COURSE SPECIFICATIONS or COURSE PROFILES

COURSE SPECIFICATIONS

Master of Engineering Management (MEM) Programme

Transportation Infrastructure Management

	Compulsory Courses	
Course No.	**Course Title**	**Credit Hrs**
EM-501	Organizational Systems	3
EM-502	Accounting and Financial Management	3
EM-503	Strategic Planning and Decision Making	3
EM-504	Project Management Framework and Tools	3
EM-505	Operations Research	3
	Common Electives	
Course No.	**Course Title**	**Credit Hrs**
EM-511	Total Quality Management	3
EM-512	Project Evaluation and Feasibility Analysis	3
EM-513	Research Methods in Engineering Management	3
	Elective Courses	
Course No.	**Course Title**	**Credit Hrs**
UE-501	Urban Transportation Management	3
UE-502	Pavement Asset Management	3
UE-503	Intelligent Transportation Systems	3
UE-504	Road Safety Analysis and Methodologies	3
UE-505	Micro-Scale Traffic Modelling	3
UE-506	Travel Demand Forecasting	3
UE-507	Geospatial Analysis for Transportation Asset Management	3
UE-508	National Transportation Management	3
UE-509	Transportation Systems Asset Management	3
UE-510	Highway Construction Project Management	3
UE-512	Sustainable Urban Transport	3
UE-600	Independent Study Project	6
UE-601	Dissertation	9

Course contents of all these courses are listed below.

EM-501 Organizational Systems

Definitions of management; Evolution of management thought, classical, quantitative and behavioral schools; interactions between organizations and their environments. The planning process; strategic and tactical planning, developing planning premises, nature of managerial decision making, quantitative aids, management by objectives. Organizational structures; behavior of the individual, work group, and organization; coordination and spans of control, the informal organization; authority delegation and decentralization, groups and committees, managing organizational change and conflict. Motivation, performance and satisfaction; building a high-performance team; leadership, interpersonal and organizational communication, staffing and personal function. The control process; budgetary and non-budgetary methods of control; team performance measurement and improvement strategies. Use of management information systems.

EM-502 Accounting and Financial Management

Foundations of finance with applications in corporate finance and investment management. Major financial decisions made by corporate managers and investors with focus on process Valuation.
Criteria for investment decisions, valuation of financial assets and liabilities, relationships between risks and return, market efficiency, and the valuation of derivative securities. Major corporate financial instruments including debt, equity and convertible securities. Analysis and projection of financial statements, cost elements in pricing, cost control and design of accounting systems.

EM-503 Strategic Planning and Decision Making

Critical issues in shaping the competitive strategy for engineering-driven companies in a turbulent business environment; corporate mission; key result areas and situational analysis including strengths, weaknesses, opportunities and threats; identifying planning assumptions, critical issues, setting objectives, formulating strategy. Managing technology as a strategic resource of the firm; understanding of the process, roles and rewards of technological innovation; integrating the strategic relationship of technology with strategic planning, marketing, finance, engineering and manufacturing; government, societal and international issues; issues pertaining to cultural diversity and ethical concerns. Subjective, judgmental and expert decisions; conflict resolution in strategic decisions involving technological alternatives; hierarchical decision modeling; individual and aggregate decisions; decision discrepancies and evaluation of group disagreements.

EM-504 Project Management Framework and Tools

Role of projects in organization's competitive strategy; Standard methodologies for managing projects; Project life cycle; Design-implementation interface; Estimating: preliminary and detailed; Contractual risk allocation; Scheduling: PBS; WBS; Integration of scope, time, resource and cost dimensions of a project; Evaluation of labor, material, equipment, and subcontract resources; Scheduling techniques including CPM/ PERT, GERT, critical chain; Solving real-world project schedules; Monte Carlo simulation; Cost budgeting; Cost baseline; Cash flow analysis; Earned value analysis; Cost control; Proposal presentation; Application of software for project management (MS Project, Primavera Project Planner-P3).

EM-505 Operations Research

Deterministic modeling: Linear programming; The Simplex method; Multiple objective linear optimization; Duality and sensitivity analysis; Post optimality analysis from the viewpoint of technology management; Transportation, transshipment, and assignment problems; Problem formulation; Goal programming; Network analysis; Dynamic programming; Integer programming and nonlinear programming. Probabilistic modeling: Markov chains; Queuing theory and applications; Inventory theory; Forecasting; Design analysis and simulation; Pareto optimality and tradeoff curves.

EM-511 Total Quality Management

Critical principles and procedures of quality management in a competitive global environment; contemporary definitions of quality; construction quality; Product quality; Process quality; Quality economics; Quality philosophies; Planning, organizing and controlling for quality; Human resource strategies; QA and QC tools.

EM-512 Project Evaluation and Feasibility Analysis

Evaluation of engineering projects from the engineering management perspective; Techniques for capital investment for decision-making; Time value of money and the concept of equivalence; Present worth, annual and rate of return analysis; Multiple alternatives; Replacement criteria; Tax considerations; Breakeven sensitivity analysis; Project evaluations under uncertainty; Risk sharing; Capital budgeting; Cost of capital depreciation; Multicriteria decisions. Project feasibility analysis; Organizational impacts; societal impacts; Environmental impacts.

EM-513 Research Methods in Engineering Management

Research methods in engineering and technology management; Statistical techniques including proper selection; Use and interpretation of parametric and non-parametric tests along with factor and discriminate analysis; Design of experiments and model misspecification; Simulation in engineering and management research and practice.

