MSc in Systems Engineering and Management

Syllabus A—Systems engineering

1. Systems Engineering—Rôle, Purpose and Value

Mission, definitions, codes of practice, competencies, relation to other corporate functions, marketing, risk-management, business performance, time-to-market

2. Systems Engineering Organization

Life cycle process models—waterfall, helix, prototyping, simultaneous/concurrent, evolutionary acquisition, Sashami, chaotic, regression, etc. The engineering and application systems model. The 5 systems model. Engineering environments; ATMOSPHERE, SEAMS, system factory, etc..

3. Methods, Modelling and Mathematics

Principles of systems creativity, system theory, dynamic systems, simulation models, queuing models, linear and non-linear control models, stochastic models, statistics. Creative methods: Ishikawa, Majaro, Causal Loop Modelling, stakeholder analysis, interpretive structural modelling.

4. Evaluating Systems

Efficiency, effectiveness, cost-effectiveness; net contribution; tradeoffs, ranking methods, weighting and scoring methods

5. Requirements

Enquiry: soft systems methodology, hierarchical issue method. Requirements definition. TRIAD building system. Requirements specification, compliance and certification specification.

6. Concept Development

Process modelling, seven-step continuum, creative entropy, necessary and sufficient sets, need and options templates, generic reference models

7. Architectonics

Architectures: clusters, links, infrastructure, entropy. Protocols, processing structures, memory, reconfigurability redundancy availability, survivability. Databuses, data links, self test and BIT(E). Interoperability, tempest, electromagnetic compatibility, security, failure modes effects and criticality analysis

8. Design and Specification

Design for:—usability, MMI/HCI, RAM-D, survival, damage tolerance, safety, reconfigurability, stealth, self-defence, self-healing, replacement, test, production, integration, installation, pre-planned improvement.

9. Development

Interface control, adjusting design for integration, configuration management, compatibility management

10. Integration and Test

Integration strategy: progression, fault-finding, soaking. Hardware-in-the loop. Scenario, environment simulation. Rig design. Rig/in-service training alignment.

11. Systems Proving and Transition to Use

Planning and analyzing results from trials, conduct of trials, demonstrating compliance/concessions, commissioning, installation, methods and support for transition into use.

12. System In-use Support

Logistics: spares ranging and scaling, transport. Maintenance: on-site reps, test and repair facilities, modifications, configuration recording, PDS. User training, simulators, part-task trainers, on-the-job training. New requirements: identification, investigation, systems engineering. Anticipation of replacement. Documentation and publications

Syllabus B—Systems Engineering Management

1. Systems theory

Modern systems thinking, human aspects, emergence and hierarchy, gestalt, generic reference models, unified systems hypothesis

2. Management of Systems Creation

Specifications, interface management, configuration management, interface management, documentation, design and partitioning management, design change control, managing integration and test, measures of effectiveness and performance, planning and managing trials, managing compliance demonstrations, commissioning, installation and acceptance, transition to use. Managing the in-service systems

3. Project Management

Planning, estimating, costing, budgeting, resource allocation, work breakdown structures, statements of work, on-line control, tiger teams, project reviews, red teams, Programme Evaluation and Review Technique, GANTT charts, audit trails, project records, data management

4. Procurement

MOD/DOD procurement cycles, design-construct contracts, whole-platform procurements. Consortia, Joint Ventures. Prime-subcontractor relationships. Evolutionary acquisition, prototyping, mid-life updates, etc.

5. Managing R&D

Planning and budgeting, identifying “winners”, value for money, organization and method, effective environments and control.

6. Quality Management

Definitions and misunderstandings. Quality ethics, right first time, zero defects, total quality management and their relationship with systems engineering. Quality practices, circles, chains, audits, control, assurance. Eliminating the need for the quality management function

7. Resource Management

Human resources, finance, accounting, life cycle costing, estimating, forecasting, investments, business computing, management of change, information management. Logistics: integrated Logistic Systems, CALS, MANPRINT, CIRPLS and RAM-D

8. Manufacturing Management

Organization and methods, principles of system design, modelling, batch and continuous flow-line, mixed system approaches, control system design, MRP II, just-in-time and the management of its risks

9. Operations Management

Operations organizations, singleton and intensive operations. Improving operational availability, modelling resource utilization, operational logistics, servicing policies

10 Maintenance Management

Strategies: on condition, lifed components, wearout, throw-away. Practices: scheduled, progressive, opportunity, opportunity-progressive. Organization: lines of servicing, workshops, local stores, fly-away operations, total cost analysis

11. Risk Management

Pros and cons of risks: technological, economic, political, commercial. Risk metrics, probabilities and impacts. Embedding risk management in process models. contingency planning. Commercial factors: warranties, terms and conditions, export credit guarantees, international law, etc.

12. Marketing

Marketing and selling, understanding the market, competition, SWOT, closing sales, bid management and proposals, publicity, image

13. Personal Management

Leadership, team leadership, communications, presentations, promoting synergy and commitment, time management, self-training and education, negotiating skills