REGISTERED ELECTRICAL ENGINEERS Pre-Board Examination
Sunday, July 31, 2016 8:00 AM - 2:00 PM

PROFESSIONAL ELECTRICAL ENGINEERING SUBJECTS

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 April 2016

1. The color reserved for use in equipment grounding conductor is
   A. Yellow (B.) Green C. White D. Gray

2. What is the emf induced across an inductor with 150 mH inductance and constant current of 4 amperes?
   A. 0.6 v (B.) 0 v C. 1.2 v D. 12 v

3. Which of the following is not a full-duplex?
   (A.) Radar B. Telephone C. Telemetry D. Local Area Network

4. In a circuit breaker, the time duration from the instant of the fault to the extinction of arc is known as
   A. operating time (B.) total clearing time C. lag time D. lead time

5. A resistance of 6 Ω is connected in parallel with another resistor R across a 120 v supply. The total current taken from the supply was found to be 40 A. What is the value of resistance R?
   A. 1 Ω B. 2 Ω C. 4 Ω (D.) 6 Ω

6. A 50 cm long conductor is moved in a field of density 1 Wb/m^2 at a velocity of 30 m/s. What is the emf induced if the motion is perpendicular to the field?
   A. 150 v B. 1.5 v (C.) 15 v D. 0.15 v

7. Two capacitors C_1 = 50 μF and C_2 = 30 μF are connected in series. Find the equivalent capacitance in μF.
   A. 1,875 B. 187.5 (C.) 18.75 D. 1.875

8. 34.5 KV to 69 KV is classified as
   A. low voltage B. medium voltage (C.) high voltage D. extra high voltage

9. Wavelength is the distance travelled by an electronic wave during the time of one cycle. Given a wavelength of 12 meters, what is the frequency?
   A. 250 kHz B. 25 kHz C. 250 MHz (D.) 25 MHz

10. A 4-pole dc generator has a total of 600 conductors in its lap wound armature. The flux per pole is 10^6 lines. Determine the generated emf if it is driven at 2,400 rpm.
    A. 230 v B. 254 v C. 234 v (D.) 240 v

11. For an RL circuit, the power factor cannot be less than 0 or greater than 1.
    (A.) 0, 1 B. 1, 0 C. 0, −1 D. −1, 0

12. In a certain country, the peak power demand for year 2005 is 9,287 MW and by year 2014 it is estimated to be 10,064 MW. Calculate the growth rate.
    (A.) 0.9% B. 0.8% C. 0.76% D. 0.85%

13. _____ is the overall energy program formulated and updated yearly by the DOE, submitted to congress pursuant to R.A. 7638.
    A. Philippine Energization Program C. Philippine Electrification Program
    (B.) Philippine Energy Plan D. Philippine Electrification Plan

14. A certain amount of fuel can be converted into 3 x 10^{-3} quads of energy. Assume a 30% overall efficiency for the power plant. If the average load on the power plant over a 24 hour period is 60 MW, how long in day/s the fuel will last?
    A. 180 B. 175 (C.) 183 D. 185

15. The lighting load for a dwelling expressed in terms of a unit load in volt-ampere per square meter must be at least _____.
    (A.) 24 B. 12 C. 16 D. 28

16. The capacitors of power factor correction are rated in terms of
    A. KV B. KW C. KVA (D.) KVAR

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$P_{max} = \frac{V^2}{4R_T} = \frac{12^2}{4(0.25)}$

17. Find the maximum power that can be drawn from a 12 v battery if its internal resistance is 0.25 Ω.
A. 72 W (B.) 144 W C. 576 W D. 36 W

18. Two identical coupled coils have an equivalent inductance of 80 mH when connected in series aiding and 35 mH in series opposing. What is the value of the coefficient of coupling K? 0.391
(A.) 0.391 B. 0.319 C. 0.193 D. 0.139

19. What is the emf induced in a coil of 500 turns and with a constant flux of 10^8 maxwells?
(A.) 0 v B. 5 v C. 50 v D. 500 v

20. In a balanced three phase wye connected circuit, the line voltage are equal
A. to the line current (C.) and so are the line currents
B. to the phase voltage D. but the line currents are unequal

21. In a given circuit when power factor is unity the reactive power is
A. maximum B. equal to I^2R (C.) zero D. minimum

22. What is the branch circuit ampacity of a hermetic motor with a full-load current of 16 A?
A. 15 A (B.) 20 A C. 25 A D. 30 A

