श्री चित्रा तिरुनाल आयुर्विज्ञान और प्रौद्योगिकीसंस्थान, तिरुवनंतपुरम्-11

SREE CHITRA TIRUNAL INSTITUTE FOR MEDICAL SCIENCES & TECHNOLOGY

THIRUVANANTHAPURAM—695 011

ENTRANCE EXAMINATION - ACADEMIC SESSION JANUARY 2022

Program: PhD Bioengineering

Time:90 Minutes | Max. Marks: 100

(Select the most appropriate answer)

(There are **no negative** marks for wrong answers)

1 The ideal Op – Amp has the following characteristics. (Ri - input impedance, A - gain, Ro - output impedance)

a. Ri = ∞, A = ∞, Ro = 0
b. Ri = 0, A = ∞, Ro = 0
c. Ri = ∞, A = ∞, Ro = ∞
d. Ri = 0, A = ∞, Ro = ∞

2 In a full wave rectifier, the current in each diode flows for :

a. whole cycle of the input signal
b. half cycle of the input signal
c. more than half cycle of the input signal
d. none of these

3 The power dissipated by a transistor approximately equals the collector current times:

a. base emitter voltage
b. base supply voltage
c. collector emitter voltage
d. 0.7V

4 The number FF in hexadecimal system has equivalence in decimal system to

a. 128
b. 256
c. 30
d. 255

5 A system with an input x(t) and output y(t) is described by the relation: y(t) = t. x(t). This system is:

a. linear and time-invariant
b. linear and time-varying
c. non-linear & time-invariant
d. non-linear and time-varying

6 A bulb in a staircases has two switches, one switch being at the ground floor and the other one at the first floor. The bulb can be turned ON and also can be turned OFF by any one of the switches irrespective of the state of the other switch. The logic of switching of the bulb resembles:

a. an AND gate
b. an OR gate
c. a NAND gate
d. an XOR gate

7 Two capacitors of 2 μF and 4 μF capacitance are connected in series across a 30 V dc battery. After the capacitors have been charged, the voltage across them will be

a. 15V each
b. 10V and 20 V
c. 20V and 10V
d. 30V each

8 If a signal of 200Hz frequency is sampled at 300Hz, what will be the frequency of the sampled signal?

a. 100Hz
b. 200Hz
c. 300Hz
d. 400Hz

9 Stroke affects which of the following body organ?

a. heart
b. brain
c. liver
d. lungs

10 What does the grey matter in the brain consist of?

a. Muscle cells
b. Collagen
c. Nerve axons
d. Neurons

11 Which node is called the pacemaker of the heart?

a. AV Node
b. SA Node
c. Lymph Node
d. Nodes of Ranvier

12 The set of coronary arteries supply blood to

a. heart
b. brain
c. liver
d. eyes

13 The CMRR of a differential amplifier is 100dB and its gain is 1000. If for an input signal the common mode voltage is 10V and differential voltage is 1mV what is the output voltage?

a. 1V
b. 1.01V
c. 1.1V
d. 2V

14 Alloy steel most widely used in implantable medical devices is

a. SS 304
b. SS 309
c. SS 316L
d. SS 409

15 A transistor can be used in which of the following modes

a. Active
b. Cut-off
c. Saturation
d. All three

16 If the resultant of two forces is equal to either of them, then the angle between the forces is

a. 30°
b. 60°
c. 90°
d. 120°

17 A particle starts from rest with a constant acceleration α m/s^2 and after some time it deccelerates at a uniform rate of β m/s2. If the total time taken between the two rest positions is t, the maximum velocity acquired by the particle is

a. $(\alpha+\beta)t/2$
b. $(\alpha-\beta)t/2$
c. $(\alpha\beta/\alpha+\beta)t$
d. $(\alpha+\beta/\alpha-\beta)t$

18 A car moving with speed u can be stopped in minimum distance x when brakes are applied. If the speed becomes n times, the minimum distance over which the car can be stopped takes the value

a. x/n
b. nx
c. x/n^2
d. n^2x

19 The stress at which a material fractures under large number of reversals of stress is called

a. Endurance limit
b. Creep
c. Ultimate strength
d. Residual Stress

20 A test specimen is stressed slightly beyond the yield point and then unloaded. Its yield strength will

a. decrease
b. increase
c. remains the same
d. becomes equal to ultimate tensile strength

21 A ductile structure is defined as one in which the plastic deformation before fracture

a. Is smaller than the elastic deformation
b. vanishes
c. Is equal to elastic deformation
d. Is much larger than elastic deformation

22 When the strain in a material increases with time under sustained constant stress the phenomenon is known as

a. Strain Hardening
b. Hysteresis
c. Creep
d. Visco-elasticity

23 The exact analysis of viscous flow problems can be made by

a. Eulers equation
b. Hagen Poiseuille's equation
c. Bernoulli's equation
d. Navier Stokes equation

