SEMESTER S5

NETWORKS LAB

(Common to CS/CD/CM/CB/CU/CI)

Course Code	**PCCSL507**	**CIE Marks**	50
Teaching Hours/Week (L: T:P: R)	0:0:3:0	**ESE Marks**	50
Credits	2	**Exam Hours**	2 Hrs. 30 Min.
Prerequisites (if any)	None	**Course Type**	Lab

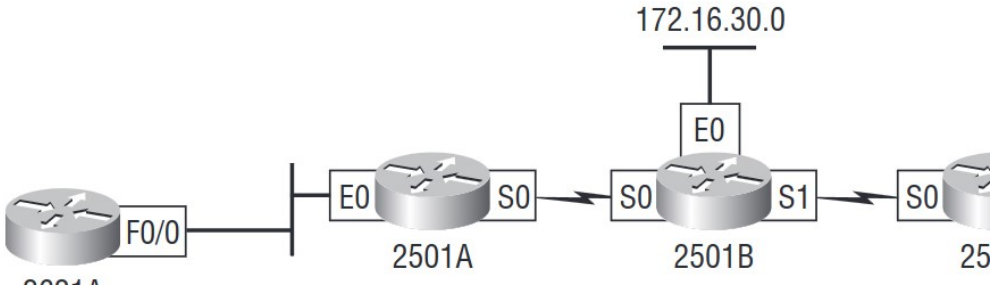
Course Objectives:

1. To provide hands-on experience in network programming using Linux System calls and network monitoring tools.
2. To comprehend the implementation of network protocols and algorithms, and configuration of network layer services using network simulators.

Expt. No.	Experiments
	Warm up
1	Familiarize Linux networking commands - ifconfig, ifplugstatus, iftop, ping, ip, traceroute, mtr, netstat, whois, nmap, nmcli, speedtest-cli, bmon, nslookup, tcpdump
	Wireshark based
2	Start your web browser and clear the browser's cache memory. Open Wireshark and start capturing. Then visit any webpage of your choice. Type **http** in the filter field of the Wireshark and click Apply so that only HTTP messages are displayed. After enough packets have been captured, select the **Capture** from the pull-down menu and select **Stop** to stop capturing. Using the captured information, determine the following: (a) the source IP address and destination IP address of the first GET message (b) the medium format, the language, the encoding, and the character set that the client can accept. (Use the first GET message) (c) the URL of the website and the user agent (Use the first GET message) (d) the source IP address and destination IP address of the first response message (e) the status codes for the first response message. (f) when the HTML file that you are retrieving was last modified at the server

	(g) value of the content-length field of the first response message (h) how long it took from the time the GET message was sent until the response message was received. (Use the timestamps of a GET message and that of the corresponding response message. By default, the time column's value is the amount of time in seconds since Wireshark tracing began.) (i) the HTTP version of your browser.
3	Compose an e-mail and address it to yourself, but do not send it yet. Open the Wireshark and start capturing. Go to your e-mail user agent and send the e-mail. In the Wireshark window, type **smtp** in the filter field and click **Apply**. Stop capturing and save the captured file. Using the captured information, answer the following: (a) All SMTP packets have the same two IP addresses. Which one is the IP address of your computer? Which host does the other IP address represent? (b) All SMTP packets have the same two port numbers. Which one is the port number of the SMTP client process? In which range is the client port number? (c) What is the port number of the SMTP server process? (d) Examine the SMTP commands or SMTP response codes in each SMTP packet and write down their meanings. (e) There is an IMF packet that is encapsulated inside an SMTP packet. What is the content of this packet?
4	First, clear the DNS record from the cache memory of your computer. For this, use **ipconfig/flushdns** on Windows or **systemd-resolve --flush-caches** on Linux. Next, clear your browser's cache memory. Open the Wireshark and start capturing. In your browser visit your college website. Wireshark starts to capture packets. Type **dns** in the filter field and press **Apply** so that only DNS messages are displayed. Stop capturing and save the captured file. Using the captured information, answer the following questions: (a) Locate the first DNS query message resolving your college website. What is the packet number (This "packet number" is assigned by Wireshark for listing purposes only; it is NOT a packet number contained in any real packet header.) in the trace for the DNS query message? (b) Is this query message sent over UDP or TCP? (c) Now locate the corresponding DNS response to the initial DNS query. What is the packet number in the trace for the DNS response message? Is this response message received via UDP or TCP? (d) What are the source and destination port numbers for the DNS query message?