23. A three-phase wye-delta connected, 50 MVA, 345/34.5 kV transformer is protected by differential protection. The current transformer on the high side for differential protection is 150:5. What is the current on the secondary side of CT's?
A. 3.83 A B. 2.53 A C. 4.50 A (D.) 4.83 A

24. Joule found out that the heat produced in a current carrying conductor is proportional to
(A.) the square of the current C. the square of resistance
B. the current D. inversely proportional to time

25. A conductor has four identical strands arranged in diamond configuration. Find the GMR of the conductor in terms of the radius r of each strand.
(A.) 1.6921r B. 1.7037r C. 1.3008r D. 1.3052r

26. The resistance of the same length of aluminum and copper wires are found to be equal. Find the ratio of radii of aluminum to copper?
A. $\frac{R_{al}}{R_{cu}} = 0.78$ (B.) $\frac{R_{al}}{R_{cu}} = 1.29$ C. $\frac{R_{al}}{R_{cu}} = 0.88$ D. $\frac{R_{al}}{R_{cu}} = 1.14$

27. In a wye connected system, line current is
A. 0.707 times the phase current (C.) equal to the phase current
B. 1.735 times the phase current D. 1.414 times the phase current

28. What is the device function number for overcurrent relay?
A. 27 Undervoltage B. 67 AC Directional Overcurrent C. 50 Instantaneous (D.) 51

29. In a series RL circuit, the inductor current _____ the resistor current.
A. lags B. leads (C.) is equal to D. is greater than

30. A three-phase, 60 Hz, transmission line has its conductors arranged in a triangular configuration so that the two distances between conductors are 5 m and the third is 8 m. The conductors have an outside diameter of 250 mils. Find the inductive reactance in ohm per km per phase of the transmission line.
A. 0.567 B. 0.283 (C.) 0.586 D. 0.293

31. Natural gas has an energy content of 0.036 watt-year/ft^3, and coal has an average energy content of 940 watt-years/ton. If 20 percent of the net energy requirement of 2.82 x 10^6 GWHR were to be met with gas and 80 percent with coal, what amount of gas would be required?
A. 1.79 x 10^6 ft^3 B. 1.79 x 10^8 ft^3 C. 1.79 x 10^{10} ft^3 (D.) 1.79 x 10^{12} ft^3

32. When one coil of a magnetically coupled pair has a current of 5 A, the resulting fluxes ϕ_{11} and ϕ_{12} are 0.4 mWb and 0.8 mWb, respectively. If the turns are N_1 = 500 and N_2 = 1,500, find L_1.
A. 20 mH B. 40 mH C. 60 mH (D.) 120 mH $L_1 = \frac{500(0.8)}{5}$

33. Three capacitances C_1 = 6 μF, C_2 = 7 μF and C_3 = 18 μF are connected in series across a 120 v supply. Find the voltage across C_3.
A. 1.826 v (B.) 18.26 v C. 54.78 v D. 5.478 v

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34. The specific resistance ρ is defined as
A. resistance of a conductor which has a length of 1 m and cross-section of 1 m^2 at 20 °C
B. resistance of any conductor at 25 °C
C. resistance of any conductor at 20 °C
D. resistance of a conductor which has a length of 1 m and cross-section of 1 cm^2 at 20 °C

35. A 15 Ω resistor connected in series with an inductor has an equivalent impedance of 30 Ω with an unknown angle. Find the power factor angle in degrees.
A. 30° B. 60° C. 45° D. 75°

36. The master control center for a cellular telephone system is the
A. cell site C. central office
B. mobile telephone switching office D. branch office

37. The permeability of a material means
A. strength of permanent magnet
B. strength of an electromagnet
C. the magnetization left in the iron after exciting field has been removed
D. the conductivity of a material for magnetic lines of force

38. A 10 KVA, 200/400 v, 1ϕ transformer is operated with open circuited secondary. Find the primary current.
A. 2 A B. 4 A C. 6 A D. 8 A

39. An office has a total area of 500 square meters. Find the total lighting load for a unit load of 28 volt-amperes per square meter.
A. 8 KVA B. 10 KVA C. 12 KVA D. 14 KVA
$500\ m^2 \left[28\ \frac{VA}{m^2}\right] = 14\ KVA$

40. Is an instrument connected across the load.
A. voltmeter B. ammeter C. ohmmeter D. wattmeter

41. A balanced delta load of 3 + j4 Ω per phase is connected to a balanced 110 v source. Find the line current.
A. 22 A B. 38.1 A C. 11 A D. 19.05 A

