

APPLIED SCIENCES SUBJECT AREA

AS 400 Industrial Management (2 credits - Compulsory)

Approaches to Management: Introduction to Management; Organizations and importance towards effective work; The scientific, the human relation, the quantitative and the systems approach.

Group Dynamics: Formal and informal organizations, teamwork & teambuilding; self managing teams; Motivation; motivational drives, models of motivation, behaviour modification, contemporary motivational approaches; Productivity and worker satisfaction.

Communication in Organizations: The Two-Way communication process, communication barriers, upward, downward and lateral communication. public speaking.

Managing Conflicts Stress and Counseling: Nature and level of conflict, sources of conflict, effects of conflict, conflict resolution, change management; Work change, resistance to change, implementing change successfully; Stress and job performance, approaches to stress management, employee counseling; Effect of culture on organizational behavior and its impact on management.

Recommended Texts

1. Jain, K.C. and Aggraval, S. (1990) *Production Planning and Control, and Industrial Management*, Khanna Publishers, Delhi.
2. Karunaratne, K.M.R.T. (1995) *Quantitative Methods for Management: with applications in planning and decision making*, author published, Moratuwa.

AS 401 Industrial Placement (8 credits)

Train students with work experience in an industrial environment and to produce a model science graduate to be competent to work in the industrial sector through variety of activities as specified by Sri Lankan industries. Students will specifically gain knowledge in the following areas during this period: Type of raw materials; Industrial process; Problems associated with the process; Quality control; Research & Development aspects; Management aspects.

This course will be graded based on evaluation by industries, report

AS 402 Research methodology and scientific writing (2 credits)

Methods of Research: To provide skills of survey and quantitative research methods.

Scientific Writing: Literature survey – traditional and modern methods; Improve scientific report writing skills: writing abstracts, summary of research papers, proposal writing, etc.

Recommended Texts:

1. Kumar, R.,(2005) *Research Methodology: A Step-by-Step Guide for Beginners*, 2nd edition.
2. Yin, R. K., (2003) *Case Study Research: Design and Methods*, 3rd edition.

AS 403 Seminar (1 credit)

Under this course undergraduate students will give oral presentations and listen to presentations by various people in Departments and by other speakers. Each student enrolled in the course will give one oral presentation which will be evaluated by a team of members of the Faculty. Learning from and with each other is one important aspect of this course. Participation includes punctual attendance, engagement with topics being discussed, answering the posed relevant questions etc.

20-minute Student Seminar: Students are encouraged to choose a topic with the guidance of a faculty member assigned. After preparation of a 20-minute presentation based on material in the published literature (journal articles or websites), it should be then submitted to the lecturer assigned by the coordinator for approval. This will be then presented to a selected audience according to a roster.

These seminars will be graded based on continuous attendance, performance/speaking ability, grasp of material, use of appropriate visual aids, answers to questions, and an overall presentation.

AS 404 Data Integrity Management & Data Analysis (2 credits-Compulsory)

Data Integrity Management: Good laboratory practice (GLP); Facilities and equipment (including computer systems); Use of equipment; Managing test and reference items and reagents; Design of experiments to obtain variable data; Record keeping; Storage and retention of records and materials; Maintenance and calibration of equipment; Standard operation procedures; Multi-site and multi-laboratory studies.

Errors of Measurements: Concept of significant figures; Uncertainty of measurements; Statistical averages and deviations such as mean, median, standard deviation, relative deviation; Statistical tests such as Q test, Z test, t test, F test, and confidence intervals; propagation of errors; Errors in instrumental methods; Linearization and graphical analysis; Method of least squares.

Data analysis: Data preparation and applications of statistical techniques using statistical software.

Recommended Texts:

1. Priyantha, N., (1999) *Measurements and Errors in Chemical Analysis*, Printing Unit, Faculty of Science, University of Peradeniya.
2. Myers, R.H., (1990) *Classical and Modern Regression with Applications*, Duxbury Press.
3. Jobson, J.D., (1991) *Applied Multivariate data Analysis, Vol I: Regression and Experimental Design*, Springer.
4. MINI TAB Reference Manual.

