| Subject Code: CSE3021 | Social and Information Networks | L,T,P,J,C<br>3,0,0,4,4 |
|---|---|---|
| **Preamble** | The course will impart an understanding of the fundamentals, models, visualization, security and applications of social and information networks.. | |
| **Objective of the course** | The objective of the course is to<br>• Understand the components of the social network<br>• Model and visualize the social network<br>• Understand the role of semantic web in the social network<br>• Familiarize the security concepts of the social network<br>• Apply and analyze the various applications. | |
| **Expected Outcome** | On completion of the course, the student should be able to<br>• Illustrate the basic concepts of social network<br>• Design and apply social network models<br>• Develop social network applications using visualization tools.<br>• Use the security features in social and information network.<br>• Apply semantic web techniques in social network. | |
| **SLO** | After successfully completing the course the student should be able to<br>2.Having a clear understanding of the subject related concepts and of contemporary issues<br>15.Having an ability to use the social media effectively for productive use<br>17.Having an ability to use techniques, skills and modern engineering tools necessary for engineering practice. | |

| Module | Topics | L Hrs | SLO |
|---|---|---|---|
| 1 | **Introduction**<br>Introduction to social network analysis – Fundamental concepts in network analysis – social network data – notations for social network data – Graphs and Matrices. | 4 | 2 |
| 2 | **Measures & Metrics**<br>Strategic network formation - network centrality measures: degree, betweenness, closeness, eigenvector - network centralization–density – reciprocity – transitivity – ego network – measures for ego network - dyadic network – triadic network - cliques - groups- clustering – search. | 5 | 2 |
| 3 | **Community networks**<br>Community structure - modularity, overlapping communities - | 6 | 17 |

| | | | |
|---|---|---|---|
| | detecting communities in social networks – discovering communities: methodology, applications - community measurement - evaluating communities – Applications. | | |
| **4** | **Models**<br>Small world network - Watts–Strogatz networks - Statistical Models for Social Networks – Network evolution models: dynamical models, growing models - Nodal attribute model: exponential random graph models – Preferential attachment - Power Law - random network model: Erdos-Renyi and Barabasi-Albert–Epidemics - Hybrid models of Network Formation. | 7 | 15 |
| **5** | **Semantic Web**<br>Modelling and aggregating social network data – developing social semantic application – evaluation of web-based social network extraction – Data Mining – Text Mining in social network – Tools – case study. | 7 | 15 |
| **6** | **Visualization**<br>Visualization of social networks – novel visualizations and interactions for social networks – applications of social network analysis – tools - sna: R Tools for Social Network Analysis - Social Networks Visualiser (SocNetV) - Pajek. | 8 | 17 |
| **7** | **Security & Applications**<br>Managing Trust in online social network – Security and Privacy in online social network – security requirement for social network in Web 2.0 - Say It with Colors: Language-Independent Gender Classification on Twitter - Friends and Circles - TUCAN: Twitter User Centric ANalyzer. | 6 | 17 |
| **8** | **Recent Trends** | 2 | |
| | Total Hrs | **45 Hrs** | |
| **Project**<br>1. Analysis of Email Ego Networks<br>2. The Role of Chatting in Online Shopping<br>3. Analysis & Generative Model for Trust Networks<br>4. Item-Basket Revenue Maximization<br>5. Finding Answerers on Yahoo! Answers<br>6. An Empirical Analysis of Communities in Real-World Networks<br>7. Analyzing conferences in Twitter with Social Aviary | | **60** [Non Contact hrs] | 17 |
| | | | |

**Text Books**

1. Stanley Wasserman, Katherine Faust, Social network analysis: Methods and applications, Cambridge university press, 2009.
2. John Scott, Social network analysis, 3rd edition, SAGE, 2013.

