



Course Description of Industrial Engineering Program

IE 1021: Engineering Drawing and Graphics 3(3, 0,1) (Core)

Constructional geometry and basics of lettering; Sketching; Orthographic projection; Sectional and auxiliary views; Dimensioning. Reading the orthographic projection by visualizing shapes. Threaded Fasteners, Introduction to Working Drawing, and Assembly Drawing. Fits, Allowances, Geometric Tolerances, and Surface Roughness. Introduction to computer graphics using AutoCAD software; Engineering applications.

Textbook: Shah, M. B., & Rana, B. C. Engineering Drawing. Pearson Education, Latest Edition.

IE 2511: Manufacturing Materials 3(2, 1, 1) (Core)

Material classifications. Material compositions and structures. Properties of materials. Phase diagrams. Ferrous materials: Production, processing, and applications. Non-Ferrous alloys: production, processing and applications. Ceramics production, processing, applications. Polymers production, processing, and applications. Composites processing and applications.

Pre-Requisite: PHYS 1040, CHEM 1010

Textbook: W.D. Callister, "Materials Science and Engineering - An Introduction", John Wiley, Latest Edition.

IE 2141: Industrial Operations Management I 3(3, 1,0) (Core)

Introduction of operations/production management: Concepts of production systems, operations strategy and responsibilities of an operations manager, Business process, input-output transformation model, productivity, and performance measures. Planning functions and tools: Basic forecasting models, capacity planning, organizing, and staffing. Planning Techniques: Concept of aggregate planning, Job-shop scheduling, and project planning. Control Function: Principles of inventory management, quality control.

Pre-Requisite: GE 3201, MATH 1060

Textbook: Jay Heizer, Barry Render, Operations Management, Pearson, Latest Edition,

IE 2521: Manufacturing processes I 3(2, 1, 0) (Core)

Introduction and overview of manufacturing. Plant and shop layout. Basic bench work operations. Metal casting fundamentals & processes. Fundamentals of metal forming. Bulk Deformation Processes (Rolling, Forming, Extrusion, and Wire and Bar Drawing). Sheet-Metal Forming Processes (sheet-metal characteristics, shearing, bending, and deep drawing). Welding processes (Fusion-Welding, Solid-State Welding, Brazing, and Soldering).

Pre-Requisite: IE 2511, ME 3570

Textbook: L. Alteng, Marcel-Dekker, "Manufacturing Engineering Processes", Latest Edition.

IE 2221: Industrial Operations Analysis I 3(3, 1,0) (Core)

Introduction to operations research. Linear programming modeling with engineering applications. Graphical solutions of linear programming problems. Theory of simplex method. Sensitivity analysis and shadow prices. Duality theory. Particular types of linear programming problems: Transportation problems and assignment problems. Network



analysis: shortest path, minimum spanning tree, maximum flow, and minimum cut problems. Goal Programming. Linear programming software.

Pre-Requisite: MATH 1070, GEU 1090

Textbook: David R. Anderson, Dennis J. Sweeney, Thomas A. Williams, R. Kipp Martin. An Introduction to Management Science: A Quantitative Approach to Decision Making, Thomson South-Western, Latest edition.

IE 3141: Industrial Operations Management II 3(3, 1, 0) (Core)

Advanced Forecasting models. Aggregate planning approaches. Master production scheduling, Material Requirement planning (MRP), and Enterprise Resource Planning (ERP). Inventory management: ABC inventory system, EOQ model, order policies, EPQ model, EMQ model, uncertainty, JIT inventory. Capacity planning: Capacity analysis and theory of constraints. Job shop scheduling: Job shop processes, issues and assumptions, the single machine model, the parallel machine model, the flow shop, and the general job shop. Manpower scheduling.

Pre-Requisite: IE 2141

Textbook: Jay Heizer and Barry Render, Operations Management. PEARSON, Latest Edition.

IE 3521: Manufacturing Processes II 3(2, 1, 1) (Core)

Fundamentals of Machining (Mechanics of Cutting, Cutting Forces and Power, Temperatures in Cutting, Tool Life, Surface Finish and Integrity, Machinability). Cutting-Tool Materials and Cutting Fluids. Machining Processes: Turning and Hole Making, Milling, Broaching, Sawing, Filing, and Gear Manufacturing. Manufacturing process planning. Machining Economics. Advanced Machining Processes.

Pre-Requisite: IE 2521

Textbook: Serope Kalpakjian and Steven R. Schmid, "Manufacturing Engineering and Technology" Pearson, Latest Edition.

