جـامعة بيروت العربية
BEIRUT ARAB UNIVERSITY

Entrance Examination

Faculty of Engineering

General Instructions

1- The First Page of the booklet is the answer sheet. Fold this page along the perforations, slowly and carefully tear off the answer sheet.

2- Write your name and your seat number then fill the seat number in the proper place on the answer sheet.

3- Be sure to fill only one answer with a pencil for each question.

1. Write a word that is only one letter different than the word *coal* and it makes one team sad and the second team happy.

   A. coil B. goal C. coat D. None of them

2. The sum of my digits is 19, the hundred digit is 4 less than 7, the thousands digit is the sum of 3 and 1, and the other two digits are the same number. What 4-digit number am I?

   A. 4366 B. 4735 C. 6643 D. None of them

3. If you're 8 feet away from a door and with each move you advance half the distance to the door. How many moves will it take to reach the door?

   A. 8 B. 4 C. 2 D. 1

4. The status of Liberty is 151 feet long. The length from head of the status to the torch is 47 feet long. How long is the statue from the neck to the bottom?

   A. 104 foot B. 104 feet C. 104 D. None of them

5. How many even numbers exists from 0 to 100?

   A. 50 B. 51 C. 100 D. None of them

6. Consider the following pattern; find the missed number?

   10,51,33,44,56,37,79, ……. ,102,23,125,16,148,9,125,2

   A. 50 B. 30 C. 79 D. None of them

7. If three boys eat three apples in 3 minutes, how many boys will it take to eat 36 apples in 6 minutes?

   A. 36 B. 12 C. 6 D. None of them

8. Two men, starting at the same point, walk in opposite directions for 4 meters, then each one turn left and walks another 3 meters. What is the distance between them?

   A. 8 B. 10 C. 14 D. None of them

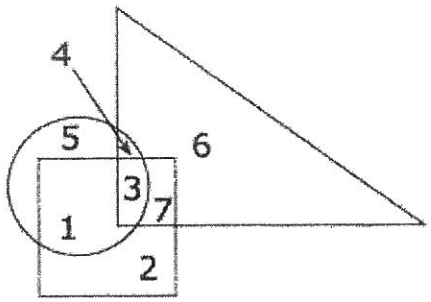
9. If you count from 1 to 100, how many 0's will you pass on the way

A. 9 B. 10 C. 11 D. 12

10. Five books colored red, green, blue, brown and black are placed on a table. If the red book is placed below the black book, the blue is placed above the brown, the green is placed below the red and the brown is placed above the black, then which book is in the middle?

A. The blue B. The red C. The green D. The black

11. Circle indicates 'strong', square indicates 'tall' and triangle 'army officers'. The tall army officers who are not strong are shown in position.....



A. 1 B. 3 C. 7 D. 4

12. If Sausages are 12$ a dozen, how much would it cost for 100 Sausages?

A. $ 12 B. $ 144 C. $ 112 D. $ 100

13. A girl spends one fifth of the money in her purse. She then spends one fifth of what remains in the purse. She spends 72$ in all. How much money did she have from the beginning?

A. $ 360 B. $ 1800 C. $ 2160 D. $ 200

14. A Street that is 60 yards long has a plant every 12 yards on one side and a plant every 10 yards on second side. How many total plants on the entire street?

A. 13 B. 12 C. 14 D. 11

15. Angela's father has four daughters: Lala, Lele, and Lulu ... can you guess the forth name?

A. Lili B. Lyly C. Lolo D. Angela

16. You have 12 black socks and 12 white socks mixed up in a drawer. It's early in the morning and you don't have any light to see the colors. How many socks must you pull out (blindly) to be sure of getting a matching pair?

A. 3 B. 2 C. 1 D. None of them

17. The Anderson family has a mother, father and 4 daughters. Each daughter has one brother. How many people are in the family?

A. 10 B. 9 C. 8 D. 7

18. The numbers 1, 2, 3, 4, 5, 6, 7, 8, and 9 must be put in the square below, replacing the "x" in such a way that the sums of the numbers in each row, column, and diagonal are equal. How should the numbers be arranged in the square?

x	x	x
x	x	x
x	x	x

A.

8	1	6
3	5	7
4	9	2

B.

1	6	8
5	7	3
9	2	4

C.

2	9	5
7	3	5
6	1	8

D.