**Reference Books**

1. M.E.J. Newman, Networks: An introduction, Oxford University Press, 2010.
2. Easley and Kleinberg, Networks, Crowds, and Markets: Reasoning about a highly connected world. Cambridge University Press, 2010.
3. Matthew Jackson, Social and Economic Networks. Princeton Univ. Press, 2008.
4. Charu Aggarwal, Social Network data analysis, Springer, 2011.
5. Peter Mika, Social network and semantic web, Springer 2007.
6. Borko Furht, Handbook of Social Network Technologies and applications, Springer, 2010.
7. Jalal Kawash, Online Social Media Analysis and Visualization (Lecture Notes in Social Networks), 2015.

**2.Knowledge Areas that contain topics and learning outcomes covered in the course**

| **Knowledge Area** | **Total Hours of Coverage** |
|---|---|
| CS: HCI(Human Computer Interaction) | 22 |
| CS:NC(Network and Communication) | 23 |
| **Total** | 45 |

**2.1 Body of Knowledge coverage**

| **KA** | **Knowledge Unit** | **Topics Covered** | **Hours** |
|---|---|---|---|
| CS: HCI | HCI/Foundations | Introduction to social network analysis – Fundamental concepts in network analysis – social network data – notations for social network data – Graphs and Matrices. Strategic network formation - network centrality measures: degree, betweenness, closeness, eigenvector - network centralization– density – reciprocity – transitivity - ego network – measures for ego network - dyadic network – triadic network - cliques - groups- clustering – search. | 9 |
| CS: HCI | HCI/New Interactive Technologies | Small world network - Watts–Strogatz networks - Statistical Models for Social Networks – Network | 7 |

| | | | |
|---|---|---|---|
| | | evolution models: dynamical models, growing models - Nodal attribute model: exponential random graph models – Preferential attachment - Power Law - random network model: Erdos-Renyi and Barabasi-Albert–Epidemics - Hybrid models of Network Formation. | |
| CS: HCI | HCI/Collaboration & Communication | Community structure - modularity, overlapping communities - detecting communities in social networks – discovering communities: methodology, applications - community measurement - evaluating communities – Applications. | 6 |
| CS: NC | NC/Networked Applications | Modelling and aggregating social network data – developing social semantic application – evaluation of web-based social network extraction – Data Mining – Text Mining in social network – Tools – case study. | 7 |
| CS: NC | NC/Networked Applications | Visualization of social networks – novel visualizations and interactions for social networks – applications of social network analysis – tools. Visualization of social networks – novel visualizations and interactions for social networks – applications of social network analysis – tools - sna: R Tools for Social Network Analysis - Social Networks Visualiser (SocNetV) - Pajek. | 8 |
| CS: NC | NC/Social Networking | Managing Trust in online social network – Security and Privacy in online social network – security requirement for social network in Web 2.0 - Say It with Colors: Language-Independent Gender Classification on Twitter - Friends and Circles - TUCAN: Twitter User Centric ANalyzer. | 8 |

**3. Where does the course fit in the curriculum?**

This course is a

- Elective Course.
- Suitable from $5^{th}$ semester onwards.
- An understanding of graph theory is desirable

**4. What is covered in the course?**

**Module 1:** The fundamental concepts,notations, graphs and matrices representations of social networks are covered in this module.

**Module 2:** In this module, the network centrality, eigen vector, ego network, dyadic and triadic network are included.

**Module 3:** This module gives the concepts of community network, structure, methodology, applications.

**Module 4:** The statistical models, network evolution, nodal attribute models, random models are covered in this module.

**Module 5:** Social semantic concepts, text and data mining in social network are included in this module.

**Module 6:** Visualization of social network, applications and tools are covered in this module.

**Module 7:** In this module, the privacy, security issues of social network and applications are included.

**Module 8:** The recent trends and case study is discussed in this module.

**5. What is the format of the course?**

This Course is designed with 100 minutes of in-classroom sessions per week. The course requires that pre-class reading material be shared with the students. This could be in videos or documents/chapters of a book. It could take a form of flipped classroom also. The student's comprehension of the pre-class reading material will be assessed by 'in-video' quiz or a short quiz at the beginning of the class. Failure to complete this pre-class work may lead to restriction in allowing classroom participation.

