TS PGECET 2026 Biomedical Engineering (BM)

Question Paper

Conducted by JNTU, Hyderabad

General Instructions

(i) The test is of 2 hours duration.

(ii) This test paper consists of 120 questions. The maximum marks are 120.

(iii) Each question carries +1 marks for correct answer and there is no negative marking for wrong answer.

1. Which of the following cannot be an eigen value for an unitary matrix?

(A) $\frac{1}{2}+\frac{\sqrt{3}}{2}i$

(B) i

(C) $-i$

(D) $\frac{1}{2}+\frac{\sqrt{5}}{2}i$

---

2. If A is symmetric, P and B are skew symmetric matrices, then which of the following is correct?

(A) $A^{13}B^{26}-B^{26}A^{13}$ is a symmetric matrix

(B) $A^{26}P^{13}-P^{13}A^{26}$ is a skew symmetric matrix

(C) $P^{13}A^{26}+A^{26}P^{13}$ is a skew symmetric matrix

(D) $P^{13}B^{26}+B^{13}P^{26}$ is a skew symmetric matrix

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3. The maximum value of x^2yz^3, subject to $x+y+z=42$ exist at $(x,y,z)=(\alpha,\beta,\gamma)$, then $\alpha\beta\gamma=$

(A) 6×7^3

(B) 7×6^3

(C) $14 \times 7 \times 21$

(D) $12 \times 6 \times 24$

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4. The evaluation of the double integral $\int_{-a}^{a}\int_{0}^{x} \frac{e^y}{(1+e^y)^2}\, dy dx =$

(A) a

(B) e^a

(C) e^{a^2}

(D) 0

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5. Given below are pair of functions $f(x)$ and $g(x)$. Which pair is not linearly independent?

(A) $f(x) = \cos x + \sin x,\ g(x) = -6\cos\frac{x}{3} - 8\cos^3\frac{x}{3}$

(B) $f(x) = -\cos x + \sin x,\ g(x) = \cos x$

(C) $f(x) = \cos x,\ g(x) = \cos^3 x - \sin^3 x$

(D) $f(x) = \sin x,\ g(x) = 6\sin\frac{x}{3} - 8\sin^3\frac{x}{3}$

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6. The solution of $\frac{\partial^2 u}{\partial t^2} = 4\frac{\partial^2 u}{\partial x^2}$, $t > 0$, $-\infty < x < \infty$ satisfying the conditions $u(x,0) = x$ and $\frac{\partial u}{\partial t}(x,0) = 0$ is

(A) x

(B) $\frac{x^2}{2} + t$

(C) $x + 2t$

(D) $\frac{t^2}{2} + x$

---

7. If A and B are independent events and $\mathbf{P}\left(\left(\frac{A}{B}\right) \cup \left(\frac{B}{A}\right)\right) = k - \mathbf{P}(A)\mathbf{P}(B)$, then $k =$

(A) $\mathrm{P}(A) - \mathrm{P}(B)$

(B) $\frac{\mathrm{P}(A)}{\mathrm{P}(B)}$

(C) $\mathrm{P}(A)\mathrm{P}\left(\frac{B}{A}\right)$

(D) $\mathrm{P}(A) + \mathrm{P}(B)$

8. From a set $\{1, 2, 3, 4, 5, 6, 7\}$ two numbers are selected at random. The random variable X is defined as the absolute difference of the numbers selected. The mean of X is

(A) 21

(B) 4

(C) $\frac{8}{3}$

(D) $\frac{7}{2}$

---

9. Newton-Raphson method is used to find the root of $x^2 - 3 = 0$. If the initial solution is taken as $x = -2$, then the iterations tend to

(A) $-\infty$

(B) $-\sqrt{3}$

(C) $\sqrt{3}$

(D) zero

---

10. While evaluating $\int_a^b f(x)\,dx$ using Trapezoidal rule and Simpson's one-third rule, $[a, b]$ is divided into n number of subintervals so that both the methods can be applied for the same division, then a possible value of n is

(A) 5

(B) 12

(C) 7

(D) Any non-prime number

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11. At $t = \infty$ in an RL circuit with DC excitation, the inductor behaves as:

(A) Open circuit

(B) Capacitor

(C) Short circuit

(D) Dependent source

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12. In a series RL circuit excited by DC, the current reaches 63.2% of its final value at:

(A) $t = RC$

(B) $t = \frac{1}{RC}$

(C) $t = \frac{R}{L}$

(D) $t = \frac{L}{R}$

---

13. If $L = 1$ H, $C = 1$ F and $R = 1\ \Omega$ in a series RLC circuit, then the circuit is:

(A) Pure oscillating

(B) Critically damped

(C) Overdamped

(D) Underdamped

---

14. In a series RLC circuit with $R = 10\ \Omega$, $L = 0.1$ H, $C = 100\ \mu$F, the resonant frequency, Q-factor and bandwidth respectively are:

(A) 50 Hz, 3.14, 15.9 Hz

(B) 50 Hz, 2.15, 9 Hz

(C) 40 Hz, 2.15, 9 Hz

(D) 50 Hz, 3.14, 16 Hz

---

15. The cut-off frequency of an RC low-pass filter is:

(A) $\frac{1}{(2\pi RC)}$

(B) $2\pi RC$

(C) $\frac{R}{(2\pi C)}$

(D) $\frac{C}{(2\pi R)}$

---

16. If a circuit has unity power factor, then reactive power is:

(A) Maximum

(B) Zero

(C) Minimum

(D) Inductive

---

17. Given $v(t) = 100\sin(100\pi t)$, the RMS value is:

(A) 50 V

(B) 100 V

(C) 70.7 V

(D) 141.4 V

---

18. Consider the following statements:

Assertion (A): Norton current is equal to the short-circuit current at the output terminals.

Reason (R): Because Norton equivalent resistance is obtained by deactivating all independent sources and calculating the resistance seen from the output terminals.

The correct answer is:

(A) Both (A) and (R) are correct and (R) is the correct explanation of (A)

(B) (A) is correct, but (R) is not correct

(C) Both (A) and (R) are correct and (R) is not correct explanation of (A)

(D) (A) is not correct, but (R) is correct

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19. The Thevenin resistance of a circuit is zero, then this implies:

(A) The circuit is open-circuited

(B) The circuit behaves as an ideal current source

(C) Maximum power transfer is impossible

(D) The circuit behaves as an ideal voltage source

---

20. If admittance of a circuit is $Y = 0.3 - j0.4$ s, then the magnitude of the impedance is:

(A) 1 Ω

(B) 2 Ω

(C) 5 Ω

(D) 10 Ω

---

21. A signal that exists only for a finite duration of time is called:

(A) Periodic

(B) Aperiodic

(C) Even

(D) Causal

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22. In an operational amplifier, slew rate limitation affects:

(A) High frequency large signal response

(B) Input offset

(C) Bandwidth only

(D) DC gain

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23. For an active low-pass filter of first order, the roll-off is:

(A) -10 dB/dec

(B) -40 dB/dec

(C) -20 dB/dec

(D) -60 dB/dec

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24. At very high frequencies, MOSFET is preferred because of:

(A) Infinite gain

(B) Low threshold

(C) High β

(D) No minority carrier storage

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25. In the ideal case, what is the input impedance of an operational amplifier?

(A) Infinite

(B) 1 MΩ

(C) Zero

(D) 100 Ω

---

26. The transfer function of an LTI system is defined as:

(A) Output signal

(B) Frequency response

(C) Impulse response

(D) Ratio of Laplace transform of output to input (zero initial conditions)

27. 1's complement and 2's complement of $(19)_{16}$ in hexadecimal are:

(A) 06 and 07 respectively

(B) 07 and 08 respectively

(C) 07 and 07 respectively

(D) 08 and 06 respectively

---

28. If the outputs of XNOR and XOR gates with inputs a, b are connected to an AND gate, then the output is:

(A) $a'b + ab'$

(B) $ab + a'b'$

(C) 0

(D) 1

---

29. Discrete-time LTI system is BIBO stable if:

(A) The absolute sum of its impulse response converges

(B) Its impulse response is finite

(C) It has no poles

(D) Its frequency response is zero

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30. For a clock frequency of 20 MHz, the output frequency of a flip-flop is:

(A) 5 MHz

(B) 20 MHz

(C) 10 MHz

(D) 40 MHz

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31. In ECG analysis, QRS detection is important because it represents:

(A) Atrial depolarization

(B) Ventricular depolarization

(C) Ventricular repolarization

(D) Atrial repolarization

32. The output voltage of a 6-bit ladder type DAC with a digital input of 111001 is (Assume maximum output voltage is 10 V):

(A) 9.04 V

(B) 9.20 V

(C) 9.06 V

(D) 8.90 V

---

33. An SAR type ADC and a Flash type ADC have identical resolution and reference voltage. If both of them have same input signal bandwidth and sampling rate, then which of the following statements is true?

