

**ARTIFICIAL INTELLIGENCE IN RADIO COMMUNICATION  
(ECEN 3221)**

**Time Allotted : 3 hrs**

**Full Marks : 70**

*Figures out of the right margin indicate full marks.*

*Candidates are required to answer Group A and  
any 5 (five) from Group B to E, taking at least one from each group.*

*Candidates are required to give answer in their own words as far as practicable.*

**Group – A  
(Multiple Choice Type Questions)**

1. Choose the correct alternative for the following: **10 × 1 = 10**
- (i) Which of the following is not a characteristic of flat fading?
    - (a) Mobile radio channel has constant gain
    - (b) Linear phase response
    - (c) Non-linear phase response
    - (d) Bandwidth is greater than the bandwidth of transmitted signal.
  - (ii) Flat fading channel is also known as which of the following?
    - (a) Amplitude varying channel
    - (b) Wideband channel
    - (c) Phase varying channel
    - (d) Frequency varying channel.
  - (iii) Which of the reception problems below that is not due to multipath?
    - (a) Delayed spreading
    - (b) Rayleigh fading
    - (c) Random Doppler shift
    - (d) Slow fading.
  - (iv) Which among the following options have forward error correction integrated into the demodulation process?
    - (a) Trellis code modulation
    - (b) Soft decoding
    - (c) Trellis code modulation and soft decoding
    - (d) Block codes.
  - (v) The sampling rate of promising SDR technology ranges between?
    - (a) 1 MHz – 100 MHz
    - (b) 10 MHz – 100 MHz
    - (c) 1 MHz – 1 GHz
    - (d) 1 MHz – 10 GHz.
  - (vi) Which of the following is not an advanced requirement in terms of Software Defined Radio?
    - (a) Adaptive networks
    - (b) Adaptive diversity
    - (c) Multiband
    - (d) Innovation signalling.
  - (vii) Smart antenna integrates the contributions of which of the following antenna elements?
    - (a) Band distributed
    - (b) Band centralized
    - (c) Spatially distributed
    - (d) Spatially centralized.



- (viii) Who is known as the -“Father of AI”?  
(a) Fisher Ada (b) Alan Turing  
(c) John McCarthy (d) Allen Newell.
- (ix) Which AI technique enables the computers to understand the associations and relationships between objects and events?  
(a) Heuristic Processing (b) Cognitive Science  
(c) Relative Symbolism (d) Pattern Matching.
- (x) Which of the following are the ways to achieve AI in real-life?  
(a) Machine Learning (b) Deep Learning  
(c) Both (a) & (b) (d) None of the above.

**Group – B**

2. (a) Define Artificial intelligence? List down some real time examples of artificial intelligence?  
(b) Discuss about simple GNU radio flow graph with proper block diagram?  
 $(2 + 4) + 6 = 12$
3. (a) Explain the importance of artificial intelligence? What are the benefits of using SDR?  
(b) What is the difference between software controlled radio and software defined radio?  
 $(4 + 4) + 4 = 12$

**Group – C**

4. (a) State the objectives that are served by cognitive engine design? Mention the basic three components required by cognitive radio actions?  
(b) Discuss the objective function dependencies with proper diagram and example?  
 $(2 + 3) + (6 + 1) = 12$
5. (a) Describe the actions of Mitola’s loop in cognitive engine with proper diagram?  
(b) Define objective space? Mention the dependencies and definition parameters of bandwidth?  
 $6 + (2 + 4) = 12$

**Group – D**

6. (a) Why genetic algorithms are used for radio optimization? State the steps of genetic algorithm?  
(b) How to develop a genetic algorithm to solve the knapsack problem?  
 $(2 + 4) + 6 = 12$



7. (a) Explain any one example of roulette wheel selection in a GA?
- (b) State the difference between exploitation and exploration with respect to search capabilities? Describe the files which provide the mechanism for genetic representation of radio platform capabilities?

**6 + (2 + 4) = 12**

**Group – E**

8. (a) Discuss the concept of distributed AI with proper example?
- (b) Explain in details about CWT's cognitive engine simulation implementation with proper block diagram?

**6 + 6 = 12**

9. Write short notes on any three of the following (4 marks each):-

**(3 × 4) = 12**

- (i) Cognitive radio networks
- (ii) CBDT
- (iii) WSGA
- (iv) Any one objective function in multi-objective optimization
- (v) Problem faced by SDR
- (vi) Artificial intelligence techniques.

Department & Section	Submission Link
CSE & ECE	<a href="https://classroom.google.com/w/Mjk5NTgzNzI5NzU0/tc/MzY0NTU3NDA2NzAx">https://classroom.google.com/w/Mjk5NTgzNzI5NzU0/tc/MzY0NTU3NDA2NzAx</a>