Online Masters of Science in Systems Engineering (Online MSSE) – Summary

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The online Master of Science in Systems Engineering (MSSE) offered by the University of Texas at El Paso (UTEP) is convenient, flexible and affordable.

• Designed for engineers and other STEM professionals seeking technical and managerial skills
• Reviews the Systems Engineering Handbook of the International Council on Systems Engineering (INCOSE)
• Analyzes the Capability Maturity Model Integration (CMMI) key concepts to manage engineering systems
• Integrates studies in technology, process engineering, and management into one multi-faceted discipline
• Develops skills to design and manage complex systems from conception to disposal
• Develops engineers skills to work in self-manage high performance teams
• Designed as hands-on learning and culminates with a practicum
• Created to serve industry partners

The program curriculum give engineers an advantage in earning their Associate/Certified Systems Engineering Professional (ASEP/CSEP) certification and prepares graduates to work in companies that utilize quality models such as the Capability Maturity Model Integration (CMMI).
Masters of Science in Systems Engineering

The online systems engineering degree requires a minimum of **30 credit hours**. During this program, students can build on fundamentals by gaining practical experience in systems engineering management, service systems, systems integration, validation and the testing of complex systems.

**Core Coursework**
- SE 5341 Systems Engineering Fundamentals
- SE 5342 Systems Engineering Management
- SE 5343 Systems Requirements Analysis
- SE 5344 Systems Integration, Verification & Validation
- SE 5345 Systems Engineering Project Practicum

**Concentration Track**
- SE 5346 Systems Architecture and Design
- SE 5347 Systems Engineering Process
- SE 5348 Systems Modeling & Simulation

**Electives**
- SE 5390 ASEP INCOSE prep exam
- SE 5390 Certified CMMI Associate
7 Modules

<table>
<thead>
<tr>
<th>Introduction to Systems Engineering</th>
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<tr>
<td>System Thinking, Complexity and Emergence</td>
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<tr>
<td>Lifecycle processes overview</td>
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<tr>
<td>SE Tools: WBS, N^2, Requirements Traceability, ...</td>
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<tr>
<td>Conf. Management &amp; Measurement and Analysis</td>
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<tr>
<td>Decision Analysis &amp; Risk Management</td>
</tr>
<tr>
<td>Service System &amp; Systems Engineering Ethics</td>
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</table>

Knowledge acquired and Professional skills

- Understand the Systems Engineering profession, current status, challenges, and application domains
- Apply system thinking approach and SE tools
- Identify types of systems and their characteristics
- Apply risk management, decision analysis, metrics, and conf. management to a project
- Discuss CMMI related process areas and INCOSE related handbook sections
- Analyze lifecycle phases, activities, associated documents, and lifecycle functions
- Compare SE lifecycle models: DoD and ISO/IEEE
- Understand the structure of the CMMI model and INCOSE Handbook
### 7 Modules

<table>
<thead>
<tr>
<th>Module</th>
<th>Description</th>
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<tbody>
<tr>
<td>Intro to the Technical Management Process</td>
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<tr>
<td>Systemics and Programmatic</td>
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<tr>
<td>Project Management vs. Systems Engineering Management: Integration of the Project and Program Domains</td>
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<tr>
<td>Project Management Technical Measures throughout the lifecycle</td>
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<tr>
<td>Project Assessment and Control Process</td>
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<tr>
<td>Organization for Project and Sys Eng. Management</td>
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<tr>
<td>Systems Engineering Applicability</td>
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</tbody>
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### Knowledge acquired and Professional skills

- Raising awareness of the application of the Systems Eng. and technical project management:
  - Planning, Monitoring, Leadership, Staffing, Resourcing and Organization
- Providing the technical and business skills needed to initiate, develop and sustain a technical project
- Employing the application and structure of the Systems Eng. Management Plan (SEMP) and Project Management Plan.
- Creating strategies for stakeholder expectations.
- Using tools to manage and control a Project.
## SE 5343 Syst. Requirements Analysis

### 7 Modules

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<th>Module</th>
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<tr>
<td>Mission Analysis and Requirements Gathering</td>
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<td>Stakeholder Requirements</td>
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<td>Analysis of Requirements</td>
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<tr>
<td>Modeling of Requirements</td>
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<tr>
<td>System Specification, Verification &amp; Validation</td>
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<tr>
<td>Requirements Management</td>
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<tr>
<td>System Requirements Reviews</td>
</tr>
</tbody>
</table>

### Knowledge acquired and Professional skills

- Apply ISO/IEC/IEEE 15288 / processes and CMMI process areas related to Requirements,
- Translate stakeholder needs into technical requirements.
- Create System Requirements (Tech Spec) document using international standard.
- Create requirements models: Class diagrams, State Transition diag., and Sequence diagrams.
- Utilize Requirements Engineering standard and best practices.
- Apply Validation and Verification techniques to requirements documents.
- Use appropriate technologies for requirements engineering and management.
SE 5343 Syst. Requirements Analysis
Sys Integration, Verification & Validation

7 Modules

- Introduction to IVV, Project, and Teams
- Definition of Integration, Verification and Val. (IVV)
- Design of the IVV Strategy
- Implementation of IVV Activities
- Integration strategy
- Qualification and Acceptance
- Quality Metrics and Analysis

