REGISTERED ELECTRICAL ENGINEERS Pre-Board Examination
Wednesday, March 14, 2018 8:00 AM - 2:00 PM

ELECTRICAL ENGINEERING

INSTRUCTION: Select the correct answer for each of the following questions. Mark **only one answer** for each item by shading the box corresponding to the letter of your choice on the answer sheet provided. **STRICTLY NO ERASURES ALLOWED**. Use pencil **No. 2** only.

MULTIPLE CHOICE: #1 to #50 → given Sept. 2017

1. Which of the following is NOT INCLUDED in the Technical Performance Standards for Distribution and Supply set by the Philippine Distribution Code?
   A. Power Quality B. Reliability C. Collection Efficiency D. System Efficiency

2. Three 3-ohm resistors are connected in parallel. This combination is then placed in series with another 3-ohm resistor. What is the equivalent resistance in ohm? $[3^{-1}+3^{-1}+3^{-1}]^{-1}+3=4$
   A. 12 B. 9 C. 4 D. 6

3. What size of branch circuit is required for a window air conditioner with a nameplate rating of 8 A if the circuit also supplies other outlets? $I=2.5(8)$ $I=20A$
   A. 17 A B. 25 A C. 20 A D. 15 A

4. Which plant takes the least time in starting from cold conditions to full load operation?
   A. Steam turbine power plant C. Gas turbine power plant
   B. Hydro power plant D. Nuclear power plant

5. What is the equivalent IEEE device number for an under-voltage relay?
   A. 67 AC Directional Overcurrent B. 52 AC CKT Breaker C. 27 D. 51 AC Time Overcurrent

6. A coil of wire having a value of 10 + j16 ohms is connected in series with a capacitive reactance X_C, and this series combination is then connected in parallel with a resistor R. If the equivalent impedance of the circuit is 8 + j0 ohms, what is the value of X_C in ohms? $Z=R+[X_L-X_C]$; $10+j16$ (X_L, X_C)
   A. 18 B. 10 C. 16 D. 5

7. To adjust the power of the alternator, adjust the _____.
   A. power factor B. governor C. field current D. frequency

8. In a series RC circuit the voltage across the capacitor and the resistor are 60 v and 80 v respectively. What is the total voltage of the circuit? $V_T=\sqrt{R^2+C^2}$ $V_T=\sqrt{60^2+80^2}=100$
   A. 120 v B. 115 v C. 100 v D. 105 v

9. A generator delivers a load through a pair of wires, each of which has a resistance of 0.06 ohm. If the load voltage and power are 120 v and 4.8 kW, respectively, what is the generated voltage? $I=4.8/120=40A$ $Eg=120+40(0.06)$
   A. 125.5 v B. 126.8 v C. 124.8 v D. 123.5 v

10. In a 4-pole, 60 Hz, 200v induction motor having a full-load current of 350 A, torque developed is 700 N-m. What is the approximate speed of the motor? $T=9.55\frac{Pd}{N}$
    A. 1100 rpm B. 955 rpm C. 870 rpm D. 1250 rpm

11. Three resistances of 4, 9, and 11 ohms are connected in series and then in parallel. Find the effective resistance for series connection.
    A. 15 ohms B. 20 ohms C. 24 ohms D. 13 ohms

12. Three resistors A, B, and C are connected in series to a 120-v supply. If the resistor A = 50 ohms and the voltage across resistor B = 40 v when the current is 1/2 A, what is the resistance of resistor C in ohm/s? $120-0.5(50)-40=$ $55(2)=110$
    A. 105 B. 90 C. 110 D. 100

13. In a transmission line of negligible resistance, the surge impedance will be _____.
    A. square root of LC B. square root of L/C C. square root of 1/LC D. square root of C/L

14. What is the purpose of reactor in short circuit?
    A. To open the line in short circuit C. To lessen the current in short circuit
    B. To decrease the circuit resistance D. To increase the current in short circuit

15. In a 12-v battery supplies 10 A, find the amount of energy in KJ delivered in one hour. $W=Pt=12(10)(3600)$
    A. 120 B. 216 C. 324 D. 432

16. A transformer rated at a maximum of 50 KVA supplies a 25 kW load at power factor 75% lagging. How many KW additional load may be added at unity power factor without exceeding the transformer rating?
    A. 24 B. 25 C. 29 D. 20