IE 4010: Engineering Economy 3(3, 1, 0) (Core)

Introduction to engineering economics. Time Value of Money, Factors of Equivalence, Comparison methods: Present worth method, Equivalent annual worth method, Rate of return method, Break-even analysis, Replacement analysis, Cost-Benefit analysis, and Payback method. Present and annual worth analysis. Depreciation. After-tax economic considerations. Effect of inflation. Economic analysis under risk (Decision Tree). Economic analysis under uncertainty (Decision Matrices).

Textbook: Sullivan G., Engineering Economy, Prentice Hall, Latest Edition.

IE 3331: Design and Analysis of Experiments 3(3, 1, 0) (Core)

Introduction to design of experiments (DoE) and industry applications. Hypothesis Testing and Simple Comparative Experiments. Experiments with a Single Factor: Analysis of Variance (ANOVA), Randomized Complete, and Incomplete Blocks Designs. General Factorial Designs. 2k Factorial Designs. Response surface methodology (RSM), and Taguchi Designs. Introduction to computer software SPSS /Minitab/or any other related software.

Pre-Requisite: GE 3201

Textbook: D.C. Montgomery, "Design and Analysis of Experiments", Wiley, Latest Edition.



IE 3411: Human Factors Engineering 3(2, 1, 1) (Core)

Introduction to human factors. Human-Machine systems, Information Input and Processing. Human Capabilities: Hearing, Vision, and Psychomotor Skills. Human-Machine Interfaces: Display Design, Control Design, Feedback and Control, Hand Tools and Devices, Workplace Design. Environmental and Thermal Factors: Lighting, Air Pollutants, Noise, Vibration. Physical Work and Manual Materials Handling: Work-Related Musculoskeletal Disorders, Ergonomic Work Assessment Techniques, Design Applications.

Pre-Requisite: IE 3331

Textbook: McCormick & Sanders, "Human Factors in Engineering and Design", McGraw-Hill, UK, Latest Edition.

IE 4020: Engineering Project Management 3(3, 1, 0) (Core)

Principles of project management. Project life cycle and organization. Different stakeholders: relations, roles and responsibilities. Project planning process: project scope, WBS, identify activities and their sequences, estimate activity resources, estimate costs, and project budget. Network: Arrow Diagram, Precedence diagram, overlapping. Duration Time Estimates: Deterministic and Probabilistic. Project scheduling: CPM, PERT, Overlapping; Slack time computation, Critical path Identification. Resource Constraints: Smoothing and leveling, Time-Cost Trade-Off and Crashing. Project Control: Gantt Chart, Milestones, earned values analysis, S-Curve. Project leadership skills and decision-making. Concepts of project risk management. Using project management software (MS project / Primavera).

Pre-Requisite: IE 4010

Textbook: John M. Nicholas, "Project Management for Engineering, Business and Technology," Routledge, Latest edition

IE 4491: Safety Engineering 3(3, 1, 0) (Core)

Introduction to law and regulations. Concepts of Hazard avoidance. Hazard analysis, Hazard Assessment, Hazard Prevention, and Hazard Control in Buildings and Facilities. Personal Protection Equipment. Fire Protection. Safety in Materials Handling and Storage. Machine Guarding. Electrical Hazards. Occupational diseases. Management of Safety and Health: OSHA Standards, Evacuation planning, First Aids in emergency, Emergency planning, and Safety Management.

Pre-Requisite: IE 2521

Co-Requisite: IE 3411

Textbook: C. Ray Asfahl, "Industrial Safety and Health Management", Prentice Hall, Latest Edition.

IE 3221: Industrial Operations Analysis II 3(3, 1, 0) (Core)

Dynamic programming: Characteristics of dynamic programming, formulation, and applications. Integer programming: Formulations, solution methodologies, Branch-and-Bound algorithms, and engineering applications. Nonlinear programming: Graphical illustrations, single and multi-variable unconstrained optimizations, and engineering applications. Quadratic programming: Karush-Kuhn-Tucker conditions. Discrete-time Markov chains: Basic concepts, Steady state distribution, and applications. Queueing Models: Markovian models with single & multiple servers, models with limited capacities, and queueing decision models.



Pre-Requisite: IE 2221

Textbook: TAHA, Hamdy A. Operations research: an introduction. Prentice Hall, Latest edition.

IE 3371: Automatic Control Systems 3 (2, 1, 1) (Core)

Introduction to factory automation. Illustrated industrial automation applications. Introduction to linear control theory. Concepts of Laplace transformation control system. Open loop and closed loop control system. Concepts of PID control system and controller gain tuning. PID function in the programmable logic controller. The main characteristics of sensors. Types of sensors and using sensors in automation systems. Types of actuators. Main criteria to choose actuators. Pneumatic and electro-pneumatic systems. Hydraulic and electro-hydraulic systems. Introduction to Programmable Logic Controller (PLC). PLC programming. PLC timer counter, registers, and analog input outputs. Microcontroller applications in industries.

