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B.M.S. College of Engineering, Bengaluru-560019

Autonomous Institute Affiliated to VTU

June / July 2024 Semester End Main Examinations

Programme: B.E. **Semester: VI**
Branch: Medical Electronics **Duration: 3 hrs.**
Course Code: 19ML6PE3CD **Max Marks: 100**
Course: Clinical Data Analytics

Instructions: 1. Answer any FIVE full questions, choosing one full question from each unit.
2. Missing data, if any, may be suitably assumed.

Important Note: Completing your answers, compulsorily draw diagonal cross lines on the remaining blank pages. Revealing of identification, appeal to evaluator will be treated as malpractice.

UNIT - I

1 a) List the characteristics of mean median and the mode. **06**

b) In a certain population 10 percent of the population is color blind. If random sample of 25 people is drawn from this population find the probability that **06**

i. Five or fewer will be color blind
ii. Six or more will be color blind
iii. Between six or nine inclusive will be color blind

c) A medical research team wished to evaluate proposed screening test for Alzheimer's disease. The test was given to random sample of 450 patients with Alzheimer's disease and independence random sample of 500 patients without symptoms of the disease. The two samples were drawn from populations of subject who were 65 years of age or older. Assume 11.3%of the population has the disease. **08**

	Alzheimer's Diagnosis		
Test Result	Yes(D)	No $(\overline{D})$	total
Positive (T)	436	5	441
Negative $(\overline{T})$	14	495	509
Total	450	500	950

Calculate the following for the given data

i. Sensitivity
ii. Specificity
iii. Positive predictive value
iv. Negative predictive value

OR

2 a) The heights of a certain population of individuals are approximately normally distributed with mean of 70 inches and std. deviation of 3 inches. What is the probability that a person picked randomly from this group will be between 65 and 74 inches tall. **08**

b) Discuss the properties of t-distribution. **05**

c) For a certain type of client the average length of home visits by nurse is 45 minutes with std. deviation of 15 mins. For another client the average home visit is 30 minutes along with std. deviation of 20 mins. If nurse randomly visits 35 clients from first population and 40 from second population what is the probability that average length of home visit between the two groups by 20 or more minutes. **07**

UNIT - II

3 a) Discuss the basic principles of experimental design. **10**

b) What are the various methods to reduce experimental error. **10**

UNIT - III

4 a) Researchers wish to know if the data gathered provide sufficient evidence to indicate a difference in mean serum uric acid levels between normal and individuals with Down's syndrome. Serum uric acid from 12 individuals with Down's syndrome and 15 normal individuals was collected. The means are, $\overline{x_1}$=4.5mg/100ml and $\overline{x_2}$=3.4mg/100ml **10**

b) List and explain each step in the ten-step hypothesis testing procedure. **10**

UNIT - IV

5 a) For the given data find out whether the means of three samples differ significantly or not? **10**

Sample1	Sample2	Sample3
20	19	13
10	13	12
17	17	10
17	12	15
16	9	5

b) Discuss the criteria for using the Wilcoxon signed rank test. Also explain assumptions, test statistics and critical value considerations for this test. **10**

UNIT - V

6 a) The height and body weight of ten males are given below. Calculate the correlation coefficient and value of 't' to find out the level of significance. **13**

Individual	1	2	3	4	5	6	7	8	9
Height	65	68	62	70	65	72	67	66	68
weight	128	140	120	152	138	160	135	130	125

b) What do you mean by regression? What is the difference in correlation and regression? **07**

OR

7 The following data was recorded on the no. of flowers and no. of seeds per plant in one of the varieties of lentil. Calculate the regression coefficient and find out its significance **20**

No. of flowers	22	24	25	11	12	9	13	14	15	16
No.of seeds	40	42	45	66	55	60	70	75	62	70

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B.M.S. College of Engineering, Bengaluru-560019

Autonomous Institute Affiliated to VTU

June / July 2024 Semester End Main Examinations

Programme: B.E. **Semester: VI**
Branch: Institutional Elective **Duration: 3 hrs.**
Course Code: 22MD6OE1ER / 19ML6OE1ER **Max Marks: 100**
Course: ERGONOMICS

Instructions: 1. Answer any FIVE full questions, choosing one full question from each unit.
2. Missing data, if any, may be suitably assumed.

Important Note: Completing your answers, compulsorily draw diagonal cross lines on the remaining blank pages. Revealing of identification, appeal to evaluator will be treated as malpractice.

