Course Title:	System Dynamics
Course Code:	SM690
Department:	Operations and Supply Chain

HSM Vision

HSM envisions its success in the sustainable contribution that it will make to the industry, academia and research in public and private sector. HSM will lead by providing professionally competent and ethically conscious human resources engaged in the global and local context to foster socio-economic growth and sustainability for the society. HSM envisages having faculty with high research potential and a deep desire for cutting edge research including collaboration with national and international partners.

HSM Mission

Being a research-oriented and student-centric business school, we emphasize research publications in impact journals as well as state-of -the-art learning methodologies. We will prepare our students to become the future ethical business leaders and the guiding post for the society, while equipping them with the knowledge and skills required by world-class professionals. We will be the leading choice for organizations seeking highly talented human resource. HSM will foster internationalization with key stakeholders and actively work to exchange best practices with business schools across Pakistan through collaborations, workshops, conferences and other means.

Program Objectives

- To hone participants' abilities through a well-developed and diversified program designed to equip graduates with essential leadership skills.
- To develop participants' expertise in order to increase their resourcefulness in better decision-making.
- To prepare participants for steering an organization through the difficult and turbulent global and domestic environment and enable the development of an implementable strategic business plan that not only addresses the financial but social and environmental issues as well.
- To produce students who have well-rounded entrepreneurial skills - who not only have great ideas, but can also make things happen by starting their own ventures.
- To enhance the proficiency of the students and groom them to deal with the complex business situations.

Course Objectives

This course was designed to impart the knowledge of systems thinking and educate them to manage the complexities of the business world using system dynamics. Corporate world is highly dynamic, complex and non-linear flooded with multiple challenges and issues. Mere intuition and experience cannot solve the issues and overcome the problematic areas. Latest management tools equipped with computer simulations can help to surmount the problematic issues. System Dynamics is a methodology that equips management to design the policies of their own choice and foresees the future of the organization while developing the structures that are desirable. The cases used for practice and discussion in class room environment contain the elements of sustainability as well as internationalization.

Learning Objectives

Learning objectives of this course include:

- understanding the computer based system dynamics modeling for managing the complexities ethically in a sustainable supply chains.

- learning the power of feedback causal loops to gain the insight of the industrial problems.
- inculcating systems thinking and computer programming using simulation software DYNAMO for modeling purpose.
- Experimentation with models to design and develop the develop policies to make the system better behaved.
- understanding the real symptoms that produce undesirable structures for inappropriate ducts and services of the organization
- understanding the impact of MPC activities on the environment

Learning Outcomes

After the completion of this course you should be able to:

1. know the basics concepts of system dynamics and understand well why system thinking is important for any individual,

2. Appreciate the overall perspective of the manufacturing function and the complexity of managing the flow of material in a business,

3. develop an ability to write the computer programme for the model of the problem understudy.

4. learn how to develop the causal loop diagram for the industrial problems and convert into stock and flow diagram for the said model boundary..

Teaching Methodology (List methodologies used –example are given below)

Interactive Classes	Case Based Teaching
Class Activities	Applied Projects
Experiential Learning	Computer Modelling

STUDENTS ARE REQUIRED TO READ AND UNDERSTAND ALL ITEMS OUTLINED IN THE PARTICIPANT HANDBOOK

Class Policy:-

- Be On Time

You need to be at class at the assigned time. After 10 minutes past the assigned time, you will be marked absent.

- Mobile Policy

  TURN OFF YOUR MOBILE PHONE! It is unprofessional to be texting or otherwise.

- Email Policy

  READ YOUR EMAILS! You are responsible if you miss a deadline because you did not read your email.

  Participants should regularly check their university emails accounts regularly and respond accordingly.

- Class Attendance Policy

  A minimum of 80% attendance is required for a participant to be eligible to sit in the final examination. Being sick and going to weddings are absences and will not be counted as present. You have the opportunity to use 6 absences out of 30 classes. Participants with less than 80% of attendance in a course will be given grade 'F' (Fail) and will not be allowed to take end term exams. International students who will be leaving for visa during semester should not use any days off except for visa trip. Otherwise they could reach short attendance.

- Withdraw Policy

  Students may withdraw from a course till the end of the 12th week of the semester. Consequently, grade W will be awarded to the student which shall have no impact on the calculation of the GPA of the student.A Student withdrawing after the 12th week shall be automatically awarded "F" grade which shall count in the GPA.

- Moodle

  UMT –LMS (Moodle) is an Open Source Course Management System (CMS), also known as a learning Management System (LMS). Participants should regularly visit the course website on MOODLE Course Management system, and fully benefit from its capabilities. If you are facing any problem using moodle, visit http://oit.umt.edu.pk/moodle. For further query send your queries to moodle@umt.edu.pk

- Harassment Policy

  Sexual or any other harassment is prohibited and is constituted as punishable offence. Sexual or any other harassment of any participant will not be tolerated. All actions categorized as sexual or any other harassment when done physically or verbally would also be considered as sexual harassment when done using electronic media such as computers, mobiles, internet, emails etc.

- Use of Unfair Means/Honesty Policy

  Any participant found using unfair means or assisting another participant during a class test/quiz, assignments or examination would be liable to disciplinary action.