	(e) What are the source and destination port numbers for the DNS response message? (f) To what IP address is the DNS query message sent? (g) What is the query message ID number? What is the response message ID number? What is the purpose of this field? (h) What is the length of the flag field in a DNS message? (i) Which bit in the flag field determines whether the message is a query or a response? (j) Which bits are used only in the response message? What is the function of these bits in the response message? (k) How many question records, answer records, authority records, and additional records are present in the query message? (l) How many question records, answer records, authority records, and additional records are present in the response message?
Socket programming based	
5	Client-Server communication using TCP:- The client inputs an integer *N* and creates a square matrix of order *N* by populating the matrix with random numbers in the range [1,50]. It then sends the matrix to the server which identifies the matrix type (upper triangular, lower triangular, diagonal). The server then informs the type (as a string) to the client which it prints.
6	Client-Server communication using UDP:- You are very good at communicating in the "new generation" English language with all sorts of abbreviations like **tbh**, **ig,** etc. Now design a client-server application as follows: The client inputs a new-generation English sentence from the user and sends it to the server. The server then translates the received sentence to formal English and sends the translated sentence back to the client which it prints. *Sample string sent to the server* Really idc about this stupid server as it is of no use irl but atm, I will design one, tbf to the professor. *Translated string sent back to the client* Really I don't care about this stupid server as it is of no use in real life but at the moment, I will design one, to be fair to the professor. You may consider only the following abbreviations: tbh, ig, tbf, atm, irl, lol, asap, omg, ttyl, idk, nvm
7	Implement a multi-user chat server using TCP as the transport layer protocol.
8	Implement a concurrent Time Server application using UDP to execute the program at a remote server. The client sends a time request to the server which sends its system time

	back. The client then displays the received time value.
9	Develop a concurrent file server that will provide the file requested by the client if it exists. If not, the server sends an appropriate message to the client. The server should also send its process ID (PID) to clients for displaying along with the file contents or with the message.
10	Develop a packet-capturing application using raw sockets.
Cisco's Packet tracer based	
11	Familiarizing router commands (a) Knowing the current mode (user or privileged), switching to privileged mode (b) Switching to configuration mode (c) Obtaining router information such as type, OS, memory stats, interface details etc. (d) Viewing the status of any routing protocols currently configured (e) Showing the routing table (f) Saving the running configuration (g) Viewing the command history (h) Viewing the router clock (i) Viewing the list of hosts (j) Displaying the statistics for all the interfaces (Both detailed and brief views) (k) Knowing the controller type (DTE or DCE) (l) Configuring serial and ethernet interfaces - enabling the interface, setting IP address, mask, and clock rate
	

router	Interface	I
2621	F0/0	1
2501A	E0	1
2501A	S0	1
2501B	E0	1
2501B	S0	1
2501B	S1	1

Figure 1: A sample network along with the interface addresses (all interfaces use a /24 mask)

12	Set up static routing for the network shown in Figure 1. Once the routes are set up, display the routing table and verify the connectivity using **ping**.
13	Implement RIPv2 routing for the network shown in Figure 1. Once the routes are set up, display the routing table and verify the connectivity using **ping**.
14	Implement OSPF routing for the network shown in Figure 1. Once the routes are set up, display the routing table and verify the connectivity using **ping**.
15	You are the network administrator of your college. A small portion of your campus network is shown in Figure 2. You want to allow only Host_B to communicate with the network 172.16.10.0. Verify your settings by the following checks: (a) Pinging Host_A from Host_B (b) Pinging Host_A from Lab_B and Lab_C