17. What is the maximum output power of a cellular transmitter?
    A. 4.5 w B. 1.5 w C. 3 w D. 6 w

16. $S^2=P^2+$

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BONUS

18. Three impedances $Z_1 = 3 + j5$, $Z_2 = 6\angle 20°$, and $Z_3 = 4\angle -30°$ Ω are connected in delta. Find the transform δ impedance into the Y impedance Z_A, Z_B, and Z_C (ACB sequence).
A. $Z_A = 2.67\angle 56.4°$, $Z_B = 1.78\angle -6.38°$ and $Z_C = 1.83\angle -3.27°$ ohms
B. $Z_A = 1.78\angle -6.38°$, $Z_B = 1.83\angle -3.27°$ and $Z_C = 2.67\angle 56.4°$ ohms
C. $Z_A = 2.67\angle 56.4°$, $Z_B = 1.83\angle -3.27°$ and $Z_C = 1.78\angle -6.38°$ ohms
D. $Z_A = 1.83\angle -3.27°$, $Z_B = 2.67\angle 56.4°$ and $Z_C = 1.78\angle -6.38°$ ohms

19. For constant transmission efficiency, voltage is increased n times, the size of the conductor would be _____.
A. reduced to (1/n) times of the original
B. reduced to $(1/n^2)$ times of the original
C. increased to n^2 times of the original
D. increased to n times of the original

20. Copper loss of a transformer are determined by means of a/an _____ test.
A. open-circuit B. polarity C. short-circuit D. inductive-circuit

21. The power transmission capacity of the transmission is _____.
A. inversely proportional to the voltage
B. directly proportional to the voltage
C. proportional to the square of the voltage
D. proportional to the cube of the voltage

22. The undervoltage relays are usually used for what protection of the electrical equipment?
A. feeder protection B. motor protection C. transformer protection D. bus-bar protection

23. In a certain area, the energy consumption is expected to double in 10 years. Assuming a simple exponential growth given by $P = P_0e^{at}$, what is the growth rate?
A. 6.39% B. 5.39% C. 6.93% D. 5.93%

24. Which of the following type of fault used only the equivalent positive sequence impedance of the circuit in the short-circuit calculation?
A. Line to Line B. Line to ground C. Double line to ground D. Three-phase fault

25. A generator delivers a load through a pair of wires, each of which has a resistance of 0.06 ohm. If the load voltage and power are 120 v and 4.8 KW, respectively, what is the power loss in the line wires?
A. 96 w B. 198 w C. 192 w D. 99 w

26. What device is used to measure the temperature of a motor winding while the motor is in operation?
A. Seismic probe
B. Resistance temperature detector
C. Thermocouples
D. Proximity probe

27. When one coil of a magnetically coupled pair has a current of 7.0 A, the resulting fluxes ϕ_{11} and ϕ_{12} are 0.50 mWb and 0.75 mWb, respectively. What is the coefficient of coupling K, if the number of turns N_1 and N_2 are 100 and 300, respectively?
A. 0.4 B. 0.8 C. 0.2 D. 0.6

28. What is V_{BN} in this balanced three-phase in which $V_{AN} = 7200\angle 20°$ and $V_{CN} = 7200\angle -100°$?
A. $7200\angle -80°$ B. $7200\angle 120°$ C. $7200\angle 90°$ D. $7200\angle 140°$

29. Which of the following is a primary disadvantage of FM over AM?
A. Lower efficiency
B. Noise susceptibility
C. Higher cost and complexity
D. Excessive use of spectrum space

30. The terminal voltage of a battery is 11.8 v when delivering 20 w of power to an external load resistor R. If the battery has an emf of 15 v, find the internal resistance of the battery.
A. 1.96 ohm B. 1.89 ohm C. 1.68 ohm D. 1.75 ohm

31. Which of the following that the voltage regulation is one of the important factors consider in the electrical power design?
A. generator B. transmission line C. feeder D. transformer

32. A small wind generator is designed to generate 75 KW of power at a wind velocity of 30 mi/hr. What is the approximate blade diameter of the wind generator in ft?
A. 35.4 B. 31.9 C. 33.6 D. 37.3

33. Single-Side Band signal produces a peak to peak voltage of 720 v on voice peaks across a 75-ohm antenna. What is the peak envelope power?
A. 865 w B. 856 w C. 835 w D. 853 w

$PEP = \frac{V^2}{R} \rightarrow \frac{\left[\frac{720}{2\sqrt{2}}\right]^2}{75} = 864\,W$

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34. Which of these is not a factor in the selection of fuse rating for protection of a branch circuit?
A. Branch full-load current C. Branch fault-current
B. System impedance D. System voltage

35. Which of the following principle will the operation of fiber-optic cable is based?
A. dispersion B. refraction C. reflection D. absorption

