ASSUMPTION UNIVERSITY

**VINCENT MARY SCHOOL OF SCIENCE AND TECHNOLOGY**

**MASTER OF SCIENCE IN COMPUTER SCIENCE**

**Course outline** (as of semester 1/2020)

**SC6201 (Advanced Computing Systems)**

**Course status:** Required Course

**Pre-requisites:** SC 5212 Computing Systems or any equivalent

**Class:**  Online via MS Teams

**Instructor:** Asst. Prof. Dr. Anilkumar K.G

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**Course Description:**

Multi-core operating systems, distributed computation, distributed objects and middleware, distributed storage systems, failures and recovery, internet scale computing, cloud systems, virtualization and hypervisors, security in the cloud, and case studies of state-of-the-art solutions for cloud computing.

**Course Objective:**

Through this course it is expected that the students will gain the theoretical viewpoints of various design aspects of an advanced computer system including its CPU structure, Storage system, Hardware System, Operating System, hypervisors, cloud computing, distributed computing, system failure and recovery.

# Text Books (References):

1. Kai Hwang, Geoffrey C. Fox, and, Jack J. Dongarra, *Distributed and Cloud Computing From Parallel Processing to the Internet of Things*, Morgan Kaufmann Publishing, 2014.
2. Abraham Silberschatz, Peter B. Galvin, and Greg Gagne, *Operating System Concepts*, Wiley, 2013.
3. John L. Hennessy and David A. Patterson, *Computer Architecture: A Quantitative Approach*, Morgan Kaufmann Publishing, 2010.
4. Douglas E. Comer, *Internetworking with TCP/IP Principles, Protocol and Architecture*, Pearson, 6th edition, 2017.
5. Mukesh S and Niranjan S, *Advanced Concept in Operating Systems*, McGraw-Hill, 1994.

# Mark allocation:

Projects: 30%

Assignments 15%

Presentations 10% Midterm examination 20%

Final examination 25%

**Lesson Schedule**

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| **Week** | **Topics** |
| 1 | **Virtual Machine:** Overview, Virtualization, Hypervisors**;** virtual building blocks,issues in virtualization,Para-virtualization, and Emulation. |
| 2 | **Virtual Machine:** Overview, Virtualization, Hypervisors**;** virtual building blocks,issues in virtualization,Para-virtualization, and Emulation. |
| 3 | **Virtualization:** Application Containment, Virtual CPU Scheduling, Memory management, I/O management, Live migration, VMware, and Java Virtual Machine. |
| 4 | **Internet Scale of Computing:** Overview of underlying network technologies, Internetworking Concept, Protocol Layering, Internet addressing, Addressing Mapping, Routing architecture, and Error and control Messages. |
| 5 | **Distributed Network Structure:** Distributed systems, Data migration and Computation, Communication Structure, naming and name resolution, routing strategies, packet strategies, and connection strategies, design principle, circuit switching, message switching, and packet switching. |
| 6 | **Distributed Network Protocols:** Communication Protocols, Failure Detection; Reconfiguration, Recovery from failure, and Fault tolerance, Design Issues; Scalability Issue, Distributed File Systems, Network Naming; Naming and Transparency, Naming structures, and Naming schemes. |
| 7 | **Distributed System Models:** Scalable computing over internet; Internet computing, High-throughput computing, Multi-threading technologies; multi-core CPU, and GPU programming model, Clusters, P2P networks, Grids, and Cloud platforms. |
| 8 | **Virtual Machines and Virtualization in Cloud Computing:** Hardware virtualization, Virtualization of server, Virtualized resources in cloud computing: Amazon Web Service, Microsoft Azure and Google App. |
| 9, 10 | **Computer Clusters for Scalable Parallel Computing:**  Clustering: design objective, design issues, dedicated clusters, enterprise clusters, load balancing clusters, resource sharing, system interconnect, design principle, fault tolerance and recovery. |
| 11 | **Cloud Computing from Clustering:** GPU clusters, Single-system image features; single file hierarchy, Single networking, single point of control, single memory space, Fault tolerant configurations, and Recovery Schemas. |
| 12 | **Cloud Platform Architecture:** Cloud computing service models; Three cloud service models, and Cloud types; public, private and hybrid clouds centralized and distributed computing, Cloud development trends; cloud ecosystem, storage clouds, generic cloud architecture, and layered cloud architecture. |
| 13 | **Multi-Core Operating Systems I:**Multi-core architecture, Symmetric shared memory systems, Distributed memory systems, Cache coherence issue, Snooping and directory based cache protocol systems. |
| 14 | **Multi-Core Operating Systems II:** Invalidation protocols in snoopy and directory based systems, Fault tolerant configurations: recovery Schemas, and analysis of job scheduling methods. |

# Projects:

# Implement a Virtual CPU system.

1. Simulate a distributed task scheduling process.