				CO	PO	Marks
			UNIT - I			
1	a)		With suitable diagrams explain the anatomy of the spine and pelvis related to the posture.	*CO1*	*PO2*	**10**
	b)		With the help of neat sketch, explain the general approach to the human-machine model.	*CO1*	*PO1*	**10**
			UNIT - II			
2	a)		Summarize on workspace design faults that increase postural stress in standing workers.	*CO2*	*PO2*	**10**
	b)		Describe the main components of the Armstrong model for the development of work related upper body musculoskeletal diseases.	*CO2*	*PO1*	**10**
			OR			
3	a)		Discuss the anatomy and physiology of standing.	*CO2*	*PO2*	**10**
	b)		Discuss methods of reducing shoulder stress.	*CO2*	*PO1*	**10**
			UNIT – III			
4	a)		Define “Heat illnesses” and narrate on the same with the conditions that can arise when the body is unable to cope with thermoregulatory challenges.	*CO3*	*PO2*	**10**
	b)		Elaborate on the basic steps involved in heat stress management.	*CO3*	*PO1*	**10**
			UNIT – IV			
5	a)		Elaborate on the factors to be considered for visual comfort and to meet visual demands in the design of lighting.	*CO4*	*PO2*	**10**
	b)		Describe the structure and function of the eye. How can this information be used to analyze practical visual problems in the workplace?	*CO4*	*PO2*	**10**

			UNIT – V			
	6	a)	Elaborate on Implementation modes for human–computer interaction.	*CO2*	*PO2*	**10**
		b)	List basic steps in the management of industrial noise exposure.	*CO2*	*PO1*	**05**
		c)	Discuss the characteristics of reverberation in rooms	*CO2*	*PO2*	**05**
			OR			
	7	a)	Define task analysis. Explain the procedure for carrying out a task analysis.	*CO2*	*PO2*	**10**
		b)	Discuss the various guidelines for the visual design of VDU tasks.	*CO2*	*PO1*	**10**

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June / July 2024 Semester End Main Examinations

Programme: B.E. **Semester: VI**
Branch: Medical Electronics Engineering **Duration: 3 hrs.**
Course Code: 22MD6PCBSP / 19ML6PCBSP **Max Marks: 100**
Course: Biomedical Signal Processing

Instructions: 1. Answer any FIVE full questions, choosing one full question from each unit.
2. Missing data, if any, may be suitably assumed.

Important Note: Completing your answers, compulsorily draw diagonal cross lines on the remaining blank pages. Revealing of identification, appeal to evaluator will be treated as malpractice.

			UNIT - I	*CO*	*PO*	Marks
1	a)		Under what conditions adaptive filters are preferred? Explain the working principle of Adaptive filter Noise Canceler.	*CO1*	*PO3*	**10**
	b)		Narrate the kinds of interferences in the biomedical signals. Propose and explain a time domain filters to remove those interference.	*CO2*	*PO3*	**10**
			UNIT - II			
2	a)		What is the need of data Compression for biomedical signals? Compare between Lossy and lossless data compression techniques.	*CO2*	*PO2*	**08**
	b)		In detail explain the Turning point algorithm used for biomedical data. What are the advantages of this algorithm over other methods?	*CO2*	*PO2*	**12**
			OR			
3	a)		With a Flow chart Illustrate the AZTEC Compression Algorithm and its application.	*CO3*	*PO3*	**12**
	b)		Justify the need of typical averaging principle with a case study and list the limitations of signal averaging.	*CO4*	*PO3*	**08**
			UNIT - III			
4	a)		Compare and contrast different types of ECG QRS detection techniques. Discuss a QRS detection by differential method.	*CO3*	*PO3*	**12**
	b)		What do you mean by arrhythmia? With relevant block diagram, explain portable arrhythmia monitoring system.	*CO3*	*PO3*	**08**
			UNIT - IV			
5	a)		Explain the different EEG components with reference to frequency range and its significance.	*CO3*	*PO3*	**10**
	b)		Illustrate the application of Linear prediction theory in a Biomedical Signal analysis.	*CO3*	*PO3*	**10**

			UNIT - V			
	6	a)	Illustrate Morphological analysis of ECG waves	*CO3*	*PO3*	**10**
		b)	Discuss the Hypnogram model parameters applicable in Sleep studies.	*CO3*	*PO3*	**10**
			OR			
	7	a)	Discuss in brief the characteristics of different stages of sleep.	*CO3*	*PO3*	**10**
		b)	Explain the principle for detection of the P wave in an ECG signal.	*CO3*	*PO3*	**10**

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Autonomous Institute Affiliated to VTU

