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Course Title: Social Network Analytics

Course Code: IS-653

Department: **Information Systems**

**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**

The School of Business and Economics at UMT is foreseeing the challenges ahead both at national and international level and the utility of data science.  In Pakistan the multi dimensional economy integrated with globalization needs a boost assisted by professionally trained and skilled Data Scientists, whom may incorporate and harmonize the unlimited bucket of resources, pouring in from springs of industry, agriculture, business, human resources etc. in a manner to achieve efficiency to its apex.  
In the competitive economy the companies need to adapt data science to gain a competitive advantage in productivity, profitability and sustainable business processes to offer better products and services to their customers. To attain this goal trained and skilled workforce in this area is the need of the hour; who are equipped to manage, understand and model the data, interpret the outcome and communicate the results for business use. Professionals holding a degree in Data Science will be well positioned to help their organizations gain a competitive advantage in a data-driven world.

**Course Objectives**

This course provides an overview and synthesis of research on social and economic networks, drawing on studies by sociologists, economists, computer scientists, physicists, and mathematicians. The course begins with some empirical background on social and economic networks, and an overview of concepts used to describe and measure networks. Next, we will cover a set of models of how networks form, including random network models as well as strategic formation models, and some hybrids. We will then discuss a series of models of how networks impact behavior, including contagion, diffusion, learning, and peer influences. Social networks are seen as an important factor in how ideas, norms, and innovations are realized. Social network research understands individuals within their social context, acknowledging the influence of relationships with others on one’s behavior. Hence, social networks can promote innovation processes and expand opportunities for learning.

**Learning Objectives**

The main learning objective with this course is to enable students to put Social Network Analysis projects into action in a planned, informed and efficient manner. This overarching goal involves the following subtasks:

* Formalize different types of entities and relationships as nodes and edges and represent this information as relational data.
* Plan and execute network analytical computations.
* Use advanced network analysis software to generate visualizations and perform empirical investigations of network data.
* Interpret and synthesize the meaning of the results with respect to a question, goal, or task.
* Collect network data in different ways and from different sources while adhering to legal standards and ethics standards.

**Learning Outcomes:**

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* Collect network data in different ways and from different sources while adhering to legal standards and ethics standards.
* Able to design and execute network analysis projects for Sustainable ecosystem including collecting data and considering ethical and legal implications, to perform systematic and informed analyses of network data for personal, commercial and scholarly use, and to critically review SNA projects conducted by others.

**Pre-requisites:**

It will be assumed that students are comfortable with basic concepts from linear algebra (e.g., matrix multiplication), probability theory (e.g., probability distributions, expected values, Bayes' rule), and statistics (e.g. Hypothesis testing), and calculus (e.g., differentiation and integration).

Knowledge of SPSS is a must for this course. Beyond those concepts, the course will be self-contained.

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

* Lectures
* Research Papers & Case Studies
* In Class Exercises
* Computer Software

**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 weddingsare 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](mailto: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**

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| --- | --- |
| Program | MS Data Science |
| Credit Hours | 3 |
| Duration | 15 Weeks |
| Prerequisites (If any) | N/A |
| Resource Person  Name and Email |  |
| Counseling Timing  (Room# 1N1 R#7 ) |  |
| Contact no. |
| Web Links:- (Face book, Linked In, Google Groups, Other platforms) |  |

**Chairman/Director Program signature………………………………….Date……………………..**

**Dean’s signature………………………… ………………….Date…………………………………………**

**Grade Evaluation Criteria**

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

**Marks Evaluation Marks in percentage**

Assignments 20%

Term Paper 10%

Paper 70%

Total 100%

**Reference Books:**

Considering the nature and requirement of this course no single book is recommended. However, there are some books available that can cover the course in its minimum requirements. This deficiency may be overcome by using some references besides a recommended book. Following is the recommended text as well as some reference texts for the course;

* The course is self-contained, so that all the definitions and concepts you need to solve the problem sets are contained in the lectures. Additional background readings, including research articles and several surveys on some of the topics will be covered in the course.
* There are many programs for analyzing networks and visualizing them and all have strengths and weaknesses: Gephi, Pajek, UCINET, Statnet, NetworkX.