Knowledge acquired and Professional skills

- Apply the key principles of integration, verification and validation plans.
- Design and apply verification requirements traceability matrices, compliance matrices, peer reviews, and task matrices at different system life-cycle stages.
- Analyze IVV quality metrics.
- Apply strategies for determining IV&V activities, obtaining quality IV&V testing data, and optimizing the overall IV&V process.
- Develop an IVV plan for realizing an optimized system with an end-to-end lifecycle perspective.
- Analyze 15288 Sys Lifecycle processes and CMMI process areas relevant to IVV.
Sys Integration, Verification & Validation
# SE 5345 Sys Eng. Project Practicum

## 7 Modules

- Problem understanding and scope
- Stakeholder requirements and Sys. Requirements
- System Eng. Management Plan
- System Verification and Validation
- System Design and Implementation
- System Quality Analysis
- Building High-Performance Self-Managed Teams & Monitoring Team Performance

## Knowledge acquired and Professional skills

- Defining Problem Statement and Project Scope
- Aligning Customer Needs with Problems
- Creating Stakeholder Specifications from Needs
- Creating Sys Specification from Customer Needs
- Validating Customer Needs and Sys Specification
- Documenting the System Design
- Piloting and Developing the System
- Creating Status Report to Manager and Customer
- Monitoring and controlling Team Performance
- Analyzing Quality of Lifecycle Process and Product
SE 5345 Sys Eng. Project Practicum
## SE 5346 Sys Architecture and Design

### 7 Modules

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<tr>
<th>Modules</th>
</tr>
</thead>
<tbody>
<tr>
<td>Introduction to Architecture and Quality Attributes</td>
</tr>
<tr>
<td>Data Centrality and Integration; DoDAF 2.0 and DM2 (DoDAF Meta-Model)</td>
</tr>
<tr>
<td>UPDM and UAF</td>
</tr>
<tr>
<td>SoS: System-of-Systems</td>
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<tr>
<td>System Dynamics and Modified Frameworks</td>
</tr>
<tr>
<td>ATAM: Architecture Tradeoff Analysis Method</td>
</tr>
<tr>
<td>Management and Project Reviews</td>
</tr>
</tbody>
</table>

### Knowledge acquired and Professional skills

- Manage an architecting team
- Apply role and activities of a professional architect
- Use heuristics for architecting
- Apply Data Centralization and Integration
- Employ Zachman, DoDAF 2.0, and other frameworks
- Apply ISO/IEC/IEEE 15288 processes
- Analyze CMMI Technical Solution Process
- Verify and Validate an Architecture
- Use SoS Principles and System Dynamics
- Conduct Architecture Tradeoff Analysis
SE 5346 Sys Architecture and Design
SE 5347 Sys Engineering Process

<table>
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<tr>
<th>7 Modules</th>
<th>Knowledge acquired and Professional skills</th>
</tr>
</thead>
<tbody>
<tr>
<td>Systems and Software Engineering Lifecycle Processes</td>
<td>• Compare &amp; contrast 15288 and CMMI processes</td>
</tr>
<tr>
<td>ISO 15288 Technical processes and CMMI Process areas categories</td>
<td>• Examine relations among Process Groups &amp; Categories</td>
</tr>
<tr>
<td>Managing organizational change</td>
<td>• Debate dependencies among technical processes</td>
</tr>
<tr>
<td>Process Improvement Infrastructure (PII)</td>
<td>• Determine factors that enable a successful organizational change</td>
</tr>
<tr>
<td>Managing process improvement</td>
<td>• Examine key components to manage process impr</td>
</tr>
<tr>
<td>Managing process adherence</td>
<td>• Use CMMI processes and 15288 processes to manage process improvement</td>
</tr>
<tr>
<td>Managing statistical process control</td>
<td>• Create and apply process assets to evaluate process adherence</td>
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<tr>
<td></td>
<td>• Determine process capacity (baselines)</td>
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<td></td>
<td>• Use process performance models to predict perform.</td>
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</table>
# SE 5348 Sys Modeling & Simulation

## 7 Modules

<table>
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<tr>
<th>Overview of models, simulations, and Model Base System Engineering</th>
</tr>
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<tbody>
<tr>
<td>Modeling dynamic behavior with Petri Nets</td>
</tr>
<tr>
<td>Analyzing dynamic behavior with State Transition Diagrams</td>
</tr>
<tr>
<td>Overview of the Systems Modeling Language and the SysML Requirements models</td>
</tr>
<tr>
<td>Creating SysML-Behavior models</td>
</tr>
<tr>
<td>Creating SysML-Structure models</td>
</tr>
<tr>
<td>Modeling systems using MBSE approach &amp; SysML</td>
</tr>
</tbody>
</table>

## Knowledge acquired and Professional skills

- Apply concepts behind models, simulation, & MBSE
- Use models and simulations to understand, define, verify and validate systems.
- Support Systems Engineering with MBSE
- Analyze complex dynamic behavior of systems like concurrency, synchronization, and orthogonality.
- Compare and contrast the models of the System Modeling Language (SysML)
- Examine SysML Requirements Diagrams
- Create a system specification using a tool that supports the SysML models.
SE 5348 Sys Modeling & Simulation

**Run a simulation**
(Click here)

**Inputs**
- Conditions
- Data

**Simulation**
Executes the code with the given inputs over a set amount of time.

**Analytical Model**
(executable code)

**Outputs**
- Test report
- Visual Representation
- Other output

**SysML Diagram Taxonomy**

Source: OMG Systems Modeling Language (OMG SysML) Specification v1.5