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(एक राष्ट्रीय महत्व का संस्थान, विज्ञान एवं प्रौद्योगिकी विभाग, भारत सरकार)
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ENTRANCE EXAMINATION - ACADEMIC SESSION JANUARY 2023

Program: PhD Bioengineering

Time:90 Minutes

Max. Marks: 100

(Select the most appropriate answer)
(There are **no negative** marks for wrong answers)

1.	If the resultant of two forces is equal to either of them, then the angle between the forces is
	a. 30^{o} b. 60^{o} c. 90^{o} d. 120^{o}
2.	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 partcle is
	a. $(\alpha+\beta)t/2$ b. $(\alpha-\beta)t/2$ c. $(\alpha\beta/\alpha+\beta)t$ d. $(\alpha+\beta/\alpha-\beta)t$
3.	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
4.	The material that exhibits the same elastic properties in all directions at a point is called
	a. Homogenous b. Orthotropic c. Viscoelastic d. Isotropic
5.	The most elastic material among the below is
	a. Rubber b. Plastic c. Brass d. Steel
6.	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
7.	When the strain in a material increases with time under sustained constant stress the phenomenom is known as
	a. Strain Hardening b. Hysteresis c. Creep d. Visco-elasticity
8.	Bernoulli's theorm deals with conservation of
	a. Mass b. Force c. Momentum d. Energy
9.	The stress strain relation of the Newtonian fluid is
	a. Linear b. Inverse type c. Parabolic d. Hyperbolic
10.	An abrupt change in cross section causes
	a. Fatigue b. Creep c. Stress Concentration d. None of these
11.	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
12.	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
13.	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
14.	An oscillator employs ..... feedback

	a. Positive b. Negative c. Neither positive nor negative d. Data Insufficient
15.	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
16.	Troponin is a biomarker for ---------- injury
	a. cerebral b. hepatic c. cardiac d. none of these
17.	----------biosensors are a group of analytical devices working on a principle of affinity interaction recording
	a. piezoelectric b. Thermal c. enzyme-based d. DNA-based
18.	Blood is a -----fluid.
	a. shear thickening b. shear thinning c. Newtonian d. none of these
19.	Reynolds number is defined as $\rho vd/ \mu$. If ρ is density of the fluid, v is the characteristic velocity, and d is the characteristic length of flow, then μ is-----
	a. dynamic viscosity b. kinematic viscosity c. shear stress d. shear strain
20.	When EEG waveforms are classified based on frequency, the range representing theta waveform is
	a. 0.5 – 4 Hz b. 4 – 7 Hz c. 8 – 12 Hz d. 12– Hz
21.	Some darts are thrown at a dartboard, wherein bulls eye (center) is the true value. If all the darts land very close together, but far from the bulls eye then
	a. there is precision, but not accuracy b. there is accuracy, but not precision c. there is neither precision , nor accuracy d. there is both precision and accuracy

22.	Which of the following is not a natural polymer
	a. Carrageenan b. chitin c. pectin d. All are natural polymers
23.	UHMWPE used in orthopedic implants is
	a. ultrahigh molecular weigh poly ester b. ultrahigh molecular weigh poly ethylene terephthlate c. ultrahigh molecular weigh poly enol d. ultrahigh molecular weigh poly ethylene
24.	ISO standard for Biomaterials to meet biocompatibilty criteria is
	a. ISO 15025 b. ISO 10993 c. ISO 17025 d. ISO 60601
25.	In pharmacokinetics, ADME refers to
	a. absorption, driving, metabolism, and excretion b. absorption, driving, maintainence, and excretion c. absorption, distribution, metabolism, and excretion d. absorption, distribution, maintenance, and excretion
26.	As per BCS (Biopharmaceutics classification system) classification, class III drugs have
	a. low solubility, low permeability b. high solubility, high permeability c. low solubility, high permeability d. high solubility, low permeability
27.	With reference to reverse phase HPLC (High performance liquid chromatography), C18 column is
	a. mobile phase b. stationary phase c. detector d. injector
28.	Which of the following is not a major class of lipid molecules in biomembranes
	a. phospholipids b. cholestrol c. glycolipids d. All of them are major classes of lipid molecules in biomembranes
29.	In mammals, which of the following is not a class of antibody
	a. IgA b. IgD c. IgO d. IgM
30.	Staphylococcus aureus is a--
	a. gram negative bacteria b. gram positive bacteria c. virus

