

Enrollment no. 2202178

Jaypee Institute of Information Technology, Noida  
End Semester Examination, EVEN 2025  
B.Tech. VI Semester

Course Title: Applied Statistical Mechanics  
Course Code: 16BINPH634

Maximum Time: 2 Hrs  
Maximum Marks: 35

CO1	Outline fundamental parameters of Thermodynamics and Statistical Mechanics.
CO2	Explain the Thermodynamic potentials, Maxwell's equations and Heat equations.
CO3	Apply the concepts of thermodynamics and statistical ensembles to understand the phase space and distribution functions.
CO4	Determine the distribution functions in case of various types of physical and chemical ensembles.
CO5	Evaluate the ideas of Entropy with respect to probability and information theory; and conclude Liouville's equation.

Note: Attempt all the questions. Notations used are standard.

- 1a) What do you mean by the "equation of state" in thermodynamics?  
b) Considering a reversible cycle, show that the entropy of a system is a state function, i.e. it depends on the initial and final states.  
c) Find the partition function of a single molecule in  $Q_1(V, T)$ , what will be the partition function for a system with  $N$  identical molecules? Here,  $V$  and  $T$  are volume and temperature respectively.  
[CO1 (Remembering), 2+2+2 = 6 Marks]

- 2a) Calculate the probability of taking  $n_1$  steps to the right and  $n_2$  steps to the left, out of total  $N$  steps in a one-dimensional random walk problem. What type of distribution is it and why?  
b) Using the inputs from the above problem, verify that the total probability is 1.  
[CO2 (Understanding), (2+1+1) + 2 = 6 Marks]

- 3a) Write down the equation of motion of a particle in a system containing  $N$  number of particles, how can one define the total energy of the system?  
b) Briefly mention the steps of Metropolis Monte Carlo algorithm.

- c) Use the Metropolis Monte Carlo algorithm to simulate Ising model.  
[CO3 (Applying), (2+1) + 2+3 = 8 Marks]

- 4a) In a random walk problem, the probability that a particle is found after  $N$  steps in the range between  $x$  and  $x + dx$  is:  $P(x)dx = \frac{1}{\sigma\sqrt{2\pi}} e^{-\frac{x^2}{2\sigma^2}} dx$ . (i) What type of distribution is it? (ii) calculate the dispersion  $(\Delta x)^2 = (x - \mu)^2$  of the above-mentioned distribution.

- b) Write down the Hamiltonian representing the interaction between external magnetic field and magnetic moment in the Ising model.  
[CO4 (Analyzing), (1+3) + 2 = 6 Marks]

- 5a) Explain ensemble forecasting of weather with proper example.

- b) What is the advantage of ensemble formation in the dynamics of neural network?

- c) Let us consider the interatomic potential energy is  $V(r) = \frac{-\alpha e^2}{r} + \frac{\beta}{r^{12}}$ , where  $e$  is the charge of electron, and  $\alpha$  and  $\beta$  are constants. (i) Calculate the distance ( $r_e$ ) at which the force is minimum and (ii) the corresponding minimum force.  
[CO5 (Evaluating), 2+3+(2+2) = 9 Marks]

Useful formula:  $\int_{-\infty}^{\infty} e^{-ax^2} dx = \sqrt{\frac{\pi}{a}}$ ,  $\int_{-\infty}^{\infty} x e^{-ax^2} dx = 0$ ,  $\int_{-\infty}^{\infty} x^2 e^{-ax^2} dx = \frac{1}{2a} \sqrt{\frac{\pi}{a}}$ .

# POSSESSION OF MOBILES IN EXAM IS UFM PRACTICE.

Name

Samin

Enrollment No.

Jaypee Institute of Information Technology, Noida

End Semester Examination, Even Semester 2024-25

B. Tech, VI Semester

Course Title: Machine Learning for signal Processing Maximum Time :2 hr

Course Code: 18B13EC314

Maximum Marks: 35

CO1	Illustrate various machine learning approaches.
CO2	Experiment with the different techniques for feature extraction and feature selection
CO3	Apply and analyze various classification models for typical machine learning applications.
CO4	Make use of deep learning techniques in real life problem.

Note: Attempt all question. Assume the required data.

Q1: A company claims that their lights bulbs last on an average of 1200 hr. A customer tests a random sample of 8 bulbs & find the following life spans (in hours)-

1180	1195	1205	1210	1170	1220	1190	1185
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At the 0.05 significant level, is their enough evidence to reject the company claim. Show using t test, when  $t_{critical} = -1.895$ .

