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SEVENTH SEMESTER **B. Tech (E&C)[Even]**
SUPPLEMENTARY EXAMINATION **FEB-2019**

CEC-411 Biomedical Signal & Image Processing

TIME: 03 Hrs **Maximum Marks: 50**

Note:
1) **Attempt any FIVE questions.**
2) **Assume suitable missing data, if any.**

Q.1
[a] Plot the graph of a normal ECG with different peaks, segments and intervals. Write the values of different segments and intervals of standard ECG. (6)

[b] Explain the baseline wander and power line interference artifacts of ECG. (4)

Q.2
[a] Draw different sub-bands of EEG waveform. Explain the different types of EEG. (5)

[b] Explain the internal and external artifacts of EEG and their effects on EEG waveform. (5)

Q.3
[a] What are the different steps of EMD? What is the most commonly used stopping criterion for EMD? (5)

[b] What are the limitations of EMD and EEMD methods? Explain CEEMD in detail with required steps/formulas. (5)

Q.4
[a] What are the applications of morphological operators in image processing? How selection of SE affects biomedical signal denoising performance? (4)

[b] Calculate Dilation and Erosion operations for given A and B. (6)

$$A = \begin{bmatrix} 0 & 1 & 0 & 0 \\ 1 & 0 & 0 & 1 \\ 0 & 0 & 1 & 0 \\ 0 & 1 & 0 & 0 \end{bmatrix} \qquad B = \begin{bmatrix} 1 & 0 & 0 \\ 0 & 0 & 1 \\ 0 & 1 & 0 \end{bmatrix}$$

Q.5

[a] What are the limitations of WT and STFT? How is Wavelet Transform (WT) used to overcome limitations of FT and STFT? (5)

[b] What is function of thresholding technique in DWT? What are the different types of thresholding technique? Explain. (5)

Q.6

[a] Write short note on followings :- (3 + 3 = 6)

i. Use of multi-frame averaging for noise minimization
ii. Transformation of signal dependent noise to signal independent noise

[b] What are the different signal dependent noises in biomedical signals? Explain Poisson Noise and its effect on biomedical images. (4)