	d. fungus
31.	With reference to spectroscopy, FTIR is
	a. Fourier transform infrared b. Fourier transport infra red c. Fourier transport internal red d. Fourier transform internal red
32.	Young's modulus is not referrred as
	a. Elastic modulus b. Poisson's ratio c. Tensile modulus d. Modulus of elastivity in tension
33.	Which of the following is NOT a technique employed for sterilization in healthcare facilities?
	a. Steam under pressure b. Eto gas c. Hydrogen peroxide gas plasma d. All of them are employed
34.	Categorization of data of feedback received for a service provided in hospitals (such as not all satisfied, satisfied, extremely satisified) is
	a. random data b. ordinal data c. nominal data d. ratio
35.	With reference to statistics, a statistical method ANOVA is
	a. analysis of variable b. anatomy of variable c. analysis of variance d. anatomy of variance
36.	In the case of a shearing, force vector ----- the plane of area over which it acts:
	a. is normal to b. lies in c. cancels over d. partitions
37.	Permanent deformation is referred to as:
	a. Fracture strain b. Pre-strain c. Linear elastic strain d. Plastic strain
38.	If a problem has more unknowns than the number of equations relating the unknowns, such a problem is referred to as:
	a. Complex b. Irrational c. Indeterminate d. Intractable

39.	When two waves travese the same medium, the displacement of any particle of the medium is the sum of displacements that each individual wave would give it; this is called:
	a. Juxtaposition b. Co-depostion c. Superposition d. Impostion
40.	Breakdown potential refers to:
	a. Dielectrice breakdown b. Electromigration potential c. Maximum voltage that a human being can withstand d. Voltage in excess of line Voltage
41.	Heat transfer by radiation scales as:
	a. $T^{1/4}$ b. T^4 c. $T^{0.4}$ d. T^2
42.	The following technique is used to probe crystal structure of materials:
	a. Dilatometry b. X-ray diffraction c. Laser ablation d. Nanoindentation
43.	The stiffness of a beam is proportional to _____power of thickness:
	a. one-third b. second c. third d. first
44.	The following is not a characteristic of a ceramic:
	a. High melting temperature b. High hardness c. Very good ductility d. Good wear resistance
45.	Two dissimilar metals placed in electrical contact, when immersed in an electrolyte, leads to corrosion. This couple is referred to as:
	a. Bimetal b. Galvanic couple c. Composite metal d. Diffusion couple
46.	The following is not a near-net-shape manufacturing process:
	a. Electrodischarge machining b. Shaped casting c. Closed-die forging d. Metal additive manufacturing

47.	A Carnot cycle is an ideal _____ cycle.
	a. thermodynamic b. electrochemical c. reversible d. electromagnetic
48.	An axial compressive force applied at the ends of a long slender member will cause:
	a. Sliding b. Buckling c. Fretting d. Slipping
49.	Which of the following is not an open chain organic molecule:
	a. Methane b. Benzene c. Isopropanol d. Pentane
50.	Glass transition temperature `Tg´ is characterstic of
	a. Steel b. Titanium alloys c. Tungsten Carbide d. High-density polyethylene
51.	The following is not a transition metal.
	a. Ni b. Ti c. Co d. Nd
52.	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. Flow rate b. Pressure c. Velocity d. Direction
53.	A ____ stress is generated when two materials of varying coefficient of thermal expansion are rigidly connected and subjected to a temperature change?
	a. Fracture b. Thermal c. Uniform d. Shearing
54.	Composites are combinations of two materials, referred to as:
	a. Conducting and insulating phases b. Matrix & reinforcing phases c. Equimolar phases d. Solvent and solute phases

55.	The tendency of alternating current to flow mostly at the outer surface of a conductor such as a metal wire is termed as:
	a. Joule effect b. skin effect c. polarization d. birefringence
56.	Which node is called the pacemaker of the heart?
	a. AV Node b. SA Node c. Lymph Node d. Nodes of Ranvier
57.	The set of coronary arteries supply blood to
	a. heart b. brain c. liver d. eyes
58.	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
59.	Alloy steel most widely used in implantable medical devices is
	a. SS 304 b. SS 309 c. SS 316L d. SS 409
60.	A transistor can be used in which of the following modes
	a. Active b. Cut-off c. Saturation d. All three
61	Autogamy refers to
	a. Self destruction of gametes b. Self polliation in flowers c. Flower withering d. Cross pollination of flowers

62	Which of the following is not used to describe variability in the data a. Range b. Standard deviation c. Mode d. Quartiles
63	What day of the week will it be 53 days from a Monday? a. Wednesday b. Friday c. Saturday d. Sunday
64	The part of root which is involved in perceiving gravity is a. Root cap b. Endodermis c. Elongation zone d. Quiescent center
65	The illuminating source used as a source of excitation of fluroscent dyes in a confocal microscope? a. Electron beam b. Masers c. Mercury lamp d. Lasers
66	The regionally localized proteins or mRNAs within the unfertilized egg that regulate development are called a. Cytoplasmic determinants b. Morphometric determinants c. Gene regulators d. Mosaic forming factors
67	Which of the following analytical technique does not use optical measurement? a. ELISA b. Spectrometry c. Flow cytometry d. Differential Scanning Calorimetry
68	The tetanus vaccine given to humans in the case of a deep cut is a a. DNA vaccine b. Toxoid vaccine c. Subunit vaccine d. Recombinant vector vaccine