36. Two compound generators are operated in parallel. If generator A has a series-field resistance of 0.0015 ohm and is adjusted to take 30% of the line load while generator B with a series field resistance of 0.001 ohm takes the remainder of the load, what is the current flow in the equalizer, when the load is 230 kW at 230 v?
A. 300 A B. 100 A C. 400 A D. 200 A

37. Determine the circuit element and its value for V = 120 sin (377t – 30°) volts and I = 4 sin (377t + 60°) amps.
A. X_C = 30 Ω and C = 66.31 μF C. X_C = 30 Ω and C = 88.42 μF
B. X_C = 40 Ω and C = 66.31 μF D. X_C = 40 Ω and C = 88.42 μF

38. A straight conductor 100 cm long and carrying a current of 40 A lies perpendicular to a magnetic field of 1.5 Wb/m^2. What is the mechanical power in watt/s required to move the conductor at a uniform speed of 6 m/s?
A. 390 W B. 300 W C. 330 W D. 360 W

39. A washing machine is, in effect, an RL circuit. If the machine takes 311 W and 4.5 A from a 115-v source when operating normally. Find its power factor.
A. 0.70 lagging B. 0.80 lagging C. 0.75 lagging D. 0.60 lagging

40. An induction motor draws 50 KW at a 0.60 lagging power factor from a 480 v, 60 Hz source. What parallel capacitor will increase the overall power factor to 0.90 lagging?
A. 532 μF B. 489 μF C. 704 μF D. 582 μF

41. When the voltage remains the same, the current will _____ as the impedance decreases.
I. decrease II. increase
A. I only B. Both C. Either I or II D. II only

42. When electrons build up pressure at one point, it is called _____.
A. ganging B. current flow C. impedance D. pressure filing

43. Which of the following type of fault used only the equivalent positive and negative sequence impedance of the circuit in the short-circuit calculation?
A. Double line to ground B. Line to line C. Three-phase D. Line to ground

44. A 69 KV three-phase transposed line is composed of one ACSR 336,400 cmil, 26/7 Linnet conductor per phase with a horizontal configuration of D_{12} = 5 ft, D_{23} = 5 ft and D_{13} = 10 ft. The conductors have a diameter of 0.721 inch and a GMR of 0.0243 ft. Find the inductance per phase per kilometer of the line.
A. 1.0963 mH/km B. 1.1116 mH/km C. 1.1505 mH/km D. 1.1233 mH/km

45. Based on the Philippine Distribution Code, all users of the distribution system must maintain a certain power factor at the connection point in order to maintain power quality in the system. What power factor should be maintained at the connection point?
A. Not less than 65% B. Not less than 70% C. Not less than 85% D. Not less than 75%

46. Which of the following is NOT considered in the selection of surge arrester?
A. Voltage rating B. Current rating C. Class of Arrester D. Insulation level

47. A transformer has a primary winding of 2000 turns and voltage of 2400 v and current of 8.66 – j5 with an impedance Z_2 connected across the secondary winding. The secondary winding has 500 turns. What is the value of the secondary impedance?
A. 8.66 + j5 ohm B. 26 + j15 ohm C. 15.32 + j10 ohm D. 13 + j7.5 ohm

48. Find the average power absorbed by a balanced three-phase load in an ABC circuit in which $V_{CB} = 208\angle 15°$ and $I_B = 3\angle 110°$?
A. 1,080 w B. 624 w C. 358 w D. 620 w

49. A 4-pole dc machine is wound duplex lap. Find the number of parallel paths.
A. 6 B. 8 C. 10 D. 4

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50. The current in a series circuit of R = 10 ohms and L = 60 mH lags the applied voltage by 80°. What is the source frequency in HZ?
A. 144.3 B. 163.5 C. 150.4 D. 174.6

51. A 240 v, 3 phase, 3-wire system has two balanced 3 phase loads. Load I, delta connected takes 24 KW at 0.8 pf leading and load 2, wye-connected takes 20 KVA at 0.766 pf lagging. Find the line current in amperes.
A. 88.6 B. 110.4 C. 92.8 D. 95.4

52. In a 3 phase, 4-wire system, the current in line a has $I_{a1} = 200\angle 0°$ A and $I_{a2} = 100\angle 60°$ A. The current through the neutral conductor is $300\angle -60°$ A. Find the line current I_b in amperes.
A. $300\angle 120°$ B. $300\angle -60°$ C. $300\angle 240°$ D. $100\angle -30°$

53. In full-wave rectification, if the input frequency is 60 Hz, then output has a frequency of _____.
A. 30 HZ B. 60 HZ C. 120 HZ D. 240 HZ