- Plagiarism Policy

  All students are required to attach a “Turnitin” report on every assignment, big or small. Any student who attempts to bypass “Turnitin” will receive “F” grade which will count towards the CGPA. The participants submit the plagiarism report to the resource person with every assignment, report, project, thesis etc. If student attempts to cheat “Turnitin”, he/she will receive a second “F” that will count towards the CGPA. There are special rules on plagiarism for final reports etc. all outlined in your handbook.

- Communication of Results

  The results of quizzes, midterms and assignments are communicated to the participants during the semester and answer books are returned to them. It is the responsibility of the course instructor to keep the participants informed about his/her progress during the semester. The course instructor will inform a participant at least one week before the final examination related to his or her performance in the course.

Course Outline

Credit Hours	3 Credit Hours
Prerequisites (If any)	Operations Management

Grade Evaluation Criteria

Following is the criteria for the distribution of marks to evaluate final grade in a semester.

Marks Evaluation	**Marks in percentage**
Quizzes	10
Assignments	10
Case Studies	10
Mid Term	20
Attendance & Class Participation	05
Term Project	10
Presentations	05
Final exam	30
Total	100

Recommended Text Books:

Sterman, John D. Business Dynamics- Systems Thinking and Modeling for a complex world McGraw-Hill Higher Education 2000

Reference Books:

1. RICHARDSON & PUGH, Introduction to System Dynamics Modeling with Dynamo, MIT Press 1981
2. FORRESTER, J.W. Principles of Systems, MIT Press, Wright-Allen series 1968
3. KHALID SAEED, Towards Sustainable Development: Essays on System Dynamics of National Policy, Progressive Publishers, Lahore
4. FORRESTER, J.W. Industrial Dynamics, MIT Press, 1961

Book: Business Dynamics by John Sterman

Sr. No	Topics to be covered	Learning Objectives of this topic	Expected outcomes from Students	Teaching Method	Assessment Criteria	Deadlines and Homework
1	Systems, its Types System Thinking and Impediments of System Dynamics	Introduction to Systems, Open Loop & Close Loop Systems, Systems Thinking and Major Impediments of System Dynamics	To understand , Open and Close Loops, Difference between Systems Thinking and System Dynamics To know about impediments of System Dynamics	Lecture as well as Case Study and Group Discussion	Class Participation	Video
2	Beer Game	Beer Game, Discussion as a case of Information Structure of System	To learn the link between structure and behaviour	Require d reading Group Discussion, Business Game	Class Participation	
3	Problem Identification, and System Conceptualization	Problem Identification, System Conceptualization, Dynamic Variables and its Behaviour Pattern	To develop the insight for problem identification and establishing the dynamic hypothesis	Lecture as well as Case Study and Group Discussion	Quiz	HW1
4	Types of Feedback Loops	Basic Concept of Feedback Loops , Types of Feedback Loop, Positive Loop & Negative Loop and its Properties	To understand concept of feedback loops, its types and properties that establish the loop dominance	Lecture as well as Case Study and Group Discussion	Skill Developmen t Exercise	Video
5	Building Blocks (Modeling Protocol)	Building Blocks (Modeling Protocol) Generic Components of Decision Process, Causal Loop Diagram	To know about the modeling protocol by understanding generic components of decision process	Lecture as well as Case Study and Group Discussion	Written Case Assignment	HW2
6	Modeling Software DYNAMO	Introduction to Modeling Software DYNAMO Formulation Levels Rates, Auxiliary	To learn the modeling language and a way to write equations from the causal loop diagram	Lecture as well as Case Study and Group Discussion	Quiz	

7	*EQUATION WRITING*	Equation writing on computer	To learn the art of equation writing from the causal loop diagram	Lecture as well as Case Study and Group Discussion	Computer Exercises	HW3
8	Mid Term Exam					
9	Formulation of SD Model, Parameters and setting initial value, Equilibrium point and Model Validation	Design and develop the system dynamics model establishing initial values and simulate the model for base run and validation	To understand how a SD model can be formed and written in the modeling language	Lecture as well as Case Study and Group Discussion	Written Case Assignment	
10	Inventory-Workforce Oscillator Lab Work	Computer Exercises	To write the equations in computer lab and simulate the basic models for learning purpose	Lecture as well as Case Study and Group Discussion	Computer Exercises	
11	Inventory-Workforce Oscillator Lab Work	Computer Exercises	To write the equations in computer lab and simulate the basic models for learning purpose	Lecture as well as Case Study and Group Discussion	Computer Exercise	HW4
12	Policy Design and Basis of Policy Analysis	Policy Design, Parametric Changes as a Policy alternatives, Structural Changes as a policy alternatives, Testing of Policies based on Operations, Information and Personal Management	To understand the norms of policy design, Policy design on the basis of Parametric changes vs Structural Changes, To learn testing of polices based on operations, information and personal management	Lecture as well as Case Study and Group Discussion	Quiz	
13	Case Study- Computer LAB	Assessment of Sustainable Performance of Construction Project	To understand the sustainable performance of construction project	Lecture as well as Case Study and Group Discussion	Computer Exercises	Project
14	Case Study- Computer LAB	Production Operations and Marketing Growth	To understand the real life model and its base run and policy run	Lecture as well as Case Study and Group	Computer Exercises	

			simulation	Discussion		
15	Case Study- Computer LAB	Dynamic of Growth in a Finite World	To understand the effect of environment and renewable energy resources	Lecture as well as Case Study and Group Discussion	Computer Exercises	
16	System Dynamics Model considering 2 - 4 stocks	Model Development	Designing and developing the SD Model and design the plausible policies		Project Presentation and project report	