69	The sum of digits of a two-digit numbers is 6. If the fraction formed by taking 3 less than the number as numerator and 4 more than the number as denominator is 3/4 , what is the a. 36 b. 24 c. 45 d. 54
70	The dye used in Gram staining is a. Giemsa b. Crystal violet c. Methylene blue d. Rhodamine
71	A train of length 110 m is moving at a rate of 180 kmph. How long it will take to cross a platform of 165m? a. 5.5 s b. 1.53 s c. 6.2 s d. 4.4 s
72	The cost of 10 books, 8 pens and 12 pencils is 240 rupees. If 8 books, 6 pens and 10 pencils costs 180 rupees, what would be the cost for 1 book, 1 pen and 1 pencil? a. 25 b. 30 c. 35 d. 40
73	Two numbers are in the ratio 5:4. Gopal subtracts 15 from each so that they're now in the ratio 7:5. Find the smaller number. a. 30 b. 35 c. 40 d. 50
74	Find the odd one out in the series: 13, 19, 29, 39, 41, 53, 59 a. 19 b. 39 c. 29 d. 59
75	Find the missing number: 4, 11, 22, 37, ... a. 43 b. 79 c. 56 d. 59

76	Find the odd one in the group: L, T, E, V, Q a. L b. E c. V d. Q
77	Today is Monday. After 63 days it, will be: a. Tuesday b. Saturday c. Monday d. Sunday
78	Three times the first of four consecultive even numbers is equal to the sum of double of third number and half of fourth number. Identify the second number a. 20 b. 24 c. 28 d. 32
79	When the digits of a two digit number interchanged it become double of its square root. Identify the number a. 64 b. 81 c. 16 d. 36
80	sum of squares of two numbers is 325 and their product is 150. The sum of the numbers is.... a. 30 b. 15 c. 25 d. 20
81	Which property measure the resistance of a liquid to flow a. Density b. Viscosity c. Volume d. Solubility
82	Mesons are found in a. X-rays b. Gamma rays c. Cosmic rays d. Laser beam

83	In a box, there are 8 red, 7 blue and 6 green balls. One ball is picked up randomly. What is the probability that it is neither red nor green? a. 1/3 b. 3/4 c. 7/19 d. 8/21
84	A person buys a shirt with marked price Rs.300/- at 20% discount. In order to make a profit of 20% the person should sell the shirt for a. Rs. 288 b. Rs. 300 c. Rs. 240 d. Rs. 360
85	Which one of the following number is a prime number a. 183 b. 157 c. 121 d. 161
86	A student received following marks in the five of the six courses, 91, 86, 81, 79 and 92. Average of his marks in six subject is 85.How may marks did he received in the sixth subject a. 83 b. 81 c. 85 d. 88
87	What is the sum of the factors of 4b2c2 – (b2 + c2 – a2) 2 ? a. a+b+c b. 2 (a+b+c) c. 0 d. 1
88	A father said to his son, "I was as old as you are at the present at the time of your birth". If the father's age is 38 years now, the son's age five years back was: a. 14 years b. 19 years c. 33 years d. 38 years

89	In a certain store, the profit is 320% of the cost. If the cost increases by 25% but the selling price remains constant, approximately what percentage of the selling price is the profit? a. 30% b. 70% c. 100% d. 250%
90	What is the unit for measuring the amplitude of a sound? a. Deceibel b. Coulomb c. Hum d. Cycles
91	Which of the following metals forms an amalgam with other metals? a. Tin b. Mercury c. Lead d. Zinc
92	The sky appears blue because of: a. Refraction b. Scattering c. Reflection d. Total Internal reflection
93	Why does a compact disc (CD) show a rainbow of colours with white light? It is due to: a. Interference b. Diffraction c. Scattering d. Dispersion
94	A person is driving towards west. What sequence of direction should he follow so that he is driving towards South a. Left,right,right b. Right,right,left c. Left,Left, Left d. Right, right,right
95	Earth, Saturn,Pluto,..... a. Uranus b. Moon c. Galaxy d. Sun

96	Find the odd man out a. RUX b. CFI c. BDG d. FIL
97	How many meaningful words can be formed from the letters of the word 'INDUSTRIAL' a. Four b. Three c. Five d. Six
98	Taj Mahal is related Love in the same way Jallianwala bagh is related to ---- a. Amritsar b. Martyrdom c. War d. Punjab
99	2021 Nobel Prize for chemistry was given for the work on a. Asymmetric organocatalysis b. Method for genome editing c. Lithium-ion batteries d. Evolution of enzymes
100	Atoms of an isotope has a. Same mass number b. Same electronic configuration c. Same atomic number d. Different Mass number