Pre-Requisite: MATH 2040, EE 3080

Textbook: R.C. Dorf "Modern Control Systems", Addison Wesley, Latest Edition.

IE 3421: Work Design and Analysis 3 (2, 1, 1) (Core)

Introduction to work systems, types of occupations, productivity, and problem-solving methods. Manual work and worker-machine systems. Methods engineering, process analysis, activity charts, man and machine charts, analysis and charting techniques, film analysis. Motion study and work design: Basic motion elements and work analysis, fundamental hand motions, principles of motion economy, and work design. Time study and work measurement: Time standards and how they are determined, pre-requisites, allowances, accuracy, and precision. Direct time study: procedures, performance rating, equipment. Micromotion study: Predetermined motion time systems, Methods-Time Measurement (MTM), Maynard Operation Sequence Technique (MOST). Work sampling. Standard data systems. Computer Systems for direct time study and work sampling. Measuring work by physiological methods.

Pre-Requisite: IE 3521

Textbook: Mikell P. Groover "work systems and the methods measurement and management of work," Pearson Education International, Latest Edition.

IE 3601: CAD/CAM 3(2,1,1) (Core)

Introduction to CAD and CAM systems. Computer graphics: Constructing the geometry, geometric transformation: 2D and 3D transformations. Geometric modeling techniques: wireframe, surface, and solid modeling. CAD/CAM database management system. Basic concepts of Finite Element modeling. Fundamentals of numerical control technology: motion control, point-to-point and continuous motions, programming numerical control machines, word address programming for CNC machines.

Pre-Requisite: IE 3521

Textbook: Mikell P. Groover, and Emory W. Zimmers, Jr.: "CAD/CAM: Computer-Aided Design and Manufacturing", Prentice Hall, Inc., Latest Edition.



IE 3391: Quality Engineering 3(2, 1, 1) (Core)

Introduction to quality control: Fundamentals of statistical quality control, the basic concepts of quality, quality engineering terminology, basic tools of quality, and Probability Distributions. Control charts for variables. Control charts for attributes. Process capability. Acceptance sampling. Lot by Lot Acceptance sampling by attributes: Concept, sampling plans design for single, double, and multiple plans. Sequential and dodge romig plans. Acceptance sampling plans by variables. Quality costs. Computer application in quality. Lab. Work: Measurement of different dimensions (length, width, and height). Use computer software for Descriptive statistics variables control charts. Design/use of gages for attribute measurement. Attributes control charts. Develop cause and effect diagram, Plot Pareto chart, scatter diagram, Dot plot, box plot, stem, and leaf plot. Perform a process capability study.

Pre-Requisite: GE 3201 - IE 3521

Textbook: D.C. MONTGOMERY, "Introduction to Statistical Quality Control," Latest edition.

IE 4382: Maintenance and Replacement Policies 3(2, 1, 1) (Core)

Maintenance systems, organization of maintenance department, and its responsibilities. Different types of maintenance policies. Corrective maintenance. Preventive Maintenance: Concepts, modeling, and analysis. Predictive maintenance, inspection, and diagnostics techniques. Maintenance operation and control: Maintenance workload analysis and calculations. Capacity planning of maintenance resources. Maintenance planning and scheduling. Maintenance material control. Maintenance auditing, cost control, performance assessment, and reporting. Manufacturing systems reliability and availability. Computerized Maintenance Management Systems (CMMS). Replacement studies.

Pre-Requisite: IE 3141, GE 3201

Textbook: Duffuaa, S. O., Raouf, A., & Campbell, J. D., "Planning and control of maintenance systems." John Wiley and Son, New York, Latest edition.

IE 4500: Industrial Facility Design 3(2, 1, 1) (Core)

Introduction to facility design: product analysis, production cycle, facility design, facility planning, and facility design phases. Production Analysis: Product-process relations, Production method-layout relation, Process design and planning charts. Capacity requirements for production line and machines, Labor, and assembly line balancing. Material handling analysis: principles, unit load, design, cost, and equipment types and selection. Factory analysis, utilities. Area allocation and space determination of personnel, production, warehousing, and physical services departments. Flow Analysis Techniques. Relationship analysis and Layout design: graphical, quantitative, qualitative methods, layout evaluation. Computerized facility layout. Location Analysis: Discrete and continuous location problems and site selection problems.

