# Question Bank BMI-II May 2022

| Q1. | **Choose the correct option for following questions. All the Questions are compulsory and carry equal marks** |
|---|---|
| | |
| 1. | The y-axis on an audiogram is |
| Option A: | Decibels |
| Option B: | Voltage |
| Option C: | Current |
| Option D: | Frequency |
| | |
| 2. | The frequency band of Alpha (α) wave of EEG is |
| Option A: | 4–8 Hz |
| Option B: | 8–13 Hz |
| Option C: | 13–22 Hz |
| Option D: | 22–30 Hz |
| | |
| 3. | 10-20 electrode configuration is used to pick _____ signal |
| Option A: | ECG |
| Option B: | EMG |
| Option C: | EEG |
| Option D: | EOG |
| | |
| 4. | When the conduction impulse bypasses the AV node it results into |
| Option A: | Premature ventricular contraction (PVC) |
| Option B: | Myocardial Infarction |
| Option C: | Atrial fibrillation |
| Option D: | Ventricular fibrillation |
| | |
| 5. | The frequency range of ECG signal is |
| Option A: | 0.05 to 120 Hz |
| Option B: | 5 to 2000 Hz |
| Option C: | 0.1 to 100 Hz |
| Option D: | dc to 100 Hz |
| | |
| 6. | Air conduction and bone conduction thresholds are determined using |
| Option A: | pure tone audiometry |
| Option B: | speech audiometry |
| Option C: | loud speaker |
| Option D: | Microphone |
| | |
| 7. | The threshold of perception of electric shock is about. |
| Option A: | 1 mA |
| Option B: | 1 A |
| Option C: | 6 mA |
| Option D: | 6 A |
| | |
| 8. | The magnitude of the voltage picked in an electromagnetic blood flow meter is given by e = CHVd where C is |

| | |
|---|---|
| Option A: | strength of the magnetic field |
| Option B: | velocity of blood flow |
| Option C: | diameter of the blood vessel |
| Option D: | constant of proportionality |
| | |
| 9. | The range of foetal heart rate is |
| Option A: | 50 to 70 bpm |
| Option B: | 70 to 110 bpm |
| Option C: | 110 to 180 bpm |
| Option D: | 180 to 220 bpm |
| | |
| 10. | Cardiac output is defined as the product of ---------- |
| Option A: | Stroke volume and heart rate |
| Option B: | End systolic volume and heart rate |
| Option C: | tidal volume and respiration rate |
| Option D: | End diastolic volume and heart rate |
| | |
| 11. | Which of this is a unipolar Lead Configuration in ECG? |
| Option A: | Lead-I |
| Option B: | Lead-II |
| Option C: | Lead-III |
| Option D: | aVR |
| | |
| 12. | Which of this is a preferred choice of Electrode for ECG Recording |
| Option A: | Limb Electrodes |
| Option B: | Suction Cup Electrodes |
| Option C: | Needle Electrodes |
| Option D: | Disposable Floating Electrodes |
| | |
| 13. | What is function of Arrhythmia Monitor? |
| Option A: | Give stimulating pulse to SA Node |
| Option B: | Scan ECG pattern and issue alarm |
| Option C: | Give High Energy shock to patient |
| Option D: | Keeps track of patients cardiac output |
| | |
| 14. | Ambulatory Monitoring of ECG is called as |
| Option A: | ECG Cardiography |
| Option B: | Normal Cardiography |
| Option C: | Vectorcardiography |
| Option D: | Holter Cardiography |
| | |
| 15. | In which of this technique heart rate is calculated by measuring time interval between two consecutive R wave? |
| Option A: | Beat-to-Beat Calculation |
| Option B: | Average Method |
| Option C: | Combination of Beat-to-Beat and average method |
| Option D: | Morphology mapping |
| | |

| | |
|---|---|
| 16. | An exercise stress testing equipment consists of a) Exercise Device b) ECG Display Device c) Defibrillator d) Blood Pressure Instrument |
| Option A: | a and b |
| Option B: | a only |
| Option C: | a, b,c & d |
| Option D: | b and c |
| | |
| 17. | Which type of Audiometer is used to identify the air conduction and bone conduction thresholds? |
| Option A: | Speech Audiometers |
| Option B: | Frequency Audiometers |
| Option C: | Amplitude Audiometers |
| Option D: | Pure Tone Audiometers |
| | |
| 18. | In a cochlear implant serial coded signal is transmitted and received by receiver through a_____ |
| Option A: | Bluetooth Link |
| Option B: | Radio Frequency Link |
| Option C: | Zigbee |
| Option D: | WLAN |
| | |
| 19. | Factors contributing to ultrasound burst at the receiver in doppler FHR meter are |
| Option A: | Opening and Closing of the Heart Valves |
| Option B: | Opening of the Heart Valves |
| Option C: | Closing of the Heart Valves |
| Option D: | Movement of the Heart Walls |
| | |
| 20. | Abdominal Fetal ECG Monitor has stronger influence of which signal? |
| Option A: | Fetal ECG |
| Option B: | Fetal Blood Pressure |
| Option C: | Mothers ECG |
| Option D: | Mothers Respiratory Activity |
| | |
| 21. | The bio-potential signal frequencies from various sections of the human body are in the |
| Option A: | RF range |
| Option B: | Microwave range |
| Option C: | 0 to few kHz |
| Option D: | Few kHz to few MHz. |
| | |
| 22. | To amplify ECG signals_____amplifier is prefered |
| Option A: | Inverting |
| Option B: | Non iverting |
| Option C: | Instrumentation |
| Option D: | Differential |
| | |
| 23. | In a standard ECG atrial depolarization is represented by |

| | |
|---|---|
| Option A: | P Wave |
| Option B: | R Wave |
| Option C: | QRS complex |
| Option D: | T Wave |
| | |
| 24. | Following technique is used in Biotelemetry so that data from multiple patients and multiple parameters is transmitted over a single channel |
| Option A: | Frequency modulation |
| Option B: | Time and frequency division multiplexing |
| Option C: | Amplitude modulation |
| Option D: | Pulse width modulation |
| | |
| 25. | Heart rate can be calculated using-------- |
| Option A: | EMG |
| Option B: | ERG |
| Option C: | EEG |
| Option D: | ECG |
| | |
| 26. | Following is the abnormal physiological parameter |
| Option A: | Heart rate: 72 BPM |
| Option B: | Respiration rate: =15 Breaths/minute |
| Option C: | Body temperature= $37^0$C |
| Option D: | Blood pressure: 220 mmHg systolic/100mmHg diastolic |
| | |
| 27. | In heart rate variability measurement the power in 0.15 Hz-0.4 Hz is-------- |
| Option A: | total power |
| Option B: | very low frequency power |
| Option C: | low frequency power |
| Option D: | high frequency power |
| | |
| 28. | In an audiogram on the y axis _____ is plotted |
| Option A: | Frequency |
| Option B: | Sound intensity |
| Option C: | Voltage |
| Option D: | Current |
| | |
| 29. | A premature neonate is kept in baby warmer |
| Option A: | Since it has not developed its thermoregulatory system |
| Option B: | To prevent external infection |
| Option C: | To avoid mosquito bites |
| Option D: | So that it does not cry |
| | |
| 30. | Electromagnetic flowmeter is based on |
| Option A: | Coulomb's Law |
| Option B: | Kirchhoff's Law |
| Option C: | Newton's Law |
| Option D: | Law of electromagnetic induction |
| | |

| Q2 | **Solve any Four out of Six** **5 marks each** |
|---|---|
| A | Draw a neat diagram of Einthoven's triangle and explain augmented lead system. |
| B | Name the methods used for blood flow measurement. Explain the principle of Doppler shift ultrasonic blood flow meter. |
| C | What is a respiration rate meter? Explain the principle of thermistor method for measurement of respiration rate. |
| D | Write the technical specifications of ECG, EEG, and EMG signals. |
| E | Explain Pure Tone audiometer |
| F | Write a short note on Indicator dilution method |
| G | Describe Holter monitor in brief. |
| H | What is point of care device? What are the design considerations for homecare devices? |
| I | Differentiate between conventional and digital hearing aids. Discuss their advantages over each other. |
| J | In an audiometer 10mV fed to an audiometer produces sound at 1 kHz, which can just be heard by a normal person. How much will be the loss in dB in a person requiring 3 volt signal to be fed to ear phone for perceiving the sound? |
| K | Using the principle of mass transport, derive the following equation for cardiac output measurement.<br>$F = (dm/dt) / \Delta C.$ |
| L | A Doppler ultrasonic flowmeter has carrier frequency of 7.5 MHz with a transducer angle of $30^{o}$ and velocity of sound as 1500m/s. If the audio frequency produced from an artery is 12.6 kHz, determine the blood velocity. |
| M | During Fick's cardiac output measurement in a patient with heart rate 60/min, oxygen consumption is observed to be 0.225 litres per minute. If the arterial and venous oxygen concentrations are 0.20 and 0.15 ml/ml, find the stroke volume and cardiac output. |
| N | A person can just hear 1 KHz pure tone at 70 and 90 dB through right and left ear respectively. Which ear is more damaged and what is his hearing loss in worst case? |
| O | A Doppler ultrasonic flowmeter has carrier frequency of 7.5 MHz with a transducer angle of 30o and velocity of sound as 1500m/s. If the audio frequency produced from an artery is 12.6 kHz, determine the blood velocity. |