UE-501 Urban Transportation Management

Introduction and strategic objectives of UTM; Techniques and procedures designed to improve traffic flow, air quality and movement of vehicles and goods, as well as enhance system access ability and safety; Quick response travel evaluation procedure; UTM actions: traffic management techniques for improving vehicular flow, preferential treatment for high occupancy mode, bus priority measures, demand management techniques for reduced traffic demand, staggered hours, and vehicle restrictions; Small area management: individual sites, residential neighborhoods, planning for pedestrians, parking management, traffic calming; Travel demand management and telemetric in travel planning.

UE-502 Pavement Asset Management

Classification of roads, Pavement Management Plans and approaches for various types of roads, Concepts of pavement maintenance and rehabilitation, pavement evaluation techniques, maintenance versus rehabilitation versus replacement alternatives, Highway Design & maintenance Standards, Modes of deterioration and maintenance, Deterioration modeling concepts, Life-Cycle of deterioration and maintenance, Road roughness: its measures and prevention methods, The roles of empirical and mechanistic methods; Cracking of bituminous surfacing: Types of cracking and its preventive measures, Pavement Deformation: its types and prediction approaches, Mechanistic and experimental models; Relative Damaging Effects: Problem and concepts, Loading characteristics of mixed traffic flow, Simulated trafficking experiments, Load and Non-Load associated damage attribution; Theoretical Mechanistic and Empirical studies.

UE-503 Intelligent Transportation Systems

ITS Applications in Transit Management and Operations; Electronic Payment Systems (EPS); Commercial Vehicle Operations (CVO); Intermodalism; Rural ITS; Advanced Telecommunications Technology; Advanced Signal Systems; Applied Systems Engineering for Advanced Transportation Projects; Deploying ITS: Strategic Planning and Implementation; Evaluating ITS Projects; Managing High Technology Projects in Transportation; Roles of Public & Private Sectors in ITS: Cooperative Partnerships.

UE-504 Road Safety Analysis and Methodologies

Road safety policy and statistic: road accident data at global, regional & local levels; Collision and Condition Diagrams, economic analysis of collisions/casualties; National Road Safety management programs in developing countries; Introduction to Road and Traffic Safety law; Traffic conflict studies techniques, road user behavioral studies; Accident Response system, key location of Ambulance booths with respect to time and space. Role of warning devises in crash prevention; Use of Haddon Matric for design of Pre-crash, and road safety review techniques; Case Studies.

UE-505 Micro-Scale Traffic Modelling

Micro-scale traffic management issues; Micro-simulation modelling techniques; aggregate and disaggregate models of traffic flow; Traffic signals and other controlling measures for micro-scale management; Computer-based assessment of different micro-level management strategies for improvement of the performance of road intersections; Some exemplary case studies and their outcomes.

UE-506 Travel Demand Forecasting

Four stage Modelling; Macro-scale network models and analysis; Stochastic and deterministic Modelling procedure; Introduction to macro-scale dynamic traffic modelling; Macro-scale demand management strategies and policies and their assessment Using EMME/2; Exemplary case studies for selected regions of Karachi.

UE-507 Geospatial Analysis for Transportation Asset Management

Overview of GIS, its data sources and classifications; Spatial data and overview of image process-ing; Remote sensing software and its application; Creating and managing GIS-based inventory and condition database for transport infrastructure; Development process of GIS-based decision support system using inventory and condition database of the road networks; GIS applications for route selection of highways, rapid transit systems, Road traffic accident analysis.

UE-508 National Transportation Management

Transportation management with a comprehensive overview of intermodal transportation and logistics management; Analysis of Recent trends in the field and its important stakeholders; Business logistics/supply chain from engineering and managerial perspectives and its impacts on physical distribution, materials management, transportation management, and logistics and supply chain management; Introduction to Freight Modelling, its principles and components; Planning, organizing, and controlling of national logistic activities including sub-activities such as transportation basics, inventory and location strategies; Exemplary case studies from developed and developing countries on logistic management.

UE-509 Transportation Systems Asset Management

Infrastructure Inventory: Defining Transportation Systems (TS) (i.e. Railways, Airports, Ports and Harbor) Infrastructure Objects, Defining relevant TS objects inventory information (attributes), Surveying TS objects. Location, Collecting, Compiling and maintaining the inventory of all objects constituting TS. Infrastructure Condition Monitoring: Defining TS objects needing condition monitoring, Defining relevant TS objects. condition information (measurements), Organizing, Scheduling and Performing condition information collection (measurement), Storing and Managing Condition information, Real time vs. Continuous (regular time-based) monitoring, Infrastructure Life cycle Management: Life cycle management principles related to TS, Degradation modelling of TS, Developing and employing cost-effective maintenance and repairing strategies, Maintenance vs. Renewal, Life cycle costing, Managing risks.

UE-510 Highway Construction Project Management

Highway Construction management needs, Highway construction planning, Highway production planning, timetables, planning of activities, Highway Construction organizational framework including Project Structure and individual's responsibilities, Highway Project Resources including Human, Material, Equipment and capital, Highway Construction Risk management including risk identification analysis and evaluation, Development and implementation of performance monitoring and maintenance management systems for highways, Highway Project Maintenance, Highway Project Delivery Methods, Computer Applications.

UE-512 Sustainable Urban Transport

Strategic challenges and financial constraints in development of sustainable urban transportation Influence of transport policies, land use impact and interaction, compression of various mass transit system sustainable freight transportation formal & informal public transport services. Sustainable transportation performance measures through environmental measures. Congestion pricing for demand management behavioral shit towards sustainability issues opportunities and technology integration case studies.