Pre-Requisite: IE 3421

Textbook: J. & White J., "Facility Planning, Tompkins", John Wiley & Sons, Latest Edition

IE 4611: Computer Integrated Manufacturing 3(2, 1, 1) (Core)

Types of CIM systems and their applications, importance, and components. Role of CNC machines in CIM system. Development of Database for CIM organizations. Integration of information between CIM components. Concept and



configuration of Industrial Robots. Automated manufacturing systems, automated handling systems. The concept of Automated storage and retrieval system (AS/RS), and different configurations. Introduction to Computer-Aided Process Planning (CAPP). Enterprise Integration and ERP. Fundamentals of smart manufacturing.

Pre-Requisite: IE 3601

Textbook: Chang, T.C., Wysk, R.A. & Wang, H.P., "Computer Integrated Manufacturing", Prentice Hall, Latest Edition.

IE 4321: Industrial System Simulation 3(2, 1, 1) (Core)

Introduction to concepts of systems, models, and simulation. Review of probability distributions and statistics. Discrete event simulation. Computer modeling and simulation process. Input data analysis. Monte Carlo Simulation. Generation of random variates. Simulation languages and their features. Model building process (e.g. SIMIO, ARENA Package/ any other simulation software). Model validation and verification. Output analysis. Stopping rules. Comparing alternative systems. Variance reduction techniques.

Pre-Requisite: IE 3141 CLE 3201

Textbook: Law and Kelton, "Simulation Modeling and Analysis", McGraw-Hill, Co., Latest Edition.

IE 4711: Manufacturing Systems 3(3, 1, 0) (Core)

Introduction to Manufacturing systems: Classifications and levels. Dedicated manufacturing lines. Reconfigurable manufacturing systems. Performance analysis of different manufacturing systems. High volume manufacturing system: Automated flow lines, Automated assembly lines. Group technology: part families, OPITZ classification system, MICLASS system. Cellular Manufacturing Systems (CMS). Flexible manufacturing system (FMS).

Textbook: Groover, M.P. "Automation Production System and Computer Integrated Manufacturing", Prentice Hall, Latest Edition.

IE 4910: Seminars for Industrial Engineering 1(0, 0, 1) (Core)

This course focuses on new developments in the field of Industrial engineering by attending workshops, Seminars, conferences, or lectures in any industrial engineering field. These include research presentations, demonstrations of new technologies or production lines, expert lectures organized by an academic institution, field trips, and career development workshops.

IE 4911: Senior Design Project I 3(1, 0, 2) (Core)

In graduation project (1), students learn how to choose a topic, establish a project, focus and conduct a literature review of the field of industrial engineering problems, including the problem definition and the existing challenges, and then propose a solution, utilizing recent scientific research papers and well-established books. They prepare and conduct preliminary experiments, if any. Students collect field data and develop the mathematical/computer model if applicable. They write a final report with a minimum of two chapters, and they may include any preliminary findings.

Pre-Requisite: 132 C.H.



IE 4921: Senior Design Project II 3(1, 0, 2) (Core)

Senior Design Project II is the continuation of the Senior Design Project I. Students work on the solution of the problem, experiment data, and survey outcomes, including running and finalizing the experimental program or the mathematical/computer model, analyzing the results and findings, and drawing the conclusion. Students are encouraged to perform a workable prototype or computer coding using software and/or mathematical modeling of the industrial engineering problem. The output and the results obtained are then documented and submitted in the form of a scientific project report and a poster. Finally, students present and defend their project in front of an examination committee.

Pre-Requisite: IE 4911

IE 4991: Practical training 1(0,0, *) (Core)

Practical Training aims to provide students with hands-on, real-world experience in practical work. This is mandatory field training. The course is designed to give students the opportunity to apply their academic education with work experience. Students are sent to different companies to get a taste of workgroups, communications, and professional development experiences. A continuous period of 6 weeks should be spent in an accepted firm to acquire practical experience. The trainee should prepare and submit a report before presenting the acquired field experience to a training committee.

Pre-Requisite: 112 C.H.

IE 3011: Product Design and innovation 3(2, 1, 1) (Elective)

Introduction to the product development process and models. Innovation management: opportunity identification, product planning, customer needs, and product specification. Concept development, selection, Quality function deployment (QFD), and concept testing. Product structure and components, function analysis, and modularity. Design for Assembly, Manufacturing, Quality, and Maintenance. Product prototyping. Product Failure Mode and Effects Analysis (FMEA). Patents and Intellectual Property, Product Development Economics. Reverse engineering process and procedures.

Pre-Requisite: IE 3601

Textbook: Ulrich, Karl T., and Steven D., "Eppinger. Product design and development," McGraw-hill, Latest edition.