4	1	6
5	7	3
9	4	2

19. What did the banana say to the dog?

A. Don't eat me B. I am delicious C. I am not delicious D. None of them

20. If an electric train is going south and the wind is blowing north, what direction is the smoke going?

A. south B. north C. West D. None of them

21. Which one of the following circle circumferences is the nearest to the point (2,1)

A. $x^2 + y^2 = 2$ B. $x^2 + y^2 = 4$ C. $x^2 + y^2 = 16$ D. $x^2 + y^2 = 8$

22. Which one of the following equations has only one solution

A. $|x| - 1 = 0$ B. $x^2 - 1 = 0$ C. $\sqrt{x} - 1 = 0$ D. $x - \frac{1}{x} = 0$

23. The intersection point of $y = 3 + x$ and $y = 5 + ax$ is (4,1), if

A. $a = -2$ B. $a = 1$ C. $a = 2$ D. none of these

24. A box contains 5 red, 10 white and 15 black balls. The probability that a person draws two balls of the same color is:

A. 12/435 B. 14/29 C. 115/870 D. 32/87

25. $\lim_{x\to 0} \frac{sinx+tanx}{tanx}$

A. $\frac{1}{2}$ B. 1 C. ∞ D. none of these

26. Two identical dice are thrown, what is the probability that the sum of the appearing numbers is at most 5?

A. 1/12 B. 2/9 C. 5/18 D. 11/36

27. Two triangles are drawn such as one of their edges is common with length (*L*) and the free vertices lie on a line perpendicular to the common edge on the same side. If (*H*) is the distance between the two vertices, then the difference between the two triangle areas is

A. $\frac{H+L}{2}$ B. $\frac{\sqrt{HL}}{2}$ C. $\frac{HL}{2}$ D. none of these

28. The solution of $\log_3 x = 1 - \log_3(x + 2)$ is

A. $x = 3$ B. $x = 1$ C. $x = -3$ D. none of these

29. A square and a circle are equal in perimeters, then the ratio of the area of the square to the area of the circle is:

A. greater than one B. less than one C. equal one D. none of these

30. If the exponential function is the inverse of the logarithmic function, then integral $\int e^{2\ln x}\, dx$ is

A. $\frac{x^3}{3}+c$ B. $\frac{1}{2}e^{2\ln x}+c$ C. $\frac{x^2}{2}+c$ D. $\frac{e^{2\ln x}}{x}+c$

31. How many inflection points can be found for a third order equation?

A. three B. more than three C. maximum two D. none of these

32. Which one of the following functions has the domain $x \leq 7$

A. $\ln(x+7)$ B. $\frac{1}{x-7}$ C. $\sqrt{7-x}$ D. none of these

33. The integral $\int_{-\pi}^{\pi} x^n \sin 3x\, dx = 0$ if the number n is

A. odd B. even C. real D. none of these

34. The solution of the simultaneous equations $\begin{matrix} x+y=4 \\ x^2+3y-y^2=11 \end{matrix}$ is

A. $x=3, y=1$ B. $x=2, y=2$ C. $x=5, y=-1$ D. none of these

35. The solution of $|4x-8|-4<12$ is

A. $x<2$ B. $x>6,\ x<2$ C. $-2<x<6$ D. none of these

36. Given that A and A^c are complementary events relative to the sample space $S = \{1,2,3,\ldots,10\}$. If $A=\{x|\ 1\leq x<8\}$ and $B=\{x|\ 6\leq x\leq 10\}$, the probability $P(B\cap A^c)$ is equal to

A. 0.35 B. 0.3 C. 0.45 D. 1.3

37. The first derivative of $y=\frac{\cos^2 x\ -\cos^4 x}{1-\sin^2 x}$, is

A. $\dot{y}=\frac{2\sin x}{(1-\sin^2 x)^2}$ B. $\dot{y}=\frac{-2\sin x+4\cos x}{(1-\sin^2 x)^2}$ C. $\dot{y}=\sin 2x$ D. none of these

