and cleaning systems. Study of factors affecting thresher performance. Study of grain combines, combine terminology, classification of grain combines, study of material flow in combines. Computation of combine losses, study of combine troubles and troubleshooting. Study of chaff cutters and capacity calculations. Study of straw combines – working principle and constructional details.

Unit III

Study of root crop diggers – principle of operation, blade adjustment and approach angle, and calculation of material handled. Study of Cotton harvesting – Cotton harvesting mechanisms, study of cotton pickers and strippers, functional components. Study of maize harvesting combines. Study of tree climbers - coconut climbers. Study of tools for rubber tapping, tea harvesting. Introduction to vegetables and fruit harvesting equipment and tools. Testing of farm machinery – types of tests, test code and procedure. Ergonomic considerations in designing farm machinery.

Practicals:

1. Study of sprayers, types, functional components.
2. Study of nozzle types and spray pattern using patternator.
3. Calibration of sprayers.
4. Study of dusters, types and functional components
5. Familiarization with manual and powered weeding equipments and identification of its functional components.
6. Study of fertilizer application equipments including manure spreaders and fertilizer broadcasters.
7. Study of various types of mowers, reaper, reaper binder.
8. Study of cutter bar mechanism of reapers and mowers.
9. Harvesting with reapers.
10. Familiarization with threshing systems and cleaning systems in threshers.
11. Practical of paddy threshing.
12. Calculations of losses, efficiencies in threshers.
13. Familiarization with functional units of Grain combines and their types.
14. Calculations for grain losses in a combine.
15. Familiarization with coconut climbing devices.
16. Familiarization with vegetable and fruit harvesters.

Course Outcome: Students have knowledge about machines / implements for plant protection, intercultural operation, harvesting and threshing.

References:

1. Jain S. C., and Grace Philip. 2012. Farm Machinery – An Approach. Standard Publishers Distributors., New Delhi
2. Kepner, R. A., Bainer, R., and Barger, E. L. 2005.Principles of Farm Machinery. CBS Publishers and Distributors Pvt. Ltd., New Delhi
3. Ojha, T. P. and Michael, A. M. 2011. Principles of Agricultural Engineering Vol. I. Jain Brothers, New Delhi
4. Sahay, J. 2015. Elements of Agricultural Engineering. Standard Publishers and Distributors, New Delhi
5. Yadav, R., and Solanki, H. B. 2009.Numericals and Short Questions in Farm Machinery, Power and Energy in Agriculture. New India Publishing Agency, New Delhi.

RAJIV GANDHI PROUDYOGIKI VISHWAVIDYALAYA, BHOPAL

New Scheme Based On AICTE Flexible Curricula

Agriculture Engineering, V-Semester

Departmental Elective AN503 (A) Strength of Materials

Course objectives: The course introduces students to basic knowledge of strength of different materials along with the stress-strain analysis for designing beams and structural members.

Unit I

Elasticity–Stresses and strains Elastic limit–Elastic constants Lateral strain Composite sections Temperature stresses Volumetric strain in a body Resilience and strain energy.

Unit II

Analysis of statically determinate beams Shear force and bending moment diagrams, Bending and shearing stresses in beams – slope and deflection of beams using double integration method, Macaulay's method, Moment area theorems and conjugate beam method.

Unit III

Combined bending and direct stresses Columns and struts Euler's theory Empirical formulae for loads on columns; Stresses in thin cylindrical shells – Torsion of shafts and springs; Analysis of statically indeterminate beams, Propped beams, fixed and continuous beams – Analysis using superposition, Three moment equation and moment distribution methods.

Unit IV

Analysis and design of singly reinforced and doubly reinforced beams – Shear, bond and torsion – Design of T beams – Slabs – Design of one way and two way slab (IS code method only) – Columns, Foundations, Retaining walls, Silos and Ferro cement tanks.

Unit V

Loads and use of BIS codes Design of riveted and welded connections – Design of structural steel members in tension, compression and bending.

Course Outcomes: After successful completion of course, the students are expected to possess basic understanding and knowledge of design of beams and how to carryout different tests in a material.