IE 3021: Industry and the Environment 3(3, 1, 0) (Elective)

Introduction to the Impact of engineering and industrial activities on the environment. Types of pollution and its sources. Water pollution and water quality control. Air pollution and global atmospheric change. Limits of pollutants. Pollution control technologies. Solid waste management, resource recovery, and recycling. Examples of corruption from various engineering and industrial disciplines.

Pre-Requisite: IE 3521

Textbook: Dix, Herbert Mason, "Environmental Pollution: Atmosphere, Land, Water & Noise," John Wiley, Chichester, Latest Edition.



IE 3151: Dynamic Forecasting 3(3, 1, 0) (Elective)

Time series and forecasting. Forecasting accuracy. Monitoring and controlling forecasts. Linear, nonlinear, and multiple regression with forecasting applications. Box-Jenkins, Autoregressive integrated moving average (ARIMA) methodologies. Introduction to neural networks. Judgmental forecasting. Applications in the industry with suitable software.

Pre-Requisite: GEU 3201

Textbook: Business Forecasting, Hanke Wichern, Pearson Prentice Hall, Latest edition.

IE 3231: Decision Analysis 3(3, 1, 0) (Elective)

Introduction to the principles of decision-making under uncertainty. Methods used in decision analysis: utility models, influence diagrams, decision trees, and Bayesian models. Psychological components of decision making. Elicitation techniques for model building. Value of information. Attitudes towards risk. Multi-attribute decision problems. Dashboards and Visualization. Practical applications in real-life problems.

Pre-Requisite: GE 3201

Textbook: Making Hard Decisions: An Introduction to Decision Analysis, Robert T. Clemen, Duxbury Press, Latest Edition.

IE 3341: Industrial Stochastic Systems 3 (3, 1, 0) (Elective)

Review probability and probability distribution. Deterministic and stochastic processes. Poisson Process and Related Processes: Poisson Process, Compound Poisson Processes, Non-Stationary Poisson Processes. Renewal-Reward Processes: Renewal Theory, Renewal-Reward Processes, The Formula of Little. Continuous-Time Markov Chains: Model, Flow Rate Equation Method, Ergodic Theory, Markov Processes on a Semi-Infinite Strip. Discrete-Time Markov Decision Processes: Model, Policy-Improvement Idea, Relative Value Function, Policy-Iteration Algorithm, Linear Programming Approach, and Industrial Systems Applications.

Pre-Requisite: GE 3201, IE 3221

Textbook: A First Course in Stochastic Models, Tijms, H.C., Wiley, New York, latest edition.

IE 3351: Productivity Engineering and Management 3 (3, 1, 0) (Elective)

Introduction to productivity. Factors affecting productivity: inflation, political power, economic power, and technological development. Total productivity model. Productivity evaluation in companies and organizations. Productivity planning in companies and organizations. Productivity improvement concept. Technology-based productivity improvement techniques. Employees-based productivity improvement techniques. Material-based productivity improvement techniques. Product-based productivity improvement techniques.

Pre-Requisite: IE 3421

Textbook: Productivity engineering and management: productivity measurement, evaluation, planning, and improvement in manufacturing and service organizations, Sumanth, D. J. McGraw-Hill College, Latest Edition.



IE 4051: Manufacturing Cost Analysis 3 (3, 1, 0) (Elective)

Principles, concepts, and the importance of manufacturing cost analysis and estimation. Manufacturing labor cost analysis: labor cost analysis and estimation, labor wages and incentive systems, Gross hourly labor cost analysis. Manufacturing materials cost analysis. Materials cost policies. Accounting analysis- overhead calculations. Operation cost estimation. Product cost estimation: Product pricing, Production Budgeting, and Performance Reports. Engineering contracts.

Pre-Requisite: GE 4010

Textbook: Ostwald, Philip F. and Timothy S. McLaren, Cost Analysis and Estimating for Engineering and Management, Pearson, Latest Edition.

IE 4131: Supply chain and Logistics 3 (3, 1, 0) (Elective)

Introduction to the management of supply chain and logistics. The management components of the supply chain. Supply chain main processes: Customer relationship management; Supplier relationship management; Customer service management; Demand management; order fulfillment; Manufacturing flow management; Product Development and commercialization and Returns management. Mapping for Supply Chain Management. Supply chain performance measurement. Developing and implementing partnerships in the supply chain. Implementing supply chain management.

Pre-Requisite: IE 3141

Textbook: Supply Chain Management: Processes, Partnerships, Performance, Douglas M. Lambert (ed). The Supply Chain Management Institute, FL. Latest Edition.