38. The simple form of $\frac{x-5}{2x^2+x-1} + \frac{3}{2x-1}$, is

A. $\frac{2}{x+1}$ B. $\frac{3}{x-1}$ C. $\frac{2}{x-1}$ D. $\frac{-3}{x+1}$

39. The area between the curves of the two functions $y = 2x$ and $y = x$ from $x = 2$ to $x = 3$, is

A. 3/2 B. 5/2 C. ½ D. none of these

40. The center of two spheres S_1 and S_1 are (0, 0, 0) and (0, 0, 7) respectively. The first sphere passes through point (-4, 3, 0). The second sphere tangents the first if its radius is equal to

A. $r_2 = 2$ B. $r_2 = 3$ C. $r_2 = 7$ D. none of these

41. The two vectors $\vec{a} =< a_1, a_2, a_3 >$ and $\vec{b} =< b_1, b_2, b_3 >$ are perpendicular, if

A. $\vec{a} \times \vec{b} = \vec{0}$ B. $\vec{a} \cdot \vec{b} = 0$ C. $\vec{a}/\vec{b} = -1$ D. $\vec{a}\,\vec{b} = 0$

42. Let $A = \begin{bmatrix} 1 & 2 & -3 \\ 0 & 1 & -5 \\ 0 & 1 & 1 \end{bmatrix}$ and $B = \begin{bmatrix} 0 & 4 & -6 \\ 0 & 0 & -10 \\ 0 & 2 & c \end{bmatrix}$. If $|2A - B| = 4$, then

A. $c = 0$ B. $c = 1$ C. $c = -1$ D. none of these

43. If $\vec{a}$ and $\vec{b}$ are two vectors, then $\vec{a} \times \vec{b}$ is

A. a vector B. a scalar C. neither scalar nor vector D. none of these

44. A point is selected at random inside a circle with radius r. The probability that the point is closer to the center of the circle than to its circumference is

A. 1/8 B. 5/6 C. ¼ D. none of these

45. The complex number $(c + di)$ is equal to $(3 - i)^2$, if c and d are

A. -6, 8 B. 8, −6 C. 8, 6 D. none of these

46. The value of C that makes the mean and the mode of the following force readings (8, 10, 11, C, 8, 9, 10, 11, 9, 12, 12) equal, is

A. 9 B. 10 C. 8 D. 11

47. The real part of the product of $(5 - 3i)$ and the conjugate of $(3 + 2i)$ is

A. 16 B. 12 C. −12 D. none of these

48. $\lim_{x\to 0} \frac{x - \sin x}{e^x \sin x}$, is

A. ∞ B. ½ C. 0 D. 1

49. If $y = x^x$, then dy/dx is

A. x^{x-1} B. $(x-1)x^{x-1}$ C. $x \ln x$ D. $x^x[\ln(x) + 1]$

50. $\int_0^1 2x^3 \ e^{x^2} \ dx$, is

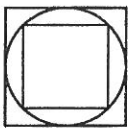
A. 1 B. 1/2 C. 2 D. −1

51. The equation $x^2 - (k-4)x + 9 = 0$ has two repeated roots, when

A. $k = 0$ B. $k = 1$ C. $k = -1$ D. $k = -2$

52. Two squares are drawn inside and outside a circle of radius r, as shown. The area between the two squares is equal to

A. r^2 B. $2r^2$ C. $r^2/4$ D. $r^2 - 4$



53. The first derivative of $f(x) = cos^2x - \frac{3}{x^2} - e^{lnx} + sin^2x$ at $x = 1$, is

A. $\grave{f}(1) = 4$ B. $\grave{f}(1) = -2$ C. $\grave{f}(1) = 2.5$ D. $\grave{f}(1) = 5$

54. The function $f(x) = x^2 - 3x$, is a decreasing function from $x = -\infty$ to

A. $x = 3/2$ B. $x = 2$ C. $x = 3/4$ D. $x = 4$

55. The points A(1,2), B(3,10), and C(4,y) are collinear (on the same line), if

A. $y = 12$ B. $y = 8$ C. $y = 14$ D. $y = 10$

56. Can a real algebraic equation have an odd number of complex roots?

A. Yes B. no C. depending on its order D. only if it is odd

57. A physics exam was given to two different classes then the average of marks for each class is calculated. The higher average means:

A. better students B. easier exam C. worse students D. no relation

58. A four sided polygon has three out of four of its internal angles equal to 90^o, then it must be?

A. Obtuse B. Hexagon C. a rectangle or a square D. none of these

59. $\int 2\frac{x\cos(x^2)}{\sin(x^2)}dx =$

A. $\ln(sin(x^2)) + c$ B. $\ln(cos(x^2)) + c$ C. $sin(x^2) + c$ D. has no solution

60. Addition of sine and cosine functions of different amplitudes and the same frequency gives:

A. exponential function B. sine wave function C. constant function D. none of these

61. A particle moves back and forth along the x axis from $x = -x_m$ to $x = +x_m$, in a simple harmonic motion with period T. At time $t = 0$ it is at $x = -x_m$. When $t = 0.75T$:

A. it is at x=0 and is traveling toward $x=+x_m$

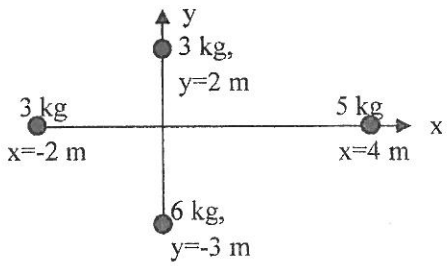
B. it is at x=0 and is traveling toward $x=-x_m$

C. it is between x=0 and $x=+x_m$ and is traveling toward $x=-x_m$

D. none of the above

62.

Four small particles are connected by rigid rods of negligible mass lying along the xy-plane as in Fig. The moment of inertia for that system about x and y-axis are given respectively as:



A. $I_x=66, I_y=92\ kg.m^2$
B. $I_x=24, I_y=24\ kg.m^2$
C. $I_x=24, I_y=92\ kg.m^2$
D. $I_x=92, I_y=66\ kg.m^2$

63. In a series R-L-C circuit operated at frequency f, the current in the capacitor

A. lags the current in the resistor by 90°
B. lags the current in the inductor by 180°
C. leads the voltage in the capacitor by 90°
D. leads the phase of the current in the resistor by 180°

64. A capacitor C is connected in series with R=1000 ohms and V=10V. The capacitor is charged to 63% of its full capacity in 1sec. Then the value of C is around

A. 1 μF
B. 0.2 mF
C. 1 mF
D. 2 μF

65. Two light rays will interfere constructively with maximum amplitude if the path difference between them is:

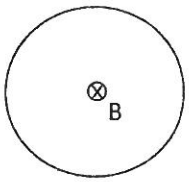
A. one wavelength
B. one-half wavelength
C. one-quarter wavelength
D. one-eighth wavelength

66. A portion of a conductor of length 10 cm is placed in a uniform magnetic field B. The conductor carries a current 2 A in direction making an angle 30° with the magnetic field direction. If the electromagnetic force acting on this portion equals 40 mN, find the value of B.

A. B=200 mT
B. B=400 mT
C. B=100 mT
D. B=20 mT

67.

A variable magnetic field $B = \pi.t$ (Tesla) is subjected to a circular coil pointed into the paper as shown in the figure. Find the induced current in the coil if it has a resistance of 0.1ohm and its radius is 10cm.



A. 1 A
B. 0.1 A
C. 0.22 A
D. 10 A

68. How much energy is required to ionize hydrogen when it is in the ground state?

A. 103 eV B. 10.2 eV C. 3.18 eV D. 13.6 eV

69. As a result of constant unbalanced forces acting on a body, this body will move with

A. uniform velocity
B. uniform speed
C. variable acceleration
D. uniform acceleration

70. A 16 V battery is connected across a 100 ohms resistor. Given that the charge of one electron equals 1.6×10^{-19} C, what is the number of electrons passing through the resistor every second ?

A. 1.0×10^{22} B. 1.0×10^{18} C. 2.0×10^{15} D. 2.0×10^{19}

71. A capacitor of capacitance 40 μF is charged under a voltage of 15 V. Find the value of the accumulated charge and the energy stored in this capacitor.