42. Transform the current given by 6 + j8 A to its time domain.
A. 100 cos (ωt + 53.13°) C. 100 cos (ωt + 36.87°)
B. 10 cos (ωt + 53.13°) D. 10 cos (ωt + 36.87°)

43. What is the equivalent phasor of i(t) = 20 cos (ωt + 40°) A?
A. 15.3 – j12.9 A B. −15.3 + j12.9 A C. 15.3 + j12.9 A D. −15.3 – j12.9 A

44. A parallel RL circuit draws a total current of 17 A and 1.8 KW from a 120 v supply. Find R.
A. 7 Ω B. 8 Ω C. 9 Ω D. 10 Ω

45. What will happen to the current of a transformer when the temperature of the transformer winding increases?
A. remains unchanged B. increases C. decreases D. dramatically changes

46. A 6 Ω resistor is connected in series with an inductor L across a 110 v, 60 Hz source and draws a current of 10 A. Find L.
A. 25.5 mH B. 26.5 mH C. 23.5 mH D. 24.5 mH
$L = \frac{X_L}{2\pi f} = 9.22/2\pi(60) =$
$Z = E/I = 110/10 = 11$
$X_L = \sqrt{Z^2 - R^2}$
$X_L = \sqrt{11^2 - 6^2} = 9.22$

47. The type of emf induced by neighboring coils.
A. self-induced B. statically induced C. dynamically induced D. mutually induced

48. Transformers are use to change the value of the following EXCEPT:
A. alternating current B. alternating voltage C. power D. resistance

49. The power factor of a 20 MW, 13.2 KV, 3ϕ motor is corrected to 0.9 by connecting a 230 μF capacitor. What is its initial power factor?
A. 0.628 B. 0.965 C. 0.765 D. 0.828

50. Two 6-ohm resistors are connected in series. When a resistor R is connected in parallel with one of them, the total resistance is 9 ohms. What is the value of R?
A. 5 Ω B. 6 Ω C. 7 Ω D. 8 Ω

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51. A coil of wire wound, with or without a magnetic core designed to have a higher self-inductance than a straight wire.
A. Toroid B. Solenoid C. Inductor D. Inductive Relay

52. What capacitance must be placed in series with an inductance of 0.05 henry, so that when the frequency is 100 Hz, the impedance becomes equal to the ohmic resistance?
A. 50.7 μF B. 31.8 μF C. 67.5 μF D. 42 μF

53. When a dc motor has no-load, what will happen to the back emf?
A. reduces B. increases C. becomes maximum D. becomes zero

54. A three-phase induction motor has a nameplate speed of 1,720 rpm. What is the rotor frequency?
A. 1.8 Hz B. 2.7 Hz C. 5 Hz D. 4.4 Hz

55. A 50 MW coal-fired power plant has an average heat rate of 11,000 BTU/kWHR. Coal has a heating value of 13,000 BTU per pound. The plant has a load factor of 80%. How much coal is burned per day?
A. 8.1×10^5 lb B. 8.1×10^6 lb C. 1.2×10^5 lb D. 7.2×10^6 lb

56. Three identical resistors are connected in wye across 220 v, 3-phase lines. The line current is 12.7 A. To what value in volts should the line voltage be changed to obtain the same line current with the resistors connected in delta?
A. 98.6 B. 132.8 C. 120 D. 73.3

57. A sinusoidal current having peak value of 7.07 A is superimposed on dc of 5 A. If a hot-wire ammeter is used to measure the combined current in the circuit, it will indicate __ amperes.
A. 7.07 B. 10 C. 12.07 D. 2.07

58. A 4-way switch controls a lamp from _____ different locations.
A. 1 B. 2 C. 3 D. 4

59. When a V-V system is converted into Δ-Δ system, increase in the capacity of the system is _____ percent.
A. 86.6 B. 73.2 C. 66.6 D. 50

60. A small wind generator is designed to generate 50 kW of power at a wind velocity of 25 miles per hour. What is the approximate blade diameter?
A. 9.98 m B. 12.98 m C. 11.98 m D. 10.98 m

61. A synchronous generator having a subtransient reactance of 0.15 pu and operating at 5 percent above its rated voltage supplies a synchronous motor having a 0.20 pu subtransient reactance. The motor is connected to the generator by a transmission line and a transformer of total reactance 0.305 pu. A sudden three-phase fault occurs at the generator terminals. Determine the per unit subtransient fault current.
A. –j7.079 pu B. –j8.079 pu C. –j9.079 pu D. –j10.079 pu