Q2: -A data contain information about the weather as shown in table. Use decision tree algorithms to determine a decision rule for whether to play tennis based the attribute outlook & temperature. Calculate the information gain for each attribute and build decision tree. [CO2,(Applying),5 Marks]

Table: Data Set

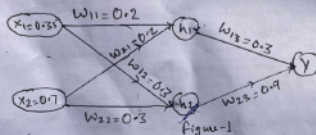
Day	Outlook	Temperature	play tennis
1	Sunny	Hot	No
2	Sunny	Hot	No
3	Overcast	Hot	Yes
4	Rain	Mild	Yes
5	Rain	Cool	Yes
6	Rain	Cool	No
7	Overcast	Cool	Yes
8	Sunny	Mild	No
9	Sunny	Cool	Yes
10	Rain	Mild	Yes
11	Sunny	Mild	Yes
12	Overcast	Mild	Yes
13	Overcast	Hot	Yes
14	Rain	Mild	No

Q3: -Realize logic X-OR Gate using neuron (McCulloch pitts)Model.

[CO3, (Analyzing),5 Marks]

Q4:-Find the updated weights of output layer and hidden layer using backpropagation methods for given neural network in figure1. When logistic sigmoid activation function is used to perform forward and backward pass on the neural network and also assume that actual output  $Y=0.5$ , and learning rate is 1.

[CO3, (Analyzing),7 Marks]



Q5: A convolution neural network applies the following operation on gray scale input image of size  $6 \times 6$  pixels

[CO4, (Evaluating),4 Marks]

1. A  $3 \times 3$  filter with no padding and stride 1.

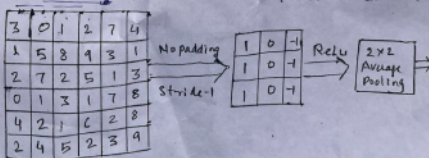
2. A  $2 \times 2$  Max pooling layer with stride 2.

a) Compute the output size of feature Map after convolution layer

b) Compute the output size after Max pooling layer.

Q6. Find the output of convolution layer after applying filter and ReLU activation function and also find the output of average pooling layer for given input image and filter.

[CO4, (Evaluating),5 Marks]



Q7(a): - Explain the types of learning paradigms in neural network.

(b) What are advantages and disadvantages of neural networks.

[CO1, (Understanding),4 Marks]

# POSSESSION OF MOBILES IN EXAM IS UFM PRACTICE.

Name Smriti

Enrollment No. 24102126

Jaypee Institute of Information Technology, Noida  
End Semester Examination, Even 2025  
B.Tech, VI Semester

Course Title: Control Systems  
Course Code: 15B11EC613

Maximum Time: 2 Hr  
Maximum Marks: 35

## COURSE OUTCOMES

CO1	Recall the concepts of Laplace Transform. Define open-loop and closed-loop system
CO2	Relate physical systems to transfer function and state-variable models.
CO3	Solve for the time domain response of first-order and second-order systems.
CO4	Analyze the stability of control systems in time and frequency domain.

## Attempt all questions

Q1. The Laplace transform of  $f(t)$  is given by  $F(s) = \frac{4}{s(s+2)}$ . Find the final value using the final value theorem and verify the result by determining  $f(t)$  using inverse Laplace transform.

[CO1 (Remembering), 3 M]

Q2. Obtain the transfer function (C/R) of the signal flow graph shown in Fig. 1.

[CO2 (Understanding), 5 M]

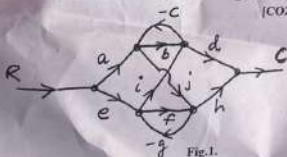
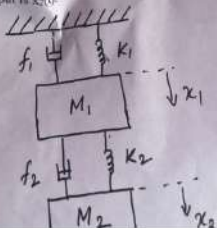


Fig. 1.

Q3. Obtain state-space model for the mechanical system shown in Fig. 2. The input to the system is  $f(t)$  and output is  $x_2(t)$ .

[CO2 (Understanding), 5 M]



- Q4. The block diagram of a unity feedback control system is shown in Fig. 3. Determine the characteristic equation of the system,  $\omega_{n0}$ ,  $\zeta$ ,  $\omega_{d0}$ ,  $t_p$ ,  $M_p$ , the time at which the first undershoot occurs, and the time period of oscillations. [CO3 (Applying), 5 M]

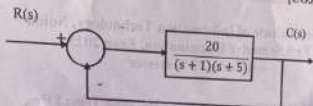


Fig. 3.