| Q3 | **Solve any Two out of the following questions** **10 marks each** |
|---|---|
| A | Explain Bekesy audiometry system with a neat block diagram. |
| B | What is biotelemetry? What is the difference between single channel biotelemetry and multi-channel biotelemetry? What is role of modulator and demodulator in biotelemetry? |

| | |
|---|---|
| C | Explain the 10-20 electrode system with a neat diagram. |
| D | PVC can be identified as it arrives early, the next beat occurs at normal time and QRS width is greater than 80 ms. Describe a software algorithm to detect and count PVC's using all this information. |
| E | What is heart rate variability? What are the time domain parameters of heart rate variability? |
| F | It is required to measure the peri-cranial muscles activity from 0.2 to 5.0 mV in the frequency range of 10 Hz to 6oo Hz. Design a suitable amplifier and filter to process the signal before it's given to ADC input of micro-controller. |
| G | What are the design considerations of medical instrumentation system? |
| H | Describe ST/AR arrhythmia algorithm. Elaborate on template matching technique for arrhythmia detection. |
| I | PVC can be identified as it arrives early, the next beat occurs at normal time and QRS width is greater than 80 ms. Describe a software algorithm to detect and count PVC's using all this information. |
| J | What is heart rate variability? What are the frequency domain parameters of heart rate variability (define)? |
| K | What is blood pressure? How the blood pressure is measured using mercury manometer? |
| L | What are the techniques used for measurement of body temperature and respiration rate? |
| M | What is apnoea? How is a capacitance type pressure sensor used for monitoring respiration of infant? |
| N | Differentiate between atrial and ventricular fibrillation. Show possible methods for their detection. |
| O | Emphasize upon need for stress electrocardiography. How do you measure ST segment level and ST slope. |

# University of Mumbai

Examinations Summer 2022

Program: **Biomedical Engineering**

Curriculum Scheme: Rev2019

Examination: **TE** Semester **VI**

Course Code: **BMC602** and Course Name: Biomedical Digital Image Processing (**BDIP**)

## Question Bank containing Sample Questions

==========

## Objective Questions (MCQs)

| | **Choose the correct option for following questions. All the Questions are compulsory and carry equal marks.** |
|---|---|
| | |
| 1. | If f(x,y) is an image then the first-derivative in the y-direction is _____. |
| Option A: | f(x+1,y)–f(x,y) |
| Option B: | f(x,y+1)+f(x,y) |
| Option C: | f(x,y+1)–f(x,y) |
| Option D: | f(x+1,y+1)–f(x,y) |
| | |
| 2. | For pixels p(x, y), q(s, t), the city-block distance between p and q is defined as: |
| Option A: | $D(p, q)=[(x–s)^2+(y–t)^2]^{1/2}$ |
| Option B: | D(p, q)=max(\|x–s\|+\|y–t\|) |
| Option C: | D(p, q)=\|x–s\|+\|y–t\| |
| Option D: | D(p, q)=\|x+s\|–\|y+t\| |
| | |
| 3. | Half Toning achieves an illusion of shades of grey using _____ grey levels. |
| Option A: | 4 |
| Option B: | 2 |
| Option C: | 256 |
| Option D: | 16 |
| | |
| 4. | If A is an image, B is the structuring element, D is dilation and E is erosion, then, Closing of A by B is given by, |
| Option A: | CLOSE(A,B)=D(E(A)) |
| Option B: | CLOSE(A,B)=E(D(A)) |
| Option C: | CLOSE(A,B)=D(D(A)) |
| Option D: | CLOSE(A,B)=E(E(A)) |
| | |
| 5. | The mask used for spatial high pass filter could be _____. |
| Option A: | (1/16)[1 2 1;2 4 2;1 2 1] |
| Option B: | [–1 –1 –1; –1 8 –1 ; –1 –1 –1] |

| | |
|---|---|
| Option C: | (1/9)[1 1 1; 1 1 1 ;1 1 1] |
| Option D: | Empty mask |
| | |
| 6. | In a 2-D digital image, the separation between samples is in terms of_____. |
| Option A: | number of voxels |
| Option B: | micro seconds |
| Option C: | milli seconds |
| Option D: | number of pixels |
| | |
| 7. | Zero crossing property of which of the following operators is used to detect edges? |
| Option A: | Sobel operator |
| Option B: | Prewitt operator |
| Option C: | Robert's operator |
| Option D: | Laplacian operator |
| | |
| 8. | Arithmetic coding is _____. |
| Option A: | a lossy compression technique |
| Option B: | also known as JPEG |
| Option C: | a variable length coding technique |
| Option D: | a DCT based coding |
| | |
| 9. | The result of thresholding is _____. |
| Option A: | an image with low contrast |
| Option B: | a binary image |
| Option C: | an image with many shades of grey |
| Option D: | a noise free image |
| | |
| 10. | Which of the following achieves dynamic range compression? |
| Option A: | Thickening transformation |
| Option B: | Log transformation |
| Option C: | Negative transformation |
| Option D: | Thinning transformation |
| | |
| 11. | Which of the following is a non-sinusoidal transform? |
| Option A: | Discrete Cosine transform |
| Option B: | Discrete Fourier transform |
| Option C: | Discrete Sine transform |
| Option D: | Discrete Walsh-Hadamard transform |
| | |
| 12. | The number of bits required to store a 256X256, 4-bit digital image is _____. |
| Option A: | 256 |
| Option B: | 65536 |
| Option C: | 1024 |
| Option D: | 262144 |

| | |
|---|---|
| | |
| 13. | Which of the following image segmentation procedure is based on discontinuity in images? |
| Option A: | Region growing |
| Option B: | Region merging |
| Option C: | Thresholding based segmentation |
| Option D: | Laplacian of Gaussian operator |
| | |
| 14. | Chain codes are _____. |
| Option A: | Area descriptors |
| Option B: | Merging techniques |
| Option C: | Compression techniques |
| Option D: | Boundary descriptors |
| | |
| 15. | Which of the following transforms points in the x-y (spatial) plane to lines the parameter space? |
| Option A: | DFT |
| Option B: | Hough transform |
| Option C: | DCT |
| Option D: | Hadamard transform |
| | |
| 16. | Digital image filtering using which of the following frequency domain filters results in maximum ringing effect? |
| Option A: | Butterworth low pass filter |
| Option B: | Gaussian high pass filter |
| Option C: | Gaussian low pass filter |
| Option D: | Ideal low pass filter |
| | |
| 17. | Histogram equalization technique guarantees a _____ histogram in the continuous case. |
| Option A: | flat |
| Option B: | declining |
| Option C: | inclining |
| Option D: | exponential |
| | |
| 18. | Convolution of an image with the 2-D spatial filter mask is equivalent to _____of the DFT of the image with the corresponding 2-D filter transfer function in the frequency domain. |
| Option A: | addition |
| Option B: | division |
| Option C: | multiplication |
| Option D: | subtraction |
| | |
| 19. | Which of the following are sensitive to low level illumination in human eye? |