References:

1. Khurmi, R.S. 1998 Strength of Materials and Mechanics of Structures,. Vol. 1& 11 S. Chand and Company, New Delhi
2. Singh Gurubaksh. 1998 Strength of Materials and Structures,. Vol. I & II Khanna Publishers, New Delhi.
3. Timoshenko, S.P. and Young, D.H. 1968.Strength of Materials. Affiliated East-West Press Pvt. Ltd., New Delhi.
4. Bansal, R.K. (1992). Engineering Mechanics and Strength of materials. Laxmi Publications, New Delhi.
5. Kumar, K. L. (2003). Engineering Mechanics. Tata Mc Graw Hill Publishing Company, New Delhi.
6. Punmia, B.C., Ashok Kumar Jain and Arun Kumar Jain. (1994). Reinforced Concrete Structures (Vol. I). Laxmi Publications, New Delhi.

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New Scheme Based On AICTE Flexible Curricula

Agriculture Engineering, V-Semester

Departmental Elective AN503 (B) Renewable Energy Sources

Unit I

Classification of energy sources, contribution of these of sources in agricultural sector.Concept a nd limitation of Renewable Energy Sources (RES), Criteria for assessing the potential of RES, Classific ation of RES, Solar, Wind, Geothermal, Biomass, Ocean energy sources, Comparison of renewable energy sources with non renewable sources.

Unit II

Solar Energy: Energy available from Sun, Solar radiation data, solar energy conversion into heat through, Flat plate and Concentrating collectors, different solar thermal devices, Principle of natural and forced convection drying system, Solar Photo voltaics: p -n junctions. Solar cells, PV systems, Standalone, Grid connected solar power station, Calculation of energy through photovoltaic power generation and cost economics**.**

Unit III

Wind Energy: Energy available from wind, General formula, Lift and drag. Basis of Wind energy conversion, Effect of density, Frequency variances, Angle of attack, Wind speed, Types of Windmill rotors, Determination of torque coefficient, Induction type generators and working principle of wind power plant.

Unit IV

Bio-mass energy: Pyrolysis of Biomass to produce solid, liquid and gaseous fuels. Biomass gasification, Types of gasifier, various types of biomass cook stoves for rural energy needs. Biogas: types of biogas plants, biogas generation, factors affecting biogas generation and usages, design consideration, advantages and disadvantages of biogas spent slurry.

References:

1. Rai, G.D. 2013. Non-Conventional Energy Sources, Khanna Publishers, Delhi.
2. Rai, G.D., Solar Energy Utilization, Khanna Publishers, Delhi.
3. Khandelwal, K.C. & S. S. Mahdi. 1990. Biogas Technology- A Practical Handbook.
4. Rathore N. S., Kurchania A. K., Panwar N. L. 2007. Non Conventional Energy Sources, Himanshu Publications.
5. Tiwari, G.N. and Ghoshal, M.K. 2005. Renewable Energy Resources: Basic Principles and Applications. Narosa Pub. House. Delhi.
6. Rathore N. S., Kurchania A. K., Panwar N. L. 2007. Renewable Energy, Theory and Practice, Himanshu Publications.

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Agriculture Engineering, V-Semester

Departmental Elective AN503 (C) Engineering Properties of Soil & Agriculture Materials

Engineering properties of soil such as stress strain relationships, permeability, shear strength, liquid limit, plastic limit etc. Determination of Field Density by Core cutter and Sand Replacement methods-Mechanical analysis of Soil Sieving-Hydrometer analysis for Grain Size Distribution-Determination of Atterberg's Limits of Soil Consistency. Experiments for the determination of physical properties like, length, breadth, thickness, surface area, bulk density, porosity, true density, coefficient of friction, angle of repose and colour for various food grains, fruits, vegetables, spices and processed foods, aerodynamic properties like terminal velocity, lift and drag force for food grains, firmness and hardness of grain, fruits and stalk.

Learning Outcome:
The students will learn about the different engineering properties of soil and agricultural materials which will be useful for design of soil engaging tools and also in the design of storage & value addition tools and equipment.