24 When a shear stress is applied to a substance it is found to resist it by static deformation. The substance is a

a. liquid
b. solid
c. gas
d. uncertain

25 An abrupt change in cross section causes

a. Fatigue
b. Creep
c. Stress Concentration
d. None of these

26 In the d.c. equivalent circuit of a transistor amplifier, the capacitors are considered

a. Short
b. Open
c. Partially short
d. None of the above

27 The purpose of d.c. conditions in a transistor is to

a. Reverse bias the emitter
b. Forward bias the collector
c. Set up the operating point
d. None of the above

28 If a three-stage amplifier has individual stage gains of 10 db, 5 db and 12 db, then total gain in db is

a. 600 db
b. 24 db
c. 14 db
d. 27 db

29 A sine wave voltage is applied across a capacitor. When the frequency of the voltage is decreased, the current

a. Ceases
b. decreases
c. increases
d. remains constant

30 The Op-amp can amplify

a. ac signals only
b. dc signals only
c. both ac and dc signals
d. neither ac or dc signals

31 The formation of this type of bond between atoms requires electrons to be shared:

a. Ionic
b. Covalent
c. Intermittent
d. Tight

32 Young's modulus of a material reflects its ability to:

a. Accelerate deformation due to an applied load
b. Induce structural changes
c. Accommodate shock due to impact load
d. Resist deformation caused by an applied load

33 What is common among mild steel, 316L medical grade steel and tool steel?

a. Ti
b. Cu
c. Fe
d. U

34 A ____ stress is generated when two materials of varying CTE are rigidly connected and subjected to a temperature change?

a. Flow
b. Thermal
c. Uniform
d. Transverse

35 Composites are combinations of two materials, referred to as:

a. Matrix & reinforcing phases
b. Strong and weak phases
c. Equimolar phases
d. Solvent and solute phases

36 The cross-product of two vectors $\boldsymbol{P}$ and$\boldsymbol{dQ}$ is a maximum when $\boldsymbol{P}$ and $\boldsymbol{Q}$ are:

a. Parallel to each other
b. 45 ^{0} to each other
c. Perpendicular
d. Anti-parallel

37 During a forward somersault dive performed by a springboard diver, the following physical quantity is conserved:

a. Rotational inertia
b. Angular Speed
c. Angular momentum
d. Acceleration

38 A solid object placed in a fluid under high pressure is compressed uniformly on all sides. This type of stress is referred to as:

a. Hydrostatic
b. Shear
c. Compressive
d. Load bearing

39 The normal blood pressure (systolic pressure) of a healthy individual reads `120` on the physician's pressure gauge. What are the units of this pressure?

a. KPa
b. torr
c. Nmm^{-2}
d. microns

40 A tube of fluid flow is defined by streamlines that form its boundary. This attribute of the fluid must be the same for all cross-sections of the tube of flow:

a. Velocity
b. Pressure
c. Flow rate
d. Direction

41 All mechanical structures have one or more natural frequencies. If a structure is subjected to a strong external driving force that matches one of these frequencies, this condition is referred to as:

a. Hazard
b. Implosion
c. Resonance
d. Interference

42 These type of waves do not require a medium for travel:

a. Seismic waves
b. Microwaves
c. Sound waves
d. Water waves

43 This specific thermodynamic property always increases when an irreversible process occurs in a closed system:

a. Volume
b. Pressure
c. Entropy
d. Energy

44 The electrical resistivity of brass (a Cu-Zn alloy), compared to pure Cu is:

a. Lower by one order of magnitude
b. Equal
c. Higher by one order of magnitude
d. Lower by two orders of magnitude

45 The ideal gas equation $PV=nRT$ is modified to $(P+an^2/V^2)(V-nb) = nRT$ to describe the behavior of a real gas. The latter equation is named after:

a. Edwin Aldrin
b. Johannes van der Waals
c. Ernest Rutherford
d. Johannes kepler

46 VLDL's (very low density lipoproteins) are synthesized in

a. Heart
b. lungs
c. liver
d. kidney

47 Bernoulli's equation in fluid flow is based on

a. First law of thermodynamics
b. Ficks second law of diffusion
c. kirchoffs circuit law
d. conservation of energy

48 FACS with reference to flow cytometry is

a. Fluorescence activated cell sorting
b. Fluorescence activated cell suspension
c. Fluoride activated cell sorting
d. Fluoride activated cell suspension

49 HEMA, one of the most common biomaterial monomer is

a. 2-hydroxy ethane molybdenum acetic acid
b. 2-hydroxy ethane manganese acetone
c. 2-hydroxyethyl methacrylate
d. None of these

50 Pharmacokinetics of a drug is impacted by

a. Absorption of drug
b. Metabolism of drug
c. Distribution of drug
d. All of these