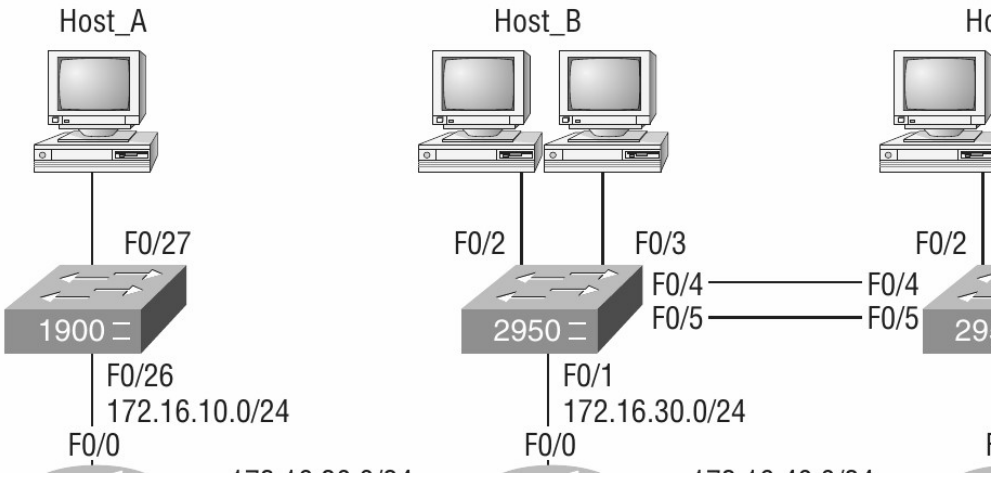


Figure 2: A portion of your college campus network

16	You are the network administrator of your college. The college is assigned a network address 140.80.0.0. There are 20 subnets in your college network. The Central Computing Facility (CCF) resides in the 4th subnet. The department of CSE is organizing an inter-department hackathon for which the registration closed yesterday. The registration was through the hackathon website hosted on a server which is assigned the 7th address in the 16th subnet. As the network administrator, your job now is to block students from accessing the hackathon website from CCF. [The server provides other services than the website hosting as well. Make sure you block only the website access. Other services should not be denied.]
17	Figure 3 shows an IPv6-based network. Interconnect the different subnets using RIPng.

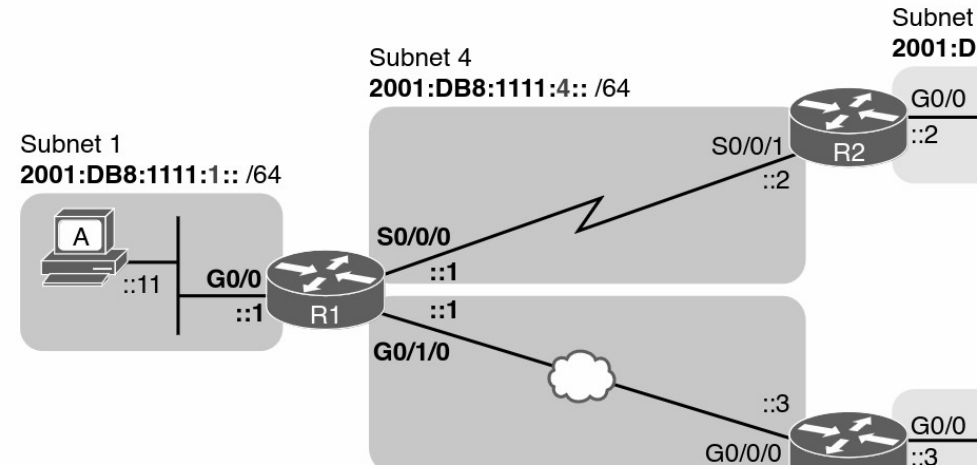


Figure 3: An IPv6 network

Course Assessment Method

(CIE: 50 marks, ESE: 50 marks)

Continuous Internal Evaluation Marks (CIE):

Attendance	Preparation/Pre-Lab Work experiments, Viva and Timely completion of Lab Reports / Record (Continuous Assessment)	Internal Examination	Total
5	25	20	50

End Semester Examination Marks (ESE):

Procedure/ Preparatory work/Design/ Algorithm	Conduct of experiment/ Execution of work/ troubleshooting/ Programming	Result with valid inference/ Quality of Output	Viva voce	Record	Total
10	**15**	**10**	**10**	**5**	**50**

- ***Submission of Record: Students shall be allowed for the end semester examination only upon submitting the duly certified record.***
- ***Endorsement by External Examiner:*** *The external examiner shall endorse the record*

Course Outcomes (COs)

At the end of the course students should be able to:

Course Outcome		Bloom's Knowledge Level (KL)
CO1	Understand the working of application layer protocols by analyzing the pertinent headers in actual data packets captured using network monitoring tools.	**K3**
CO2	Exploit the client server paradigm to develop real time networking applications using transport layer protocols.	**K3**
CO3	Employ IPv4 and IPv6 addressing, subnetting to efficiently design networks.	**K3**
CO4	Simulate core networking concepts using a network simulator.	**K3**

Note*: K1- Remember, K2- Understand, K3- Apply, K4- Analyse, K5- Evaluate, K6- Create*