- Q5. Plot the Nyquist plot to determine the range of K for stability. Also, determine the gain margin and phase margin for  $K = 3$ . [CO4 (Analyzing), 6 M]

$$G(s)H(s) = \frac{2.5K}{s(0.4s+1)(0.2s+1)}$$

- Q6. Sketch the asymptotic Bode plot for the transfer function using semi-log graph paper

$$G(s)H(s) = \frac{2(s+0.25)}{s^2(s+1)(s+0.5)}$$

- Determine (a) Phase crossover frequency and Gain Margin  
(b) Gain crossover frequency and Phase Margin  
(c) Comment on the stability. [CO4 (Analyzing), 6 M]

- Q7. Sketch the root locus for the transfer function

$$G(s)H(s) = \frac{K}{s(s+6)(s^2+4s+13)}$$

- Determine (a) The break-away points.  
(b) The angle of departure.  
(c) The stability conditions. [CO4 (Analyzing), 5 M]

-----Best of Luck-----

**End Semester Examination, EVEN 2025**  
**B. Tech. VI Semester**

Course Title: VLSI Design  
Course Code: 18B11EC315

Maximum Time: 2 Hrs  
Maximum Marks: 35

After the completion of the course the students will be able to

CO1	Understand VLSI design flow, VLSI design styles, digital systems modeling using Verilog HDL.
CO2	Apply MOSFET models for circuits simulation and its effect on scaling.
CO3	Analyze the concept of static and dynamic characteristic of MOS inverters, combinational and sequential circuits.
CO4	Explain and evaluate dynamic logic circuits, stick diagram, layout and different types of semiconductor memories.

**Q1.** The following parameters are given for an N-MOS process.

$T_{ox} = 500 \text{ \AA}$ , substrate doping ( $N_A = 1 \times 10^{16} \text{ cm}^{-3}$ ), polysilicon doping ( $N_D = 1 \times 10^{20} \text{ cm}^{-3}$ ) and oxide interface fixed-charge density ( $N_{ox} = 2 \times 10^{10} \text{ cm}^{-2}$ )

- Calculate  $V_T$  for and un-implanted transistor.
- What type and concentration of impurities must be implanted to achieve  $V_T = 2V$ .

[CO2 (Applying), 5 Marks]

**Q2.** Consider a CMOS inverter, with the following device parameters:

- $V_{Tn} = 0.8V$
- $V_{Tp} = -1.0V$
- $W_{n0} = 1.2\mu m$
- $\mu_n C_{ox} = 120 \mu A/V^2$
- $\mu_p C_{ox} = 60 \mu A/V^2$

Design the CMOS inverter by determining the channel width  $W_n$  and  $W_p$  of the N-MOS and P-MOS transistors to meet the following performance specifications:

- $V_{DD} = 1.5V$  for  $V_{Tn} = 3V$ .
- Propagation delay times  $t_{PHL} \leq 0.2ns$  and  $t_{PLH} \leq 0.15ns$ .

Assume a combined output load capacitance of  $100 fF$  and an ideal step input.

[CO3 (Analyzing), 5 Marks]

**Q3.** Implement and explain the working of D-latch (version-1) using transmission gate and CMOS logic.

[CO3 (Analyzing), 4 Marks]

**Q4.** Describe the biasing and operating region of CMOS transmission gate as a function of output voltage.

Realize the Boolean expression  $F = AB + A'C = AB'C$  using transmission gates.

[CO3 (Analyzing), 6 Marks]

**Q5.** Explain read, write and hold operation of 6T<sup>1</sup> SRAM cell. How does a 6T<sup>1</sup> SRAM cell achieve low power consumption?

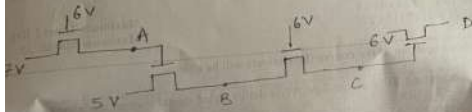
Draw the stick diagram of CMOS NAND gate using color code.

[CO4 (Evaluate), 5 Marks]

Q6 (a) Draw the CMOS realization of following Boolean function and find (W/L)<sub>n</sub>, equivalent of the same. Assume (W/L)<sub>p</sub> = 9 for all N-MOS transistor.

$$Z = ((D+E+A) (B+C))'$$

(b) Find the static voltage at node A, B, C and D in the circuit shown below. Assume each NMOS transistor has threshold voltage of 1V and ignore substrate body effect.



[CO3 (Analyzing), 5 Marks]

Q7 (a) Draw and Explain the three domains of Gajski-Kuhn Y-chart

(b) Write various abstraction levels of Verilog.

[CO1 (Understanding), 5 Marks]

# POSSESSION OF MOBILES IN EXAM IS UFM PRACTICE

Name Samir

Enrollment No. 82102178

Jaypee Institute of Information Technology, Noida

End Semester Examination, 2025

B. Tech, VI-Semester

Course Title: International Trade & Finance  
Course Code: I9B12H5613

Maximum Time: 2 Hours  
Maximum Marks: 35

CO1	Understand the foundations of international trade and finance in the era of globalization
CO2	Apply the major models and theories of international trade
CO3	Analyze the impact of trade barriers and dynamics on macroeconomic equilibrium
CO4	Evaluate the role of regional blocs and international organizations in economic integration

Note: Attempt all the questions.