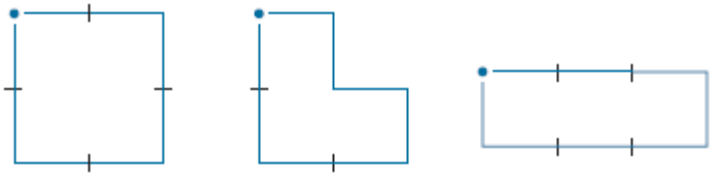
June / July 2024 Semester End Main Examinations

Programme: B.E. **Semester: VI**
Branch: Medical Electronics Engineering **Duration: 3 hrs.**
Course Code: 22MD6PCMIP / 19ML6PCMIP **Max Marks: 100**
Course: MEDICAL IMAGE PROCESSING

Instructions: 1. Answer any FIVE full questions, choosing one full question from each unit.
2. Missing data, if any, may be suitably assumed.

Important Note: Completing your answers, compulsorily draw diagonal cross lines on the remaining blank pages. Revealing of identification, appeal to evaluator will be treated as malpractice.

			UNIT - I	*CO*	*PO*	Marks
1	a)		Discuss the simple image formation model.	*CO1*	*PO1*	**04**
	b)		Identify and explain the objectives of biomedical image analysis.	*CO1*	*PO1*	**08**
	c)		Derive the equations to convert colours from HSI to RGB color model	*CO1*	*PO1*	**08**
			UNIT - II			
2	a)		Analyse the application of the following point processes i) Image Negative ii) Log Transformation iii) Contrast Stretching	*CO2*	*PO2*	**12**
	b)		For the given 4X4 image having gray scales between [0,9],find the histogram equalized image and draw the histogram of the image before and after equalization. 2 3 3 2 4 2 4 3 3 2 3 5 2 4 2 4 Fig Q2.b	*CO2*	*PO2*	**08**
			OR			
3	a)		Justify the following statement ”Histogram gives an insight about the contrast of an image”.	*CO2*	*PO2*	**06**
	b)		Discuss the first order derivatives for image sharpening.	*CO2*	*PO2*	**06**
	c)		Specify the significance of bit planes and compute the bit planes for the image segment shown in fig Q3.c.	*CO2*	*PO2*	**08**

			0 10 50 100 50 95 150 200 110 150 190 210 175 210 255 110 FigQ3.c			
			UNIT - III			
4	a)	Summarize the steps that has to be followed to perform filtering in frequency domain.	*CO2*	*PO2*	**06**
	b)	Explain ideal, butterworth and Gaussian highpass filters w.r.t. frequency domain with relevant equation.	*CO2*	*PO2*	**06**
	c)	Propose a technique to improve the appearance of an image by simultaneous intensity range compression and contrast enhancement in the frequency domain.	*CO2*	*PO2*	**08**
		UNIT - IV			
5	a)	Elaborate on image restoration by employing mean and order statistics filters in the spatial domain.	*CO2*	*PO2*	**12**
	b)	Derive a minimum mean square error filter to restore an image.	*CO2*	*PO2*	**08**
		UNIT - V			
6	a)	Enumerate the rules that need to be followed while partitioning a spatial region R occupied by an image into n sub-regions.	*CO2*	*PO2*	**05**
	b)	Choose a technique to detect lines in an image.	*CO2*	*PO2*	**06**
	c)	For the figures shown in FigQ6.c i) What is the order of the shape number? ii) Obtain the shape number.  FigQ6.c	*CO2*	*PO2*	**09**
		OR			
7	a)	Summarize the Otsu's optimal thresholding algorithm.	*CO2*	*PO2*	**07**
	b)	Illustrate the region growing segmentation algorithm by an example.	*CO2*	*PO2*	**06**
	c)	Specify the significance of basic boundary descriptors.	*CO2*	*PO2*	**07**

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June / July 2024 Semester End Main Examinations

Programme: B.E. **Semester: VI**
Branch: Medical Electronics Engineering **Duration: 3 hrs.**
Course Code: 22MD6PCMLM **Max Marks: 100**
Course: Machine Learning for Medical Engineering

Instructions: 1. Answer any FIVE full questions, choosing one full question from each unit.
2. Missing data, if any, may be suitably assumed.

Important Note: Completing your answers, compulsorily draw diagonal cross lines on the remaining blank pages. Revealing of identification, appeal to evaluator will be treated as malpractice.