| | |
|---|---|
| Option A: | RBCs |
| Option B: | Cones |
| Option C: | WBCs |
| Option D: | Rods |
| | |
| 20. | In an 8-bit image, which is the bit plane with the maximum visually significant data? |
| Option A: | $0^{th}$ (LSB) bit plane |
| Option B: | $1^{st}$ bit plane |
| Option C: | $6^{th}$ bit plane |
| Option D: | $7^{th}$ (MSB) bit plane |
| | |
| 21. | The cosine transform matrix is _____. |
| Option A: | Real and symmetric but not orthogonal |
| Option B: | Complex and orthogonal but not symmetric |
| Option C: | Real, orthogonal and symmetric |
| Option D: | Real and orthogonal but not symmetric |
| | |
| 22. | One of the feature extraction methods used in morphological image processing is _____. |
| Option A: | Bit plane slicing |
| Option B: | Log transformation |
| Option C: | Fourier descriptors |
| Option D: | Contrast stretching |
| | |
| 23. | Identify the filter that is based on illumination-reflectance model of a digital image. |
| Option A: | Butterworth low pass |
| Option B: | Gaussian high pass filter |
| Option C: | Homomorphic filter |
| Option D: | Ideal low pass filter |
| | |
| 24. | Which of the following is a dictionary based coding? |
| Option A: | Statistical coding |
| Option B: | Huffman coding |
| Option C: | Arithmetic coding |
| Option D: | LZW coding |
| | |
| 25. | Probability for the symbol A in the data stream {A,A,A,A,A,B,B,B,B,C,C,C,C,D,D,E,E,E,E,E,F,F,F,F,F,G,G,G} is approximately _____. |
| Option A: | 0.14 |
| Option B: | 0.07 |
| Option C: | 0.11 |

| | |
|---|---|
| Option D: | 0.18 |
| | |
| 26. | In relation to image filtering in the spatial domain, which of the following is correct? |
| Option A: | High pass=(Original–Low pass) |
| Option B: | High pass=(Original+ Low pass) |
| Option C: | High pass=(Original*Low pass) |
| Option D: | High pass=(Original/Low pass) |
| | |
| 27. | Gradient operator is _____ . |
| Option A: | a first order derivative |
| Option B: | a zero order derivative |
| Option C: | a second order derivative |
| Option D: | an integral |
| | |
| 28. | For a given chain code 0757544, its first difference (8-directional) is _____. |
| Option A: | 762706 |
| Option B: | 762670 |
| Option C: | 763671 |
| Option D: | 761670 |
| | |
| 29. | If for an image, most populated histogram bins are concentrated on the lower end of the intensity scale then it will be a _____. |
| Option A: | dark image |
| Option B: | light image |
| Option C: | low contrast image |
| Option D: | high contrast image |
| | |
| 30. | The Hadamard matrix has _____ entries. |
| Option A: | Only 1's |
| Option B: | Only 1's and 0's |
| Option C: | Only –1's |
| Option D: | Only 1's and –1's |
| | |

## Subjective/descriptive Questions

## Questions carrying 5 Marks:

1. Explain the terms Sampling and Quantization of image.
2. Describe the digital image file formats.
3. Describe Brightness Adaptation.
4. Explain the process of image formation in the eye.
5. Illustrate how spatial averaging filter causes blurring of an edge.
6. Distinguish between point processing and neighborhood processing giving an example each.
7. Describe Contrast Stretching and give its application.
8. Compare and contrast between Histogram Equalization and Histogram Matching.
9. Explain Image Zooming by Interpolation.
10. Describe Homomorphic filtering.
11. Explain why Prewitt and Sobel operators are better than Roberts operator.
12. Explain 8- and m-connectivity.
13. Explain thresholding based segmentation.
14. Derive the expression for Laplacian of Gaussian operator.
15. Explain compass operator.
16. Explain IGS Quantization.
17. Explain Objective Error Criteria.
18. Explain LZW coding.
19. Explain Arithmetic coding.
20. Write the equation for both forward and inverse 2-D DCT. State few properties of DCT.
21. Generate Hadamard transform matrix H(4). Show if H(4) is orthogonal or not.
22. Explain morphological operations of Opening and Closing.
23. Describe Region Filling in morphological image processing.
24. Explain Hit-or Miss transformation.

## Questions carrying 10 Marks:

1. Equalize the following histogram

| Grey Level | 0 | 1 | 2 | 3 | 4 | 5 | 6 | 7 |
|---|---|---|---|---|---|---|---|---|
| No. of pixels | 0 | 0 | 0 | 614 | 819 | 1230 | 819 | 614 |

Draw the original and equalized histograms.

2. State and prove the following properties of DFT::
    a. Separability
    b. Translation.

3. Given is the grey level statistics for an image. Perform Histogram Linear Stretching.

| Grey levels | 0 | 1 | 2 | 3 | 4 | 5 | 6 | 7 |
|---|---|---|---|---|---|---|---|---|
| Number of pixels | 0 | 0 | 50 | 96 | 60 | 30 | 20 | 0 |

Plot the input and output histograms.

4. Explain the Ideal, Butterworth and Gaussian High pass filters in detail.
5. Explain the various similarity-based Image Segmentation methods.
6. Explain image segmentation based on various types of the discontinuities.
7. What is edge linking? Explain how Local Processing and Hough Transform could help link the edges after implementation of the edge detection procedure.
8. Find Huffman coding for transmitting the data ($x_1,x_1,x_1,x_2,x_2,x_2,x_2,x_2,x_2,x_2,x_4,x_4,x_4,x_4,x_4,x_3,x_3,x_3,x_3,x_5,x_5,x_5,x_5,x_6,x_6,x_6,x_6,x_7$).
9. Compute the DFT of the following 4X4 pseudo image.

| | | | |
|---|---|---|---|
| 1 | 2 | 3 | 4 |
| 5 | 6 | 7 | 8 |
| 4 | 3 | 2 | 1 |
| 8 | 7 | 6 | 5 |

10. Explain various image redundancies and discuss one method to reduce/eliminate each of the redundancies.
11. Explain image compression model in detail.
12. Explain the following feature extraction techniques:
    a. Polygonal approximations
    b. Moments.

X----------X ----------X

QUESTION BANK
SUB: DATA ANALYTICS IN HEALTHCARE
TE SEM-VI(BIOMEDICAL ENGINEERING) R-2019

<table>
<tr><td>1</td><td>Height (h) and weight (w) of 4 TE students as follows<br><table><tr><td>h (meters)</td><td>1.5</td><td>1.6</td><td>1.7</td><td>1.8</td></tr><tr><td>w (pounds)</td><td>130</td><td>138</td><td>146</td><td>154</td></tr></table>Correlation between the two is between</td></tr>
<tr><td>Option A:</td><td>-1.00 to -0.50</td></tr>
<tr><td>Option B:</td><td>-0.50 to 0.00</td></tr>
<tr><td>Option C:</td><td>0.00 to 0.50</td></tr>
<tr><td>Option D:</td><td>0.50 to 1.00</td></tr>
<tr><td>2</td><td>For a standard normal distribution, the probability $p(z \geq 2.71)$ is------</td></tr>
<tr><td>Option A</td><td>1</td></tr>
<tr><td>Option B</td><td>0.9966</td></tr>
<tr><td>Option C</td><td>0.0034</td></tr>
<tr><td>Option D</td><td>0</td></tr>
<tr><td>3</td><td>Relation between mean, mode and median is-----</td></tr>
<tr><td>Option A</td><td>Mean – Median = (Mean – Mode)/3</td></tr>
<tr><td>Option B</td><td>Mean – Median = (Mean + Mode)/3</td></tr>
<tr><td>Option C</td><td>Mean + Median = (Mean – Mode)/3</td></tr>
<tr><td>Option D</td><td>Mean + Median = (Mean + Mode)/3</td></tr>
<tr><td>4</td><td>Variance of the following data is 30, 30, 30, 30, 30, 30, 30, 30, 30, 30, 30, 30, and 30</td></tr>
<tr><td>Option A:</td><td>15</td></tr>
<tr><td>Option B:</td><td>30</td></tr>
<tr><td>Option C:</td><td>3</td></tr>
<tr><td>Option D:</td><td>0</td></tr>
<tr><td>5</td><td>Formula for test of significance of difference between sample mean and population mean for small sample if standard deviation of population is given is</td></tr>
<tr><td>Option A:</td><td>$t=\frac{\bar{x}-\mu}{s/\sqrt{n-1}}$</td></tr>
<tr><td>Option B:</td><td>$t=\frac{\bar{x}-\mu}{\sigma/\sqrt{n-1}}$</td></tr>
<tr><td>Option C:</td><td>$z=\frac{\bar{x}-\mu}{\sigma/\sqrt{n}}$</td></tr>
<tr><td>Option D:</td><td>$Z=\frac{\bar{x}-\mu}{s/\sqrt{n-1}}$</td></tr>
<tr><td>6</td><td>If $f(x) = k(x^7 - x^8), 0 \leq x \leq 1$ is the continuous P. d. f. Then value of K is</td></tr>
<tr><td>Option A</td><td>77</td></tr>
<tr><td>Option B</td><td>72</td></tr>
<tr><td>Option C</td><td>27</td></tr>
</table>

