

# HONORS SUBJECTS IN IT

## SYLLABUS OF

### SOFTWARE METRICS

Instruction: 3Periods/week

Credits:3

Internal: 30Marks

External:70Marks

Total: 100Marks

#### Course Objectives:

The main objective of the course is to expose the students to different software metrics used in projects and their Management. Upon completion of this course, the student should be able to:

- Analyze basics of Measurement.
- Learn about different Methods of Data Collection.
- Learn about measuring Internal and External Product Attributes.
- Analyze software quality measurements and metrics.
- Plan measurement programs.

**Course Outcomes:** At the end of the course the student will be able to:

- Understand and analyze various fundamentals of measurement and software metrics.
- Apply frame work and analysis techniques for software measurement.
- Analyze internal and external attributes of software product for effort estimation.
- Apply reliability models for predicting software quality.
- Able to create a plan for measurement program and apply the metrics tools.

#### Syllabus

**Fundamentals of Measurement:** Measurement: what is it and why do it?: Measurement in Software Engineering, Scope of Software Metrics, The Basics of measurement: The representational theory of measurement, Measurement and models, Measurement scales and scale types, meaningfulness in measurement.

**A Goal-Based Framework For Software Measurement:** Classifying software measures, Determining what to Measure, Applying the framework, Software measurement validation, Performing Software Measurement validation. Empirical investigation: Principles of Empirical Studies, Planning Experiments, Planning case studies as quasi-experiments ,Relevant and Meaningful Studies.

**Software Metrics Data Collection:** Defining good data ,Data collection for incident reports, How to collect data, Reliability of data collection Procedures. Analyzing software measurement data:

Statistical distributions and hypothesis testing, Classical data analysis techniques, Examples of simple analysis techniques.

**Measuring internal product attributes:** Size Properties of Software Size, Code size, Design size, Requirements analysis and Specification size, Functional size measures and estimators, Applications of size measures.

**Measuring internal product attributes:** Structure: Aspects of Structural Measures, Control flow structure of program units, Design-level Attributes, Object-oriented Structural attributes and measures.

**Measuring External Product Attributes:** Modeling software quality, Measuring aspects of quality, Usability Measures, Maintainability measures, Security Measures Software Reliability: Measurement and Prediction: Basics of reliability theory, The software reliability problem, Parametric reliability growth models, Predictive accuracy,

**Resource measurement:** Productivity, teams, tools and method, making process predictions, Planning a measurement program, Measurement in Practice, Empirical Research in Software Engineering, Metrics Tools.

#### **Text Books:**

1. Fenton, Pfleeger, Software Metrics, A Rigorous and Practical Approach, 2nd Edition, Thomson, 1998.
2. Stephen H. Kan, Metrics & Models in Software Quality Engineering, 2nd Edition, Addison-weseley Pearson Education, 2002.

#### **References:**

1. Sheppard, Software Engineering Metrics, 1st Edition, Mc GrawHill Publications, 1994.
2. Pertis et al, Software Metrics, An Analysis and Evaluation, 1st Edition, MIT Press, 1981.

# SOCIAL MEDIA ANALYTICS

Instruction: 3Periods/week

Credits:3

Internal: 30Marks

External:70Marks

Total: 100Marks

## Course Objectives:

- To understand the basics of online social networks and large-scale data availability in social networks.
- To understand and analyse the several computational, algorithmic, and modelling challenges of massive networks.
- To understand the structure and analyse large network models and algorithms
- To understand the robustness and fragility of networks, algorithms for WWW.
- To understand how prediction and recommendation in online social networks are done

## Course Outcomes:

- To learn and explore the basics of online social networks and large-scale data availability in social networks.
- To acquire knowledge on several computational, algorithmic, and modelling challenges of massive networks.
- To acquire knowledge on large network models and implement the algorithms.
- To understand the robustness and fragility of networks and learn various algorithms used in WWW.
- To acquire knowledge on prediction and recommendations performed in online social networks.

## Syllabus:

**Internet and Social Media :** History of Internet – Viewing the Internet as a Mass Medium – New Developments in the field of Internet – Definition of Social Media – Understanding Social Media – Significance of Social Media – Categories of Social Media – Mainstream Media Vs Alternative Media.

**Introduction to Networks in Social media :** Introduction to Social Network ,Types of Networks, Network Data and Measures , Network Growth Models , Link prediction , Link Analysis, Community Structure in Networks.

**Data Visualization:** Notation for Social Network Data, Introduction to Python/Colab, Graph Visualization Tools ; Community Detection, Cascade Behaviour and Network Effects, Anomaly detection.

**Graph Representations:** Types of Graphs, Graph Representation, Graph Representation Learning, Coding on Graph Representation Learning, study on DeepWalk, Node2Vec, GCN, graph neural network, Graph Convolutional Network, Graph Attention Network.