(A) Flash ADC consumes comparators exponentially

(B) SAR ADC has better DNL performance inherently

(C) SAR ADC has lower conversion latency always

(D) Flash ADC has a simpler analog layout architecture

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34. Increasing the resolution of an ideal N-bit ADC at constant reference voltage will:

(A) Increase quantization noise power linearly

(B) Decrease quantization noise power linearly

(C) Not affect quantization noise power

(D) Decrease quantization noise power exponentially

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35. A 24 MHz microcontroller executes one instruction per clock cycle. If an interrupt service routine consumes 120 cycles, then the time taken by the ISR to execute is:

(A) 10 μs

(B) 5 μs

(C) 20 μs

(D) 1 μs

---

36. In an 8-bit microcontroller, if the program counter is 16-bit wide, then the maximum addressable memory space is:

(A) 64 kB

(B) 128 bytes

(C) 1 MB

(D) 256 kB

---

37. Which of the following statements is true?

(A) I/O-mapped I/O reduces instruction set size

(B) I/O-mapped I/O increases addressable memory space

(C) Memory-mapped I/O allows use of all memory instructions

(D) I/O-mapped I/O increases instruction set size

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38. In a $16\mathbf{k} \times 8$ **microprocessor, the number of address and data lines respectively are:**

(A) $14,\ 8$

(B) $16,\ 8$

(C) $8,\ 16$

(D) $8,\ 14$

---

39. CPU utilization in polling-based I/O is:

(A) Less than zero

(B) Maximum

(C) Zero

(D) Independent of device speed

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40. Signal conditioning is required mainly to:

(A) Match signal level to ADC input range

(B) Increase sampling rate

(C) Increase resolution

(D) Reduce memory requirement

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41. Accuracy in measurement relates to:

(A) Systematic error

(B) Random error

(C) Noise

(D) Resolution

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42. Q factor of a tuned amplifier does not depend on:

(A) Capacitance

(B) Gain

(C) Resistance

(D) Inductance

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43. Which of the following is satisfied by a linear system?

(A) Reciprocal property

(B) Time invariance

(C) Zero initial condition

(D) Homogeneity

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44. Transfer function is valid only for:

(A) Linear time-invariant systems

(B) Linear time-variant systems

(C) Non-linear time-invariant systems

(D) Non-linear time-variant systems

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45. Which of the following statements is true?

(A) More zeros always improve transient response

(B) Zero in right hand plane affects steady-state error

(C) Improper systems are physically unrealizable

(D) Stability depends on zeros

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46. The spike-and-wave complex of the EEG is detected using:

(A) HPF

(B) LPF

(C) Wiener filter

(D) Template Matching

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47. The AZTEC algorithm converts the raw ECG sample points into:

(A) Slopes and segments

(B) Segments and curves

(C) Points and plateaus

(D) Plateaus and slopes

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48. In the most commonly used derivative-based QRS detection technique, the weighting factors for the first and second derivatives respectively are around:

(A) 1.3 and 1.1

(B) 1.5 and 1.8

(C) 1.5 and 0.8

(D) 0.8 and 1.3

---

49. The adaptive filter used by Widrow to suppress the maternal ECG during fetal heart rate monitoring has following taps and a delay respectively:

(A) 16, 1s

(B) 16, 100 ms

(C) 2, 129 ms

(D) 32, 1s

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50. In sleep, K-complex occurs spontaneously or in response to:

(A) Very slowly changing stimulus

(B) Very high stimulus

(C) Very low stimulus

(D) Sudden stimulus

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51. The ST-segment analyzer measures:

(A) ST amplitude and ST frequency

(B) ST slope and ST segment level

(C) ST frequency and ST slope

(D) ST segment level and ST frequency

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52. The optimal Wiener filter can be designed if noise is a stationary random process that is statistically:

(A) Independent of the stationary signal

(B) Dependent on the non-stationary signal

(C) Independent of the non-stationary signal

(D) Dependent on the stationary signal

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53. Among the following which is not an ECG compression algorithm:

(A) AZTEC

(B) CORTES

(C) Pan-Tompkins

(D) TPA

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54. The sleep spindle is an episodic rhythm with:

(A) 30 Hz frequency and 50 mV amplitude

(B) 14 Hz frequency and 50 μV amplitude

(C) 50 Hz frequency and 50 μV amplitude

(D) 60 Hz frequency and 50 mV amplitude

---

55. Integer filters are digital filters that use only integer coefficients for:

(A) Real-time processing speeds

(B) Low processing speeds

(C) Medium processing speeds

(D) High processing speeds

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56. Linear phase is easily achievable in:

(A) IIR filters

(B) FIR filters

(C) Analog filters

(D) Band pass filters

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57. Circular convolution occurs due to:

(A) DFT operation

(B) Sampling theorem

(C) Correlation

(D) Infinite-length signals

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58. A first-order system has transfer function $H(s) = \frac{1}{(s+2)}$. Its impulse response is:

(A) $2e^{-t}u(t)$

(B) $2e^{-2t}u(t)$

(C) $e^{-2t}u(t)$

(D) $e^{-t}u(t)$

---

59. If ROC of a Laplace transform is $\text{Re}(s) > -2$, then the system is:

(A) Unstable

(B) Causal

(C) Stable

(D) Anti-causal

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60. Among the following, which signal is aperiodic?

(A) $\cos(10t)$

(B) $e^{j2\pi t}$

(C) $\sin(4t + \pi)$

(D) $e^{-2t}u(t)$

---

61. Thermistors are generally sintered mixtures of:

(A) Sulphides and oxalates of nickel, cobalt and manganese

(B) Sulphides and oxides of nickel, cobalt and manganese

(C) Oxalates and phosphates of nickel, cobalt and manganese

(D) Phosphates and oxides of nickel, cobalt and manganese

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62. The features of push-pull self-inductance transducer are

(A) Immune to effects of external magnetic field and reduced mechanical input impedance

(B) Immune to effects of external magnetic field and increased mechanical input impedance

(C) Susceptible to effects of external magnetic field and reduced mechanical input impedance

(D) Susceptible to effects of external magnetic field and increased mechanical input impedance

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63. In a capacitive transducer used for the measurement of angular displacements and angular vibrations, the capacitance of the transducer, when all teeth are aligned is

(A) Directly proportional to gap between the teeth and inversely proportional to number of pairs of teeth

(B) Directly proportional to number of pairs of teeth and inversely proportional to length of each tooth

(C) Directly proportional to length of each tooth and inversely proportional to number of pairs of teeth

(D) Directly proportional to length of each tooth and inversely proportional to gap between the teeth

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64. The Hall effect transducer is used as

(A) Displacement transducer and position detector

(B) Position detector and acceleration sensor

(C) Displacement transducer, proximity detector and transducer for measuring magnetic fields

(D) Displacement transducer, position detector and transducer for measuring electric fields

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65. Among the following, torque is measured with

(A) Cantilever-type bender bimorph

(B) Parallel bimorph

(C) Series bimorph

(D) Piezoelectric strain multi morph

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66. A differential amplifier has the following features

(A) Susceptibility to common-mode signals, sensitivity to temperature, versatility

(B) Immunity to common-mode signals, sensitivity to temperature, versatility

(C) Insensitivity to temperature, high stability, versatility

(D) Sensitivity to temperature, low stability, versatility

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67. Typical amplitude of ECG signal is

(A) 5 - 10 mV

(B) 0.5 - 5 mV

(C) 10 - 50 mV

(D) 50 - 100 mV

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68. EMG signal amplitude mainly depends on

(A) Respiration

(B) Electrode placement and muscle activity

(C) Blood pressure

(D) Body temperature

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69. In transformer coupling employed for protection against leakage currents, a carrier signal is employed with

(A) Frequency or pulse width modulation

(B) Amplitude modulation

(C) Phase modulation

(D) Pulse amplitude modulation

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70. The amplitude of the ERG voltage is typically

(A) 50 mV and is a function of the movement of the eye

(B) 5 mV and is a function of the intensity of the light falling on the eye

(C) 500 μV and is a function of the intensity of the light falling on the eye

(D) 50 μV and is a function of the movement of the eye

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71. EEG alpha rhythm occurs in the frequency range