<table>
<tr><td>Option A</td><td>22</td></tr>
<tr><td>7</td><td>The probability density function of random variable X is<br><table><tr><td>X</td><td>113</td><td>123</td><td>133</td><td>143</td></tr><tr><td>P(X=x)</td><td>115k</td><td>125k</td><td>135k</td><td>145k</td></tr></table>Then value of k is------.</td></tr>
<tr><td>Option A</td><td>$\frac{1}{520}$</td></tr>
<tr><td>Option B</td><td>$\frac{1}{502}$</td></tr>
<tr><td>Option C</td><td>520</td></tr>
<tr><td>Option A</td><td>502</td></tr>
<tr><td>8</td><td>Range of Spearman’s rank correlation coefficient R is</td></tr>
<tr><td>Option A:</td><td>-1.5<R<0.5</td></tr>
<tr><td>Option B:</td><td>0.5<R<1.5</td></tr>
<tr><td>Option C:</td><td>-2<R<2</td></tr>
<tr><td>Option D:</td><td>-1≤R≤1</td></tr>
<tr><td>9</td><td>If x is a Poisson variable with parameter 4555 then mean of x is?</td></tr>
<tr><td>Option A</td><td>4555</td></tr>
<tr><td>Option B</td><td>-4555</td></tr>
<tr><td>Option C</td><td>5455</td></tr>
<tr><td>Option A</td><td>-5455</td></tr>
<tr><td>10</td><td>Which of the following is true</td></tr>
<tr><td>Option A:</td><td>The mean of a Poisson distribution is 3 and variance 2.</td></tr>
<tr><td>Option B:</td><td>The mean of a Poisson distribution is 3 and variance 3.</td></tr>
<tr><td>Option C:</td><td>The mean of a Poisson distribution is 2 and variance 3.</td></tr>
<tr><td>Option D:</td><td>The mean of a Binomial distribution is npq and variance np.</td></tr>
<tr><td>11</td><td>Ratio of variances of two normally distributed populations follows which distribution</td></tr>
<tr><td>Option A:</td><td>F-distribution</td></tr>
<tr><td>Option B:</td><td>Poisson</td></tr>
<tr><td>Option C:</td><td>Gaussian</td></tr>
<tr><td>Option D:</td><td>Chi-sq</td></tr>
</table>

| | |
|---|---|
| 12 | If the point estimate is 9 and margin of error is 4 then the confidence interval is |
| Option A: | 5,13 |
| Option B: | 4,14 |
| Option C: | 5,14 |
| Option D: | 4,13 |
| 13 | If population standard deviation is known and n > 30 then appropriate test statistics for mean comparison is |
| Option A: | t-test |
| Option B: | z-test |
| Option C: | F-test |
| Option D: | $\chi^2 - test$ |
| 14 | The process by which we estimate the value of dependent variable on the basis of one or more independent variables is called |
| Option A: | Correlation |
| Option B: | Regression |
| Option C: | Residual |
| Option D: | Slope |
| 15 | In a study, subjects are randomly assigned to one of three groups; control, experimental A or experimental B. After treatment, the mean scores for the three groups are compared. The appropriate statistical test for comparing these means is |
| Option A: | Analysis of Variance |
| Option B: | The Correlation Coefficient |
| Option C: | Z-test |
| Option D: | $\chi^2 - test$ |
| 16 | Median is which of following value in the given ascending array of size 2N+1 |
| Option A: | average |
| Option B: | frequently repeated |
| Option C: | $(N+1)^{th}$ |
| Option D: | $N^{th}$ |
| 17 | Given a normally distributed population with a mean 75 and variance of 625, find: P(30≤x≤110) |
| Option A: | -1.8833 |
| Option B: | 0.8833 |

| | |
|---|---|
| Option C: | -0.8833 |
| Option D: | 1.8833 |
| 18 | Weights in Kg of 10 students are given below 38, 40, 45, 53, 47, 43, 55, 48, 52, 49. For finding confidence interval of the standard deviation of the population at 5% level of significance, what will you use |
| Option A: | Chi-square-Test |
| Option B: | t-Test |
| Option C: | Z-Test |
| Option D: | F-Test |
| 19 | Formula for test of significance of difference between sample mean and population mean for small sample if standard deviation of population is not known is given as |
| Option A: | $t=\frac{\bar{x}-\mu}{s/\sqrt{n}}$ |
| Option B: | $t=\frac{\bar{x}-\mu}{s/\sqrt{n-1}}$ |
| Option C: | $t=\frac{\bar{x}-\mu}{\sigma/\sqrt{n-1}}$ |
| Option D: | $z=\frac{\bar{x}-\mu}{s/\sqrt{n}}$ |
| 20 | 5% level of significance corresponds to which confidence interval |
| Option A: | 99% |
| Option B: | 95% |
| Option C: | 97.50% |
| Option D: | 90% |
| 21 | Formula for Test of significance of the difference between two large samples if samples are drawn from same population with population variance is given is |
| Option A: | $Z=\frac{\bar{x}_1-\bar{x}_2}{\sqrt{\frac{s^2{}_1}{n_1}+\frac{s^2{}_2}{n_2}}}$ |
| Option B: | $Z=\frac{\bar{x}-\mu}{\sigma/\sqrt{n-1}}$ |
| Option C: | $Z=\frac{\bar{x}_1-\bar{x}_2}{\sigma\sqrt{\frac{1}{n_1}+\frac{1}{n_2}}}$ |

| | |
|---|---|
| Option D: | $t = \frac{\bar{x}_1 - \bar{x}_2}{\sqrt{\frac{n_1 {s^2}_1 + n_2 {s^2}_2}{n_1 + n_2 - 2} \times \left(\frac{1}{n_1} + \frac{1}{n_2}\right)}}$ |
| 22 | Which test you will apply for discriminating mean of two populations not following normal distribution |
| Option A: | t-test |
| Option B: | Wilcoxon-Mann-Whitney U test |
| Option C: | Chi-square test |
| Option D: | Kruskal-Wallis test |
| 23 | If A and B are independent, and $P(A) = \frac{5}{15}, \&, P(B) = \frac{3}{105}$ then $P(A \cap B) =?$ |
| Option A | $\frac{2}{105}$ |
| Option B | $\frac{3}{105}$ |
| Option C | $\frac{1}{105}$ |
| Option A | $\frac{4}{105}$ |
| 24 | Type-I error corresponds to which of following |
| Option A: | FP |
| Option B: | FN |
| Option C: | TP |
| Option D: | TN |
| 25 | The upper and lower boundaries of confidence interval are classified as |
| Option A: | Error based limits |
| Option B: | Marginal limits |
| Option C: | Estimate limits |
| Option D: | Confidence limits |
| 26 | The sum of squares of deviation of a set of value is minimum when taken about--- |
| Option A: | Median |
| Option B: | Mean |
| Option C: | Mode |
| Option D: | geometric mean |
| 27 | Test statistic for one way ANOVA is |
| Option A: | MSA/MST |

| | |
|---|---|
| Option B: | MSA/MSW |
| Option C: | MSTr/MSBl |
| Option D: | MSTr/MSE |
| 28 | if<br><table><tr><td>X</td><td>5</td><td>14</td><td>78</td><td>96</td><td>35</td><td>42</td><td>87</td></tr><tr><td>Y</td><td>5</td><td>14</td><td>78</td><td>96</td><td>35</td><td>42</td><td>87</td></tr></table><br>Then value of Karl-Pearson's correlation coefficient is $r_{xy}$is |
| Option A: | -0.57 |
| Option B: | 1 |
| Option C: | 2 |
| Option D: | -2 |
| 29 | If $O_i$ be the observed frequency and $E_i$ be the expected frequency then Formula for chi-square test is |
| Option A: | $\chi^2 = \sum_{i=1}^{n} \left[\frac{(O_i - E_i)}{E_i}\right]$ |
| Option B: | $\chi^2 = \sum_{i=1}^{n} \left[\frac{(O_i - E_i)^2}{E_i}\right]$ |
| Option C: | $\chi^2 = \sum_{i=1}^{n} \left[\frac{(O_i - E_i)^2}{E^2{}_i}\right]$ |
| Option D: | $\chi^2 = \sum_{i=1}^{n} \left[\frac{(O_i - E_i)}{E^2{}_i}\right]$ |
| 30 | If n and p are the parameters of a binomial distribution, then mean of a binomial distribution is ------ |
| Option A | np |
| Option B | $np^2$ |
| Option C | n/p |
| Option D | p/n |

1. The following scores represent nurses' assessment (x) and a physicials' assessment (y) of the condition of 10 patients at time of admission to a trauma centre. Find the regression equation.

| | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| X | 18 | 13 | 18 | 15 | 10 | 12 | 8 | 4 | 4 | 7 |
| Y | 23 | 20 | 18 | 16 | 14 | 11 | 10 | 7 | 6 | 4 |

Calculate the coefficient of determination.