			UNIT - I	*CO*	*PO*	Marks
1	a)		Are dictionary same as functions in python? Justify your answer with an example.	*CO1*	*PO1*	**10**
	b)		Illustrate the lifecycle of data science with the help of a neat diagram.	*CO1*	*PO1*	**10**
			UNIT - II			
2	a)		Differentiate Regression and Classification with an example.	*CO3*	*PO3*	**10**
	b)		How do you ensure the performance of classification is better with the imbalanced dataset? Explain with pseudocode.	*CO3*	*PO3*	**10**
			UNIT - III			
3	a)		Elucidate the types of cost functions to evaluate the linear models with appropriate formulas	*CO3*	*PO3*	**10**
	b)		Differentiate between Bagging and boosting in Ensemble learning?	*CO2*	*PO2*	**10**
			UNIT - IV			
4	a)		What is a confusion matrix? derive different performance metrics from the confusion matrix of a binary classifier.	*CO2*	*PO2*	**10**
	b)		Implement Naive bayes algorithm for classification using Python.	*CO3*	*PO3*	**10**
			OR			
5	a)		Write pseudocode to depict the use of naive Bayes for email spam filters.	*CO3*	*PO3*	**10**
	b)		Explain the following feature selection methods used in machine learning ● Recursive feature elimination (RFE) ● LASSO Regularization L1	*CO2*	*PO2*	**10**

			UNIT - V			
	6	a)	"The SHAP library offers different visualizations". Describe them.	*CO2*	*PO2*	**10**
		b)	What is IaaS, PaaS, and SaaS?	*CO2*	*PO2*	**05**
		c)	Explain criteria to consider when designing the Machine learning system architecture	*CO1*	*PO1*	**05**
			OR			
	7	a)	Explain the difference between ELI5 and Skater.	*CO2*	*PO2*	**10**
		b)	What are the PROs of using Joblib compared to Pickle.	*CO2*	*PO2*	**05**
		c)	Summarize the constituents of Explainable AI?	*CO2*	*PO2*	**05**

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June / July 2024 Semester End Main Examinations

Programme: B.E. **Semester: VI**
Branch: Medical Electronics Engineering **Duration: 3 hrs.**
Course Code: 22MD6PE2CD **Max Marks: 100**
Course: CLINICAL DATA ANALYTICS

Instructions: 1. Answer any FIVE full questions, choosing one full question from each unit.
2. Missing data, if any, may be suitably assumed.

		UNIT - I	CO	PO	Marks
1	a)	A researcher studied 8 HIV-positive patients who were treated with highly active antiretroviral therapy for at least 6 months. The CD4 T cell counts (X 10^6 /L) at baseline for the 8 subjects are listed below. 1: 172.5; 2: 216.63; 3: 212.62; 4: 98.97; 5: 66.95; 6: 239.76; 7: 19.57; 8: 195.72 Compute i) the mean ii) the median iii) the mode iv) the range v) standard deviation and vi) C.V.	CO1	PO3	06
	b)	List, describe and compare the four measurement scales.	CO1	PO3	06
	c)	The following table shows the number of hours 45 hospital patients slept following the administration of a certain anesthetic. 7 10 12 4 8 7 3 8 5 12 11 3 8 1 1 13 10 4 4 5 5 8 7 7 3 2 3 8 13 1 7 17 3 4 5 5 3 1 17 10 4 7 7 11 8 From these data construct: i) A Frequency distribution ii) A relative frequency distribution iii) A histogram iv) A frequency polygon	CO1	PO3	08
		OR			
2	a)	Sample of birth weights (g) of live-born infants born at a private hospital in Delhi, during a 1-week period is given in the table below. Calculate Mean, Median and Mode. i: 1; xi: 3265; i: 6; xi: 3323; i: 11; xi: 2581; i: 16; xi: 2759	CO1	PO3	06

2	3200	7	3649	12	2841	17	3248	
3	3245	8	3200	13	3609	18	3314	
4	3484	9	3031	14	2838	19	3101	
5	4146	10	2069	15	3541	20	2834	

	b)	In a study by few researchers, patients who were involved in problem gambling treatment were asked about co-occurring drug and alcohol addictions. Let the discrete random variable X represent the number of co-occurring addictive substances used by the subjects. The following table summarizes the frequency distribution for this random variable. Number of co-occuring Additive Substances Used by Patients in Selected Gambling Programs Construct a table of the relative frequency and the cumulative frequency for this discrete distribution.	***CO1***	***PO3***	**06**
	c)	David et al. examined glomerular filtration rate (GFR) in pediatric renal transplant recipients. GFR is an important parameter of renal function assessed in renal transplant recipients. The following are measurements from 19 subjects of GFR measured with diethylenetriamine pentaacetic acid. (Note: some subjects were measured more than once) 18 21 21 23 27 27 30 32 32 32 36 37 41 42 42 43 43 48 48 51 55 58 60 62 67 68 88 63 Construct a box-and-whisker plot.	***CO1***	***PO3***	**08**
		UNIT - II			
3	a)	Based on data collected by the National Center for Health Statistics and made available to the public in the Sample Adult database, an estimate of the percentage of adults who have at some point in their life been told they have hypertension is 23.54 percent. If we select a simple random sample of 20 Indian adults and assume that the probability that each has been told that he or she had hypertension is 0.24, find the probability that the number of people in the sample who have been told that they have hypertension will be: i)exactly three	***CO2***	***PO3***	**06**

