**Detailed Syllabus**

**Lecture-wise Breakup**

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| **Course Code** | 15B11CI412 | **Semester Odd**  **(specify Odd/Even)** | | **Semester** V **Session** 2022-23 Month from July to Dec 2023 | |
| **Course Name** | Operating Systems and Systems Programming | | | | |
| **Credits** | 4 | | **Contact Hours** | | 3-1-0 |

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| **Faculty (Names)** | **Coordinator(s)** | Sec 62: Dr. Vikash, Sec 128: Dr. Gaurav Kumar Nigam |
| **Teacher(s) (Alphabetically)** | Sec 62:, Dr Vivek Kumar Singh, ,Mr. Kashav Ajmera, Dr. Prakash Kumar, Mr. Prashant Kaushik , Dr. Taj Alam, Ankita Jaiswal  Sec 128: Dr. Anubhuti, Ambalika, Ashish Sharma |

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| **COURSE OUTCOMES** | | **COGNITIVE LEVELS** |
| **C311.1** | Describe and explain the fundamental components of operating systems and system programming. | Understand Level (C2) |
| **C311.2** | Apply and compare various policies of scheduling in processes and threads in OS. | Apply Level (C3) |
| **C311.3** | Describe and discuss various resource management techniques of operating systems and compare their performances. | Compare Level (C3) |
| **C311.4** | Understand the concept of IPC and describe various process synchronization techniques in OS. | Describe Level (C2) |
| **C311.5** | Discuss the working of IO management and apply various disk scheduling techniques. | Apply Level (C3) |
| **C311.6** | Analyze and report appropriate OS design choices when building real-world systems. | Analyze Level (C4) |

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| **Module No.** | **Title of the Module** | **Topics in the Module** | **No. of Lectures for the module** |
| **1.** | Introduction and Historical context of Operating Systems | What are Operating Systems? All components Description, The Evolution of OS: Batch Systems, multi programming systems, Time sharing systems, Parallel systems, Real Time systems, Distributed systems. | 2 |
| **2.** | Operating Structure and Architecture | Operating system structure: Micro kernel, Monolithic systems, Layered systems, Virtualization, Client-server model, Mobile Operating System.  X86 architecture overview, Booting sequences, Boot loaders and their stages, BIOS and its routines, Interrupts. | 2 |
| **3.** | Process Concepts, Threads & Concurrency, Scheduling Concurrency & Synchronization issues, | Process concepts, Threads: Overview, Benefits, User and Kernel threads, Multithreading models. Scheduling, Operations on processes, Cooperative processes, IPC, Scheduling criteria, Scheduling algorithms, Multiple processor scheduling, Process synchronization: Critical section problems, Semaphores, Synchronization hardware and monitors. | 10 |
| **4.** | Deadlock | System model, Characterization, Methods for handling deadlocks. Deadlock prevention, Avoidance and detection, Recovery from deadlock | 5 |
| **5.** | Memory Management. | Background, Swapping, Contiguous memory allocation, Paging, Segmentation, Segmentation with Paging, Virtual Memory | 8 |
| **6.** | File System management and Input output management | File concept, Access models, Directory structure, Protection, File-system Structure, Allocation methods, Free space management. Overview, I/O hardware, Application I/O interface. | 2 |
| **7.** | Secondary Storage Management | Disk structure, Disk scheduling, Disk management., Swap-space management | 2 |
| **8.** | Fault and Security Issues | Overview of system security, Security methods and devices, Protection, access, and authentication, Models of protection, Memory protection. | 2 |
| **9.** | Distributed O.S | Int. to distributed operating systems, synchronization and deadlock in distributed systems | 1 |
| **10.** | Case studies of OS | Windows, Linux ,IBM, Tizen Operating System | 2 |
| **11.** | System Programming | Introduction, Components of a Programming System: Assemblers, Loaders, Macros, Compliers, Formal System. | 2 |
| **12.** | Interrupts and Exceptions | Synchronous and asynchronous interrupts, Calling a System Call from User Space, INT, Trap Handling, System call dispatch, arguments and return value, Device Interrupts. | 2 |
| **13.** | Kernel Synchronization, System Calls and System Signals | Disabling Interrupts, Lock Implementation, Linux Synchronization Primitives | 2 |
| **Total number of Lectures** | | | **42** |
| **Evaluation Criteria**  **Components Maximum Marks**  T1 20  T2 20  End Semester Examination 35  TA 25 (Attendance, Quiz/Assignment/Mini Project/Case Study )  **Total 100** | | | |

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| **Recommended Reading material:** Author(s), Title, Edition, Publisher, Year of Publication etc. ( Text books, Reference Books, Journals, Reports, Websites etc. in the IEEE format) | |
| **1.** | William Stallings, “OPERATING SYSTEMS INTERNALS AND DESIGN PRINCIPLES”. |
| **2.** | Andrew S. Tanenbaum, “Operating Systems Design and Implementation”, Third Edition,Prentice Hall Publications2006 |
| **3.** | A.S. Tanenbaum, “Modern Operating Systems”, 2nd edition, Prentice Hall India. |
| **4.** | A.Silberschatz, P.Galvin, G. Gagne, “Operating systems concepts” Willey international company (sixth edition) |
| **5.** | Gary Nutt, “Operating Systems – A modern perspective”, Pearson Education |
| **6.** | David Solomon and Mark Russinovich ,” Inside Microsoft Windows 2000”, Third Edition, Micorosoft Press |
| **7.** | D. M. Dhamdhere, “ Systems Programming and Operating systems” TMH, 2nd revised edition.2006 |
| **8.** | ACM/IEEE transactions on operating systems concepts. |
| **9.** | [www.vmware.com](http://www.vmware.com) |
| **10.** | www.luitinfotech.com/kc/what-is-cloud-computing.pdf |
| **11.** | https://cs162.eecs.berkeley.edu/static/sections/section8.pdf |
| **12.** | CharlesCrowley “Operating System A Design Approach”TMH. |