CO- PO Mapping (Mapping of Course Outcomes with Program Outcomes)

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	3	3	3	3							3
CO2	3	3	3	3		2						3
CO3	3	3	3	3								3
CO4	3	3	3	3	3							3

1: Slight (Low), 2: Moderate (Medium), 3: Substantial (High), -: No Correlation

Text Books				
Sl. No	**Title of the Book**	**Name of the Author/s**	**Name of the Publisher**	**Edition and Year**
1	Unix Network Programming, Volume 1: The Sockets Networking API	W. Richard Stevens, Andrew M. Rudoff, Bill Fenner	Pearson Education	3/e, 2004
2	CCNA Cisco certified network associate study guide Exam 640-802 6	Todd Lammle	Wiley	6/e, 2007
3	Beej's Guide to Network Programming: using Internet Sockets	Brian "beej Jorgensen" Hall	Amazon Digital Services	2019

Reference Books				
Sl. No	**Title of the Book**	**Name of the Author/s**	**Name of the Publisher**	**Edition and Year**
1	Computer Networks: A Top-Down Approach	Behrouz A Forouzan	McGraw Hill	SIE, 2017
2	Computer Networking: A Top-Down Approach Featuring Internet	J. F. Kurose and K. W. Ross	Pearson Education	8/e, 2022

Video Links (NPTEL, SWAYAM…)	
No.	**Link ID**
1	https://nptel.ac.in/courses/106106091

Continuous Assessment (25 Marks)

1. Preparation and Pre-Lab Work (7 Marks)

- Pre-Lab Assignments: Assessment of pre-lab assignments or quizzes that test understanding of the upcoming experiment.

- Understanding of Theory: Evaluation based on students' preparation and understanding of the theoretical background related to the experiments.

2. **Conduct of Experiments (7 Marks)**

- Procedure and Execution: Adherence to correct procedures, accurate execution of experiments, and following safety protocols.
- Skill Proficiency: Proficiency in handling equipment, accuracy in observations, and troubleshooting skills during the experiments.
- Teamwork: Collaboration and participation in group experiments.

3. **Lab Reports and Record Keeping (6 Marks)**

- Quality of Reports: Clarity, completeness and accuracy of lab reports. Proper documentation of experiments, data analysis and conclusions.
- Timely Submission: Adhering to deadlines for submitting lab reports/rough record and maintaining a well-organized fair record.

4. **Viva Voce (5 Marks)**

- Oral Examination: Ability to explain the experiment, results and underlying principles during a viva voce session.

Final Marks Averaging: The final marks for preparation, conduct of experiments, viva, and record are the average of all the specified experiments in the syllabus.

Evaluation Pattern for End Semester Examination (50 Marks)

1. **Procedure/Preliminary Work/Design/Algorithm (10 Marks)**

- Procedure Understanding and Description: Clarity in explaining the procedure and understanding each step involved.
- Preliminary Work and Planning: Thoroughness in planning and organizing materials/equipment.
- Algorithm Development: Correctness and efficiency of the algorithm related to the experiment.
- Creativity and logic in algorithm or experimental design.

2. **Conduct of Experiment/Execution of Work/Programming (15 Marks)**

- Setup and Execution: Proper setup and accurate execution of the experiment or programming task.

3. **Result with Valid Inference/Quality of Output (10 Marks)**

- Accuracy of Results: Precision and correctness of the obtained results.
- Analysis and Interpretation: Validity of inferences drawn from the experiment or quality of program output.

4. **Viva Voce (10 Marks)**

- Ability to explain the experiment, procedure results and answer related questions
- Proficiency in answering questions related to theoretical and practical aspects of the subject.

5. **Record (5 Marks)**

- Completeness, clarity, and accuracy of the lab record submitted

SEMESTER 5

MACHINE LEARNING LAB

(Common to CS/CA)

Course Code	**PCCSL508**	**CIE Marks**	50
Teaching Hours/Week (L: T:P: R)	0:0:3:0	**ESE Marks**	50
Credits	2	**Exam Hours**	2 Hrs. 30 Min.
Prerequisites (if any)	None	**Course Type**	Lab

Course Objectives:

1. To give the learner a practical experience of the various machine learning techniques and be able to demonstrate them using a language of choice.

