**Unix System & Network Programming (Integrated type)**

| Course Code | 21CS64 | Course type | IPCC | Credits L-T-P | 3 - 0- 1 |
|---|---|---|---|---|---|
| Hours/week: L-T-P | 3 - 0 - 2 | | | Total credits | 4 |
| Total Contact Hours | L = 40 Hrs; T = 0 Hrs; P = 20 Hrs<br>Total = 60 Hrs | | | CIE Marks | 100 |
| Flipped Classes content | 5 Hours | | | SEE Marks | 100 |

| Course learning objectives | |
|---|---|
| 1. | To introduce POSIX and UNIX standards along with basics of working with UNIX Environment. |
| 2. | To develop the ability to work with UNIX Files and UNIX processes |
| 3. | Demonstrate working with Transport layer Protocols using TCP & UDP |

**Required Knowledge of :** C,C++, Computer Networks, Operating System

| Unit – I | Contact Hours = 8 Hours |
|---|---|
| **Introduction to UNIX and its Commands:** UNIX and ANSI Standards: The ANSI C Standard, The POSIX Standards, UNIX and POSIX APIs: The POSIX APIs, The UNIX and POSIX Development Environment, API Common Characteristics,<br>Basics of working with UNIX Operating system and executing UNIX General commands like calendar, date etc. | |

| Unit – II | Contact Hours = 8 Hours |
|---|---|
| **UNIX Files:** File Types, The UNIX and POSIX File System, The UNIX and POSIX File Attributes, Inodes in UNIX System V, Application Program Interface to Files, UNIX Kernel Support for Files, General File APIs: Open, Read, Write, Close, lseek, fcntl(with usage in File Locking), Stat, chmod, chown. | |

| Unit – III | Contact Hours = 8 Hours |
|---|---|
| **UNIX Processes:** UNIX Kernel Support for Processes, Process Termination, Command-Line Arguments, Environment List, Memory Layout of a C Program, Environment Variables, setjmp and longjmp Functions, getrlimit, setrlimit<br>**Process Control:** Process Id and its applicability , API'S(FORK,VFORK,WAIT & WAIT PID) | |

| Unit – IV | Contact Hours = 8 Hours |
|---|---|
| **Introduction to Transport Layer:** TCP, UDP and SCTP, TCP Connection Establishment and Termination. **Sockets Introduction:** Introduction, Socket Address Structures, Value-Result Arguments, Byte<br>Ordering and Manipulation Functions.<br>**Elementary TCP Sockets**: socket, connect, bind, listen, accept, fork and exec, Concurrent Server design, getcsockname and getpeername functions | |

| Unit –V | Contact Hours = 8 Hours |
|---|---|
| **Elementary UDP Sockets:** recvform and sendto Functions, UDP Echo Client/Server- main, dg_echo and dg_cli Functions, Lost Datagrams, Verifying received Responses, Server Not Running, connect Function with UDP, Lack of Flow control with UDP, Determining Outgoing Interface with UDP, TCP and UDP Echo Server using select. | |

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| **Ipv4 and IPv6 Interoperability:** IPv4 Client and IPv6 Server, IPV6 Client ad IPv4 Server, |

**Flipped Classroom Details**

| Unit No. | I | II | III | IV | V |
|---|---|---|---|---|---|
| No. for Flipped Classroom Sessions | 1 | 1 | 1 | 1 | 1 |

**List of Experiments**

| Unit No. | No. of Experiments | Topic(s) related to Experiment |
|---|---|---|
| 1 | **2** | UNIX environment and UNIX commands, POSIX runtime and compile time limits, UNIX / Linux virtualization |
| 2 | **2** | Basic Unix File Commands, Hard Link and Symbolic<br>File And Record Locking |
| 3 | **2** | Differentiating The Parent & Child Processes Using FORK (The resources that are shared and not shared between parent & child)<br>Race Condition Handling Using Tell & Wait Functions |
| 4 | **2** | Client server communication using socket programming that uses connection oriented protocol at transport layer<br>Simulation of Network Applications using NS2/NS3 |
| 5 | **2** | WIRESHARK tool for Network Analysis for data transfer of UDP & TCP applications.<br>Simulation of Network Applications using NS2/NS3 |

| Unit No. | Self-Study Topics |
|---|---|
| 1 | FIPS & X/OPEN STANDARDS, study of latest OS's with their applicability in the industry |
| 2 | Device and directory file API'S |
| 3 | Exec Functions & Process Accounting |
| 4 | TCP Echo Client/Server Functions. |
| 5 | STCP One-to-Many-Style Streaming Echo Client and Server main Functions. IPv6 Address-Testing Macros, Source Code Portability |