54. The specific gravity of a lead-acid cell is often used as a measure of its _____.
A. rate of discharge B. operating temperature C. state of charge D. life expectancy

55. A hydroelectric power plant consumes 60 x 10^6 KWHR per year. What is the net head if the expected flow is 1,500 m^3/min and overall efficiency is 63%?
A. 33.3 m B. 44.3 m C. 55.3 m D. 66.3 m

56. The purpose of insulating oil when used on power circuit breaker are the following, EXCEPT;
A. Coolant B. Interrupter C. Quencher D. Insulation

57. What is the total flux emitted of four lamps having an intensity of 100 Cd each?
A. 1,256 lm B. 2,512 lm C. 5,026 lm D. 10,052 lm

58. What is the Thevenin's equivalent reactance of a certain electric system rated 20 MVA at 34.5 KV if the available short circuit MVA is 950?
A. 2.10% B. 1.75% C. 2.25% D. 1.59%

59. A transmitter supplies 10 KW of carrier power to the antenna. The total radiated power with 40% modulation is _____ KW.
A. 14 B. 1.6 C. 10.8 D. 25

60. The field system of a 60 HZ alternator has a sinusoidal flux per pole of 0.1 Wb. Calculate the emf generated in one turn which spans two-thirds of a pole pitch.
A. 5.2 v B. 19.2 v C. 23.1 v D. 33.3 v

61. A single-phase transformer is rated 110/440 v, 2.5 KVA. Leakage reactance measured from the low-tension side is 0.06 Ω. Determine the leakage reactance in percent.
A. 4.21% B. 1.42% C. 14.2% D. 1.24%

62. A six-pole, 3ϕ SCIM is connected to a 60-HZ supply. At full-load, the rotor's induced emf makes 72 complete cycles in 1 minute. What is the rotor speed?
A. 1,154 rpm B. 1,176 rpm C. 1,180 rpm D. 1,186 rpm

63. The commonly used light sensor in a modern fax machine is the _____.
A. photo tube B. photo transistor C. charge couple device D. liquid crystal display

64. A standard candle emits a total luminous flux of _____ lumens.
A. 12.57 B. 25.14 C. 78.96 D. 157.90

65. A space station with communication equipment that synchronizes with the earth's orbit.
A. space craft B. space probe C. satellite D. space CATV

66. What is the total energy generated by a station in KWHR in a year if its maximum demand and annual load factor is 150-KW and 45%, respectively?
A. 1,314,000 B. 591,300 C. 67,500 D. 24,637

67. A 5,000 KVA synchronous condenser operates with a leading power factor of 0.032. The total losses are 160 KW. What is the power input of the motor?
A. 320 kW B. 5,160 kW C. 5,320 kW D. 160 kW

68. A magnetizing force of 1,000 AT/m will produce a flux density of _____ in air.
A. 0.63 mT B. 0.63 T C. 1.257 mT D. 1.257 T

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69. Impurities in an electrolyte can cause an internal short circuit condition called
A. local action B. depolarization C. polarization D. electrolysis

70. The average value of the function i = 50 sin ωt + 30 sin 3ωt is equal to _____.
A. 38.2 A B. 31.8 A C. 40 A D. 51 A

71. A single-phase, 10-km transmission line has 16.65 mH total inductance. If the distance between the conductors is 1 m, what is the conductor radius?
A. 1 cm B. 2 cm C. 1.5 cm D. 0.75 cm

72. What must be the maximum tidal head available for a proposed 1,000 MW tidal power plant if the area of the tidal bay is 112 km^2? 0.219 h^2 A
A. 7.52 m B. 7.12 m C. 6.38 m D. 6.74 m

73. As load power factor of an alternator becomes more lagging, the value of generated voltage required to give rated terminal voltage _____.
A. increases B. decreases C. remains unchanged D. varies with rotor speed

74. Three 10:1 transformers are connected Δ-Y for stepping up the 2,300 v three-phase source. Calculate the secondary line voltage.
A. 23,000 v B. 46,000 v C. 69,000 v D. 40,000 v

75. A 69 KV, three-phase short transmission line is 16 km long. The line has a per phase series impedance of 0.125 + j0.4375 ohm per km. Determine the transmission efficiency when the line delivers 70 MVA, 0.80 lagging power factor at 64 KV.
A. 93.75% B. 94.75% C. 96.90% D. 95.90%

76. A 5 MVA, 13.8 KV/480 V, 5% impedance transformer is tapped at 13.8 KV line where the Thevenin's equivalent impedance is 0.5 ohm. Determine the fault current at the primary for a three-phase fault at the secondary.
A. 4,200 A B. 3,300 A C. 10,500 A D. 6,050 A