2. In a study designed to determine patient acceptance of a new pain reliever, 100 physicians each selected a sample of 25 patients to participate in the study. Each patient, after trying the new pain relief for a specified period of time, was asked whether it was preferable to the pain reliever used regularly in the past. The results of the study are shown in the following table. Determine whether or not these data are compatible with the hypothesis that they were drawn from a population that follows a binomial distribution. Also use chi-square test for goodness-of-fit test.

| Number of patients out of 25 preferring new pain reliever | Number of Doctors reporting this number | Total Number of patients preferring new pain reliever by Doctor |
|---|---|---|
| 0 | 5 | 0 |
| 1 | 6 | 6 |
| 2 | 8 | 16 |
| 3 | 10 | 30 |
| 4 | 10 | 40 |
| 5 | 15 | 75 |
| 6 | 17 | 102 |
| 7 | 10 | 70 |
| 8 | 10 | 80 |
| 9 | 9 | 81 |
| 10 or more | 0 | 0 |
| Total | 100 | 500 |

3. Cardiac output (liters/ min) was measured by thermodilution in a simple random sample of 15 post cardiac surgical patients in the left lateral position. The results were as follows

4.91, 4.10, 6.74, 7.27, 7.42, 7.50, 6.56, 4.64, 5.98, 3.14, 3.23, 5.80, 6.17, 5.39, 5.77

On the basis of these data, can it be concluded that the population mean is different from 5.05.
(Use Wilcoxon signed-rank test)

4. In an experiment adult ovariectomized female mongrel dogs were treated with Estrogen, progesterone, or estrogen plus progesterone. Five untreated animals served as controls. A variable of interest was concentration of progesterone in the serum of the animals 14 to 21 days after treatment. It is to known that the treatments have different effects on the mean serum concentration of progesterone.

Concentration of serum progesterone (ng/dl) in Dogs Treated with, progesterone, Estrogen plus progesterone and in untreated Controls

| | Treatment | | | | |
|---|---|---|---|---|---|
| | Untreated | Estrogen | progesterone | Estrogen +progesterone | |
| | 117 | 440 | 605 | 2664 | |
| | 124 | 264 | 626 | 2078 | |
| | 40 | 221 | 385 | 3584 | |
| | 88 | 136 | 475 | 1540 | |
| | 40 | | | 1840 | |
| Total | 409 | 1061 | 2091 | 11706 | 15267 |
| Mean | 81.80 | 265.25 | 522.75 | 2341.20 | 848.1667 |

5. Calculate the Karl Pearson's correlation coefficient for the following height (in inches) of father(X) and their sons (Y)

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| X | 65 | 66 | 67 | 67 | 68 | 69 | 70 |
| Y | 67 | 68 | 65 | 68 | 72 | 72 | 69 |

6. The following table of 1000 nursing school applications classified according to scores made on a college entrance examination and the quality of the high school from which they graduated, as rated by a group of educators:

| | Quality of high schools | | | |
|---|---|---|---|---|
| | Poor | Average | Superior | Total |
| Score | (P) | (A) | (S) | |
| Low(L) | 105 | 60 | 55 | 220 |
| Medium(M) | 70 | 175 | 145 | 390 |
| High(H) | 25 | 65 | 300 | 390 |
| Total | 200 | 300 | 500 | 1000 |

Calculate the probability that an applicant picked at random from this group (i)Made a low score on the examination and graduated from a superior high school.(ii) Made a low score on the examination given that he or she graduated from a superior high school

7. Weight in kg. of 10 students are given below 38, 40, 45, 53, 47, 43, 55, 48, 52, 49. Find the confidence interval of the standard deviation of the population at 5% level of significance.

8. A random sample of 100 people shows that 25 have opened IRA(individual retirement arrangement) this year. Construct 95% confidence interval for the true proportion of population who have opened IRA.

9. A sample of 100 students is taken from a large population. The mean height of the students in this sample is 160 cm. Can it be reasonably regarded that, in the population the mean height is 165 cm, and S.D. is 10 cm?

10. A sample of 15 patients suffering from asthma participated in an experiment to study the effect of a new treatment on pulmonary function. Among the various measurements recorded were those of forced expiratory volume (liters) in 1 second (FEV1) before and after application of the treatment. The result were as follows:

| Subject | Before | After | Subject | Before | After |
|---|---|---|---|---|---|
| 1 | 1.69 | 1.69 | 9 | 2.58 | 2.44 |
| 2 | 2.77 | 2.22 | 10 | 1.84 | 4.17 |
| 3 | 1.00 | 2.07 | 11 | 1.89 | 2.42 |
| 4 | 1.66 | 3.35 | 12 | 1.91 | 2.94 |
| 5 | 3.00 | 3.00 | 13 | 1.75 | 3.04 |
| 6 | 0.85 | 2.74 | 14 | 2.46 | 4.62 |
| 7 | 1.42 | 3.69 | 15 | 2.35 | 4.42 |
| 8 | 2.82 | 5.14 | | | |

On the basis of these data, can one conclude that the treatment is effective in increasing the FEV1 level? Use sign test

11. Nancy Stearns Burgers conducted a study to determine weight loss, body composition, body fat distribution and resting metabolic rate In obese subject before and after 12 weeks of treatment with a very-low calories diet (VLCD) and to compare hydrodensitomentry with bioelectrical impedance analysis. The 9 subjects participating in the study were from an outpatient hospital-based treatment program for obesity. The women's weight before and after the 12 weeks VLCD treatment are shown in the table

| | | | | | | |
|---|---|---|---|---|---|---|
| Before-treatment(x) | 117 | 111 | 98 | 104 | 105 | 100 |
| After-treatment(y) | 83 | 85 | 75 | 82 | 82 | 77 |

We wish to know if these data provide sufficient evidence to allow us to conclude that the treatment is effective in causing weight reduction in obsess women.

12. The effect of two drugs on reaction time to a certain stimulus was studied in three samples of experimental animals. Sample III served as a control while the animals in sample I were drug A and those in sample II were treated with drug B prior to the application of the stimulus. Following table shows the reaction in seconds of the 13 peoples.Using The Kruskal-Wallis One-Way Analysis of Variance, Can we concluded that the three populations represented by the three samples differ with respect to reaction time? We can so conclude if we can reject the null hypothesis that the three populations do not differ in their reaction times.

| Sample | | |
|---|---|---|
| I | II | III |
| 17 | 8 | 2 |
| 20 | 7 | 5 |
| 40 | 9 | 4 |
| 31 | 8 | 3 |
| 35 | --- | ----- |

13. An experiment was conducted to test the efficiency of chloromycetin in checking typhoid. In a certain hospital chloromycetin was given to 285 out of the 392 patients suffering from typhoid. The number of typhoid cases were as follows.

| | Typhoid | No Typhoid | Total |
|---|---|---|---|
| Chloromycetin | 35 | 250 | 285 |
| No chloromycetin | 50 | 57 | 107 |
| Total | 85 | 307 | 392 |

Test the effectiveness of chloromycetin in checking typhoid.

14. In a telephone survey conducted by Professor Bikram Garcha(A-9) responds were asked to indicate their level of agreement with the statement' 'Cigarette smoking should be banned in public places" The results were as follows

| Gender | Level of agreement | | | | | Total |
|---|---|---|---|---|---|---|
| | Strongly agree | Agree | neutral | Disagree | Strongly disagree | |
| Female | 40 | 38 | 16 | 37 | 5 | 136 |
| Male | 16 | 25 | 11 | 25 | 10 | 87 |
| Total | 56 | 63 | 27 | 62 | 15 | 223 |

Can we conclude on the basis of these data that males and females differ with respect to their level of agreement on the banning of cigarette smoking in public place?