IE 4141: Legislations & Contracts 3 (3, 1, 0) (Elective)

Law, rules, and regulations concerning the Saudi Engineering Council. Contractors' union and environment protection. Understanding Contracts and Tenders: Elements of a Contract, Tendering and Contract Documents, Tendering procedures, Bidding and Award of contracts. Relationship between the parties of local and international agreements in civil and administrative laws. Procurement methods, in-house versus Outsourcing, Contract (Payment) Types, Delivery Methods. Claims and dispute resolutions. Settlement of disputes in local and international contracts, institutional arbitration.

Pre-Requisite: IE 4020

Textbook: Henry Henkin, "Drafting Engineering Contracts", Taylor & Francis, Latest Edition.

IE 4151: Reverse Engineering 3 (3, 1, 0) (Elective)

Introduction to Reverse Engineering (RE): definition of RE, uses of RE, process, and phases of RE. Methodologies and Techniques for RE. Computer-aided Reverse Engineering. RE-Hardware and Software. Selecting a Reverse Engineering System. Rapid Prototyping. Relationship Between RE and Rapid Prototyping. Applications of RE in different industries. Legal Aspects of RE.

Pre-Requisite: IE 3141

Textbook: Reverse Engineering: An Industrial Perspective by Raja and Fernandes. Springer-Verlag, Latest edition.



IE 4161: Risk management 3 (3, 1, 0) (Elective)

Introduction to Risk Management: Risk definition, Impact of risks on organizations, Principles of risk management. Methods and tools for identifying, assessing, mitigating, and controlling risk in business and engineering design activities: Risk types, Risk management planning, Risk identification, Risk breakdown structure (RBS), Qualitative and Quantitative Risk Analysis, Identification of Barriers, Risk assessment, Probabilistic Risk Assessment (PRA), Risk treatment, Risk attitudes, Risk appetite, Risk Communication, Risk monitoring and review, Recording and reporting, ISO 31000.

Pre-Requisite: IE 4020

Textbook: Fundamentals of Risk Management: Understanding, Evaluating and Implementing Effective Risk Management, Latest edition.

IE 4171: Advanced safety engineering 3 (3, 1, 0) (Elective)

Definitions and fundamental Concepts of safety engineering. Safety standards. Safety management system: Principles and applications. Hazard Analysis. Risk assessment. Process Safety Analysis: Checklist, Hazard and Operability (HAZOP), Failure mode and effects analysis (FMEA), Fault tree analysis (FTA). Accident Investigation and Reporting.

Pre-Requisite: IE 4491

Textbook: Nicholas J. Bahr, "System Safety Engineering and Risk Assessment", Latest Edition.

IE 4181: Human resources management 3 (3, 1, 0) (Elective)

Introduction to Human Resource Management in Organizations. Strategic Human Resource Management and Planning. Workers, Jobs, and Job Analysis. Human Resource Planning and Retention. Recruiting and Labor Markets. Training Human Resources. Talent Management. Performance Management and Appraisal. Total Rewards and Compensation. Incentive Plans and Executive Compensation. Managing Employee Benefits. Risk Management and Worker Protection. Employee Rights and Responsibilities.

Pre-Requisite: IE 3411

Textbook: Mathis, R. L., Jackson, J. H., Valentine, S. R., & Meglich, P. Human resource management. Cengage Learning. Latest Edition.

IE 4191: Feasibility Study 3 (3, 1, 0) (Elective)

Introduction to feasibility studies: Definitions and importance of feasibility analysis, Elements of feasibility study. Marketing feasibility: present and future market study, demand, pricing, and revenue. Technical feasibility: site selection, materials, Labor, equipment, know-how, and shipping. Financial feasibility: project financing, production cost, break-even analysis, profitability analysis. Sensitivity analysis, Economic evaluation. Organizational and administrative feasibility: Organizational structure, governmental regulations, safety and environmental standards, patents, and human relations, Reporting, and presentation.

Pre-Requisite: IE 4020

Textbook: Stevens, Robert R, "How to prepare a feasibility study: a step-by-step guide including 3 model studies", Prentice-Hall, Latest edition.



IE 4211: Total Quality Management 3(3, 1, 0) (Core)

Principles and fundamentals of quality, quality control, quality assurance, and total quality Management (TQM). Philosophies and Views of the Quality Gurus. Basic Concepts of TQM: Customer Focus, Management Commitment, Employees. Involvement, supplier partnership, continuous improvement, Process measurement. Ethics and quality statements. Customer satisfaction and customer retention. Performance measures. Quality costs and quality awards. Benchmarking, Quality Function Deployment (QFD). International Quality Standards (ISO 9000 & ISO 14000 Series).