77. A certain copper wire has a resistance of 0.5 Ω when the length is 10 m. What is its diameter in mils?
A. 38 B. 33 C. 26 D. 21

78. A half-wave rectified sine wave has an average value of 100 A. What is its effective value?
A. 70.71 A B. 141.4 A C. 100 A D. 157 A

79. Two impedances Z_1 = 12 + j16 ohms and Z_2 = 4 – j4 ohms are connected in parallel across 240 v, 60 Hz ac supply. Find the total power factor.
A. 0.766 B. 0.877 C. 0.828 D. 0.846

80. In a commutator
A. copper is harder than mica C. mica is harder than copper
B. mica and copper are equally hard D. none of these

81. The changes in volume of transformer cooling oil due to variation of atmospheric temperature during day and night is taken care of by which part of transformer?
A. Conservator B. Breather C. Bushings D. Buchholz relay

82. Centrifugal switch disconnects the auxiliary winding of the motor at about _____ percent of synchronous speed.
A. 30 to 40 B. 70 to 80 C. 80 to 90 D. 100

83. The material commonly used for insulation in high voltage cables is
A. lead B. paper C. rubber D. glass

84. An energy of 10.152 x 10^{18} J is equal to _____ quads.
A. 9.623 B. 96.23 C. 962.3 D. 9,623 9.470862890317

85. A frequency of 27 MHz has a wavelength of approximately _____.
A. 9 m B. 13 m C. 7 m D. 11 m

86. For a series RLC circuit at resonance, the current amplitude is maximum for a fixed voltage amplitude and the power factor is unity.
A. minimum, zero B. minimum, unity C. maximum, zero D. maximum, unity

87. If the length of a cable is doubled, its capacitance
A. becomes one-fourth B. becomes one-half C. becomes double D. remains unchanged

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88. A central station has annual factors as follows:
Load = 58.5% Capacity = 40.9% Use = 45.2%
The reserve carried over and above the peak load is 8,900 kW. What is the installed capacity?
A. 20,700 KW (B) 29,600 KW C. 25,900 KW D. 40,000 KW

89. Wye-delta starting is equivalent to autotransformer starting with 58% tapping.
A. 73% B. 67% (C) 58% D. 33%

90. These days DC motors are widely used in
A. pumping sets B. air compressors (C) electric tractions D. machine shops

91. A balanced delta connected load draws 30 A phase current from a balanced 3-phase supply. An open circuit fault occurs in one of the lines. Determine the line current in amperes.
(A) 45 B. 60 C. 90 D. 100

92. Breather mounted on transformer tank contains
A. water B. oil C. liquid (D) calcium

93. A switch is connected across a 220 v supply. What is the voltage across the switch if it is closed?
(A) 0 B. 220 v C. 110 v D. infinity

94. The current in a coil decays as follows: when t = 0.002 sec, the current is 10 mA; when t = 0.006 sec, the current drops to 4 mA. What is the time constant of the coil?
A. 3.28 ms (B) 4.36 ms C. 5.36 ms D. 6.28 ms

95. As load power factor of an alternator becomes more leading, the value of generated voltage required to give rated terminal voltage _____.
A. increases (B) decreases C. remains unchanged D. varies with rotor speed

96. Two(2), 1ϕ, 25-KVA transformers are connected in open delta bank supplying a balanced 3ϕ load of 40 KVA. What is the percentage load of the bank?
A. 80% B. 86.4% C. 90.4% (D) 92.4%

97. A hermetic motor compressor has a rated load current of 25 A. What is the allowable rating for branch disconnecting means?
(A) 28.75 A B. 31.25 A C. 30 A D. 37.5 A

98. The process by which metallic parts are demagnetized is called _____.
(A) degaussing B. demagnetizing C. degrading D. degreasing

99. Synchronous motors are
A. self-starting (B) not self-starting C. essentially self-starting D. none of these

100. A generating plant has a minimum and maximum outputs of 50 MW and 100 MW, respectively. It generates an energy of 1.8×10^6 KWHR for 24 hours at an average power factor of 90%. What is the load factor of the plant?
A. 65% (B) 75% C. 80% D. 85%

*** END ***

SUBMIT THIS TEST QUESTION SET TOGETHER WITH THE ANSWER SHEET TO YOUR WATCHERS. BRINGING THE TEST QUESTION SET OUT OF THE ROOM WILL BE A GROUND FOR DISCIPLINARY ACTION