15. A remotivating team in psychiatric hospital conducted an experiment to compare five methods for remotivating patients. Patients were grouped accordingly to level of initial motivation. Patients in each group were randomly assigned to the five methods. At the end of the experimental period the patients were evaluated by a team composed of a psychiatrist, a psychologist, a nurse, and a social worker, none of whom was aware of the method to which patients had been assigned. The team assigned each patient a composite score as a measure of his or her level of motivation. The results were as follows.

| Level of initial motivation | Remotivating method | | | | |
|---|---|---|---|---|---|
| | A | B | C | D | E |
| Nill | 58 | 68 | 60 | 68 | 64 |
| Very low | 62 | 70 | 66 | 80 | 68 |
| Low | 68 | 78 | 68 | 80 | 70 |
| Average | 70 | 80 | 70 | 90 | 74 |

Do these data provide sufficient evidence to indicate a difference mean score among Remotivating methods?

16. A study was conducted to examine those variables thought to be related to the job satisfaction of nonprofessional hospital employees. A random sample of 10 employees gave the following data.

| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| $X_1$ | 8 | 12 | 1 | 3 | 15 | 14 | 14 | 9 | 4 |
| $X_2$ | 3 | 7 | 9 | 1 | 1 | 2 | 10 | 1 | 5 |
| $X_3$ | 31 | 49 | 43 | 12 | 30 | 37 | 61 | 31 | 31 |

1) Find: Find $r_{12}$, $r_{13}$, and $r_{23}$,2) Find $R_{1.23}$3) Find the multiple regression equation of $X_3$ on $X_1$& $X_2$, 4) Let $X_1$=10 & =5 and find the predicated value of $X_3$

17. The fact sheet of patients' records maintained in a local health department contains 10 entries. A sample of 100 records revealed the following distribution of erroneous entries.

No. of erroneous entries: 0 1 2 3 4 5 or more
No. of records :8 25 32 24 10 1
Test the goodness of fit of these data to the binomial distribution with p = 0.2

18. Estimate the 95% and 99% confidence intervals for the mean maximal strength of a particular muscle in a certain group of individuals. The strength scores are approximately normally distributed with a variance of 144. A sample of 15 subjects who participated in the experiment yielded a mean of 84.3

19. Investigate the association between the darkness of eye color in father and son from the following data using Chi-square test.

| Colour of father's eyes | | | |
|---|---|---|---|
| Colour of son's eyes | Dark | Not Dark | Total |
| | 48 | 90 | 138 |
| | 80 | 782 | 862 |
| | 128 | 872 | 1000 |

20. Two kins of manures were used in seventeen plots of the same size other conditions being same. The yields in quintals are given below.

Manure I: 35, 42, 40, 34, 24, 42

Manure II: 34, 44, 32, 40, 52, 41, 50, 40 ,42, 45.

Test at 5% level of significance whether the two manures differ as regards their mean yields.$t_\alpha =$ 2.131(15 d.o.f)

21. The table shows the corresponding values of three variables x, y, z.
(i)Find the line of regression of z on x and y.
(ii) Estimate z when x =7 and y =5.
(iii)Find $r_{12}, r_{13}, r_{23}$.

| x | 3 | 5 | 6 | 8 | 12 | 14 |
|---|---|---|---|---|---|---|
| y | 16 | 10 | 7 | 4 | 3 | 2 |
| z | 90 | 72 | 54 | 42 | 30 | 12 |

22. To assess the significance of possible variations in performance in a certain test between grammar schools of a city, a common test was given to a number of students taken at random from four schools. Test at 5% LoS whether there is a difference in the four schools. Use One -way ANOVA F (3,16) = 3.24.

| School A | School B | School B | School B |
|---|---|---|---|
| 8 | 12 | 18 | 13 |
| 10 | 11 | 12 | 9 |
| 12 | 9 | 16 | 12 |
| 8 | 14 | 6 | 16 |
| 7 | 4 | 8 | 15 |

23. A shoe company wants to know if three groups of workers have different salaries:
Women: 23K, 41K, 54K, 66K, 78K.
Men: 45K, 55K, 60K, 70K, 72K
Minorities: 20K, 30K, 34K, 40K, 44K.
Use Kruskal Wallis Test.

24. Differentiate between 1-way and 2-way ANOVA

25. Explain randomized block design and two-way ANOVA

26. Construct two-way ANOVA table for the following.

| Plot | Yield | | | |
|---|---|---|---|---|
| | Fertilizer1 | Fertilizer2 | Fertilizer3 | Fertilizer4 |
| A | 27 | 28 | 30 | 23 |
| B | 31 | 30 | 27 | 20 |
| C | 35 | 38 | 34 | 30 |
| D | 20 | 18 | 20 | 14 |

27. In a study of factors thought to be related to patterns of admission to a large general hospital, an administrator obtained these data on 10 communities in the hospitals catchment area.

| | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| X1 | 61 | 53 | 65 | 64 | 72 | 52 | 50 | 44 | 53 | 53 |
| X2 | 6 | 4 | 9 | 8 | 10 | 5 | 8 | 4 | 9 | 7 |
| X3 | 6 | 6 | 4 | 6 | 7 | 8 | 4 | 6 | 3 | 7 |

Calculate $R_{1.23}$

Find the equation of regression of X1 on X2 and X3.

28. A sample of 150 chronic carriers of a certain antigen and a sample of 500 non-carriers revealed the following blood group distribution.

| Blood Group | Carriers | Non-carriers |
|---|---|---|
| O | 72 | 230 |
| A | 54 | 192 |
| B | 16 | 63 |
| AB | 8 | 15 |

Can one conclude from these data that the two populations from which the samples were drawn differ w.r.to blood group distribution?

29. A re-motivation team in a psychiatric hospital conducted an experiment to compare 4 methods with following results.

| Level of initial motivation | Scores by Methods | | | |
|---|---|---|---|---|
| | A | B | C | D |
| NIL | 58 | 68 | 50 | 68 |
| Very low | 62 | 70 | 65 | 80 |
| Low | 67 | 78 | 68 | 81 |
| Average | 70 | 81 | 70 | 80 |

Use 1 way ANOVA to check if the data indicates difference in scores among methods. Given $F_{(3,12)} = 3.50$ and $F_{(12,3)} = 8.74$.

30. Prepare 2-way ANOVA table for following data

| Age | Method-A | Method-B | Method-C |
|---|---|---|---|
| Under 20 | 7 | 8 | 10 |
| 20-29 | 8 | 9 | 10 |
| 20-39 | 9 | 9 | 12 |
| 40-49 | 10 | 9 | 12 |
| 50 and above | 11 | 12 | 14 |

31. Following table gives 1000 nursing school applications classified according to scores made on a college entrance examination and quality of their graduating high school.

| Score | Quality of High School | | |
|---|---|---|---|
| | Poor(P) | Average(A) | Superior(S) |
| Low(L) | 105 | 60 | 55 |
| Medium(M) | 70 | 175 | 145 |
| High(H) | 25 | 65 | 300 |

Calculate P(A), P(H), P(A\H) and P(M∩P).

32. Glucose responses to oral glucose were recorded for 11 patients with Huntington's disease (group 1) and 13 control subjects (group 2). Sample variances were observed to be 105 and 148 respectively. Construct 95% confidence interval for ratio of two population variances. Given $F_{(10,12,0.025)} = 3.37$ and $F_{(10,12,\ 0.975)} = 0.28$.

33. Construct 90, 95 and 99% confidence interval for the population mean μ. The average number of heart beats per minute for a sample of 49 subjects is found to be 90. Assume population standard deviation to be 10.