62. The capacitance between any two conductors of a three-phase, three-conductor cable is 2 μF. The cable operates at 11 kV line voltage and 50 Hz. What is the charging current through the cable capacitance?
A. 7.98 A B. 4 A C. 6.93 A D. 12 A

63. A meter has a full-scale current of 50 μA, what is its sensitivity?
A. 20 kΩ/V B. 20 v/kΩ C. 50 kΩ/v D. 50 μA/v

64. The current-carrying capacity of a copper wire having twice the diameter of another copper wire is _____ as great.
A. twice B. half C. 4 times D. 3 times

65. In a 10-pole synchronous machine, 20 electrical degrees are equivalent to how many mechanical degrees?
A. 2 B. 8 C. 4 D. 10

66. You have 120 volts at the panel and 115 volts at the load. What is the percentage voltage drop?
A. 5% B. 4.35% C. 4.17% D. 3%

67. A delta 3ϕ, 4-wire secondary 230/115 v would have a high-leg to neutral voltage of _____.
A. 208 v B. 230 v C. 277 v D. 199 v

68. The conductors of a three-phase transmission line are arranged in the form of an equilateral triangle with sides of 6 m each. If the conductors are 500 mils in diameter and the line is 25 km long, what is its inductance per phase?
A. 35.5 mH B. 3.55 mH C. 71 mH D. 7.1 mH

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69. A 10-km long, single-phase short transmission line has $0.5\angle 60^\circ$ Ω/km impedance. The line supplies a 316.8 kW load at 0.8 power factor lagging. What is the voltage regulation if the receiving end voltage is 3.3 kV?
A. 12.94% B. 16.94% C. 14.94% D. 10.94%

70. The positive, negative, and zero sequence reactances of a 20-MVA, 13.2 KV synchronous generator are 0.3 pu, 0.2 pu, and 0.1 pu, respectively. The generator is solidly grounded and is not loaded. A line to ground fault occurs on phase a. Neglecting all the resistances, determine the positive sequence of the fault current.
A. 4,374 A B. 1,458 A C. 2,525 A D. 7,576 A

71. Converts energy of water to mechanical energy.
A. pump B. turbine C. generator D. draft tube

72. Calculate the capacitance of a parallel plate capacitor having 20 cm x 20 cm square plates separated by a distance of 1 mm. Assume the dielectric medium to be air with permittivity of 8.85×10^{-12} F/m.
A. 354 μF B. 354 pF C. 3.54 μF D. 3.54 pF

73. A current of 10 A is flowing in a flexible conductor of length 1.5 m. A force of 15 N acts on it when it is placed in a uniform field of 2 T. Calculate the angle between the magnetic field and the direction of the current.
A. 90° B. 60° C. 45° D. 30°

74. If the waveform of a current has form factor 1.2 and peak factor 1.7, find the average value of the current if the maximum value of the current is 100 A.
A. 45 A B. 47 A C. 49 A D. 51 A

75. The applied voltage in a transformer is increased by 50% and frequency is reduced by 50%. The maximum core flux density will become _____.
A. same B. 1.5 times C. 3 times D. 5 times

76. A device that establishes an electrical connection to the earth.
A. Grounding conductor C. Grounding electrode
B. Grounded conductor D. Grounding electrode conductor

77. A transformer has 4% resistance and 6% reactance drop. Find the voltage regulation at full-load 0.8 p.f. lagging.
A. 6.8% B. 5.8% C. 4.8% D. 3.8%

78. A 6-pole, 50 Hz, three-phase induction motor has a maximum torque of 200 N-m when it is running at a speed of 900 rpm. The resistance of the rotor is 0.25 Ω. Neglecting stator impedance, determine the torque at 5% slip.
A. 180 N-m B. 140 N-m C. 150 N-m D. 160 N-m

79. In a certain country, the equivalent fuel reserve for power generation is 3×10^6 MW-years. The present peak power demand is 200 GW, and the expected power consumption growth rate is 2.1 percent. How long will the fuel reserve last?
A. 8 years B. 11 years C. 13 years D. 14 years

80. Which of the following is not a standard branch circuit ampere rating?
A. 15 A B. 25 A C. 30 A D. 40 A

81. Once residual magnetism of a shunt generator is lost, it may be restored by connecting its shunt field
A. to earth C. to an external battery
B. in reverse D. to an alternator