Pre-Requisite: IE 3391

Textbook: Evans J., Lindsay W., The Management and Control of Quality, South, Western College Publications, Latest edition.

IE 4231: Queuing systems 3 (3, 1, 0) (Elective)

Characteristics of queuing systems. General arrival and service patterns. Poisson process and Erlangian models. Birth and death processes in queuing systems. Markovian and non-Markovian queuing models. Steady-state and transient solutions. Optimization in queuing systems. Queuing systems applications in production, transportation, communication, and public service systems.

Pre-Requisite: GEU 3201

Text book: Shortle, J. F., Thompson, J. M., Gross, D., & Harris, C. M. Fundamentals of queueing theory. John Wiley & Sons, Latest edition.

IE 4241: Optimization Methods 3 (3, 1, 0) (Elective)

Unconstrained optimization, necessary and sufficient conditions for unconstrained optimization. Derivative-free algorithms. The steepest decent and Newton algorithms. Conjugate gradient and Quasi-Newton methods. Constrained optimization: Karush-Kuhn-Tucker conditions for optimality, constrained optimization algorithms, approximation, and methods of feasible directions. Optimization applications in different engineering disciplines.

Pre-Requisite: IE 3221

Text book: Introduction to Operations Research, Hillier, Frederick S., McGraw Hill Higher Education, Latest edition.

IE 4351: Inventory management 3 (3, 1, 0) (Elective)

Introduction: Objective of Inventory Management, Costs Associated with Inventory, Pre-requisites for Effective Inventory Management; Types of Inventory: Classification of Inventory, Measures of Inventory Effectiveness, Responsibility for Inventory Management; Operational Environments: Make-to-Stock Environment, Make-to-Order Environment, Engineer-to-Order Environment, Flow Process Environment; Inventory Transactions: Need for Inventory Records, Inventory Record Accuracy, Part Numbering Schemes (significant, non-significant, combination), Types of Inventory Transactions, Transaction Errors; Inventory Planning and Replenishment: Concept of Physical Inventory, Inventory Planning, Dependent and Independent Demand, Operational Situations, Reorder Point Technique (EOQ, Visual technique), Storage and Physical Control: Receiving Process, Physical Locations, Point-of-Use Inventory, Supplier- Managed Inventory; Warehouse Management: Types of warehouse operation, Warehouse management systems, storage and handling equipment.

Pre-Requisite: IE 3141

Text book: Hands-On Inventory Management by Ed C. MErcado, Auerbach Publications, New York; Latest Edition.



IE 4371: Material Handling and Packaging 3 (3, 1, 0) (Elective)

Introduction to Material handling and packaging. Objectives and principles of material handling and packaging. Material handling concepts: unit load, containerization, Types of material handling equipment and their economics, Types of Automated Storage and Retrieval Systems (ASRS), and specific applications. Considerations and safety issues in material handling. Role of packaging in material handling. Areas of special importance to packaging. Package design and material selection. Economics of packaging. Automation in packaging, Package development, and testing. Management of the packaging function.

Pre-Requisite: IE 3141

Textbook: MATERIAL HANDLING, Raymond A. Kulwiec, John Wiley, New Jersey Last Edition & FUNDAMENTALS OF PACKAGING TECHNOLOGY, Klalter Soroka, Richard Warrington, Last Edition.

IE 4372: Lean Manufacturing 3 (3, 1, 0) (Elective)

Lean philosophy, Lean strategy, Five basic principles of Lean manufacturing, Waste according to Lean philosophy, Just-in-Time (JIT), Value Stream Mapping (VSM), Takt Time, Root Cause Analysis, 5S, Jidoka, visual management, SMED, Poka Yoke, standardized work, Heijunka, improvement strategies (i.e., Kaizen), Hoshin Kanri, daily management, Lean leadership, PDCA, implementation issues, and Agile manufacturing.

Pre-Requisite: IE 3421

Textbook: Liker, Jeffrey K, Meier, David, The Toyota way fieldbook: a practical guide for implementing Toyota's 4Ps McGraw-Hill, Latest edition.

IE 4381: Reliability Engineering 3 (3, 1, 0) (Elective)

Basic concepts in Reliability Engineering. Reliability measures: Reliability function, hazard function of important distribution functions. Fault tree analysis, Hazard models, product lifetime, data analysis & model parameter estimation. Extreme value distribution. Static reliability models. Dynamic reliability models. Bayesian reliability analyses. System effectiveness measures. Reliability allocation and optimization. Human reliability.

Pre-Requisite: GEU 3201

Textbook: C.E. Ebeling, "An Introduction to Reliability and Maintainability Engineering". Waveland Press, Inc., Latest Edition.