Question Bank
Curriculum Scheme: R2019
Examination: TE Semester VI
Course Code: BMC604 and Course Name: Biomechanics, Prosthetics and Orthotics
==========

| MCQ | |
|---|---|
| 1. | The slope of the stress-strain curve in the elastic deformation region is _____ |
| Option A: | Elastic Modulus |
| Option B: | Plastic Modulus |
| Option C: | Poisson's ratio |
| Option D: | Yield point |
| | |
| 2. | When a right-angle loading acting in opposite directions it is called |
| Option A: | Torsion |
| Option B: | Shear |
| Option C: | Compression |
| Option D: | Tension |
| | |
| 3. | As you stand on your tip toes your foot is acting as what type of lever? |
| Option A: | Class 1 |
| Option B: | Class 2 |
| Option C: | Class 3 |
| Option D: | Class 4 |
| | |
| 4. | Varus is |
| Option A: | an excessive inward angulation |
| Option B: | Outward angulation |
| Option C: | Stiffness |
| Option D: | Elasticity |
| | |
| 5. | Which of the following orthosis does not provide movement |
| Option A: | Temporary orthosis |
| Option B: | Permanent orthosis |
| Option C: | Static orthosis |
| Option D: | Dynamic orthosis |
| | |
| 6. | This phase begins following maximum knee flexion and ends when the tibia is in a vertical position |
| Option A: | Preswing |
| Option B: | Initial Swing |
| Option C: | Terminal Swing |
| Option D: | Mid Swing |
| | |
| 7. | Amputation of toe with its corresponding metatarsal is called |
| Option A: | Ray Amputation |
| Option B: | Row Amputation |
| Option C: | Toe Amputation |
| Option D: | Tarsal Amputation |
| | |
| 8. | Lami's theorem includes |
| Option A: | Three concurrent forces |
| Option B: | Three parallel forces |
| Option C: | Three collinear forces |

| | |
|---|---|
| Option D: | Three non concurrent, non coplanar forces |
| | |
| 9. | _____Used to measure timing of foot contact and/or position of foot on ground |
| Option A: | Goniometer |
| Option B: | Instrumented Walkway |
| Option C: | Footswitch |
| Option D: | Selspot |
| | |
| 10. | The total-contact socket is designed to reduce pressure on the stump _____and increase the pressure_____. |
| Option A: | Proximally, distally |
| Option B: | Distally, proximally |
| Option C: | Anteriorly, posteriorly |
| Option D: | Posteriorly, anteriorly |
| | |
| 11. | Knee joint is an example of _____ joint |
| Option A: | Hinge |
| Option B: | Ball and socket |
| Option C: | Pivot |
| Option D: | fibrous |
| | |
| 12. | The property of bone which depends on direction of load applied is called |
| Option A: | Viscoelasticity |
| Option B: | Anisotropy |
| Option C: | Stress strain curve |
| Option D: | Creep |
| | |
| 13. | When load is in between fulcrum and effort, it is termed as |
| Option A: | First class lever |
| Option B: | Second class lever |
| Option C: | Third class lever |
| Option D: | Type I lever |
| | |
| 14. | This phase begins following maximum knee flexion and ends when the tibia is in a vertical position |
| Option A: | Preswing |
| Option B: | Initial Swing |
| Option C: | Terminal Swing |
| Option D: | Mid Swing |
| | |
| 15. | Interrupted light photography utilizes walkway that is _____ and _____ |
| Option A: | Reflective and Black |
| Option B: | Reflective and Grey |
| Option C: | Non reflective and Grey |
| Option D: | Non reflective and Black |
| | |
| 16. | Which of the following orthosis does not provide movement |
| Option A: | Temporary orthosis |
| Option B: | Permanent orthosis |
| Option C: | Static orthosis |
| Option D: | Dynamic orthosis |
| | |
| 17. | Any material that creates a force against the skin should be of dimension to _____the force on the tissue |

| | |
|---|---|
| Option A: | minimize |
| Option B: | maximize |
| Option C: | maintain |
| Option D: | minimize or maintain |
| | |
| 18. | Varus condition is also represented by |
| Option A: | Knock Knees |
| Option B: | Bowleggedness |
| Option C: | Outward angulation of heel |
| Option D: | Both a and c |
| | |
| 19. | The total-contact socket is designed to reduce pressure on the stump _____and increase the pressure_____. |
| Option A: | Proximally, distally |
| Option B: | Distally, proximally |
| Option C: | Anteriorly, posteriorly |
| Option D: | Posteriorly, anteriorly |
| | |
| 20. | Which of the following abnormal curvature is also called as humpback or hunchback? |
| Option A: | Scoliosis |
| Option B: | Idiopathic Scoliosis |
| Option C: | Lordosis |
| Option D: | Kyphosis |
| | |
| 21. | Hookes law is obeyed in the/at _____region |
| Option A: | Elastic |
| Option B: | Plastic |
| Option C: | Plateau |
| Option D: | Yield point |
| | |
| 22. | When a specimen is loaded in tensile mode it fails/fractures because of |
| Option A: | Torsion |
| Option B: | Shear |
| Option C: | Compression |
| Option D: | Elongation |
| | |
| 23. | As you flex your elbow, it is acting as what type of lever? |
| Option A: | Class 1 |
| Option B: | Class 2 |
| Option C: | Class 3 |
| Option D: | Class 4 |
| | |
| 24. | Valgus is |
| Option A: | an excessive inward angulation |
| Option B: | Outward angulation |
| Option C: | Stiffness |
| Option D: | Elasticity |
| | |
| 25. | Scoliosis can be observed in the |
| Option A: | Sagittal plane |
| Option B: | Transverse plane |
| Option C: | Coronal plane |

| | |
|---|---|
| Option D: | Lateral plane |
| | |
| 26. | The approximate percentage of double stance in gait cycle is |
| Option A: | 5 % |
| Option B: | 10 % |
| Option C: | 15 % |
| Option D: | 20 % |
| | |
| 27. | Amputation of the hand at the wrist joint is called as |
| Option A: | Wrist Disarticulation |
| Option B: | Transhumeral Amputation |
| Option C: | Amputation |
| Option D: | Forequarter Amputation |
| | |
| 28. | Levers work on the principle of |
| Option A: | Concurrent forces |
| Option B: | Parallel forces |
| Option C: | Four point pressure |
| Option D: | Non-parallel forces |
| | |
| 29. | _____used to measure joint angle during gait |
| Option A: | Goniometer |
| Option B: | Instrumented Walkway |
| Option C: | Footswitch |
| Option D: | Selspot |
| | |
| 30. | The PTB socket is used for |
| Option A: | Below knee amputation |
| Option B: | Above knee amputation |
| Option C: | Hip disarticulation |
| Option D: | Ray’s amputation |

| | **5 Marks Questions** |
|---|---|
| 1 | Discuss and classify different types of Forces in Biomechanics |
| 2 | Write a short note on Viscoelastic property. |
| 3 | Describe the materials used for prosthetics and orthotics |
| 4 | Explain Jaipur foot in brief |
| 5 | Write a short note on Goniometer |
| 6 | Explain three Biomechanical Principles used in orthotics design |
| 7 | Give two anatomical examples of class I lever. |
| 8 | Draw and explain typical stress strain curve |
| 9 | Write a short note on synovial joint classification |
| 10 | Write a short note on instruments used for gait analysis |
| 11 | Explain SACH foot in brief |
| 12 | What are abnormal spinal curvatures? |
| 13 | State three-point pressure principle giving two examples of the same. |
| 14 | Write a short note on Milwaukee brace |
| 15 | Explain compression closing footswitch |

| | 10 marks Questions |
|---|---|
| 1 | Explain typical stress strain curve in detail |
| 2 | Define levers and its mechanical advantages, explain different types of levers with examples |
| 3 | Explain the steps of PTB fabrication |
| 4 | Explain the swing phase of human gait cycle in detail with neat stick diagrams. |
| 5 | Explain Human Gait cycle in detail |
| 6 | Explain knee ankle foot orthosis in detail |
| 7 | Explain typical stress strain curve of bone in detail with a neat diagram. Explain anisotropic behavior of bone tissue. |
| 8 | Define levers. State the mechanical advantage for different classes of lever. Explain different classes of levers with one anatomical example for each class. |
| 9 | Explain the PTB socket with a neat diagram |
| 10 | Explain Biomechanics of tendons and ligaments. |
| 11 | Explain the stance phase of human gait cycle in detail with neat stick diagrams. |
| 12 | Explain the Milwaukee brace in detail with a neat diagram. |
| 13 | Define and explain the different gait parameters with neat diagrams. |
| 14 | Explain Biomechanics of skin. |
| 15 | Explain any two rigid cervical orthoses with neat diagram |

