

B.E. / B.Tech. - DEGREE EXAMINATIONS, APRIL / MAY 2023

Fourth Semester

Artificial Intelligence and Data Science

20AIPC402 - BIOMEDICAL SIGNAL AND IMAGE PROCESSING

(Regulations 2020)

Duration: 3 Hours

Max. Marks: 100

**PART - A (10 × 2 = 20 Marks)**

Answer ALL Questions

- |  | <i>Marks,<br/>K-Level, CO</i> |
|--|-------------------------------|
| 1. Compare energy and power signals.                             | 2,K2,CO1                      |
| 2. Find the periodicity of $\cos(0.1\pi n)$ .                    | 2,K1,CO1                      |
| 3. Mention any four types of surface electrodes.                 | 2,K1,CO2                      |
| 4. What is the need of bio-signal amplifier?                     | 2,K1,CO2                      |
| 5. Distinguish between smoothing and sharpening filters.         | 2,K2,CO3                      |
| 6. What are the types of derivative filters in Image Processing? | 2,K1,CO3                      |
| 7. Mention the applications of image processing.                 | 2,K1,CO4                      |
| 8. How a digital image can be represented?                       | 2,K2,CO4                      |
| 9. Compare CT and MRI images with X-ray.                         | 2,K2,CO5                      |
| 10. What is image restoration?                                   | 2,K1,CO5                      |

**PART - B (5 × 13 = 65 Marks)**

Answer ALL Questions

11. a) (i) Examine whether the following systems are time invariant or not. 7,K3,CO1
- (a)  $y(t) = t x(t)$
- (b)  $y[n] = x(n) + nx(n-1)$
- (ii) What is the power and RMS value of the signal? 6,K3,CO1
- (a)  $(t) = e^{j\omega t} \cos \Omega_0 t$ .
- (b)  $(t) = 10 \cos 5t \cos 10t$ .

**OR**

- b) Check and classify whether the following systems are static/dynamic, linear/non-linear, time-invariant or time-variant, and causal or noncausal. 13,K3,CO1

(i)  $y(n) = 2x(n) + \frac{1}{x(n-1)}$

(ii)  $y(n) = x^2(n) + \frac{1}{x^2(n-1)}$

*K1 - Remember; K2 - Understand; K3 - Apply; K4 - Analyze; K5 - Evaluate; K6 - Create*

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12. a) Describe the different lead systems and standard 12 lead configurations in ECG Wave form recording. *13,K2,CO2*

**OR**

b) Design and explain the 10-20 electrode system used in EEG recording. *13,K2,CO2*

13. a) Explain about spatial enhancement techniques and Median filtering. *13,K2,CO3*

**OR**

b) Explain the various techniques in frequency domain to enhance an image with necessary examples. *13,K2,CO3*

14. a) (i) Give in detail about image acquisition system. *7,K2,CO4*  
(ii) Illustrate how the image is digitized by sampling and quantization process. *6,K2,CO4*

**OR**

b) Explain the method to obtain DFT from the continuous transform of a sampled function. *13,K2,CO4*

15. a) Explain in detail about watershed algorithm with suitable diagrams. *13,K2,CO5*

**OR**

b) What is the objective of image segmentation? Explain any one of the region-based image segmentation technique in detail. Mention two applications of image segmentation. *13,K2,CO5*

**PART - C (1 × 15 = 15 Marks)**

16. a) Draw and explain the working principle of 3 D ultrasound imaging technique. *15,K2,CO6*

**OR**

b) Describe the recording setup used in EMG with neat diagram. *15,K2,CO6*