A. 600 μC, 4.5 mJ B. 60 μC, 4.5 mJ C. 600 μC, 9 mJ D. 60 μC, 18 mJ

72. An inductor, resistor and a DC. 12v supply are connected in series. The inductance is 0.3 H and the resistance is 15 ohms. The switch is now closed. The steady current is reached after

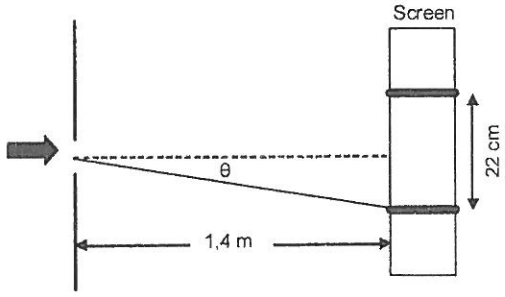
A. 0.1 s B. 0.01 s C. 0.135 s D. 2 s

73. A light wave travelling through vacuum strikes a block of glass with an angle of incidence of 30°. Then the frequency

A. increases
B. decreases by a factor of 1/2
C. decreases by a factor of 1/3
D. remains constant

74.

In one of their experiments, they place the screen at a distance of 1.4 m from a single slit and observe a pattern on the screen. The width of the central bright band is measured as 22 cm. If the wavelength of the incident blue light is 470 nm., the width of the slit is around



A. 12 mm B. 6 mm C. 2 mm D. 0.6 mm

75. A 240 V electric kettle has a heating element with resistance of 20 ohms. The kettle boils a certain amount of water in 4 minutes. Assuming 100% efficiency, the electrical energy used to boil this quantity of water is:

A. 2.88 kJ B. 1152 kJ C. 691.2 kJ D. 576 kJ

76. A cube has a side length 10 cm. If the weight of the cube equals 50 N, the material density for this cube is

A. 50000 kg/m^3 B. 5000 kg/m^3 C. 500 kg/m^3 D. 0.05 kg/m^3

77. A mass m is attached to a spring, of force constant k, on a horizontal plane. Pulling it by 1 m from its rest position stretches the spring. The maximum velocity of m is

A. $2\sqrt{k/m}$ B. $\sqrt{k/m}$ C. k/m D. $k/4\pi^2 m$

78. A capacitor and a resistor are connected in series across the terminals of a battery. If the resistance is increased, then

A. the final charge on the capacitor is increased

B. the final charge on the capacitor is decreased

C. the final charge on the capacitor is the same but the capacitor charges more slowly

D. charging time is decreased

79. Consider the following table and pick the true statement, taking into account that Blank's constant equals ($h=6.6\times10^{-34}$) :

Work function of zinc	7.0×10^{-19} J
Frequency of ultraviolet light	8×10^{14} Hz
Frequency of red light	4.3×10^{14} Hz

A. red light fails to emit photoelectrons from the surface of zinc plate

B. ultraviolet light fails to emit photoelectrons from the surface of zinc plate

C. both fail to emit photoelectrons from the surface of zinc plate

D. both have tendency to emit photoelectrons from the surface of the zinc plate

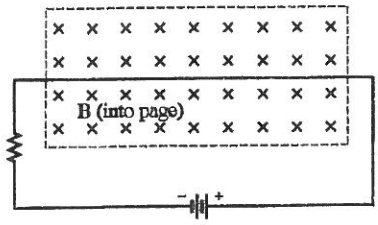
80. In the sun, helium is produced from hydrogen by

A. radioactive decay B. disintegration C. fusion D. fission

81. A ball of mass m=1kg and momentum p=3 kg.m/s, has kinetic energy equals to which of the following?

A. 5.4 J B. 0.45 J C. 0.54 J D. 4.5 J

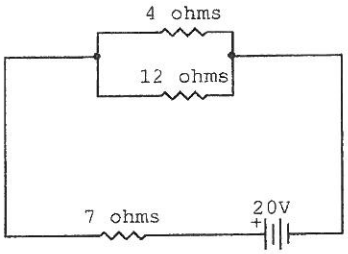
82.



A section of wire in the given circuit, lies in a region of magnetic field B directed into the page. The magnetic force on this section of wire is directed

A. toward the right
B. toward the left
C. toward the top of the page
D. toward the bottom of the page

83. In the given electric circuit, the current in the (4 ohms) resistance and the power lost in this resistance are given as



A. 1.5 A, 9 W
B. 1.5 A, 24 W
C. 2 A, 32 W
D. 2 A, 12 W

84. For a rectangular glass slab, the entering ray and the emerging ray

A. are parallel
B. form a right angle
C. form an acute angle
D. form an obtuse angle

85. The position x of a particle at time t is given by $\sqrt{x} = 10 + t$, then

A. velocity is constant
B. acceleration α t
C. acceleration is zero
D. velocity α t

86. Two copper wires, the first has length L and a cross-section area A while the second has length L/2 and a cross section area 3A. The ratio between the resistivity of the first wire and the second wire equals