# University of Mumbai

## Sample Questions Bank- Nuclear Medicine

==========

| | MCQ Questions |
|---|---|
| 1. | For Carbon-12 calculate the ratio of N/Z |
| Option A: | 1:1 |
| Option B: | 1:2 |
| Option C: | 2:1 |
| Option D: | 2:2 |
| | |
| 2. | What happens in Alpha Decay |
| Option A: | A- reduces by 4 and Z-reduces by 4 |
| Option B: | A- reduces by 2 and Z-reduces by 2 |
| Option C: | A- reduces by 4 and Z-reduces by 2 |
| Option D: | A- reduces by 2 and Z-reduces by 4 |
| | |
| 3. | Radioactive Decay Curve is |
| Option A: | Linear |
| Option B: | Exponential |
| Option C: | Random |
| Option D: | Cyclic |
| | |
| 4. | Radioactive decay rate of 3.7*10^10 decays per second is called as |
| Option A: | Becquerel |
| Option B: | Curie |
| Option C: | RAD |
| Option D: | Gray |
| | |
| 5. | When radiation interacts with the living tissue, primarily there is_____ reaction |
| Option A: | Excitation |
| Option B: | Ionization |
| Option C: | Relaxation |
| Option D: | Nucleation |
| | |
| 6. | Identify role of focusing grid used in Photomultiplier Tube |
| Option A: | Multiplies electrons in PMT |
| Option B: | Directs the photoelectrons toward the dynode |
| Option C: | Magnetically shields the PMT |
| Option D: | Creates a vacuum space in the PMT |
| | |
| 7. | In a gas filled detector if the externally applied voltage across anode and cathode is less than Vs, it goes in |
| Option A: | Saturation Region |
| Option B: | Recombination Region |
| Option C: | Proportional Counter Region |
| Option D: | GM Counter Region |

| | |
|---|---|
| | |
| 8. | If image size is I and object size is O, how is magnification/minification factor expressed |
| Option A: | I/O |
| Option B: | O/I |
| Option C: | I-O |
| Option D: | O-I |
| | |
| 9. | Converging collimators gives what kind of image |
| Option A: | Magnified, Inverted |
| Option B: | Same size, Non Inverted |
| Option C: | Magnified, Non Inverted |
| Option D: | Minified, Non Inverted |
| | |
| 10. | Thyroid uptake monitoring can be used to diagnose which types of diseases |
| Option A: | Jaundice |
| Option B: | Coronary Artery Disease (CAD) |
| Option C: | Alzheimers Disease |
| Option D: | Hyperthyroidism |
| | |
| 11. | What is the average energy of the gamma photons ejected in PET scan |
| Option A: | 511 Mev |
| Option B: | 511 eV |
| Option C: | 511 keV |
| Option D: | 5.1 keV |
| | |
| 12. | High sensitivity collimators have |
| Option A: | smaller & shorter holes |
| Option B: | smaller & longer holes |
| Option C: | Wider & longer holes |
| Option D: | Wider & shorter holes |
| | |
| 13. | The preferred physical half-life for therapeutic radionuclides is around |
| Option A: | Between 6 hours and 7 days |
| Option B: | Less than 6 hours |
| Option C: | Few minutes |
| Option D: | Few seconds |
| | |
| 14. | Half life of F-18 isotope use in PET is |
| Option A: | 50 mins |
| Option B: | 80 mins |
| Option C: | 110 mins |
| Option D: | 140 mins |
| | |
| 15. | For thyroid uptake monitoring which of this radionuclide is preferred |
| Option A: | C-12 |
| Option B: | I-123 |
| Option C: | O-15 |
| Option D: | N-17 |
| | |

| | |
|---|---|
| 16. | TLD stands for in personal dosimetry |
| Option A: | Time Life Dosimeter |
| Option B: | Thermoluminescent Dosimeter |
| Option C: | Thermal Latent Distance |
| Option D: | Translucent Latent Dosimeter |
| | |
| 17. | number of counts per second in gamma camera obtains for each unit of activity is called as |
| Option A: | Uniformity |
| Option B: | Resolving time |
| Option C: | Sensitivity |
| Option D: | Resolution |
| | |
| 18. | When both photons from an annihilation event are detected by detectors in coincidence is called as |
| Option A: | Random coincidence |
| Option B: | Scatter coincidence |
| Option C: | True coincidence |
| Option D: | False coincidence |
| | |
| 19. | ____ is the reactor produced radionuclide |
| Option A: | Fluorine-18 |
| Option B: | Molybdenum-99 |
| Option C: | Oxygen-15 |
| Option D: | Nitrogen-13 |
| | |
| 20. | The probability of photoelectric interaction is _____- |
| Option A: | inversely proportional to the cube of γ-ray energy |
| Option B: | directly proportional to the cube of γ-ray energy |
| Option C: | inversely proportional to the square of γ-ray energy |
| Option D: | directly proportional to the square of γ-ray energy |
| | |
| 21. | Best method to dispose radioactive waste with short half-life (5 days) |
| Option A: | Dilute and disperse |
| Option B: | Store and Decay |
| Option C: | Concentrate and bury |
| Option D: | Incineration |
| | |
| 22. | Electron Capture involves _____ |
| Option A: | an electron combining with a proton |
| Option B: | a neutron being ejected from the nucleus |
| Option C: | an electron being ejected from the nucleus |
| Option D: | an electron combining with a neutron |
| | |
| 23. | What is a half life of Tc - 99m? |
| Option A: | 67 days |
| Option B: | 6 days |
| Option C: | 67 hours |
| Option D: | 6 hours |
| | |

| | |
|---|---|
| 24. | In a typical nuclear medicine application, which of this detector is not used |
| Option A: | Gas filled detectors |
| Option B: | Semiconductor detectors |
| Option C: | Scintillation detectors |
| Option D: | Quantum detectors |
| | |
| 25. | Which component is responsible for selecting a radioactive event based on its energy |
| Option A: | NaI (TI) detector |
| Option B: | Amplifier |
| Option C: | Pulse Height Analyzer |
| Option D: | Analog Ratemeter |
| | |
| 26. | In RIA a known quantity of antigen is made radioactive by |
| Option A: | Labeling with Radioactive isotopes |
| Option B: | Fusion process in cyclotron |
| Option C: | Mixing with neutron rich element |
| Option D: | Nuclear Fission |
| | |
| 27. | For a dual head gamma camera two simultaneous image can be acquired at an angle of |
| Option A: | 90° |
| Option B: | 120° |
| Option C: | 180° |
| Option D: | 270° |
| | |
| 28. | Which is this a semiconductor detector? |
| Option A: | NaI(TI) Detector |
| Option B: | BGO Detector |
| Option C: | CsI(TI) Detector |
| Option D: | Si Detector |
| | |
| 29. | Diameter range of scintillator crystal used in Gamma camera is |
| Option A: | 5-10cm |
| Option B: | 10-25cm |
| Option C: | 25-40cm |
| Option D: | 40-60cm |
| | |
| 30. | PET-CT hybrid imaging provides |
| Option A: | Only Anatomical information of tissues |
| Option B: | Only Physiological information of tissues |
| Option C: | Both Anatomical and Physiological information of tissues |
| Option D: | None of Anatomical and Physiological information of tissues |
| | |

**Descriptive Questions (05 Marks each)**

1. Draw spectra of commonly used radio nuclides Tc-99m, Cs-137.

2.Describe methods for Radioactive waste management.

3.Explain working principle of GM Counter.

4.What is RIA? Mention its clinical applications.

5. Write different units of radioactivity measurement.

6.What are the advantages of SPECT-CT over conventional CT Imaging.

7.Mention radionuclides used for therapeutic applications in nuclear medicine.

8.Write short notes on Palliative methods in cancer management.

9.Define following parameters.

Spatial Resolution.

Detector Efficiency

10.Write short notes on Single Isotope Method.

11.Mention advantages of Semiconductor detectors over Gas filled detectors.

12.Derive radioactive decay equation.

13.Compare PET and SPECT Imaging.

14. The half-life of 99mTc is 6 hours. After how much time will 1/8th of the radioisotope remains?

15.Write short notes on collimator used in gamma camera.

**Descriptive Questions (10 Marks each)**

1.How remote production of radionuclides is achieved using Tc-Mo Generator. Mention some of the issues involved in using Tc-Mo Generator.

2.Draw and explain block diagram of Liquid Scintillation Counting System.

3.With a neat, labelled diagram explain principle of operation of Gamma Camera.

4.With a neat block diagram explain working of Single and Multichannel Pulse Height Analyzers.

5.What is difference between Radionuclides and Radiopharmaceuticals. Explain different methods of radiolabeling for the preparation of radiopharmaceuticals.

6. Draw and explain block diagram of rectilinear scanner

7. Draw and explain block diagram of scintillation counting system.

8. Describe working principle of PET. Mention its five clinical applications

9. Describe working principle of SPECT. Mention its five clinical applications.

10. Explain prevention measures for internal radiation exposure.

11. Describe different types of gamma radiation interactions with matter

12.Explain block diagram of hybrid imaging PET-CT. State its two clinical applications

13. Explain alpha, beta and gamma decay

14. Describe quality control procedure of rectilinear scanner

15. Describe the concept of Statistics of Counting in nuclear medicine