AS 409 Industry and the Environment (2 credits-Compulsory)

Chemical Aspects: Effect of industrial activities on the environment; Guidelines for discharge of industrial effluents; Water quality and air quality: chemical aspects, classical and instrumental methods for determination of water quality and air quality parameters, analytical aspects; Treatment of water and waste water: chemical and biological methods, low-cost and modern methods.

Sound Pollution: Sound pollution due to various industrial activities in Sri Lanka; Pollution parameters of sound and measurements of sound pollution.

Air Pollution: Air pollution and climate change; Biomonitoring of environmental pollution: concepts, active and passive monitoring, bioindicator parameters, control of air pollution by plants, green belt design.

Field Visits: Industrial /Field visits to various industries.

Recommended Texts:

1. Manahan, S.E., (1994) *Environmental Chemistry*, Lewis Publishers.
2. Ileperuma, O.A., (1995) *Environmental Pollution and the Future of Mankind*, Science Education Unit, Faculty of Science, University of Peradeniya.
3. Alloway, B.J., and Ayres, D.C., (1993) *Chemical Principles of Environmental Pollution*, Blackie Academic Professional.

AS 410 Industrial Applications Laboratory (2 credits)

Analysis of Industrial Effluents: Determination of parameters, such as DO, BOD, COD, TDS, SS, floatables, conductivity, hardness, anions, etc.

Analysis and quality control of industrial materials: Operation of modern instrumentation used in the industrial sector such as X-ray fluorescence spectrometer, X-ray diffractometer, atomic absorption spectrophotometer, gas chromatograph, thermogravimetric apparatus & differential thermal apparatus, etc; Selected experiments using above instruments as applied to quality control processes of industries; Analysis of industrial raw materials and products such as cement clinker, ceramics, clay, dolomite, apatite, mineral sands, etc.

Recommended Texts:

1. Shoemaker, D.P., Garland, C.W. and Nibler, J.W., (1996) *Experiments in Physical Chemistry*, McGraw Hill
2. Skoog, D.A., Holler, F.A. and Crouch, S.R. (2007) *Principles of Instrumental Analysis*, Thomson

AS 414 Industrial Microbiology (2 credits)

Microorganisms with industrial and environmental use and their products; Growth and product formation in industrial processes; Large scale fermentations: proteins, antibiotics, organic acids, amino acids, enzymes, vitamins, food, alcoholic beverages, fuel and energy, microbial quality of water; Setting up a microbiological laboratory. [Selected titles from the above course content will be offered each year]

Recommended Texts:

1. Glazer, A.N., and Nikaido, H., 1995. *Microbial biotechnology. Fundamentals of Applied Microbiology*. New York: W.H. Freeman & Company
2. Madigan, M.T., Martinko, J.M. and Parker. J., 2000. *Brock Biology of Microorganisms*. 9th ed. Prentice Hall

AS 415 Biodiversity Conservation and Sustainable Development (2 credits)

Impart Knowledge and Develop Skills on Biodiversity Conservation and Management: Changes of biodiversity over space and time; Assessing and Monitoring biodiversity; Conservation of biodiversity; Managing species and habitats

Sustainable Use of Biodiversity: Timber and non timber forest products; Medicinal plants and lesser known timber species in Sri Lanka, Indigenous knowledge; Ecotourism

Production Forestry and Biodiversity Conservation: Forest management; Impacts of forestry practices in the conservation of biodiversity, Sustainable forestry practices; Soil fertility management for the conservation of biodiversity;

Computer Aided Data Analysis and Management of Biodiversity: Identification and classification of vegetation types/habitats using the computer programmes PC ORD, XL stat, Estimates.

Laboratory and Field Work: Assessing and monitoring biodiversity, Estimating the plant species diversity in a forest, data analyses and identifying different vegetation types

Recommended Texts:

1. Meffe, G.K. and Carroll, C.R. (1997). *Principles of Conservation Biology*
2. Primack, R.B. A, *Primer of Conservation Biology*
3. Kent, M and Coker, P. (1992). *Vegetation description and analysis- a practical approach*. Jhon Wiley & Sons, New York

AS 416 Fisheries and Aquaculture (2 credits)

Inland Fisheries in Sri Lanka: Brief history and the recent developments in the industry, species involved and the gear used. Fishery regulation, sustainable utilization and potential for future developments.