| | Books |
|---|---|
| | **Text Books:** |
| 1. | Terrence Chan: UNIX System Programming Using C++, Prentice Hall India, 1999 and onwards |
| 2. | W. Richard Stevens, "Advanced Programming in the UNIX Environment" , Pearson Education, 2nd Edition and onwards |
| 3. | W. Richard Stevens, Bill Fenner, Andrew M. Rudoff: "UNIX Network Programming". Volume 1, Third Edition, Pearson 2004 and onwards |
| 4. | Sumitabha Das: "Concepts and applicaions", Tata McGraw Hill, 2012 and onwards |
| | **Reference Books:** |
| 1. | Richard Stevens: "UNIX Network Programming". Volume 2, Second Edition 2006 and onwards. |
| | **E-resources (NPTEL/SWAYAM. Any Other)- mention links**<br>**Following courses have Good Learning Resources as well:** |
| 1. | **A CERIFICATION Course on Linux Operating System**<br>https://onlinecourses.swayam2.ac.in/aic20_sp24/preview |

| | |
|---|---|
| 2. | **A CERIFICATION Course on computer-networks-and-internet-protocol**<br>https://elearn.nptel.ac.in/shop/nptel/computer-networks-and-internet-protocol/ |

| Course delivery methods | | Assessment methods | |
|---|---|---|---|
| 1. | Chalk and Talk | 1. | IA tests |
| 2. | PPT and Videos | 2. | Lab Project |
| 3. | Flipped Classes | 3. | Lab Test |
| 4. | Practice session/Demonstrations in Labs | 4. | Semester End Examination |

| **Course Outcome (COs)**<br>**Learning Levels:**<br>**Re - Remember; Un - Understand; Ap - Apply; An - Analysis; Ev - Evaluate; Cr - Create** | | | | |
|---|---|---|---|---|
| At the end of the course, the student will be able to | | **Learning Level** | **PO(s)** | **PSO(s)** |
| 1. | **Describe** the features of POSIX and UNIX standards | **Re** | 1 | 1 |
| 2. | **Demonstrate** handling of UNIX files and UNIX Processes | **Ap** | 3,5,11 | 1,2,3 |
| 3. | **Design and implement** programs for inter process communication using UDP & TCP sockets | **Ap** | 3,5,11 | 1,2,3 |
| 4. | **Apply** basics of Unix OS & TCP/UDP to develop basic networking applications | **Ap** | 1,2,3,5,9,10,11,12 | 1,2,3 |

**Scheme of Continuous Internal Evaluation (CIE):**

For integrated courses, a lab test also will be conducted at the end of the semester. The lab test **(COMPULSORY)**will be part of the CIE. **No SEE for Lab**.

| **THEORY (60 marks)** | | | **LAB (40 marks)** | | Total |
|---|---|---|---|---|---|
| IA test 1 | IA test 2 | Assignment (OBA/Lab Project/ Industry assignment)/ Course project | Conduction | Lab test | |
| 25 marks | 25 marks | 10 marks | 15 marks | 25 marks | 100 marks |

**IA Test:**

1. No objective part in IA question paper
2. All questions descriptive

**Conduct of Lab:**

1. Conducting the experiment and journal: 5 marks
2. Calculations, results, graph, conclusion and Outcome: 5 marks
3. Viva voce: 5 marks

**Lab test: (Batch wise with 15 students/batch)**

1. Test will be conducted at the end of the semester
2. Timetable, Batch details and examiners will be declared by Exam section
3. Conducting the experiment and writing report: 5 marks
4. Calculations, results, graph and conclusion: 10 marks
5. Viva voce: 10 marks

**Eligibility for SEE:**

| |
|---|
| 1. 40% and above (24 marks and above) in theory component<br>2. 40% and above (16 marks and above) in lab component<br>3. **Lab test is COMPULSORY**<br>4. Not eligible in any one of the two components will make the student **Not Eligible** for SEE |

| **Scheme of Semester End Examination (SEE):** | |
|---|---|
| 1. | It will be conducted for 100 marks of 3 hours duration. |
| 2. | **Minimum marks required in SEE to pass:** Score should be ≥35, however, overall score of CIE+SEE should be ≥40%. |
| 3. | Question paper contains three parts **A,B and C**. Students have to answer<br>1. From Part A answer any 5 questions each Question Carries 6 Marks.<br>2. From Part B answer any one full question from each unit and each Question Carries 10 Marks.<br>3. From Part C answer any one full question and each Question Carries 20 Marks. |

| **CO-PO Mapping (planned)** | | | | | | | | | | | | | **CO-PSO Mapping(planned)** | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **CO** | **PO 1** | **PO 2** | **PO 3** | **PO 4** | **PO 5** | **PO 6** | **PO 7** | **PO 8** | **PO 9** | **PO1 10** | **PO 11** | **PO 12** | **PSO 1** | **PSO 2** | **PSO 3** |
| **1** | ✓ | | | | | | | | | | | | ✓ | | |
| **2** | | | ✓ | | ✓ | | | | | | ✓ | | ✓ | ✓ | ✓ |
| **3** | | | ✓ | | ✓ | | | | | | ✓ | | ✓ | ✓ | ✓ |
| **4** | ✓ | ✓ | ✓ | | ✓ | | | | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ |
| **Tick mark the CO, PO and PSO mapping** | | | | | | | | | | | | | | | |

| **Skill & competence enhanced after undergoing the course** | **Applicable Industry Sectors & domains** | **Job roles students can take up after undergoing the course** |
|---|---|---|
| Network Application development in open source Operating Systems | Computer Networking and Communication Industries | Network application developer |