82. Power in balanced 3-phase system is measured by the two-wattmeter method and it is found that the ratio of the two-wattmeter readings is 2 is to 1. What is the power factor of the system?
A. 0.9 B. 0.82 C. 0.866 D. 0.707

83. A coil with 40 ohm resistance and 0.02 H inductance and a pure capacitor are connected in parallel across a 60 Hz supply. Find the value of the capacitor in μF if the circuit is resonant.
A. 14.35 B. 12.07 C. 11.67 D. 15.82

84. A balanced delta connected load draws 100 A line current from a balanced 3-phase supply. Determine the zero sequence components of the currents.
A. $-50 - j86.6$ B. $50 - j86.6$ C. $86.6 - j50$ D. 0

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85. Surge impedance of transmission line is given by
A. $\sqrt{C/L}$ B. $\sqrt{LC}$ C. $1/\sqrt{LC}$ D. $\sqrt{L/C}$

86. In full-wave rectification, if the input frequency is 60 Hz, then output has a frequency of _____.
A. 120 Hz B. 60 Hz C. 30 Hz D. 15 Hz

87. Determine the total inductance of a single-phase overhead transmission line of 10 km long. The diameter of each conductor is 0.8 cm and the distance between them is 1.2 meters.
A. 11.9 mH B. 23.8 mH C. 35.7 mH D. 47.6 mH

88. A diversity factor of 2 gives a saving of _____ % in generating equipment.
A. 33 B. 50 C. 67 D. 75

89. A room 8 m x 12 m is lighted by 15 lamps to fairly uniform illumination of 100 lumens per square meter. What is the coefficient of utilization if the output of each lamp is 1,600 lumens?
A. 40% B. 60% C. 30% D. 50%

90. A 440-v, 70-HP shunt motor has an armature of 0.185 Ω and field resistance of 350 Ω. The current drawn by this machine is 135 A at full-load. If this machine is to deliver torque equal to 175 percent of that at full-load, what would be the resistance of its starter?
A. 3.4 Ω B. 5.6 Ω C. 2.2 Ω D. 1.7 Ω

91. In a parallel RC circuit, as the capacitance decreases, the power factor _____.
A. increases B. decreases C. remains the same D. becomes zero

92. Find the amount of electrical energy expended in raising the temperature of 45 liters of water by 75 °C. Assume a heater efficiency of 90%.
A. 2.64 KWHR B. 3.46 KWHR C. 4.36 KWHR D. 6.34 KWHR

93. A capacitor of 40 μF capacitance in series with 2,000 ohms is suddenly connected across a 200-volt source. What is the energy stored in the capacitor after 0.04 sec?
A. 0.124 J B. 0.241 J C. 0.412 J D. 2.41 J

94. Calculate the average voltage generated in a six-turn full-pitch coil of a 25-cycle alternator if the flux per pole is 7.2×10^5 maxwells.
A. 7.48 v B. 8.64 v C. 1.08 v D. 4.32 v

95. A 13.8 kV/440 v, 50 kVA single-phase transformer has a leakage reactance of 300 ohms referred to the 13.8 kV side. Determine the per unit value of the leakage reactance for the low voltage base.
A. 0.305 B. 0.040 C. 0.097 D. 0.079

96. A 100 km transmission line has a 1,000 ohms shunt reactance. What is the per km shunt reactance?
A. 1,000 Ω B. 100,000 Ω C. 10 Ω D. 100 Ω

97. A 5,000 kVA synchronous condenser operates with a leading p.f. of 0.032. The losses are 160 kW. What is the power input to the motor?
A. 5,160 kW B. 5,320 kW C. 160 kW D. 320 kW

98. The current flowing in the armature conductors of a dc motor is
A. ac B. dc C. ac as well as dc D. transients

99. The sequence components of phase c current of a 3-phase system are as follows: $I_{c0} = 0$, $I_{c1} = 18.4 \angle 88.4°$ A and $I_{c2} = 3.23 \angle 48.2°$ A. Find the phase b current in amperes.
A. $19.24 \angle -218°$ B. $18 \angle 42°$ C. $18 \angle -42°$ D. $19.24 \angle 218°$

100. A current of 20 A is flowing in an RL series circuit the instant before the switch is opened. If R = 10 Ω and L = 10 H, find the current after 3 seconds has elapsed.
A. 1 A B. 2 A C. 3 A D. 4 A

*** 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