Aquaculture: General principles and economics of aquaculture, culturable fish and shellfish species, design and construction of aquafarms, fish nutrition and feeding, farm management, integration of aquaculture with crop and livestock farming, marketing of aquaculture products and aquarium fish trade.

Laboratory studies: Identification of fish species, fish parasites and diseases, preparation of aquarium tanks

Field visits: visits to brackish water prawn farm, cage culture facility, fish processing unit, freshwater aquarium fish farm, reservoir with well organized fishery.

Recommended Texts:

1. Agarwal, A.C. 1994. *A hand book of fish farming*. Narendra Publishing House, Delhi, India.
2. Santhanam, R., Sukumaran, N, and Natarajan, P. *A Manual of Freshwater Aquaculture*.
3. Baluyut, E.A. *Aquaculture Systems and Practices: A Selected Review*.
4. Vadapalli Satyanarayana. 1996. *A symposium on fish culture*. Narendra

AS 417 Food and Fresh Produce Technology (2 credits)

Training on research & development and quality control aspects of fresh produce handling; food processing and safety; packaging and analysis; floriculture.

Recommended Texts:

1. Kirk, R.S. and Sawyer, R. (1991) *Pearson's Composition and Analysis of Food*, Longman.
2. Vanderwerf, C.A. (1960) *Food Chemistry, Reinhold Organic Chemistry and Biochemistry Textbook Series*.

AS 418 Ecotourism (2 credits)

Impart knowledge and develop awareness on non-detrimental tourism; develop skills as ecotourism guides and operators.

Recommended Texts:

1. Fennell, D.A. *Ecotourism: An Introduction*
2. Ashton, P.S. and Ashton, R.E. Jr. *Ecotourism: Sustainable Nature and Conservation Based Tourism*.

AS 431 Chemical Technology (2 credits)

Introduction: Chemical engineering stoichiometry; Chemical plant technology: safety, services, storage, etc; fluid flow; Industrial chemical engineering equipments: reactors (batch, flow, semi batch); Chemical engineering economics and planticides: cost, investments, fixed charges etc.

Chemical Technology: Raw materials, raw materials for the chemical industry; New development in chemical technology; Automation and some selected examples.

Chemical Kinetics: Chemical kinetics in plant design for isothermal, constant volume batch reactions, isothermal variable volume batch reactions, plug flow reactions continuous stirred tank reactants (Industrial reactants).

Catalysis: Homogenous, heterogeneous catalysis, pack bed reactors, fluid dye pack reactors; Electrochemical industries.

Recommended Texts:

1. Panel on the Applications of Biotechnology to Traditional Fermented Foods, (1992) *Applications of Biotechnology in Traditional Fermented Foods*, National Research Council.

AS 432 Cleaner Production for Industry (2 credits)

Introduction: Introduction to cleaner production, cleaner production tools; Assessment and audits; Introduction of cleaner production in an enterprise and cleaner production methodology; Prerequisite for success of cleaner production.

Industrial Aspects: Cleaner production assessment, cleaner production team, process mapping and process flow diagram, data sources, material balance, energy balance, costing of waste; alternating option generations; Better process control, equipment and product modification, technology change, onsite recovery/reuse; Implementation of cleaner production options and pay back period.

ISO Standards: ISO standards in industrial processes.

Case Studies and Group Exercises:

Recommended Texts:

1. National Cleaner Production Centre (2006) *Proceedings: Seminar on Introduction to Cleaner Production into University Curriculum*, Colombo
2. National Cleaner Production Centre (2005) *Cleaner Production: A Way to Improve Your Enterprise*

AS 433 Industrial Waste Management (2 credits)

Characterization of Industrial Waste: Types of waste; Toxic substances in different types of waste; Chemical and physical methods of determining pollution parameters of industrial waste.

