

THIRD SEMESTER

M.Tech. (IEM)

END-TERM EXAMINATION

NOV 2025

OME601 OPTIMIZATION TECHNIQUES

Time: 3:00 Hours

Max. Marks: 50

Note: Answer **any five** questions. Assume suitable missing data, if any.

1.(a). What are the advantages of duality? Construct the dual of the problem:

$$\text{Minimize } Z = x_2 + 3x_3$$

$$\text{Subject to } 2x_1 + x_2 \leq 3, x_1 + 2x_2 + 6x_3 \geq 5, -x_1 + x_2 + 2x_3 = 2,$$

$$x_1, x_2, x_3 \geq 0$$

[5](CO # 3)[B3]

(b) Differentiate between sensitivity analysis and post-optimality analysis.

[5](CO # 2)[B3]

2. (a) Determine an initial basic feasible solution to the following transportation problem using Vogel's approximation method: [5] (CO#3)[B4]

	Destination						
Origin		P	Q	R	S	T	Supply
	A	2	11	10	3	7	4
	B	1	4	7	2	1	8
	C	3	9	4	8	12	9
	Demand	3	3	4	5	6	

- (b) Explain the branch and bound method for solving an Integer Programming Problem. [5] (CO#2)[B3]

3. (a) Explain the following terminologies used in dynamic programming:
 (i) Stage (ii) State (iii) Decision variables (iv) Criterion of effectiveness.
 Also, describe the process of backward recursion. [5] (CO#1)[B3]
 (b) Obtain the optimal point of U and check its nature, where
 $U = x^2 + y^2 + z^2 + x - 2z - xy$ [5] (CO#3)[B3]

4. (a) Consider the following minimization problem.
 Minimize $U = x^2 + y^2 + z^2$;
 Subject to constraint: $4x - y + 2z = 8$
 Solve this using the Lagrange multiplier method. [5] (CO#4)[B3]

- (b) Explain the Random Search Technique for multi-variable non-linear programming problem. [5] (CO#1)[B2]

5. (a) Explain the steepest descent method for multi-variable unconstrained non-linear problems. [5] (CO#2)[B2]

- (b) Explain the procedure for any one of the nature-inspired techniques from GA/SA/ACO/PSO. [5] (CO#2)[B2]

6. (a) Discuss applications of optimization in the defence sector. [5](CO # 2)[B2]

- (b) Explain any one algorithm for multi-variable constrained optimization problems. [5](CO # 1)[B2]

7. Write short notes on any two topics out of the following:[5X2](CO # 1)[B1]

- [a] Dual Simplex method
- [b] Assignment model
- [c] KKT conditions
- [d] Classification of optimization techniques.

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END TERM EXAMINATION

November-2025

OMG-601 Geoinformatics and GNSS for Multidisciplinary
Engineering Solutions

Time: 3:00 Hours

Max. Marks: 50

Note : Answer any FIVE.

All questions carry equal marks.

Assume suitable missing data, if any.

- Q.1 a) Define Signals, Systems, Sampling, Quantization, Time and frequency domain Concept. [5][CO1]
b) Discuss different type of signals and with its graphs and its functions. [5][CO2]
- Q.2 a) How does trilateration work in determining a GPS receiver's position? Explain in details. [5][CO3]
b) A GPS Receiver detects signals from four satellites at distance of 20,000, 20,100 and 20,300 kms. Estimate the Receiver's Position error (due to clock bias) if the speed of light is 3×10^8 km/s. [5][CO3]
- Q.3 a) Why does GPS use dual frequencies (L1 and L2)? How does it help in correcting ionospheric errors? [5][CO4]
b) What is the role of Doppler shift in GPS positioning? [5][CO4]
- Q.4 a) What is the Keplerian orbital model, and how does it describe GPS satellite motion? [5][CO5]
b) A GPS Satellite orbits at an altitude of 20,200 km with a velocity of 3.87 km/s. Calculate its orbital period using Kepler's third law [5][CO5]
- Q.5 a) What are the primary sources of error in GPS positioning? [5][CO6]
b) A GPS satellite has a clock drift of 10 nanoseconds. Calculate the error in distance measurement caused by drift. [5][CO6]

Q.6 Write notes (any two):

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[5x2] [CO1][CO2]

- a) Integration of Remote sensing, GIS and GNSS in sustainable infrastructure development
- b) Data models in GIS (Vector vs Raster)
- c) Spatial data acquisition methods

END SEMETER EXAMINATION

OEN-601 GREEN TECHNOLOGY & SUSTAINABILITY

Time: 01 Hour

Use of calculator is not permitted. All the answers must be written in the answer book only. No marks will be given for answers written on the question paper.