(A) 0.5 - 4 Hz

(B) 8 - 13 Hz

(C) 4 - 7 Hz

(D) 30 - 50 Hz

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72. Power line interference affects the ECG signal recording and one way to minimize this interference is by

(A) Shielding and grounding each lead at the ECG machine

(B) Raising the skin-electrode impedances

(C) Reducing the magnetic field strength in the vicinity of the ECG machine

(D) Shielding the ECG machine

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73. Among the voltage-limiting devices used to protect the electrocardiograph, the miniature neon lamps provide a break down voltage in the range of:

(A) 20-50 mV

(B) 20-50 V

(C) 5-9 V

(D) 50-90 V

74. As compared to those employed for ECG recording, the electrodes and the preamplifier for EEG recording must have:

(A) Lower contact impedance and higher input impedance respectively

(B) Lower contact impedance and lower input impedance respectively

(C) Higher source impedance and higher input impedance respectively

(D) Higher source impedance and lower input impedance respectively

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75. Surgical diathermy causes electromagnetic interference and in this process, the lead wires and the subject serve as:

(A) Out-of-band noise source

(B) Antenna

(C) Shielding

(D) Attenuator

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76. In the microtip fiber optic pressor sensor for in-vivo measurements, the characteristic curve between the sensor output and the membrane displacement is:

(A) Almost linear at very low displacements

(B) Highly non-linear at very low displacements

(C) Highly non-linear at all displacements

(D) Linear at higher displacements

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77. The most important features of thermocouples are:

(A) Fast response time, high sensitivity and small size

(B) Long-term stability, high sensitivity and low output voltage

(C) Low sensitivity, ease of fabrication and fast response time

(D) Long-term stability, slow response time and difficulty in fabrication

---

78. The range of resistivity of thermistors which are used in medical applications, is:

(A) 1 and 20 Ω

(B) 0.1 and 100 Ω

(C) 50 and 1000 Ω

(D) 0.5 and 1000 Ω

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79. Which of the following statements is true with respect to the blood pressure measurement involving an occlusive cuff?

(A) The length of the cuff is approximately 4 times the arm circumference

(B) Positioning of the cuff does not matter if a shorter cuff is used

(C) Longer cuff leads to misalignment

(D) The width of the cuff is approximately 0.4 times the arm circumference

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80. In the blood volume determination, the movement of the photoplethysmography relative to the tissue causes change in the:

(A) Baseline reflectance leading to sensor overload

(B) Baseline transmittance leading to amplifier saturation

(C) Baseline transmittance leading to sensor overload

(D) Sensor sensitivity leading to amplifier saturation

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81. Which of the following statement is false?

(A) Transformer voltage develops in electromagnetic flowmeters employing AC magnetic current with sine wave excitation

(B) The best technique to minimize the transformer voltage effect is to employ quadrature suppression circuit

(C) In sine wave blood flowmeters, the signal-to-noise ratio is enhanced by employing low-noise FETs at amplifier output stage and half-wave demodulators

(D) In sine wave blood flowmeters, the signal-to-noise ratio is enhanced by employing low-noise FETs at amplifier input stage and full-wave demodulators

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82. In sine wave blood flowmeters, the signal-to-noise ratio is enhanced by employing:

(A) Low-noise FETs at amplifier output stage and half-wave demodulators

(B) Full-wave demodulators and low-noise FETs at amplifier output stage

(C) Half-wave demodulators and proper turns ratio for the step-down transformer

(D) Low-noise FETs at amplifier input stage and full-wave demodulators

83. Arterial oxygen saturation at the forehead, chest and limbs can be measured with a:

(A) Transcutaneous reflectance oximeter

(B) Percutaneous transmittance oximeter

(C) Transcutaneous transmittance oximeter

(D) Blood gas analyzer

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84. In pulse oximetry, the light sources used are typically:

(A) Blue and green

(B) Green and yellow

(C) Red and infrared

(D) Ultraviolet and visible

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85. The energies required for defibrillation using implantable defibrillators and transthoracic defibrillators respectively are:

(A) 5 to 30 W and 50 to 100 W

(B) 5 to 30 W-sec and 50 to 100 W-sec

(C) 15 to 50 J and 500 to 1000 J

(D) 15 to 30 W-sec and 150 to 1000 W-sec

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86. In the human cell, the rough endoplasmic reticulum has ribosomes attached to its outer surface and the smooth endoplasmic reticulum manufactures and packages:

(A) DNA into vesicles

(B) Hormones into vesicles

(C) Glucose into vesicles

(D) Lipids into vesicles

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87. The four primary types of tissues in the human body are:

(A) Muscular, nervous, connective and epithelial

(B) Adipose, nervous, connective and epithelial

(C) Muscular, adipose, connective and epithelial

(D) Bone, muscular, nervous and epithelial

88. The electrical impulse generated by the SA node travels through the AV node, Purkinje fibers and ventricular muscle respectively at speeds of (in m/s):

(A) 0.5, 2 and 1

(B) 1, 0.3 and 2

(C) 0.05, 3 and 0.5

(D) 0.5, 1 and 2

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89. With reference to the nervous system, which of the following statements is false?

(A) In a divergent circuit, each axonal branch of the presynaptic neuron connects with the dendrite of a different postsynaptic neuron

(B) In a convergent circuit, axons from several presynaptic neurons meet at the dendrite(s) of a single postsynaptic neuron

(C) A three-neuron circuit consists of a sensory neuron, an interneuron in the spinal cord, and a motor neuron

(D) Reflex arc is a special type of neural circuit with only 3 neurons

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90. In the muscular system, which of the following statement is true?

(A) The H zone and the area in which the actin and myosin overlap form the I band

(B) The H zone and the area in which the actin and myosin overlap form the A band

(C) The I band consists exclusively of thick myosin filaments

(D) The H zone contains both thin and thick structural filaments

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91. Under what type of loading and direction, the human cortical bone exhibits highest ultimate strength?

(A) Compressive, longitudinal

(B) Tensile, axial

(C) Bending, longitudinal

(D) Torsion, axial

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92. On application of tensile forces, cancellous bone exhibits a brittle behavior but yielding occurs under:

(A) Longitudinal bending

(B) Transverse bending

(C) Compressive loading

(D) Torsion

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93. In Poiseuille flow, the flow rate is directly proportional to:

(A) Length of the vessel, pressure, coefficient of viscosity

(B) Pressure drop, length of the vessel, coefficient of viscosity

(C) Pressure drop, diameter of the vessel

(D) Radius of the vessel, coefficient of viscosity

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94. The percentage of body's blood volume that veins hold is:

(A) 40%

(B) 60%

(C) 50%

(D) 30%

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95. As their aspect ratio is high, collagen fibers are not effective under:

(A) Axial tension

(B) Transverse tension

(C) Transverse compression

(D) Axial compression

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96. The ligament connects:

(A) Two muscles

(B) Two bones

(C) Muscle and bone

(D) Bone and cartilage

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97. Among the viscoelastic models:

(A) Voigt model behaves as a viscoelastic solid

(B) Kelvin model behaves as a viscoelastic fluid

(C) Maxwell model behaves as a viscoelastic fluid

(D) Maxwell model behaves as a viscoelastic solid

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98. Distance between corresponding successive points of heel contact of the opposite feet is termed step length and its mean value for a normal adult is around:

(A) 30 inches

(B) 20 inches

(C) 15 inches

(D) 25 inches

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99. Which of the following is true with respect to the mobility of the joints?

(A) Amphiarthrodial > Diarthrodial > Synarthrodial

(B) Diarthrodial > Synarthrodial > Amphiarthrodial

(C) Diarthrodial < Synarthrodial < Amphiarthrodial

(D) Diarthrodial > Amphiarthrodial > Synarthrodial

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100. An agonist muscle causes movement through concentric contraction and an antagonist muscle controls the movement through:

(A) Concentric contraction

(B) Eccentric contraction

(C) Isovolumic contraction

(D) Isometric contraction

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101. High efficiency in CT detectors results in:

(A) High dynamic range and minimum patient dose

(B) Minimum patient dose and low dynamic range

(C) High dynamic range and high patient dose

(D) High contrast and low patient dose

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102. Cardiac images obtained with conventional CT may not be precise due to:

(A) Limited number of detectors

(B) Size of the detectors

(C) Power line interference

(D) Motion artifact

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103. In a PET scanner, the positron combines with:

(A) Neutron and emits one gamma ray

(B) Electron and emits photon

(C) Electron and emits high-energy photo

(D) Electron and emits two gamma rays

---

104. In MRI system, longitudinal relaxation time is slower than:

(A) Phase relaxation time

(B) Spin lattice relaxation time

(C) Transverse relaxation time

(D) De-phasing relaxation time

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105. CT imaging reconstructs cross-sectional images primarily using:

(A) Reflection of X-rays

(B) Mathematical reconstruction from multiple projections

(C) Magnetic resonance

(D) Ultrasound echoes

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106. The atomic number of the anode material in an X-ray tube is Z. If the X-ray tube has an anode-to-cathode voltage of V, the efficiency of X-ray production is proportional to:

(A) $\frac{Z}{V}$

(B) ZV^2

(C) $\frac{V^2}{Z}$

(D) ZV

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107. In an image intensifier, the factors contributing to brightness gain are:

(A) Electronic gain and voltage gain

(B) Geometric gain and power gain

(C) Electronic gain and geometric gain

(D) Current gain and voltage gain

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108. Acoustic impedance of a medium is defined as the product of:

(A) Density and wavelength

(B) Pressure and velocity

(C) Density and velocity of sound

(D) Frequency and wavelength

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109. With reference to Ultrasonography, the correct order of the materials/tissues with ascending values for the half value layer is:

(A) Bone, fat, water

(B) Water, fat, bone

(C) Water, fat, brain

(D) Fat, muscle, brain

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110. SPECT systems are not suitable for dynamic studies because:

(A) They must enhance the variations in attenuation of the patient

(B) They must compensate for variations in attenuation of the patient

(C) They must enhance the attenuation coefficient of the patient which is a time-consuming process

(D) They must compensate for variations in acoustic coefficient of the patient which is complex

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111. In an ultrasonic transducer with radius R and ultrasound wavelength λ, the near field extends to a distance given by:

(A) $\left(\frac{R^2}{\lambda}\right)-\left(\frac{\lambda}{4}\right)$

(B) $\left(\frac{R^2}{\lambda}\right)-\left(\frac{\lambda}{16}\right)$

(C) $\left(\frac{R}{\lambda}\right)-\left(\frac{\lambda}{2}\right)$

(D) $\left(\frac{R^2}{2\lambda}\right)-\left(\frac{\lambda}{4}\right)$

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112. Among the piezoelectric materials, PZT crystals show better electro-mechanical conversion efficiency than Quartz crystals upto a frequency of about:

(A) 15 MHz

(B) 25 MHz

(C) 25 kHz

(D) 15 kHz

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113. The correct combination of biomaterials and their medical applications are:

(A) Zirconia - Cochlear replacements, PVC - Intraocular lenses

(B) Nylon - Artificial heart valves, Zirconia - Cochlear replacements

(C) Cellulose - Drug delivery, PVC - Facial prostheses

(D) Gold - Electrodes, PVC - Intraocular lenses

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114. Metals are commonly used as biomaterials mainly because of their:

(A) High strength and toughness

(B) High corrosion rate

(C) Low density

(D) Optical transparency

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115. Carbonated apatite and brushite are the different atomic phases of calcium phosphate and they are:

(A) Polymeric biomaterials

(B) Metallic biomaterials

(C) Ceramic biomaterials

(D) Composite biomaterials

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116. For a compound, Agar diffusion test is used to evaluate:

(A) Mechanical strength

(B) Thermal conductivity

(C) Corrosion resistance

(D) Cytotoxicity

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117. The common characterization technique used to measure Young's modulus of a brittle biomaterial is:

(A) Compression test

(B) Dynamic mechanical analysis

(C) Three- and four-point bend test

(D) Tensile test

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118. To produce high-resolution images, Transmission Electron Microscope uses a high-energy electron beam of typically:

(A) $5000 - 10000$ V

(B) $1000 - 300kV$

(C) $50 - 80$ kV

(D) $200 - 1000$ kV

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119. The capacity of a material to decompose naturally in a biological environment is biodegradability and it is brought by:

(A) Hormones and enzymes

(B) Microorganisms and liver

(C) Hormones and liver

(D) Microorganisms and enzymes

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120. Which of the following is the first level of biocompatibility testing?

(A) Secondary test

(B) In vitro test

(C) Clinical trial

(D) In vivo animal model test