Minimization of Waste and Management of Waste: Traditional and modern concepts, advantages and disadvantages of different waste management strategies.

Development of Industries Using Waste as a Resource: Value addition methods for waste for reuse.

Recommended Texts:

1. Pichtel, J. (2005) *Waste Management Practices*

AS 434 Industrial Organic Chemistry (2 credits)

Industries Which Use Organic Materials: To impart a theoretical and practical knowledge of industries in Sri Lanka which use fats & oils, phospholipids and waxes with emphasis on soap making and surface active compounds, manufacture of biodiesel and the food industry.

Essential Oils in Sri Lanka: Overview of the essential oil industry in Sri Lanka, including the methods of extraction, analysis and quality standards utilized.

Tea Industry in Sri Lanka: Tea industry and the processing technology and the importance of tea flavours.

Recommended Texts:

1. Oils and Fats in Industry. Publication no. 25. Science Education Unit Publication 2006. D.N. Karunaratne.
2. Textbook of chemical Technology Vol. 11 Shukla SD and Pandey GN
3. Food Chemistry L.H. Meyer
4. Industrial Chemistry E.R Riegel.

AS 444 Industrial and Economic Minerals (2 credits)

Introduction to Gemmology: Introduction to gems and gemstones, basic physical properties of gem minerals-crystallography, colour, hardness (durability), lustre, cleavage, general optical properties-reflection, refractive index, pleochroism, special properties-special optical properties, luminescence, fluorescence, dispersion, Introduction to fashioning.

Industrial Minerals: Mechanisms of formation and distribution of metallic and non metallic ore deposits; Classification of industrial minerals and rocks; Geology and origin of industrial minerals and rocks; Deposits of industrial minerals and rocks (quartz, feldspars, carbonates, asbestos, clay, phosphates).

Exploration and Mining Techniques: Introduction to mine planning, mining methods, mine plant design and mineral processing

Recommended Texts:

1. Read, Peter G. (1995). *Gemmology*, Butterworth & Heineman
2. Hurlburt, C.S Jr. and Switer, G.S. (1979) *Gemology*
3. Maning, D.A.C. (1995) *Introduction to Industrial Minerals*, Chapman & Hall

AS 445 Remote Sensing and Geographic Information Systems (2 credits)

Remote Sensing: Overview and concepts of Remote Sensing technology, basics of photogrammetry, practical uses of aerial photographs in various disciplines, fundamental characteristics of electromagnetic radiation, remote sensing platforms, satellite system and sensors, active and passive sensing systems, concepts of spatial, spectral, radiometric and temporal resolution, overview of RS applications.

GIS (Geographic Information System): Introduction to GIS, definition, concepts of GIS, scope and application areas, purpose and benefits of GIS, functional elements of GIS, required hardware and software for GIS, installation of GIS, map projection, data structures [WINDOWS-1252?]- raster and vector data structures, input of geospatial data, sources of data and input devices, spatial database data acquisition and management techniques, data manipulation and analysis, map output generation.

Laboratory Sessions: Visual interpretation of aerial photographs for land use, land pattern analysis, hands-on practical sessions on GIS, data input, linking non-spatial and spatial database, database editing and updating, GPS data integration in GIS, data manipulation and pre-processing, spatial analysis, map generation, mini-project for GIS application.

Recommended Texts:

1. Thomas M. Lillesand, Ralph W. Kiefer, (1999) *Remote Sensing and Image Interpretation*, 4th Edition
2. Burrough, P.A. and McDonnell, R.A. (1998) *Principles of Geographical Information Systems*, Oxford University Press

AS 451 Industrial Mathematics (2 credits)

Mathematical Modelling: Linear programming, integer programming and non-linear programming models.

Network Modelling: The transshipment problem, the shortest path problem, the equipment replacement problem, transportation/assignment problems, generalized network flow problems, maximal flow problems, special modeling considerations and minimal spanning tree problems.

Project Management: Introduction, creating the project network, critical path method, project crashing, project evaluation and review technique, simulating project networks and Microsoft project.