1. a. Describe the green revolution in respect of CO₂ K3
environmental degradation.
- b. Discuss the different configurations/units for urban CO₂ K3
stormwater treatment.
2. a. What are the key components of the technology? CO₂ K3
Which components have maximum environmental
consequences? Explain.
- b. What is 'industrial ecology'? How does industrial CO₂ K4
ecology help in minimising the environmental
effects? Discuss with suitable examples.
3. a. What is Environmental Leap frogging? Discuss its CO₂ K3
role towards achieving sustainability.
- b. What is atom economy? Discuss with suitable CO₂ K4
example.
4. Discuss the principles of green chemistry in respect CO₂ K3
of improving environmental quality.
5. a. Is domestic Reverse Osmosis-based water treatment CO₂ K4
a green technology? Discuss with suitable
justification.
- b. Discuss the role of solar energy in respect towards CO₂ K3
improving quality of life and environment in India.
6. 'ECO-SAN' has significantly improved the quality CO₂ K4
of living in rural areas. Discuss the green
technologies being used to manage waste and
improve environmental quality.
7. Delhi Technological University (DTU) has taken CO₂ K3
some green initiatives to manage the organic food
waste generated from the mess and canteen?
Describe, in detail, the technology being used for
treatment and management of food waste. What are
its environmental benefits? Explain.

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III SEMESTER

M.Tech

END TERM EXAMINATION

Dec-2025

COURSE CODE: OCS601/UEC601

COURSE TITLE: AI in Healthcare

Time: 03:00 Hours

Max. Marks: 50

Note : All questions carry equal marks.
Assume suitable missing data, if any.

Q.1

(a) Explain the different types of healthcare data: EHRs, medical images, physiological signals, and genomics. For each data type, describe one real-world application and the challenges associated with using it for AI-based decision-making.

(b) A diagnostic model produced the following results on a test set of 200 patients: True Positives (TP) = 56, False Positives (FP) = 12, True Negatives (TN) = 110, False Negatives (FN) = 22

Compute:

- Sensitivity
- Specificity
- Precision
- F1-Score
- AUC (Assume the model's ROC points are (0,0), (0.1,0.7), (0.3,0.85), (1,1); compute AUC using trapezoidal rule)

Interpret what these metrics imply for clinical deployment.

[4+6=10M][CO1][BTL4]

Q.2

(a) Discuss the importance of handling imbalanced, missing, and longitudinal healthcare data. Provide two techniques for each challenge and explain why they are crucial in a medical context.

(b) A hospital dataset contains 25,000 patient records; disease prevalence is 3.5%.

- Compute the number of positive and negative samples.
- If SMOTE is applied to balance the dataset, calculate the number of synthetic samples required.
- Explain how domain adaptation helps when training on Hospital A's data but testing on Hospital B's data.

[4+6=10M][CO2][BTL4]

Q.3

(a) Explain the architecture and working of U-Net and ResNet for medical imaging tasks. Compare their strengths for segmentation vs. classification.

(b) An MRI image of size 512×512 is processed through a CNN with:

- i. Conv layer (stride = 2)
- ii. Max-pool layer (stride = 2)
- iii. Conv layer (stride = 2)
- iv. Upsampling layer (scale factor = 2)
- v. Conv layer (stride = 1)

Compute the feature map dimensions after every step. Show calculations clearly. [4+6=10M][CO3][BTL4]

Q.4

(a) Explain the working of clinical NLP pipelines including de-identification, NER, entity linking, and clinical summarization. How do BioBERT, ClinicalBERT, and GPT-based models improve the quality of these tasks?