IE 4391: Advance Maintenance Engineering 3 (3, 1, 0) (Elective)

Introduction to advanced maintenance: Objectives of maintenance engineering, Asset management, maintenance manager responsibilities. Concepts of maintainability engineering, Design for maintainability. Advanced maintenance philosophies: Reliability-centered maintenance, Total Productive Maintenance, Overall Equipment Effectiveness (OEE), Root cause failure analysis, Failure modes and effect analysis, Intelligent Maintenance. Maintenance Quality Control, Maintenance master budget, Safety in maintenance, Maintenance Key Performance Indicators (KPIs), and Maintenance balanced scorecard.

Pre-Requisite: IE 4382

Textbook: Duffuaa, S. O., Raouf, A., & Campbell, J. D., Planning and control of maintenance systems. John Willey and Son, New York, Latest edition.



IE 4411: Energy efficiency and sustainability 3 (3, 1, 0) (Elective)

Introduction: Attitudes to energy efficiency, energy management objectives, priorities, and strategies. Introduction to Sustainability: Business case for sustainability, strategies, and processes. Plant control systems, control, and use of an energy management system. Monitoring: Remote monitoring and out-station operation, Key Performance Indicators (KPIs), Audits: Economic, Environmental, and social aspects. Energy Modelling and Forecasting, reserves, and relation of resources to future options. Energy demand models, Energy Transmission and Utilization, Waste Heat Recovery System. Energy transitions: Resources, Challenges, and strategies.

Pre-Requisite: IE 3521

Textbook: Energy Efficiency and Climate Change: Conserving Power for a Sustainable Future: B. Sudhakara Reddy, Gaudenz B. Assenza, Dora Assenza, Franziska Hasselmann. SAGE Publication, Latest edition.

IE 4621: Industrial Information Systems 3 (3, 1, 0) (Elective)

Introduction to information systems. Management Information Systems in the enterprise. Managing hardware and software. Design of industrial information systems. Planning and control of information flow. Information systems requirements. Data collection, data storage, data analysis, data processing, and data retrieval. Database management systems. Concepts of e-commerce. Decision support and expert systems. Internet security. Internet of things (IoT).

Pre-Requisite: IE 3141

Textbook: O. Hick, "Information Systems in Business: An Introduction", James West Publishing Co., Latest Edition.

IE 4622: Artificial intelligence in industry 3 (3, 1, 0) (Elective)

Introduction: Goals of AI, Techniques, Branches, Knowledge types, Knowledge representation. Search Engines: Basic search types, Heuristic search, non-heuristic search. Reasoning: Forward and Backward chaining. Expert Systems: Construction, knowledge acquisition, Inference engines, applications. Neural Networks: Construction, types, Training, applications. Fuzzy Logic: Fuzzification, Defuzzification, Inference systems, Membership functions, applications. Evolutionary Computation. Basics of Machine Learning. Industrial applications, MATLAB utilization.

Pre-Requisite: GEU 1090

Textbook: Russell S. and Peter N., "Artificial Intelligence: A Modern Approach", Prentice Hall, Latest Edition.

IE 4661: Machine Learning 3 (3, 1, 0) (Elective)

Introduction: Basics of Machine learning and its classifications. Machine learning model design and development. Supervised learning: linear models, support vector machine (SVM), decision tree, Combining data and models, classification, regression, generalization, overfitting, and under fitting, deep learning, and neural networks (for univariate and multivariate). Unsupervised learning: clustering and dimension reduction. Applications in Industrial engineering applications.

Pre-Requisite: GEU 3201

Textbook: Andreas C. Müller, Sarah Guido - Introduction to Machine Learning with Python: A Guide for Data Scientists-O'Reilly Media, Latest Edition.



IE 4721: Sequencing and Scheduling 3 (3, 1, 0) (Elective)

Introduction to sequencing and scheduling, basic concepts, and terminology. Single and parallel machine sequencing and scheduling using different approaches and optimization methods. Constructive algorithms for flow-shop and job-shop problems. NP-hard problems and NP-completeness. Applications of Heuristic and Metaheuristic algorithms.

Pre-Requisite: IE 3221

Textbook: Principles and Sequencing and Scheduling, Kenneth R. Maker and Dan Trietsch, John Wiley and Sons Inc, Latest Edition.

IE 4811: Special topics in industrial engineering 3 (3, 1, 0) (Elective)

In-depth study of relevant and recent topics in industrial engineering that are not covered in other courses of the program in order to enhance student's knowledge in the field of industrial engineering.

Pre-Requisite: Department Approval

Textbook: Will be identified according to the selected topics.
