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| *Mr.G.Muruganandam, Group Project Manager, HCL Technologies, Chennai* | *Dr.S.Gopinathan, Professor, University of Madras, Chennai* | *1. Dr. Agusthiyar Ramu SRMIST* |
| *Mr.M. Hemachandar, Tech Lead, Wipro Limited, Chennai* | | *2. Dr.S.Albert Antony Raj, SRMIST* |

| Course Code | *PCA20C02J* | Course Name | OPERATING SYSTEM | Course Category | C | Professional Core Course | L | T | P | C |
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| Pre-requisite Courses | Nil | Co-requisite Courses | Nil | Progressive Courses | Nil |
| Course Offering Department | Computer Applications | | Data Book / Codes/Standards | Nil | |

| Course Learning Rationale (CLR): | The purpose of learning this course is to, |
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| CLR-1 : | *Introduce the key role of an Operating system* |
| CLR-2 : | *Insist the Process Management functions of an Operating system* |
| CLR-3 : | *Emphasize the importance of Memory Management concepts of an Operating system* |
| CLR-4 : | *Realize the significance of Device Management part of an Operating system* |
| CLR-5 : | *Comprehend the need of File Management functions of an Operating system* |
| CLR-6 : | *Explore the services offered by the Operating system practically* |

| Course Learning Outcomes (CLO): | At the end of this course, learners will be able to: | Learning | | | Program Learning Outcomes (PLO) | | | | | | | | | | | | | | |
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| | | 1 | 2 | 3 | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 | 14 | 15 |
| | | Level of Thinking (Bloom) | Expected Proficiency (%) | Expected Attainment (%) | Disciplinary Knowledge | Critical Thinking | Problem Solving | Analytical Reasoning | Research Skills | Team Work | Scientific Reasoning | Reflective Thinking | Self-Directed Learning | Multicultural Competence | Ethical Reasoning | Community Engagement | ICT Skills | Leadership Skills | Life Long Learning |
| CLO-1 : | *Identify the need of an Operating system* | 2 | 85 | 80 | H | H | H | H | H | - | - | M | M | L | - | H | - | - | - |
| CLO-2 : | *Know the Process management functions of an Operating system* | 3 | 85 | 80 | L | H | H | H | H | - | - | M | M | L | - | H | - | - | - |
| CLO-3 : | *Understand the need of Memory Management functions of an Operating system* | 3 | 85 | 80 | L | H | H | H | H | - | - | M | M | L | - | H | - | - | - |
| CLO-4 : | *Find the significance of Device management role of an Operating system* | 3 | 85 | 80 | L | H | H | H | H | - | - | M | M | L | - | H | - | - | - |
| CLO-5 : | *Recognize the essentials of File Management part of an Operating system* | 3 | 85 | 80 | L | H | H | H | H | - | - | M | M | L | - | H | - | - | - |
| CLO-6 : | *Gain an insight of Importance of an Operating system through practical* | 3 | 85 | 80 | L | H | H | H | H | - | - | M | M | L | - | H | - | - | - |

| Duration (hour) | | 15 | 15 | 15 | 15 | 15 |
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| S-1 | SLO-1 | *Operating System Objectives and functions- Gaining the role of Operating systems* | *Overview of Process scheduling- Understand the process concepts* | *PROCESS SYNCHRONIZATION: Background, Critical section Problem* | *MEMORY MANAGEMENT: Memory Management: Logical Vs Physical address space, Swapping* | *STORAGE MANAGEMENT : Mass storage structure – Overview of Mass storage structure – Magnetic Disks* |
| | SLO-2 | *The evolution of operating system* | *Operations on Process – Process creation, Process termination* | *Understanding the race conditions and the need for the Process synchronization* | *Understanding the basics of Memory management* | *Understanding the Basics in storage management* |

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| S-2 | SLO-1 | *Understanding the evolution of Operating systems from early batch processing systems to modern complex systems* | *Understanding the system calls – fork(),wait(),exit()* | *PROCESS SYNCHRONIZATION : Peterson's solution, Synchronization hardware* | *Contiguous Memory allocation – Fixed and Dynamic partition* | *FILE SYSTEM INTERFACE: File concept, File access methods* |
| | SLO-2 | *Architecture of OS* | *Inter process communication* | *Understanding the two-process solution and the benefits of the synchronization hardware* | *Getting to know about Partition memory management and issues: Internal fragmentation and external fragmentation problems* | *Understanding the file basics* |
| S-3 | SLO-1 | *Understanding the architecture* | *Thread* | *Process synchronization: Semaphores, usage, implementation* | *Paged memory management* | *File sharing and Protection* |
| | SLO-2 | *Operating system operations-* | *Understanding the importance of thread* | *Gaining the knowledge of the usage of the semaphores for the Mutual exclusion mechanisms* | *Understanding the Paging technique. PMT hardware mechanism* | *Emphasis the need for the file sharing and its protection- FILE SYSTEM IMPLEMENTATION: : File system structure* |
| **S-4 to S-5** | **SLO-1** | ***Lab 1 : Understanding the booting process of Linux*** | ***Lab 4 : Understanding various phases of compilation and System admin commands – Simple task automations*** | ***Lab 7: Shell Programs – Basic level*** | ***Lab 10: Programs using file system*** | ***Lab13:Program to implement file system interface*** |
| S - 6 | SLO-1 | *Real time understanding of operations* | *Inter process communication - Learn the thread concepts* | *Classical Problems of synchronization – Readers writers problem, Bounded Buffer problem- Good understanding of synchronization mechanisms* | *Segmented memory management -Understanding the users view of memory with respect to the primary memory* | *To get the basic file system structure- Directory Implementation* |
| S-7 | SLO-1 | *Operating system services* | *Inter Process communication : Shared memory* | *Classical Problems of synchronization - Dining Philosophers problem (Monitor )* | *Paged segmentation Technique* | *Understanding the various levels of directory structure* |
| | SLO-2 | *Learning of services* | *Understanding the need for IPC* | *Understanding the synchronization of limited resources among multiple processes* | *Understanding the users view of memory with respect to the primary memory* | *FILE SYSTEM IMPLEMENTATION :Free space Management* |
| S-8 | SLO-1 | *System calls* | *message passing, Pipe()* | *DEADLOCKS: Necessary conditions, Resource allocation graph, Deadlock prevention methods-* | *VIRTUAL MEMORY – Basic concepts – age fault handling* | *Understanding the methods available for maintaining the free spaces in the disk* |
| | SLO-2 | *Examples* | *Understand the message passing, Pipe()* | *Understanding the deadlock scenario -Deadlocks : Deadlock Avoidance* | *Understanding , how an OS handles the page faults- Performance of Demand paging* | *FILE SYSTEM IMPLEMENTATION* |