**Course: -Social Network Analysis Course code: Book:**

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| --- | --- | --- | --- | --- | --- | --- |
| **No** | **Topics to be**  **covered in the course** | **Learning Objective**  **of this topic** | **Expected Outcomes from Students** | **Teaching Method** | **Assessment Criteria** | **Deadlines and Homework** |
| 1 | Introduction to Social Network Analysis | Provide the basic introduction of SNA with examples of Social Networks and their Impact, Definitions, Measures and Properties: Degrees, Diameters, Small Worlds, Weak and Strong Ties, Degree Distributions, Homophily, | Students will be able to understand the basic terminology SNA with its impact. | Lecture | Assignment | Within a Week |
| 2 | Empirical Background and Definitions | Understanding the concept of Dynamics, Centrality Measures: Degree, Betweenness, Closeness, Eigen-vector, and Katz-Bonacich. Erdos and Renyi Random Networks: Thresholds and Phase Transitions | Students will be able to learn the Empirical Background and technical key Definitions used in SNA | Case Discussion | Assignment | Within a Week |
| 3 | Random Networks | Understanding the basics of Poisson Random Networks, Exponential Random Graph Models, | They will be in position to understand Poisson Random Networks, Exponential Random Graph Models. | Case Discussion + Lecture | Class Activity | Within a Week |
| 4 | Random Networks (Cont.) | Understand the Growing Random Networks, Preferential Attachment and Power Laws, Hybrid models of Network Formation. | After this lecture, students will be able to get the Random Networks knowledge at Advance Level. | Lecture + Lab work | Class Activity | Within a Week |
| 5 | Strategic Network | Understanding how to solve The Conflict between Incentives and Efficiency, Dynamics, Directed Networks, Hybrid Models of Choice and Chance. | They will be able to work on Strategic Network and its different types | Case Discussion + Lecture | Research Paper Discussion | Within a Week |
| 6 | Strategic Network Formation | Getting in depth of Game Theoretic Modeling of Network Formation, The Connections Model, | Students will understand the advance level of forming Strategic Networks | Case Discussion + Lab Work | Assignment | Within two Weeks |
| 7 | Graph Mining and Patterns Discovery | Understanding of Sub-graph Mining and Communities | After this, students will learn the use of Graph Mining and Patterns Discovery | Lecture | Class Activity | Within two Weeks |
| 8 | Ethics and Social Media Analytics | Ethics and the alleged misuse of social media data | Students will learn how to approach data analytics through ethical perspective. | Lecture | Class Activity | Within two Weeks |
| 9 | Mid-Term Exam | Mid Term | Mid Term | Mid Term | Mid Term | Mid Term |
| 10 | Diffusion on Networks | Understanding the Empirical Background, The Bass Model and Random Network Models of Contagion | After this lecture, students have understood the foundation level of Diffusion includingbackground The Bass Model and Random Network Models of Contagion | Case Discussion+ Lab work | Assignment | Within a Week |
| 11 | Diffusion on Networks (Cont.) | Understanding the basics The SIS model, Fitting a Simulated Model to Data. | After this lecture, they are able to understand the advance level of Diffusions Network how this knowledge will help in future. | Lab Work + Case Study | Research Paper Discussion | Within a Week |
| 12 | Learning on Networks | Bayesian Learning on Networks, The DeGroot Model of Learning on a Network, Convergence of Beliefs, The Wisdom of Crowds, and How Influence depends on Network Position. | Student will fully perform Learning on Networks and how Influence depends on Network Position. | Lab Work + Case Discussion | Assignment | Within two Weeks |
| 13 | Games on Networks - Peer Effects | Understanding of basic Network Games, Peer Influences: Strategic Complements and Substitutes, the Relation between Network Structure and Behavior, | They will be able to understand the fundamental of Games on Networks | Lecture | Assignment | Within two Weeks |
| 14 | Games on Networks - Peer Effects (Cont.) | How to work on A Linear Quadratic Game, Repeated Interactions and Network Structures. | Now they will be in position to work on Games on Networks - Peer Effects at advance level. | Lab Work + Case Study | Class Activity | Within a Week |
| 15 | Role of Social Media in Sustainability |  | Guest speaker Interaction and Student presentation | Presentation and QA session | Class Activity |  |