Expt. No.	**Experiments**
1	Implement linear regression with one variable on the California Housing dataset to predict housing prices based on a single feature (e.g., the average number of rooms per dwelling). Tasks: ● Load and preprocess the datase. ● Implement linear regression using both gradient descent and the normal equation. ● Evaluate the model performance using metrics such as Mean Squared Error (MSE) and R-squared. ● Visualize the fitted line along with the data points.
2	Implement polynomial regression on the Auto MPG dataset to predict miles per gallon (MPG) based on engine displacement. Compare polynomial regression results with linear regression. Tasks: ● Load and preprocess the dataset. ● Implement polynomial regression of varying degrees. ● Compare the polynomial regression models with linear regression using metrics such as MSE and R-squared. ● Visualize the polynomial fit.
3	Implement Ridge and Lasso regression on the Diabetes dataset. Compare the performance of these regularized models with standard linear regression. Tasks:

	• Load and preprocess the dataset. • Implement Ridge and Lasso regression. • Tune hyperparameters using cross-validation. • Compare performance metrics (MSE, R-squared) with standard linear regression.
4	Estimate the parameters of a logistic regression model using MLE and MAP on the Breast Cancer Wisconsin dataset. Compare the results and discuss the effects of regularization. Tasks: • Load and preprocess the dataset. • Implement logistic regression with MLE. • Apply MAP estimation with different regularization priors (L1 and L2 regularization). • Compare the performance and parameter estimates with MLE and MAP.
5	Use MLE and MAP to estimate the parameters of a multinomial distribution on the 20 Newsgroups dataset. Explore the impact of different priors on the estimation. Tasks: • Load and preprocess the dataset. • Implement MLE for multinomial distribution parameter estimation. • Apply MAP estimation with various priors (e.g., Dirichlet priors). • Compare results and evaluate the effect of different priors.
6	Implement a logistic regression model to predict the likelihood of a disease using the Pima Indians Diabetes dataset. Compare the performance with and without feature scaling. Tasks: • Load and preprocess the Pima Indians Diabetes dataset. • Implement logistic regression for binary classification. • Evaluate model performance with and without feature scaling. • Analyze metrics such as accuracy, precision, recall, and F1-score.
7	Implement a Naïve Bayes classifier to categorize text documents into topics using the 20 Newsgroups dataset. Compare the performance of Multinomial Naïve Bayes with Bernoulli Naïve Bayes. Tasks: • Load and preprocess the 20 Newsgroups dataset. • Implement Multinomial Naïve Bayes and Bernoulli Naïve Bayes classifiers. • Evaluate and compare the performance of both models using metrics such as accuracy and F1-score. • Discuss the strengths and weaknesses of each Naïve Bayes variant for text classification.

8	Implement the K-Nearest Neighbors (KNN) algorithm for image classification using the Fashion MNIST dataset. Experiment with different values of K and analyze their impact on model performance. Tasks: ● Load and preprocess the Fashion MNIST dataset. ● Implement KNN for multi-class classification. ● Experiment with different values of K and evaluate performance. ● Discuss the impact of different K values on model accuracy and computational efficiency.
9	Implement a Decision Tree classifier using the ID3 algorithm to segment customers based on their purchasing behavior using the Online Retail dataset. Analyze the tree structure and discuss the feature importance. Tasks: ● Load and preprocess the Online Retail dataset. ● Implement Decision Tree using the ID3 algorithm. ● Visualize the decision tree and analyze feature importance. ● Discuss how the tree structure helps in understanding customer behavior.
10	Implement and compare Logistic Regression and Decision Trees on the Adult Income dataset for predicting income levels. Evaluate both models based on performance metrics and interpretability. Tasks: ● Load and preprocess the Adult Income dataset. ● Implement both Logistic Regression and Decision Trees. ● Compare the models based on metrics such as accuracy, precision, recall, and F1-score. ● Discuss the interpretability of both models and their suitability for the dataset.
11	Implement a Linear Support Vector Machine (SVM) to classify the Iris dataset. Visualize the decision boundary and discuss how the margin is determined. Tasks: ● Load and preprocess the Iris dataset. ● Implement a Linear SVM for binary classification (e.g., classify Setosa vs. Non-Setosa). ● Visualize the decision boundary and margin. ● Discuss the concept of the margin and how it influences classification.
12	Implement and compare the performance of SVM classifiers with linear, polynomial, and RBF kernels on the Fashion MNIST dataset. Analyze the advantages and disadvantages of each kernel type.