References:

1. Mohsenin, N.N. 1970. Physical properties of plant and animal materials Grodon and Breach publishers, Ludhiana
2. Singhal, O.P. and Samuel, D.V.K. 2011. Engineering properties of biological materials. Saroj Prakashan, Allahabad. ISBN: 8170976253.
3. Kachra, R.P., Gupta, R.K. and Alam, A. 1994. Physico- chemical constituents and engineering properties of food crops. Scientific publishers, Jodhpur. ISBN: 9788172330835.
4. Rao, M. A. and Rizvi, S.S.H. 1986. Engineering properties of foods. Marcel deker, New York. ISBN: 9780824775261
5. Punmia B C, Jain A K and Jain A K. 2005. Soil Mechanics and Foundations. Laxmi Publications (P) Ltd. New Delhi.
6. Ranjan Gopal and Rao A S R. 1993. Basic and Applied Soil Mechanics. Welley Easters Ltd., New Delhi.
7. Singh Alam. 1994. Soil Engineering Vol. I. CBS Publishers and Distributions, Delhi.

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Agriculture Engineering, V-Semester

Departmental Elective AN503 (D) Fluid Mechanics

Unit I

Fundamental Fluid Properties: – Engineering units of measurement – Mass, density – specific weight, specific volume – specific surface tension – capillarity. Viscosity, bulk modulus of elasticity, pressure and vapour pressure. Fluid Statics: Pressure at a point, pressure variation in static fluid, Absolute and gauge pressure, manometers, Forces on plane and curved surfaces (Problems on Gravity Dams and Tainter Gates), buoyant force, stability of floating and submerged bodies, relative equilibrium.

Unit II

Kinematics and Dynamics of flow: Introduction to basic lines – Streamlines, Streak lines, pathlines various types of fluid flow. Velocity potential function, Stream function, Vortcity and Circulation Flow net. Basic equations of fluid flow like Energy equation, continuity equation and momentum equation. Bernoulli's equation and its applications.

Unit III

Laminar Flow and Turbulent Flow: Introduction to laminar & turbulent flow, Reynolds experiment & Reynolds number. Velocity distribution, Laminar and turbulentboundary layers and laminar sublayer, boundary layer concept, aging of pipes. Losses due to sudden expansion and contraction, losses in pipe fittings and valves, concepts of equivalent length, hydraulic and energy gradient lines, siph on, pipes in series, pipes in parallel, branching of pipes, concept of water Hammer transmission of power.

Unit IV

Open channels: Channel geometry and elements of channel selection, velocity distribution, energy in open channel flow, specific energy, types of flow, critical flow and its computations, uniform flow and its computations, chezy's and Manning's formulae, determinations of normal depth and velocity, normal and critical slopes, economical sections. Basic assumptions and dynamic equations of gradually varied flow, characteristics analysis and computations of flow profiles, rapidly varied flow hydraulic jump in rectangular channels and its basic characteristics, surges in open channels & channel flow routing.

Course Outcome: Knowledge of the basic concept and principles of fluid mechanics. Ability to analyze fluid flow problems with the application of momentum and energy equations. Ability to distinguish between various types of fluid flow. Ability to find solutions to typical pipe flow problems,

References:

1. Bansal, R.K., 2002. A text book of fluid mechanics and hydraulic machinery, Laxmi publications (P) Ltd., New Delhi
2. Grade, RJ., 2002. Fluid mechanics through problems. Wiley eastern Ltd., Madras
3. Jagadish Lal, 2000. Hydraulic machines. Metropolitan book house, New Delhi.
4. Donald, Pritchard Fluid Mechanicas-Wiley India, New Delhi.
5. John F. Douglas, J.M. Gasoriek, John Swaffield, Lynne Jack, Fluid Mechanics, Pearson Edu

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New Scheme Based On AICTE Flexible Curricula

Agriculture Engineering, V-Semester

Open Elective AN504 (A) Modelling and Simulation

Scope of dimensional analysis and simulation modeling, transformation of units of measurement. Dimensional homogeneity, Buckingham's Pi theorem, simulation for system modelling, simulation models-formulation and testing. Simulation modelling as applied to problems of stress analysis, fluid mechanics, and heat transfer. Mathematical modelling through ordinary differential equation of first order, second order andpartial differential equation. Application of simulation modelling to problems of agricultural engineering.

References:

1. Langhaar HL. Dimensional Analysis and Similitude. McGraw Hill.
2. Sedov LI. Similarity and Dimensional Methods in Mechanics. Mir Publ., Moscow.