(b) Given the following ECG samples recorded at 250 Hz:

0.22, 0.24, 0.31, 0.47, 0.63, 0.58, 0.49, 0.38, 0.29, 0.21, 0.18

Perform:

- i. 5-point moving average smoothing
- ii. Compute the heart rate (in BPM) if R-peaks occur at sample indices 50 and 300

Explain how such preprocessing and peak detection are used in automated ECG diagnosis. [4+6=10M][CO4][BTL4]

Q.5

(a) Discuss major ethical concerns in AI-driven healthcare, including bias, fairness, privacy, algorithmic accountability, and regulatory compliance. Use a real-world failure case of an AI system to support your argument.

(b) Explain the working of SHAP or LIME with a detailed example (EHR-based or imaging-based).

Describe how such explainability methods help:

- Improve physician trust
- Support clinical decision making
- Meet regulatory requirements (HIPAA/GDPR/FDA)

[4+6=10M][CO5][BTL5]

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III-SEMESTER

M.Tech. (OBT:-Industrial Biotechnology)

OBT-601 HUMAN NUTRITION

END SEMESTER EXAMINATION

DEC-2025

Time: 3:00 Hours

Max. Marks: 50

Note: Answer all questions. Assume suitable missing data, if any.

Q1. Answers all questions. [3x5]

(CO# 1,2,4)

- a) Write down the different types of carbohydrates?
- b) Describe the importance of calcium and phosphorus in the human body
- c) List and describe the major nutrients required by the human body along with their energy values
- d) Write short note on Body Mass Index (BMI)
- e) Write short note on calorific value

Q.2 Answers any two. [2x5]

(CO# 2,4)

- a) Explain in detail why a balanced diet is essential for maintaining overall health.
- b) Describe how amino acids acts as building blocks of proteins

OR

- a) Describe major disorders related to carbohydrate metabolism with suitable examples.
- b) Explain the function and dietary requirement of protein. Discuss any two methods of measurement of proteins.

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Q3. Answers any two [2x5]

(CO# 3,4)

- a) Discuss about the major minerals and vitamins highlighting their sources, functions, and importance
- b) Explain the significance of lipids in the human body

OR

- a) Describe the importance of water in the human body and explain its roles.
- b) Discuss the essential fatty acids, explain their sources, functions and importance.

Q4. Answer all questions. [2x5]

(CO# 1,4)

- a) What is Glycemic index of food, how is it measured. Also explain its significance in health management.
- b) Write down the different types of micro and macro minerals, their dietary sources, recommended intake, and physiological roles.

Q5. Answers any one [1x5]

(CO# 5)

- a) Write a comprehensive note on the difference between fat-soluble and water-soluble vitamins.

OR

- a) Explain any two diseases caused by vitamin deficiency, explain its causes and symptoms.

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END SEMESTER

M.Tech.

END TERM EXAMINATION

November-2025

OCE601 Economic & Social Resilience Through Sustainable Infrastructure

Time: 3:00 Hours

Max. Marks: 50

Note : Answer any FIVE.

All questions carry equal marks.

Assume suitable missing data, if any.

- Q.1 a) Define Sustainable Development Goals (SDGs). How SDG establish framework for developing resilient infrastructure. [5][CO1]
- b) Discuss the role of policy and governance in steering sustainable infrastructure development. [5][CO2]
- Q.2 a) Differentiate between the concepts of 'recovery' and 'resilience' within the context of post-disaster infrastructure management. [5][CO3]
- b) What is 'Functional Interdependencies Analysis' in urban subsystems? Provide one relevant example. [5][CO3]
- Q.3 a) Elaborate on the economic principles of land use planning and their importance in fostering resilient cities. [5][CO4]
- b) Name and briefly describe two modelling tools used for risk and resilience analysis of infrastructure systems. [5][CO4]
- Q.4 a) Discuss the interrelationship between disaster, society, and infrastructure providing one illustrative example for each intersecting case. [5][CO5]
- b) Explain the concept of the "resilience gap" in the context of infrastructure systems. [5][CO5]

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Q.5 a) Analyse the influence of policy and governance on the trajectory of sustainable infrastructure development. [5][CO6]

b) How does the socio-economic profile of a community determine its vulnerability and resilience to infrastructural failures? [5][CO6]

Q.6 Write notes (any two):

[5x2] [CO1][CO2]

- a) Land use planning and its significance
- b) Interrelationship between disaster, society, and infrastructure
- c) Public-Private Partnerships (PPPs)'s role in achieving SDGs