A. 2
B. 6
C. 1
D. 3

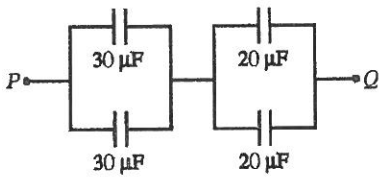
87. A radio-station broadcasts at 30 m wavelength. The frequency of electromagnetic waves transmitted from this station could be

A. 10 kHz
B. 3×10^{10} Hz
C. 10 MHz
D. 3×10^{8} Hz

88. A block of mass 3 kg slides along a horizontal surface that has negligible friction except for one section. The block arrives at the rough section with a speed of 5 m/s and leaves it 0.5 sec later with a speed of 3 m/s. What is the magnitude of the average frictional force exerted on the block by the rough section of the surface? Knowing that the speed decreases uniformly in the rough section

A. 30 N B. 12 N C. 4.5 N D. 4 N

89. Consider the diagram below. What is the equivalent capacitance between points P and Q?



A. 6 µF B. 24 µF C. 25 µF D. 50 µF

90. A 0.1 kg ball is dropped freely toward the ground from an altitude of 1.8 m. Just after impact with the ground the speed is reduced to 1/3 of the value of the speed just before impact. Then the variation of momentum in kg.m/s is around:

A. 0.08 B. 0.4 C. 0.04 D. 0.8

91. What pressure (in atm.) would be exerted by 76 g of fluorine gas in a 1.50 liter vessel at -37°C? (R = 0.082 L.atm/K.mole) (F = 19)

A. 25.8 atm. B. 4.1 atm. C. 19,6 atm. D. 84 atm.

92. What quantity of heat is evolved when 5.55 mol $H_2O(l)$ is formed from the combustion of $H_2(g)$ and $O_2(g)$?

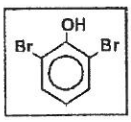
$$H_2(g) + \tfrac{1}{2}O_2(g) \rightarrow H_2O(l) \qquad \Delta H = -285.8 \text{ kJ}$$

A. 51.44 kJ B. 285.8 kJ C. 1586 kJ D. 2297 kJ

93. The pH of an aqueous solution is 4.32. the $[OH^-]$ is

A. 6.4×10^{-1} M B. 2.1×10^{-10} M C. 4.8×10^{-5} M D. 1.6×10^{-14} M

94. What is the name of the following compound?



A. 1,3-dibromophenol B. 2,5-dibromophenol C. 2,6-dibromophenol D. m-dibromophenol

95. $K_c = 0.040$ for the system below at 450°C:

$$PCl_5(g) \leftrightarrows PCl_3(g) + Cl_2(g)$$

Evaluate K_p for the reaction at 450°C. (R = 0.082 L.atm/K.mole)

A. 2.38 B. 0.64 C. 0.40 D. 0.052

96. A student combines 0.25 mole of NaOH and 0.20 mole of HCl in water to make 2 liters of solution. The pH of this solution is

A. 1.3 B. 1.6 C. 12.4 D. 12.7

97. Given: $A + 3B \rightarrow 2C + D$

This reaction is first order with respect to reactant A and second order with respect to reactant B. If the concentration of A is doubled and the concentration of B is halved, the rate of the reaction would _____ by a factor of _____.

A. increase, 2 B. decrease, 2 C. increase, 4 D. not change

98. Which molecule has a linear arrangement of all component atoms?

A. CH_4 B. CO_2 C. H_2O D. NH_3

99. What is the value of ΔH for the reaction, $S(s) \rightarrow S(g)$?

$$S(s) + O_2(g) \rightarrow SO_2(g) \qquad \Delta H_1 = -395 \text{ kJ}$$
$$S(g) + O_2(g) \rightarrow SO_2(g) \qquad \Delta H_2 = -618 \text{ kJ}$$

A. -1013 kJ B. -223 kJ C. +1013 kJ D. +223 kJ

100. Electrons are lost by the

A. reducing agent as it undergoes oxidation B. reducing agent as it undergoes reduction

C. oxidizing agent as it undergoes oxidation D. oxidizing agent as it undergoes reduction