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| **S-9 to S-10** | **SLO-1** | ***Lab 2:understand the behavior of the OS and get the CPU type and model*** | ***Lab 5: System admin commands – Basics*** | ***Lab 8:Process Creation and Overlay concept*** | ***Lab 11: Programs to implement shared memory*** | ***Lab14: Understand the basic methods of free space management*** |
| S-11 | SLO-1 | *Types* | *CPU Scheduling: Round robin, Multilevel queue Scheduling, Multilevel feedback Scheduling* | *Detection and Recovery* | *Understanding the relationship of effective access time and the page fault rate* | *Allocation methods* |
| | SLO-2 | *Understanding of different types* | *Understanding the scheduling techniques* | *Understanding the deadlock avoidance, detection and recovery mechanisms* | *Thrashing* | *Understanding the pros and Cons of various disk allocation methods* |
| S-12 | SLO-1 | *System programs* | *Real Time scheduling: Rate Monotonic Scheduling and Deadline Scheduling and Deadline Scheduling* | *Deadlocks characterization* | *,Causes of Thrashing* | *FILE SYSTEM IMPLEMENTATION :Free* |
| | SLO-2 | *Learn with examples* | *Understanding the real time scheduling* | *Understand the characterization* | *Understanding the Thrashing* | *Understanding the methods available for maintaining the free spaces in the disk* |
| S13 | SLO-1 | *System Design and implementation* | *Scheduling Algorithms, Multiprocessor Scheduling* | *Deadlock detection and Recovery* | *Working set Model* | *Disk Scheduling algorithms* |
| | SLO-2 | *Implementation with design process* | *Understand the scheduling criteria and algorithms* | *Killing the process and resource preemption* | *Understanding the working set model for controlling the Working set model* | *Scheduling Algorithms* |
| **S-14 to S-15** | **SLO-1** | ***Lab 3: Understanding the Linux file system*** | ***Lab 6 : Linux commands*** | ***Lab 9: File system and working with test programs*** | ***Lab 12: understand the paging operations*** | ***Lab15:programs to implement the various CPU Scheduling Algorithms*** |

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| *Learning Resources* | *1. Abraham Silberschatz, Peter Baer Galvin, Greg Gagne, Operating systems, 9th ed., John Wiley & Sons, 2013* | *3. Andrew S.Tanenbaum, Herbert Bos, Modern Operating systems, 4thed., Pearson, 2015* |
| | *2. William Stallings, Operating Systems-Internals and Design Principles, 7th ed., Prentice Hall, 2012* | *4. Bryant O'Hallaxn, Computer systems- A Programmer's Perspective,Pearson, 2015* |

| Learning Assessment | | | | | | | | | | | |
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| Level | Bloom's Level of Thinking | Continuous Learning Assessment (50% weightage) | | | | | | | | Final Examination (50% weightage) | |
| | | CLA – 1 (10%) | | CLA – 2 (10%) | | CLA – 3 (20%) | | CLA – 4 (10%)# | | | |
| | | Theory | Practice | Theory | Practice | Theory | Practice | Theory | Practice | Theory | Practice |
| Level 1 | Remember | 20% | 20% | 15% | 15% | 15% | 15% | 15% | 15% | 20% | 20% |
| | Understand | | | | | | | | | | |
| Level 2 | Apply | 20% | 20% | 20% | 20% | 20% | 20% | 20% | 20% | 20% | 20% |
| | Analyze | | | | | | | | | | |
| Level 3 | Evaluate | 10% | 10% | 15% | 15% | 15% | 15% | 15% | 15% | 10% | 10% |
| | Create | | | | | | | | | | |
| | Total | 100 % | | 100 % | | 100 % | | 100 % | | 100 % | |

# CLA – 4 can be from any combination of these: Assignments, Seminars, Tech Talks, Mini-Projects, Case-Studies, Self-Study, MOOCs, Certifications, Conf. Paper etc.,

| Course Designers | | |
|---|---|---|
| Experts from Industry | Experts from Higher Technical Institutions | Internal Experts |
| *Mr.G.Muruganandam, Group Project Manager, HCL Technologies, Chennai* | *Dr.S.Gopinathan, Professor, University of Madras, Chennai* | 1. *Ms.D. Kanchana, SRMIST* |
| *Mr.M. Hemachandar, Tech Lead, Wipro Limited, Chennai* | | 2. *Dr.S.Albert Antony Raj, SRMIST* |