1. Discuss the concept of protectionism in international trade. Why do countries adopt protectionist policies despite advocating globalization? Explain.

[CO1, (Understanding), 4 Marks]

2. How does the marginal propensity to import affect the size of foreign trade multiplier? Suppose an economy experiences a rise in the exports of \$200 million. The marginal propensity to consume (MPC) is 0.75 and the marginal propensity to import (MPM) is 0.1. Calculate the foreign trade multiplier and solve for the total change in income due to the increase in exports.

[CO2, (Applying), 4 Marks]

3. Apply Raymond Vernon's 'Product Life Cycle' theory to explain how the production and export of personal computers have changed from the 1980s to today.

[CO2, (Applying), 4 Marks]

4. The nation of 'Cologon' is 'large' but unable to affect world prices. It imports chocolates at the price of \$20 per box. The demand and supply curves are given as:

$$D = 300 - 10P$$

$$S = 200 + 10P$$

- i. Determine the free trade equilibrium.
- ii. Suppose an import quota that limits imports to 50 boxes has been imposed. Analyze:
  - a) The increase in domestic price.
  - b) The quota rents for the government.
  - c) The deadweight loss.

[CO3, (Analyzing), 6 Marks]



8. Analyze the effectiveness of monetary policy changes under fixed versus flexible exchange rate regimes in the IS-LM-BP framework. Additionally, what role does capital mobility play in determining the slope of the BP curve.

[CO3, (Analyzing), 6 Marks]

6. How does a country's decision to devalue its currency affect its exchange rate? Analyze the potential economic consequences for trade and capital flows?

[CO3, (Analyzing), 3 Marks]

7. Is the World Trade Organization still relevant in today's global environment? Justify your answer with reference to recent shifts in global trade dynamics.

[CO4, (Evaluating), 4 Marks]

8. To what extent do IMF structural adjustment programs align with the domestic policy goals and socio-economic needs of developing nations. Evaluate.

[CO4, (Evaluating), 4 Marks]

# POSSESSION OF MOBILES IN EXAM IS UFM PRACTICE

Name \_\_\_\_\_

Enrollment No. \_\_\_\_\_

**Jaypee Institute of Information Technology, Noida**  
**End Semester Examination, Even - 2025**  
**B.Tech. (ECE) 6<sup>th</sup> Sem/ACT(4<sup>th</sup> Sem)**

Course Title: Telecommunication Networks  
 Course Code: 15B11EC611

Maximum Marks: 35  
 Maximum Time: 2 Hours

## Course Outcomes:

CO1	To understand the basic concepts of Telecommunication network model, Traffic engineering and switching technology. Also, to understand various mechanisms involved in OSI model, TCP/IP and LAN access protocols, ATM and ISDN protocols for solving network related problems.	Understanding Level (C2)
CO2	To apply the concepts of traffic engineering, switching technologies and various network protocols for solving network related problems.	Applying Level (C3)
CO3	To analyze the link utilization and data packet generated after incorporation of data link error control and flow control mechanisms.	Analyzing Level (C4)
CO4	To apply the concept of subnetting for creating and assigning address blocks in a network. Applying various routing algorithms to create routing table for communication between two nodes.	Evaluating Level (C5)

Note: Attempt all the questions.

**Q.1a)** An ISP is granted a block of addresses starting with 170.70.0.0/16. The ISP distributes this block as follows:

- The first group has 200 businesses; each need 64 addresses.
- The second group has 40 businesses; each need 256 addresses.
- The third group has 2000 households; each need 4 addresses.

iv) Determine the remaining addresses.

b) Explain various methods used for making IPv4 and IPv6 compatible.

[CO4, Evaluating, (4 + 3 = 7 Marks)]

**Q.2 a)** With detailed diagram, explain the count to infinity problem.

b) For the following network, create routing table at Node A using Link State routing method.



[CO4, Evaluating, (3 + 4 = 7 Marks)]

Q.3) Explain various types of frames used in HDLC protocol with the help of detailed frame formats.

b) Over a 20 minutes observation interval, 40 subscribers initiate the calls. Total duration of the calls is 4800 seconds. Calculate the load offered to the network by the subscribers and the average subscriber traffic.

[CO1, Understanding, (5 + 2 = 7 Marks)]

Q.4) Explain with proper flow diagram, the steps taken by the TCP protocol for the congestion avoidance and congestion detection.

b) What do you understand by the term QoS? List the various methods of scheduling to improve QoS.

[CO2, Applying, (5 + 3 = 8 Marks)]

Q.5) Explain in detail the p-persistent CSMA protocol.

b) A slotted ALOHA network transmits 200 bits frames on a shared channel of 200 Kbps. Determine the throughput, if all the stations together produce 500 frames per second.

[CO3, Analyzing, (4 + 2 = 6 Marks)]