	Tasks: ● Load and preprocess the Fashion MNIST dataset. ● Implement SVM with linear, polynomial, and RBF kernels. ● Compare the classification performance for each kernel. ● Discuss the strengths and weaknesses of each kernel type.
13	Implement and train a Multilayer Feed-Forward Network (MLP) on the Wine Quality dataset. Experiment with different numbers of hidden layers and neurons, and discuss how these choices affect the network's performance. Tasks: ● Load and preprocess the Wine Quality dataset. ● Design and implement an MLP with varying architectures (different hidden layers and neurons). ● Train and evaluate the network. ● Discuss the impact of architecture choices on performance.
14	Implement and compare the performance of a neural network using different activation functions (Sigmoid, ReLU, Tanh) on the MNIST dataset. Analyze how each activation function affects the training process and classification accuracy. Tasks: ● Load and preprocess the MNIST dataset. ● Implement neural networks using Sigmoid, ReLU, and Tanh activation functions. ● Train and evaluate each network. ● Compare training times, convergence, and classification accuracy.
15	Implement and perform hyperparameter tuning for a neural network on the Fashion MNIST dataset. Experiment with different learning rates, batch sizes, and epochs, and discuss the impact on model performance. Tasks: ● Load and preprocess the Fashion MNIST dataset. ● Experiment with different hyperparameters (learning rate, batch size, epochs). ● Train and evaluate the network. ● Discuss how hyperparameter choices affect model performance.
16	Implement and compare hierarchical (agglomerative) and partitional (K-means) clustering algorithms on the Mall Customers dataset. Discuss the strengths and weaknesses of each method based on clustering results and evaluation metrics. Tasks: ● Load and preprocess the Mall Customers dataset. ● Apply both hierarchical (agglomerative) and K-means clustering. ● Compare results using metrics such as inertia, silhouette score, and clustering

	visualization. ● Discuss the advantages and disadvantages of each clustering method.
17	Implement and apply K-means clustering to the Digits dataset. Experiment with different numbers of clusters and evaluate the clustering results using metrics such as inertia and silhouette score. Analyze how the choice of K affects clustering performance. Tasks: ● Load and preprocess the Digits dataset. ● Implement K-means clustering with various numbers of clusters. ● Evaluate clustering performance using inertia and silhouette score. ● Analyze the impact of the number of clusters on clustering quality.
18	Implement bootstrapping and cross-validation on the Iris dataset. Compare the model performance metrics (e.g., accuracy, F1-score) obtained using these resampling methods. Discuss the advantages and disadvantages of each method. Tasks: ● Load and preprocess the Iris dataset. ● Implement bootstrapping to generate multiple samples and evaluate the model. ● Implement k-fold cross-validation and evaluate the model. ● Compare the performance metrics and discuss the pros and cons of each resampling method.
19	Implement bagging and boosting ensemble methods on the Titanic dataset. Compare the performance of both methods in terms of accuracy, precision, recall, and F1-score. Discuss how each method improves model performance and their respective strengths and weaknesses. Tasks: ● Load and preprocess the Titanic dataset. ● Implement bagging using a base classifier (e.g., decision tree) and evaluate performance. ● Implement boosting using a boosting algorithm (e.g., AdaBoost) and evaluate performance. ● Compare performance metrics and discuss the strengths and weaknesses of each method.
20	Investigate the bias-variance tradeoff using polynomial regression on the Boston Housing dataset. Plot the training and validation errors for various polynomial degrees and discuss the tradeoff between bias and variance. Tasks: ● Load and preprocess the Boston Housing dataset. ● Implement polynomial regression with varying degrees.

	• Plot training and validation errors for each degree. • Discuss the bias-variance tradeoff and its impact on model performance.

Course Assessment Method

(CIE: 50 marks, ESE: 50 marks)

Continuous Internal Evaluation Marks (CIE):

Attendance	Preparation/Pre-Lab Work experiments, Viva and Timely completion of Lab Reports / Record (Continuous Assessment)	Internal Examination	Total
5	25	20	50

End Semester Examination Marks (ESE):

Procedure/ Preparatory work/Design/ Algorithm	Conduct of experiment/ Execution of work/ troubleshooting/ Programming	Result with valid inference/ Quality of Output	Viva voce	Record	Total
10	15	10	10	5	50

- ***Submission of Record: Students shall be allowed for the end semester examination only upon submitting the duly certified record.***
- ***Endorsement by External Examiner:*** *The external examiner shall endorse the record*