51 As per Beer-lambert law, if A is absorbance, a is absorptivity or extinction coefficient, b is length of the beam in absorbing medium, and c is the concentration of the absorbing species

a. A = abc
b. A= ab/c
c. A= bc/a
d. ca/b

52 Phospholipids in biomembranes are

a. Only Hydrophilic
b. Amphipathic (both hydrophilic and hydrophobic part)
c. Only Hydrophobic
d. None of these

53 With reference to protein structures, Alpha-helix is a type of

a. Primary structure
b. Secondary structure
c. Tertiary structure
d. Quaternary structure

54 As per le chatelier's principle, for an exothermic reaction, increasing the temperature

a. would lead to equilibrium shift towards reactants (towards left)
b. would lead to equilibrium shift towards products (towards right)
c. would have no impact
d. None of these

55 Which immunoglobin can significantly cross placenta

a. IgA
b. IgD
c. IgE
d. IgG

56 Which of the following is a gram-positive bacterium?

a. Yersinia pestis
b. Klebsiella pneumonia
c. Staphylococcus aureus
d. Chlamydia trachomati

57 For a HPLC (High performance liquid chromatography), which of the following are false

a. Sample is introduced along with a mobile phase
b. Separation is achieved by different moving speeds of each compound
c. Detector connected to column outlet monitors each eluting compound from the column
d. All are true

58 Ratio of inertia forces to viscous force is called

a. Froude's number
b. Reynolds number
c. weber number
d. Euler number

59 Biological evaluation and screening test that uses tissue cells in vitro to observe the cell growth, reproduction and morphological effects by medical devices is called as

a. Cytotoxicity test
b. Hemocompatibility test
c. sensitization test
d. skin irritation test

60 For a normal distribution of data,

a. 90% of data falls within 2 standard deviations of the mean
b. 68% of data falls within 2 standard deviations of the mean
c. 99.7% of data falls within 2 standard deviations of the mean
d. 95% of data falls within 2 standard deviations of the mean

61 Genome of COVID-19 causing virus genome is made of

a. ssDNA
b. dsDNA
c. ssRNA
d. dsRNA

62 PPE means?

a. Public private enterprise
b. Personal protective equipment
c. Public protection entity
d. Personal protection enterprise

63 In a certain code "DIVISION" is written as "DVISOIN", then how is "STATES" written?

a. SATETS
b. SATTES
c. SAETTS
d. STTAES

64 A room has 10 doors. In how many ways one can enter through a door and exit through a different door?

a. 9
b. 10
c. 100
d. 90

65 In this "see and tell" sequence, what is the next number?: 1, 11, 21, 1211, 111221, _____.

a. 312211
b. 1112221
c. 1112222
d. 112131

66 At extreme depths in the sea (beyond 170 m depth), divers experience hallucinations, dizziness, tremors etc because of --------- .

a. hyperventilation
b. decompression sickness
c. high-pressure neurological syndrome
d. diving reflex

67 Which is the primary stress hormone

a) cortisol
b) aldosterone
c) adrenaline
d) noradrenaline

68 Name a plastic-degrading systems

a. PETase
b. ACE
c. MHETase
d. both 1 &3

69 SARS-CoV-2 spike protein is a

a. surface glycoprotein
b. small envelope protein
c. nucleocapsid protein
d. matrix protein

70 Covishield is a ---------- type of vaccine

a. whole virion inactivated
b. recombinant, replication-deficient adenovirus vector encoding Spike protein
c. mRNA
d. DNA

71 Paralympic Games 2020 was conducted at

a. Abu Dhabi
b. Tokyo
c. Rio
d. Beijing

72 Nobel Prize for Physics in 2020 was awarded for the discovery of

a. cosmology
b. optical tweezers
c. theory for Black hole formation
d. discovery in alloys

73 The theory of relativity is presented by which scientist

a. Albert Einstein
b. Isaac Newton
c. Stephen Hawking
d. Marie Curie

74 Total number of elements in the Periodic table

a. 112 c. 115
b. 118 d. 127

75 Which one is the purest form of carbon

a. coal c. graphite
b. diamond d. iron

76 The membrane proteins can span across the lipid bilayer strictly due to the presence of

a. alpha helices c. antiparallel beta sheet
b. parallel beta sheet d. zinc finger domain