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Agriculture Engineering, V-Semester

Open Elective AN504 (B) Sprinkler and Micro - Irrigation Systems

Unit I

Sprinkler irrigation: adaptability, problems and prospects, types of sprinkler irrigation systems; design of sprinkler irrigation system: layout selection, hydraulic design of lateral, sub-main and main pipe line, design steps; selection of pump and power Module for sprinkler irrigation system; performance evaluation of sprinkler irrigation system: uniformity coefficient and pattern efficiency;

Unit II

Micro Irrigation Systems: types-drip, spray, & bubbler systems, merits and demerits, different components; Design of drip irrigation system: general considerations, wetting patterns, irrigation requirement, emitter selection, hydraulics of drip irrigation system, design steps; necessary steps for proper operation of a drip irrigation system;

Unit III

Maintenance of micro irrigation system: clogging problems, filter cleaning, flushing and chemical treatment; fertigation: advantages and limitations of fertigation, fertilizers solubility and their compatibility, precautions for successful fertigation system, fertigation frequency, duration and injection rate, methods of fertigation.

References:

1. Choudhary M.L and Kadam U.S 2006. Micro irrigation for cash crops Westville Publishing House.
2. Keller Jack and Bliesner Ron D.2001. Sprinkle and Trickle Irrigation. Springer Science+ business Media, New York .
3. Mane M.S and Ayare B.L. and MagarS.S.2006.Principles of Drip Irrigation systems, Jain Brothers, New Delhi.
4. Mane M.S. and Ayare B.L.2007. Principles of Sprinkler Irrigation systems, Jain Brothers, New Delhi.
5. Michael A.M. 2012. Irrigation: Theory and Practice. Vikas Publishing Vikas Pub. House New Delhi.
6. Michael AM, Shrimohan and KR Swaminathan. Design and evaluation of irrigation methods, (IARI Monograph No.1). Water Technology Centre, IARI New Delhi.
7. Sivanappan R.K., 1987 “Sprinkler Irrigation”, Oxford and IBH Publishing Co., New Delhi.
8. Suresh, R., 2010“Principles of Micro-Irrigation Engineering”, Standard Publishers Distributors, New Delhi.

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Agriculture Engineering, V-Semester

Open Elective AN504 (C) Machine Design

Course Objective: To provide basic knowledge on the design consideration and methodology of various machine elements.

Unit I

Meaning of design, Phases of design, design considerations. Common engineering materials and their mechanical properties. Types of loads and stresses, theories of failure, factor of safety, selection of allowable stress. Stress concentration. Elementary fatigue and creep aspects.

Unit II

Cotter joints, knuckle joint and pinned joints, turnbuckle. Design of welded joints subjected to static loads. Design of threaded fasteners subjected to direct static loads, bolted joints loaded in shear and bolted joints subjected to eccentric loading.

Unit III

Design of shafts under torsion and combined bending and torsion. Design of keys. Design of muff, sleeve, and rigid flange couplings. Design of helical and leaf springs.

Unit IV

Design of flat belt, V-belt drives and pulleys. Design of gears. Design of screw motion mechanisms like screw jack, lead screw, etc. Selection of anti-friction bearings.

Course Outcome: Students have knowledge of design phases, design consideration, design of shafts, various joints, design of belts, pulleys, etc.

References:

1. Anonymous. 1984. Design data Hand book. PSG, Coimbatore.
2. Jain.R.K. 2013.Machine Design.Khanna Publishers, 2-B Nath Market, NaiSarak, New Delhi.
3. K Mahadevan and K Balaveera Reddy. 2013. Design Data Handbook for Mechanical Engineering in SI and Metric Units. CBS publications, New Delhi.
4. Khurmi.R.S and Gupta.J.K. 2014.A Text Book of Machine Design. S. Chand & Company Ltd., New Delhi.
5. Maleev and Hartman. 1978. Mechanical Design of Machines. CBS Publications, New Delhi. Norton. R.L. 1991.Machine Design. Pearson Education, New Delhi.
6. Pandya.N.C and Shah.C.S. 1981.Machinedesign.Charotar Book Stall, Anand.
7. Shigley.J.E and C.R. Mischke.Mechanical Engineering Design. 2004. Tata McGraw Hill India Ltd., New Delhi.