Recommended Texts:

1. Spreadsheet Modelling and Decision Analysis (Fourth Edition), Cliff T. Ragsdale *Thomson Press*
2. Data Analysis and Decision Making with Microsoft Excel, Albright, Winston, Zappe, *Duxbury Press*
3. Simulation Modeling using @RISK, Wayne L. Winston, *Duxbury Press*
4. Operations Research (An Introduction – Seventh Edition), Hamdy A. Taha, Eastern Economy Edition

AS 452 Financial Mathematics (2 credits)

Introduction to mathematical models that comes under finance. Introduction of MATHEMATICA software package at an advanced level and prepares students to use software to solve mathematical problems related to finance through practical sessions.

AS 461 Semiconductor Device Technology and Application (2 credits)

To provide knowledge on the physics behind semiconductor devices and the fabrication of semiconductor devices and IC circuits.

Recommended Texts:

1. Sze, S.M. (1981) *Physics of Semiconductor Devices*, 2nd ed, John Wiley & sons,
2. Neamen, D.A. (1992) *Semiconductor Physics and Devices*, Richard D. Irwin,

AS 462 Science and Technology of Ceramic Materials (2 credits)

Introduction: Traditional and modern ceramics (Technical ceramics), ceramic industry in Sri Lanka,

Raw Materials: Clays, talc, refractories, fluxes, enamels, glazes. purification of clays, value addition to the raw materials.

Power Processing: Crushing, grinding, sizing, chemical methods

Shape Forming: Pressing, isostatic pressing, casting, mould preparation, tape casting, extrusion, injection molding, binders.

Densification: Theory of sintering, Control of sintering parameters, firing and kilns, hot pressing (HP), hot isostatic pressing (HIP), sintering problems, densification by chemical processes.

Glass and Glass Ceramics(5L): structure of glass materials, concept of glass-ceramics, properties and application of glass-ceramics. glass ceramic composites

Quality assurance(2L): non destructive testing, environmental issues related to ceramic industry;

Practical Classes and industrial visits

Recommended Texts:

1. Kingery, W.D. Bowen, H.K. and Uhlmann, D.R. (1976) *Introduction to Ceramics*, John Wiley & sons
2. Richardson, D.W. (1992) *Modern Ceramic Engineering* Marcel Dekker

AS 463 Energy; Sources, Use and Conservation (2 credits)

Energy resources:

- a. Fossil Fuels; Coal (electricity generation from coal, coal for industry), petroleum (refining, different products and their usage)
- b. Alternative energy resources; nuclear energy (nuclear energy from fission, nuclear power plants, advantages and problems, nuclear energy from fusion), solar energy (direct use of solar energy; Solar collectors, solar chimneys)(indirect use of solar energy; PV cells; Efficiencies, limitations), wind energy (wind blow, power dependence, efficiency with wind speed), tidal energy (origin, tidal fences, tidal turbines/offshore turbines), geothermal energy (high temperature resources, moderate/low temperature resources), biomass energy (direct use, through conversion; biofuel; ethanol, bio-diesel), batteries (fuel cells)

Energy Picture of Sri Lanka: Main sources available, Energy consumption pattern, Use of biomass, Petroleum requirement, Electricity generation, Alternative sources, New power projects

Conservation of Energy: Different methods to conserve energy; Advantages and disadvantages of different methods

AS 464 Workshop Practice (2 credits)

Introduction: Introduce technical drawing methods, measuring instruments, handling of basic hand tools and portable machines used in sheet metal works.

Use of a Machines: machines of lath, milling and drilling machines, etc

Wood and Plastic Machining: Practice basic wood and plastic working methods in wood and plastic machines of portable bench types

Glass Work: Practice glass cutting methods and blowing methods

AS 465 Industrial Applications (Electronics/Hardware) Laboratory (2 credit)

Digital Electronics: Logic gates, combinational and sequential logics, flip flops; counters, 7-segment display and driver circuits; Stepper motors, sensors, DAC and ADC, interfacing exercises.

Analogue Electronics: Power supplies and amplifier circuits, opamps.

