Reg. No										

AY 24

Gandhi Institute of Engineering and Technology University, Odisha, Gunupur
(GIET University)

M.Tech. (First Semester – Regular/Supplementary) Examinations, January – 2026

24MECPE11021– Cognitive Radio

Time: 3 hrs Maximum: 60 Marks

Answer ALL questions
(The figures in the right hand margin indicate marks)

PART – A **(2 x 5 = 10 Marks)**

Q.1. Answer ALL questions		CO #	Blooms Level
a.	What is spectrum sensing? Mention its objective.	CO1	K2
b.	What is a geo-location database in TVWS operation?	CO2	K1
c.	Mention two typical constraints in dynamic spectrum allocation.	CO3	K1
d.	State one challenge in centralized DSA.	CO4	K2
e.	Mention one challenge in spectrum trading implementation.	CO5	K2

PART – B **(10 x 5 = 50 Marks)**

Answer ALL the questions		Marks	CO #	Blooms Level
2. a.	Describe spectrum sensing, spectrum analysis, and spectrum decision stages. Explain the inputs/outputs of each stage.	5	CO1	K3
b.	Explain the main hardware and software components of a CR transceiver and their roles in reconfigurability.	5	CO1	K2
	(OR)			
c.	Discuss design requirements for a CR (agility, reliability, interference avoidance, security). Propose suitable design measures.	5	CO1	K5
d.	Write short notes on any two cognitive radio applications (e.g., public safety, rural broadband, IoT) and justify suitability.	5	CO1	K4
3.a.	Derive/Explain key performance metrics for sensing: probability of detection (Pd), probability of false alarm (Pfa), and miss detection.	5	CO2	K3
b.	Explain geo-location database–assisted spectrum access for TVWS. Discuss benefits, limitations, and regulatory aspects.	5	CO2	K4
	(OR)			
c.	Discuss spectrum sharing business models: spectrum commons vs real-time secondary spectrum market. Compare incentives and risks.	5	CO2	K5
d.	Design a simple sensing-and-sharing workflow for a community TVWS network using both sensing and database assistance.	5	CO2	K6
4.a.	Describe dynamic programming for sequential spectrum decision-making. Provide a stepwise solution outline for a multi-stage problem.	5	CO3	K3
b.	Explain stochastic programming for spectrum allocation under uncertain PU activity. Discuss scenario-based formulation.	5	CO3	K4
	(OR)			
c.	Compare LP, convex, non-linear, integer, dynamic, and stochastic programming for DSA in terms of solvability and use-cases.	5	CO3	K5
d.	Propose a hybrid optimization workflow for DSA combining sensing uncertainty and allocation fairness. Justify your design.	5	CO3	K6

5.a.	Discuss learning-based approaches for DSA (e.g., reinforcement learning, multi-armed bandits). Explain how learning improves access decisions.	5	CO4	K4
b.	Explain cognitive radio protocol stack considerations (PHY/MAC/routing) for dynamic spectrum management.	5	CO4	K4
	(OR)			
c.	Design a learning-based distributed protocol for channel selection among SUs. Provide states, actions, reward, and update rule conceptually.	5	CO4	K6
d.	Analyze key security and reliability issues in DSA (e.g., sensing attacks, selfish users). Suggest countermeasures.	5	CO4	K5
6.a.	Explain auction theory for spectrum allocation. Discuss bidder valuation, bidding strategy, and efficiency concepts.	5	CO5	K3
b.	Compare auction types: single vs double; concurrent vs sequential. Discuss when each is preferred in CR markets.	5	CO5	K3
	(OR)			
c.	Design a simple double-auction mechanism for secondary spectrum trading. Explain steps and how truthfulness/fairness can be encouraged.	5	CO5	K4
d.	Discuss practical issues in spectrum trading (regulation, collusion, interference externalities, transaction costs) and possible remedies.	5	CO5	K3

--- End of Paper ---