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Agriculture Engineering, V-Semester

Open Elective AN504 (D) IC ENGINES

Introduction to SI and DI engines, Engine operating characteristics, Ideal cycle analysis, Disassembly and assembly of engines, Combustion and thermochemistry, Kinetics, equilibrium and dissociation, Gas properties and fuel - air cycle; cycle simulation

Mixture preparation in SI engines, Intake and exhaust processes, SI engine combustion, knocking, SI engine emissions, Engine performance and emissions measurements, SI engine emissions control

Diesel engine characteristics, Diesel engine: injection, ignition and combustion, Diesel engine emissions and control, Engine heat transfer, Engine friction and tribology, Turbocharging

Hydrogen, fuel cell and battery, Bio fuels and hybrids

References:

1. Mathus, M.L., and Sharma, R.P. (1994). A Course in Internal Combustion Engines. Danpat Rai & Sons, Delhi.
2. Gill Paul, W., Smith James, H., and Ziurys Eugene, J. (1967). Fundamentals of Internal Combustion Engines. Oxford & IBE Publishing Company, New Delhi.
3. Kepner, R. A., Bainer Roy, and Barges, E.C. (1978). Principles of Farm Machinery. CBS Publishers and Distributors, Delhi 17.
4. Heywood, J. B. Internal Combustion Engine Fundamentals. New York, NY: McGraw-Hill, 1988. ISBN: 9780070286375.

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New Scheme Based On AICTE Flexible Curricula

Agriculture Engineering, V-Semester

AN505 Tractor and Farm Machinery Operations - I

Familiarization with different makes and models of agricultural tractors and Power Tillers. Identification of functional systems and controls of tractors. Safety rules and precautions. Maintenance and trouble shooting. Driving practice of tractor and Power tiller. Familiarization with tools for general and special maintenance.

Practicals:

1. Familiarization with different makes and models of agricultural tractors and Power Tillers
2. Identification of functional systems including fuels system, cooling system, transmission system, steering and hydraulic systems.
3. Identification of functional systems including fuels system, cooling system, transmission system, steering and hydraulic systems.
4. Familiarization with controls on a tractor, Safety rules and precautions to be observed while driving a tractor.
5. Study of maintenance points to be checked before starting a tractor.
6. Starting and stopping practice of tractor and Power tiller
7. Driving practice of tractor
8. Driving practice of power tiller
9. Introduction to tractor maintenance – precautionary and break-down maintenance.
10. Tractor starting with low battery charge.
11. Introduction to trouble shooting in tractors.
12. Familiarization with tools for general and special maintenance.
13. Introduction to scheduled maintenance after 10, 100, 300, 600, 900 and 1200 hours of operation.
14. Fuel saving tips. Preparing tractor for storage.

References:

1. Ghosh, R. K., Swan, S. 1993. Practical Agricultural Engineering. Kolkata NayaPrakosh.
2. Jain, S. C., and Rai, C. R. 2013.Farm Tractor Maintenance and Repair. Standard Publishers Distributors., New Delhi.
3. Operators Manuals of Tractors.
4. Service manuals provided by manufacturers.
5. Surendra Singh, Verma, S. R. 2009. Farm Machinery Maintenance and Management.India Council of Agricultural Research, New Delhi.

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New Scheme Based On AICTE Flexible Curricula

Agriculture Engineering, V-Semester

AN506 Measurements Systems Lab

Sensing Elements: Resistance Thermometers and Thermistors. Metal and Semiconductor Resistance strain Gauges. Resistance temperature Characteristics of a thermistor, Strain Gauge transducer, Linear variable differential Transformer, Capacitive Transducer, Temperature – emf characteristics of thermocouple. Piezoelectric Transducer and their characteristics, Hall –effect transducer, Photodiode Measurement of characters, Instrumentation Amplifier, Analogue to Digital Conversion, Digital to Analogue Conversion.

References:

1. W. Bolton Industrial Control and Instrumentation.
2. D. Patranabis. Sensors and Transducers. Wheeler publishing.
3. John Bantly. Principles of Measurement Systems – 3rd Edition.