Course Outcomes (COs)

At the end of the course students should be able to:

Course Outcome		Bloom's Knowledge Level (KL)
CO1	Understand complexity of Machine Learning algorithms and their limitations;	**K2**
CO2	Understand modern notions in data analysis-oriented computing;	**K2**
CO3	Apply common Machine Learning algorithms in practice and implement their own.	**K3**
CO4	Performing experiments in Machine Learning using real-world data.	**K3**

Note*: K1- Remember, K2- Understand, K3- Apply, K4- Analyse, K5- Evaluate, K6- Create*

CO- PO Mapping (Mapping of Course Outcomes with Program Outcomes)

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	3	3		3							3
CO2	3	3	3		3							3
CO3	3	3	3		3							3
CO4	3	3	3		3							3

1: Slight (Low), 2: Moderate (Medium), 3: Substantial (High), -: No Correlation

Text Books				
Sl. No	**Title of the Book**	**Name of the Author/s**	**Name of the Publisher**	**Edition and Year**
1	Introduction to Machine Learning	Ethem Alpaydin	MIT Press	4/e, 2020
2	Machine Learning using Python	Manaranjan Pradhan | U Dinesh Kumar	Wiley	1/e, 2019
3	Machine Learning: Theory and Practice	M.N. Murty, V.S. Ananthanarayana	Universities Press	1/e, 2024

Reference Books				
Sl. No	**Title of the Book**	**Name of the Author/s**	**Name of the Publisher**	**Edition and Year**
1	Data Mining and Analysis: Fundamental Concepts and Algorithms	Mohammed J. Zaki | Wagner Meira	Cambridge University Press	1/e, 2016
2	Neural Networks for Pattern Recognition	Christopher Bishop	Oxford University Press	1/e, 1998

Video Links (NPTEL, SWAYAM…)	
No.	**Link ID**
1	https://archive.nptel.ac.in/courses/106/105/106105152/
2	https://archive.nptel.ac.in/courses/106/106/106106139/
3	https://nptel.ac.in/courses/106106202

Continuous Assessment (25 Marks)

1. **Preparation and Pre-Lab Work (7 Marks)**

   - Pre-Lab Assignments: Assessment of pre-lab assignments or quizzes that test understanding of the upcoming experiment.
   - Understanding of Theory: Evaluation based on students' preparation and understanding of the theoretical background related to the experiments.

2. **Conduct of Experiments (7 Marks)**

   - Procedure and Execution: Adherence to correct procedures, accurate execution of experiments, and following safety protocols.
   - Skill Proficiency: Proficiency in handling equipment, accuracy in observations, and troubleshooting skills during the experiments.
   - Teamwork: Collaboration and participation in group experiments.

3. **Lab Reports and Record Keeping (6 Marks)**

   - Quality of Reports: Clarity, completeness and accuracy of lab reports. Proper documentation of experiments, data analysis and conclusions.
   - Timely Submission: Adhering to deadlines for submitting lab reports/rough record and maintaining a well-organized fair record.

4. **Viva Voce (5 Marks)**

   - Oral Examination: Ability to explain the experiment, results and underlying principles during a viva voce session.

Final Marks Averaging: The final marks for preparation, conduct of experiments, viva, and record are the average of all the specified experiments in the syllabus.

Evaluation Pattern for End Semester Examination (50 Marks)

1. **Procedure/Preliminary Work/Design/Algorithm (10 Marks)**

   - Procedure Understanding and Description: Clarity in explaining the procedure and understanding each step involved.
   - Preliminary Work and Planning: Thoroughness in planning and organizing materials/equipment.
   - Algorithm Development: Correctness and efficiency of the algorithm related to the experiment.

- Creativity and logic in algorithm or experimental design.

2. Conduct of Experiment/Execution of Work/Programming (15 Marks)

- Setup and Execution: Proper setup and accurate execution of the experiment or programming task.

3. Result with Valid Inference/Quality of Output (10 Marks)

- Accuracy of Results: Precision and correctness of the obtained results.
- Analysis and Interpretation: Validity of inferences drawn from the experiment or quality of program output.

4. Viva Voce (10 Marks)

- Ability to explain the experiment, procedure results and answer related questions
- Proficiency in answering questions related to theoretical and practical aspects of the subject.

5. Record (5 Marks)

- Completeness, clarity, and accuracy of the lab record submitted

SEMESTER 6

COMPUTER SCIENCE AND ENGINEERING