Repair of instruments: Repair of simple instruments such as colorimeters, ph meters, uv-vis spectrophotometers, etc.

Recommended Texts:

1. Horowitz, P. and Hill, W. (1989) *The Art of Electronics*, Cambridge University Press.

AS 471 Design and Development of Software Systems (2 credits)

Software process and advantages of software process; Feasibility study; Requirement analysis ; Requirement specification; Software design; Implementation; Testing and maintenance.

Recommended Texts:

1. Pressman, R. S. and Ince, D.(2000) *Software Engineering: A practitioner's Approach*, McGraw-Hill

AS 472 Management of Computers and Computer Networks (2 credits)

PC management; PC trouble shooting; Computer networks; Network configuration; Device interfacing; Data acquisition and data processing; Micro – controllers; Instrument control.

Recommended Texts:

1. Tanenbaum, A.S. (1996) *Computer Networks*, Prentice Hall

AS 473 Visualizing Statistical Concepts using Java and Software Development (2 credits)

To provide experience to undergraduates in development of statistical software.

Recommended Texts:

1. Wesley, T. A. (1998) *Addition Data Structures in Java*, Standish.
2. Ditel, H.M. and Hall, P. P.J. (1999) *Java How to Program*.

AS 474 Statistical Applications in Industry and Project Presentation (2 credits).

To provide experience in handling statistical problems in industry and to improve project presentation skills and report writing.

Online PowerPoint Tutorials:

<http://www.actden.com/pp/>,

<http://einstein.cs.uri.edu/tutorials/csc101/powerpoint/ppt.html>

<http://presentationism.com/>

AS 481 Enzymes in Industry (2 credits)

Proteins and Protein Purification: Amino acids and proteins, protein structure and function, protein purification and characterization, chromatography and electrophoresis.

Enzyme; The Agents of Life: Enzymes as catalysts in biological systems, enzyme classification, enzyme kinetics, enzyme assay methods, regulatory enzymes.

Application of Enzymes Technology in Industry: Bakery industry, food and dairy industry, textile industry, enzymes as detergents, enzymes in biotechnology.

Laboratory work: Laboratory experiments relevant to above aspects.

Recommended Texts:

1. Lehninger A.L., Nelson D.L and Cox M.M (1993) *Principles of Biochemistry*, 2nd edition, Worth Publishers
2. Scope, R.K. (1993) *Protein Purification: Principles and Practice*, 3rd edition, Springer.
3. Fersht, A. (1998) *Structure and Mechanism in Protein Science: A Guide to Enzyme Catalysis and Protein Folding*, 3rd edition, Freeman.

AS 482 Biochemistry and Molecular Laboratory Instrumentation (1 credits)

Introduction, preparation of biochemical laboratory solutions, pH and buffers; Absorption spectroscopic methods in biochemical applications; Chromatography methods; Electrophoresis; DNA isolation and analysis; Immunochemical methods (immunoblotting and ELISA); DNA isolation and analysis; Polymerase chain reaction.

Recommended Texts:

1. Sambrook, J. Fritsch, E.F. and Maniatis, T. (1989) *Molecular Cloning – A Laboratory Manual*, Cold Spring Harbor Laboratory Press
2. Keith Wilson and John Walker (2000) *Principles and Techniques of Practical Biochemistry*. Cambridge University Press
3. Alexander J. Ninfa, David Ballou (1998) *Fundamental Laboratory Approaches for Biochemistry and Biotechnology*. Fitzgerald Science Press, Inc

AS 483 Bioinformatics (2 credits)

Introduction to Bioinformatics; Structure and function of DNA; Collecting and storing sequence data; Biological databases and retrieval of information; Sequence alignment; Database searching for similar sequences; Phylogenetic analysis; Prediction of genes and regulatory sequences; Protein structure prediction.

Recommended Texts:

1. Baxevanis, A. (1998) *Bioinformatics: A practical Guide to Analysis of Genes and Proteins*, John Wiley
2. David W. Mount (2004) *Bioinformatics: Sequence and Genome Analysis*, Cold Spring Harbor Laboratory Press