The course also requires 100 minutes of non-contact time spent on implementing a course related project. Generally, this course should have the combination of lectures, in-class discussion, case studies, guest-lectures, mandatory pre-class reading material & quizzes.

**6. How are students assessed?**

- Students are assessed on a combination classroom discussion (continuous), quizzes, assignment submissions (8-10 experiments), one group project and continuous, final assessment tests.
- Additional weightage will be given based on innovative projects implemented.
- Students can earn additional weightage based on the certificate of completion of a related MOOC course.

**7. Session wise plan**

| Sl. No | Topic Covered | Class Hour | Levels of mastery | Reference Book | Remarks |
|---|---|---|---|---|---|
| 1 | Introduction to social network analysis – Fundamental concepts in network analysis | 2 | Familiarity | 1,2 | |
| 2 | social network data – notations for social network data – Graphs and Matrices | 2 | Familiarity | 1,2 | |
| 3 | Strategic network formation - network centrality measures: degree, betweenness, closeness. | 1 | Familiarity | 1,2 | |
| 4 | Eigen vector - network centralization– density - reciprocity– transitivity | 2 | Familiarity | 1,2 | |
| 5 | ego network – measures for ego network - dyadic network - triadic network - cliques - groups- clustering – search | 2 | Familiarity | 1,2 | |
| 6 | Community structure - modularity, overlapping communities - detecting communities in social networks – discovering | 3 | Familiarity | 1 | |
| 7 | Communities: methodology, applications - community measurement | 2 | Familiarity | 1 | |
| 8 | evaluating communities – Applications. | 1 | Assessment | 1 | |

| | | | | | |
|---|---|---|---|---|---|
| 9 | Small world network - Watts–Strogatz networks - Statistical Models for Social Networks – | 1 | Assessment | Ref.2 | |
| 10 | Network evolution models: dynamical models, growing models | 1 | Assessment | Ref.2 | |
| 11 | Nodal attributes model: exponential random graph models – | 1 | Assessment | Ref.3 | |
| 12 | Preferential attachment - Power Law - random network model - | 2 | Familiarity | Ref.3 | |
| 13 | Erdos-Renyi and Barabasi-Albert– Epidemics - Hybrid models of Network Formation | 2 | Assessment | Ref.3 | |
| 14 | Modelling and aggregating social network data – developing social semantic application | 2 | Familiarity | Ref.4 | |
| 15 | Evaluation of web-based social network extraction – Data Mining | 2 | Assessment | Ref.4 | |
| 16 | Text Mining in social network – Tools – case study | 3 | Usage | Ref.5 | |
| 17 | Visualization of social networks – novel visualizations and interactions for social networks. | 2 | Familiarity | Ref.4 | |
| 18 | Applications of social network analysis – tools. | 3 | Usage | Ref.4 | |
| 19 | sna: R Tools for Social Network Analysis - Social Networks Visualiser | 3 | Usage | Ref.7 | |

| | | | | | |
|---|---|---|---|---|---|
| | (SocNetV) - Pajek. | | | | |
| 20 | Managing Trust in online social network – Security | 2 | Familiarity | Ref.6 | |
| 21 | Privacy in online social network – security requirement for social network in Web 2.0 | 2 | Familiarity | Ref.6 | |
| 22 | Say It with Colors: Language-Independent Gender Classification on Twitter | 1 | Assessment | Ref.7 | |
| 23 | Friends and Circles - TUCAN: Twitter User Centric ANalyzer. | 1 | Assessment | Ref.7 | |
| 24 | Recent Trends | 2 | Usage | | |
| Total hours covered | | **45Hrs** | | | |