**Department of Computer Science and Engineering & Information Technology**

**AY: 2023-24, (Even Semester)**

**Detailed Syllabus**

**Lecture-wise Breakup**

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| **Course Code** | 15B11CI412 | **Semester Even** **(specify Odd/Even)** | **Semester** VI **Session** 2023-24 **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: Ashish Kumar |
| **Teacher(s) (Alphabetically)** | Sec 62:, Dr Vivek Kumar Singh, Mr. Kashav Ajmera, Dr. Prakash Kumar, Mr. Prashant Kaushik , Dr. Taj Alam,Dr. Ankita Jaiswal  Sec 128: Dr. Anubhuti, Ambalika, Ashish Sharma |

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| **COURSE OUTCOMES** | | **COGNITIVE LEVELS** |
| C311.1 | Explain the fundamental concepts along with the various components of operating systems and system programming. | Remember Level (C1) |
| C311.2 | Apply various OS scheduling techniques and algorithms for processes and threads | Apply Level (C3) |
| C311.3 | Elaborate the various resource management techniques of operating systems and their performance. | Evaluate Level (C5) |
| C311.4 | Omit the concept of IPC and describe various process synchronization techniques in OS. | Understand Level (C2) |

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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 | |
| **Text Books:** | |
| 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 |
| **Reference Books:** | |
| 6 | William Stallings, “OPERATING SYSTEMS INTERNALS AND DESIGN PRINCIPLES”. |
| 7 | Andrew S. Tanenbaum, “Operating Systems Design and Implementation”, Third Edition,Prentice Hall Publications2006 |
| 8 | A.S. Tanenbaum, “Modern Operating Systems”, 2nd edition, Prentice Hall India. |
| 9 | A.Silberschatz, P.Galvin, G. Gagne, “Operating systems concepts” Willey international company (sixth edition) |
| 10 | Gary Nutt, “Operating Systems – A modern perspective”, Pearson Education |
| 11 | David Solomon and Mark Russinovich ,” Inside Microsoft Windows 2000”, Third Edition, Micorosoft Press |
| 12 | D. M. Dhamdhere, “ Systems Programming and Operating systems” TMH, 2nd revised edition.2006 |