**Case Studies:** The students are advised to acquaint themselves with different social media platforms and perform different data analytics with respect to Community detections, COVID -19, Pinterest

**Text Books:**

1. Social Network Analysis, Tanmoy Chakraborty, Wiley, 2021-(NPTEL lectures also available)
2. Social Network Analysis: Methods and Applications, Stanley Wasserman, Katherine Faust

**Reference Books:** 1. Network Science, Albert-Lazslo Barabasi

## REINFORCEMENT LEARNING

Instruction: 3Periods/week

Credits:3

Internal: 30Marks

External:70Marks

Total: 100Marks

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### Course Objective:

- To provide the fundamentals of Reinforcement learning.
- To solve problems based on reinforcement learning.
- To study and analyse about different decision making process.
- To study about various methods used for problem solving

### Course Outcomes:

- Enumerate the elements of Reinforcement Learning
- Solve the n-armed Bandit problem
- Compare different Finite Markov Decision Process
- Discuss about Monte Carlo Methods in solving real world problems
- List the Applications and Case Studies of Reinforcement Learning

### Syllabus:

**The Reinforcement Learning Problem:** Reinforcement Learning, Examples, Elements of

Reinforcement Learning, Limitations and Scope, An Extended Example: Tic-Tac-Toe, Summary, History of Reinforcement Learning.

**Multi-arm Bandits:** An n-Armed Bandit Problem, Action-Value Methods, Incremental Implementation, Tracking a Non-stationary Problem, Optimistic Initial Values, Upper-Confidence-Bound Action Selection, Gradient Bandits, Associative Search (Contextual Bandits)

**Finite Markov Decision Processes:** The Agent–Environment Interface, Goals and Rewards, Returns, Unified Notation for Episodic and Continuing Tasks, The Markov Property, Markov Decision Processes, Value Functions, Optimal Value Functions, Optimality and Approximation.

**Monte Carlo Methods:** Monte Carlo Prediction, Monte Carlo Estimation of Action Values, Monte Carlo Control, Monte Carlo Control without Exploring Starts, Off-policy Prediction via Importance Sampling, Incremental Implementation, Off-Policy Monte Carlo Control, Importance Sampling on Truncated Returns

**Applications and Case Studies:** TD-Gammon, Samuel's Checkers Player, TheAcrobot, Elevator Dispatching, Dynamic Channel Allocation, Job-Shop Scheduling.

**Text Books:**

1. Richard S. Sutton and Andrew G. Barto, "Reinforcement Learning-An Introduction",2nd Edition, The

MIT Press,2018

2. Marco Wiering , Martijn van Otterlo Reinforcement Learning: State-of-the-Art (Adaptation, Learning, and Optimization (12)) 2012th Edition

**Reference Books:**

1. Vincent François-Lavet , Peter Henderson , Riashat Islam, An Introduction to Deep Reinforcement

Learning (Foundations and Trends(r) in Machine Learning) , 2019

# MALWARE ANALYSIS

**Instruction: 3 Periods/week**

**Time: 3 Hours**

**Credits: 3**

**Internal: 30 Marks**

**External: 70 Marks**

**Total: 100 Marks**

**Course objectives:** The students will be exposed to different malwares and security techniques. The student should be able to

- Learn about various malwares and various threats.
- Understand the different types of Malware analysis.
- Knowledge about Malware detection techniques
- Basics of Kernel and Root kit mechanisms

**Course Outcomes:** At the end of the course, the student has

- The ability to Analyse and identify various Malwares
- The knowledge on various types of malware analysis
- The Knowledge on detecting Malwares
- Ability to identify Rootkits and kernel manipulation

## Syllabus:

**INTRODUCTION :** Introduction to malware, OS security concepts, malware threats, evolution of malware, malware types viruses, worms, rootkits, Trojans, bots, spyware, adware, logic bombs, malware analysis, static malware analysis, dynamic malware analysis.

**STATIC ANALYSIS :** X86 Architecture- Main Memory, Instructions, Opcodes and Endianness, Operands, Registers, Simple Instructions, The Stack, Conditionals, Branching, Rep Instructions, C Main Method and Offsets. Antivirus Scanning, Fingerprint for Malware, Portable Executable File Format, The PE File Headers and Sections, The Structure of a Virtual Machine.

**DYNAMIC ANALYSIS :** Live malware analysis, dead malware analysis, analyzing traces of malware-system-calls, api-calls, registries, network activities.

**ANTI-DYNAMIC ANALYSIS :** Techniques anti-vm, runtime-evasion techniques, Malware Sandbox, Monitoring with Process Monitor, Packet Sniffing with Wireshark. Downloader, Backdoors, Credential Stealers, Persistence Mechanisms, Privilege Escalation

**COVERT MALWARE LAUNCHING:** Launchers, Process Injection, Process Replacement, Hook Injection, Detours, APC injection.

**MALWARE DETECTION TECHNIQUES:** Signature-based techniques: malware signatures, packed malware signature, metamorphic and polymorphic malware signature Non-signature based techniques: similarity-based techniques, machine-learning methods, invariant inferences.

**INTRODUCTION TO KERNEL:** Kernel basics, Windows Kernel API, Windows Drivers, Kernel Debugging - , Rootkit Techniques- Hooking, Patching, Kernel Object Manipulation ,Rootkit Anti-forensics

**TEXT BOOK:**

1. Michael Sikorski and Andrew Honig, " Practical Malware Analysis", No Starch Press,2012
2. Learning Malware Analysis: Explore the Concepts, Tools, and Techniques to Analyze and Investigate Windows Malware by Monnappa K A