Number of Substances Used	Frequency
0	144
1	342
2	142
3	72
4	39
5	20
6	06
7	09
8	02
9	01
Total	777

			ii)three of more iii) Fewer than three iv)Between three and seven, inclusive follows a binomial distribution.			
		b)	In a certain population an average of 13 new cases of esophageal cancer are diagnosed each year. If the annual incidence of esophageal cancer follows a Poisson distribution, find the probability that in a given year the number of newly diagnosed cases of esophageal cancer will be: i)exactly 10 ii)At least eight iii)No more than 12 iv)Fewer than seven	***CO2***	***PO3***	**06**
		c)	For a subject (39-year-old male) in the study by Donald et al., acetone levels were normally distributed with a mean of 870 and a standard deviation of 211 ppb. Find the probability that on a given day the subject's acetone level is: i) Between 600 and 1000 ppb ii) Over 900 ppb iii)Under 500 ppb iv)Between 900 and 1100 ppb	***CO2***	***PO3***	**08**
			UNIT - III			
	4	a)	If the mean and standard deviation of serum iron values for healthy men are 120 and 15 micrograms per 100ml, respectively, what is the probability that a random sample of 50 normal men will yield a mean between 115 and 125 micrograms per 100 ml.?	***CO2***	***PO3***	**07**
		b)	Suppose it has been established that for a certain type of client the average length of a home visit by a public health nurse is 45 minutes with a standard deviation of 15 minutes, and that for a second type of client the average home visit is 30 minutes long with a standard deviation of 20 minutes. If a nurse randomly visits 35 clients from the first and 40 from the second population, what is the probability that the average length of home visit will differ between the two groups by 20 or more minutes.	***CO2***	***PO3***	**07**
		c)	Blanche Mikhail studied the use of prenatal care among low-income Indo-American women. She found that only 51 percent of these women had adequate prenatal care. Let us assume that for a population of similar low income Indo-American women, 51 percent had adequate prenatal care. If 200 women from this population are drawn at random, what is the probability that less than 45 percent will have received adequate prenatal care?	***CO2***	***PO3***	**06**
			OR			
	5	a)	What is a sampling distribution and the steps to construct a sampling distribution.	***CO2***	***PO3***	**06**
		b)	In a survey report 28% of the subjects self-identifying as white said they had experienced lower back pain during the three months	***CO2***	***PO3***	**07**

			prior to the survey. Among subjects of Himalayan origin, 21 % reported lower back pain. Let us assume that 0.28 and 0.21 are the proportions for the respective races reporting lower back pain in India. What is the probability that independent random samples of size 100 drawn from each of the populations will yield a value of $\hat{p}_1 - \hat{p}_2$ as large as 0.10?			
		c)	The 2023 National Health Interview Survey, researchers found that among Indian adults ages 75 or older, 34 percent had lost all their natural teeth and for Indian adults ages 65-74,26 percent had lost all their natural teeth. Assume that these proportions are the parameters for the Indians in those age groups. If a random sample of 250 adults ages 65-74 and an independent random sample of 200 adults ages 45-64 years old are drawn from these populations, Find the probability that the difference in percent of total natural teeth loss is less than 5 percent between the two populations.	***CO3***	***PO3***	**07**
			UNIT - IV			
	6	a)	What are the steps in the procedure of testing the hypothesis?	***CO3***	***PO3***	**10**
		b)	The average weight of all residents in Bangalore city is 168lbs.A nutritionist believes the true mean to be different. She measured the weight of 36 individuals and found the mean to be 169.5lbs with a standard deviation of 3.9. i) State the null and alternative hypothesis. ii) At a 95% confidence level is there enough evidence to discard the null hypothesis.	***CO3***	***PO3***	**10**
			UNIT - V			
	7	a)	What is meant by regression? Mention its types in detail. And explain the procedure of linear regression analysis method.	***CO4***	***PO3***	**10**
		b)	Calculate the correlation coefficient between the height of the father and the son in the given data. Test the significance of correlation coefficient and interpret the results.	***CO4***	***PO3***	**10**

Height of Father	65	66	57	67	68	69	70	72
Height of son	67	56	65	68	72	72	69	71

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