77 To detect specific macromolecule or structure by electron microscopy, the frequently used procedure is to couple the antibody with

a. Osmium tetraoxide c. Gold Particle
b. Alexa 568 d. Cy5

78 The inner cell mass of mammalian embryo in the blastocyst stage are

a. totipotent c. multipotent
b. pluripotent d. unipotent

79 Which of the following number is a prime number

a. 121 c. 183
b. 163 d. 1020

80 The enzyme Rennin is secreted in which among the following parts of the Alimentary Canal?

a. Mouth c. Pancreas
b. Duodenum d. Stomach

81 Both prokaryotic as well as eukaryotic cells have

a. Lysosomes c. Ribosomes
b. Mitochondria d. Golgi Bodies

82 Which one of the following is does not involve in maturation of red blood cells

a. pyridoxine c. vitamin B12
b. tocopherol d. folic acid

83 Migration of individual cells from the surface into the embryo's interior is termed as

a. ingression c. invagination
b. involution d. delamination

84 Which of the following hormone is detected by pregnancy kits?

a. Estrogen c. Human Chorionic Gonadotropin
b. Progesterone d. Lutinizing Hormone

85 Five persons A, B, C, D, and E are sitting in a row. C in the middle of the group and D is at an extreme end. There are at least two persons between B and E. Which of the following statements is incorrect?

a. E can be on extreme left c. A cannot be on extreme left
b. A is always a neighbour of B or D d. E can be on extreme right

86 Each pixel in a liquid crystal display (LCD) television is composed of 3 sub-pixels that can transmit red, green and blue colours because

a. White light is made of three primary colours viz red, green, blue
b. Liquid crystals can only filter these primary colours
c. The human retina contains only three types of colour-sensitive cells
d. These colours are the most pleasing to the human eye.

87 The Nobel prize in physiology or medicine 2020 was shared by Harvey J. Alter, Michael Houghton and Charles M. Rice for

a. The development of a method for genome editing
b. The discovery of Hepatitis C virus
c. The discoveries of how cells sense and adapt to oxygen availability
d. The discoveries of molecular mechanisms controlling the circadian rhythm

88 The first WHO recognized outbreak of Nipah virus was reported in

a. Malaysia
b. Bangladesh
c. Singapore
d. India

89 Who among the following is a climate campaigner?

a. Verghese Kurien
b. Malala Yousafzai
c. Greta Thunberg
d. Michelle Obama

90 The only active volcano of India is located at

a. Gujarat
b. Haryana
c. Maharashtra
d. Andaman & Nicobar Islands

91 EJOT, DHLP, CFIL, ?

a. BHLM
b. BDFH
c. DGKL
d. DEIJ

92 A man walks 30 meters towards south. Then turning to his right, he walks 30 meters. Then turning left, he walks 20 meters. Again, he turns to his left and walks 30 meters. How far is he from his initial position?

a. 110 meters
b. 80 meters
c. 60 meters
d. 50 meters

93 The ratio of the ages of a man and his wife is 4:3. After 4 years, this ratio will be 9:7. If at the time of marriage, the ratio was 5:3, then how many years ago were they married?

a. 15 years
b. 12 years
c. 10 years
d. 8 years

94 The first track and field athlete to win a gold medal for India at the Olympics

a. AbhinavBindra
b. PV Sindhu
c. Neeraj Chopra
d. Nirav Modi

95 By the end of next month my grandmother _____ in the same house for more than 80 years

a. will have been living
b. will live
c. will have lived
d. will be living

96 Leaf of a plant appears green in daylight. If this plant were observed in red light, what colour would its leaf appear ?

a. green
b. black-brown
c. red
d. blue

97 Twenty one liters of milk in a tank is to be divided into three equal parts using only5, 8 and 12 liters capacity cans. The minimum number of transfers needed to achieve this is.....

a. 3
b. 4
c. 5
d. 7

98 How many times starting at 1:00 pm would the minute and hour hands of a clock make an angle of 40 Degree with each other in the next 360 minutes?

a. 6
b. 7
c. 11
d. 12

99 Which is not an essential amino acid

a. proline
b. methionine
c. valine
d. lysine

100 Which Indian city has the Drink-from-Tap facility for the first time in India?

a. Bangalore
b. Srinagar
c. Trivandrum
d. Puri

Academic Session – January 2022

Answer Key: PhD Bioengineering

1	a
2	b
3	c
4	d
5	b
6	d
7	c
8	a
9	b
10	d
11	b
12	a
13	c
14	c
15	d
16	d
17	c
18	d
19	a
20	b

21	d
22	c
23	d
24	b
25	c
26	b
27	c
28	d
29	b
30	c
31	b
32	d
33	c
34	b
35	a
36	c
37	c
38	a
39	b
40	c

41	c
42	b
43	c
44	c
45	b
46	c
47	d
48	a
49	c
50	d
51	a
52	b
53	b
54	a
55	d
56	c
57	d
58	b
59	a
60	d

61	c
62	b
63	a
64	d
65	a
66	c
67	a
68	d
69	a
70	b
71	b
72	c
73	a
74	b
75	b
76	a
77	c
78	b
79	b
80	d

81	c
82	b
83	c
84	c
85	b
86	c
87	b
88	a
89	c
90	d
91	b
92	d
93	b
94	c
95	a
96	b
97	d
98	c
99	a
100	d