ELECTRICAL ENGINEERING   ~ 1-38 Sept. 2018

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. The voltage applied across an electric press was reduced by 50%. The power consumed by the press will
   be reduced to
   A. 25%   B. 50%   C. 60%   D. 75% (Reduced By)

2. The law that induces emf and current always opposes the cause producing them was discovered by
   A. Faraday   B. Maxwell   C. Lenz   D. Ohm

3. Series capacitors are used to
   A. improve the line voltage   C. compensate for line capacitive reactance
   B. compensate for line inductive reactance   D. none of these

4. A 4,400 v, 60 Hz transformer has core loss of 840 watts, of which one-third is eddy current loss. What is
   the core loss when the transformer is connected to a 4,600 v, 60 Hz source?
   A. 926 W   B. 907 W   C. 873 W   D. 944 W

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

6. Which of the following distribution systems gives the greater reliability?
   A. radial system →   B. ring system ○   C. DC three wire system D. open loop system

7. The nameplate speed of a 60 Hz, 3-phase induction motor is 1,175 rpm. What is its number of poles?
   A. 2   B. 4   C. 6   D. 8

8. The transformer oil used in transformers provide
   A. cooling and lubrication   C. insulation and cooling
   B. insulation and lubrication   D. insulation, cooling and lubrication

9. Two identical coupled coils have an equivalent inductance of 80 mH when connected in series aiding and
   35 mH in series opposing. Find the coefficient of coupling.
   A. 0.39   B. 0.43   C. 0.5   D. 0.64

10. To protect the Δ-Δ power transformer against fault, the CT will have
    A. Δ-Δ connection   B. Δ-Y connection   C. Y-Δ connection   D. Y-Y connection

11. Three 6.66 Ω resistors are connected wye. What is the equivalent of each delta connected resistors?
    A. 2.22 Ω   B. 20 Ω   C. 11.54 Ω   D. 10 Ω $3R_y = R_\Delta$

12. For a detection of the occurrence of the severe synchronizing power surges
    A. impedance relays are best suited   C. MHO relays are best suited
    B. reactance relays are best suited   D. split-phase relays are best suited

13. Two wattmeters both have readings of 5 kW when connected for the two-wattmeter method in a 480-v
    three-phase circuit that has a balanced Δ load. Find the Δ phase impedance. $Z_0 = \dfrac{3 V_0^2}{P_T}$
    A. 69.1∠90° Ω   B. 69.1∠−90° Ω   C. 69.1∠45° Ω   D. 69.1∠0° Ω

14. Which of the following cannot have a single unit of 100 MW?
    A. Hydro power plant   B. Steam power plant   C. Diesel power plant   D. Nuclear power plant

15. If the capacitance of the transmission line is increased, the transmitted power will
    A. remain same   C. decrease
    B. increase   D. tend to zero at the receiving end

16. Which of the following tests are conducted for transformer oil?
        I. dielectric   III. color of oil   V. power factor
        II. interfacial tension   IV. neutralization number   VI. specific gravity
    A. I, II, III, and IV   B. I, II, III, and V   C. II, III, IV, and V   D. I, II, V, and VI

ELECTRICAL ENGINEERING

17. Peak load plants are designed to supply power at
    A. low capital cost and low operating cost   C. low capital cost and high operating cost
    B. high capital cost and low operating cost   D. high capital cost and high operating cost
       (base load plants)

18. A light source is located 2 m from a surface produces an illumination of 50 lux on that surface. Find the
    intensity of the light source in candela. $E = \dfrac{I\cos\theta}{r^2}$
    A. 100   B. 50   C. 150   D. 200

19. Which is not a standard distribution voltage in the Philippines?
    A. 13.2 kV   B. 13.8 kV   C. 34.5 kV   D. 69 kV

20. The power plant has a peak demand of 90 MW, capacity factor of 0.50, use factor of 0.80 and load factor   LOAD =
    of 0.60. Find the plant installed capacity. $\dfrac{0.6}{0.5} = \dfrac{IC}{90}$ CAP
    A. 105 MW   B. 108 MW   C. 110 MW   D. 115 MW

21. A 500 MCM ACSR cable has 37 strands. Determine the diameter in mils of each strand.   500 000 /37 =13
    A. 120.24   B. 110.35   C. 118.34   D. 116.25
                                                                                          $\sqrt{13513} = 116.$

22. Three unbalanced 3-phase currents are given as follows:
       $I_a = 10\angle{-30°}$ A, $I_b = 0$ and $I_c = 10\angle{-150°}$ A. Find I_{c1}.
    A. 3.34∠150° A   B. 3.34∠−150° A   C. 3.34∠210° A   D. 3.34∠−135° A

23. What is the maximum number of conductors in a raceway that does not need to be derated?
    A. 2   B. 3   C. 4   D. 5

24. When peace and order problem exist, National Grid Corporation of the Philippines (NGCP) issues   Security Red
    A. security alert   B. imminent danger alert C. trouble alert   D. red alert   Alert

25. Which increases the resistance of a conductor?
    A. increase in size   B. increase in length   C. decrease in length   D. none of these

26. Red, red, orange, silver indicates a resistance of _____.
    A. 22 Ω, ±5%   B. 220 Ω, ±5%   C. 2.2 kΩ, ±10%   D. 22 kΩ, ±10%

27. A type of electronics communication in which only one party transmits at a time.
    A. Full duplex   B. Half duplex   C. Bicom   D. Simplex
       2 at a time

28. 21 is the device function number for this relay.
    A. Undervoltage relay   B. Overvoltage relay   C. Distance relay   D. Directional power relay
       27   39   32

29. AC system has the following disadvantages over DC system.
    A. skin effect exists   B. line regulation is more C. charging current exists D. proximity effect exists

30. A three-phase transformer rated for 33 kV/6.6 kV is connected Y-Δ and the protecting current transformer
    on the low voltage side have a ratio of 400/5. What is the ratio of the current transformer on the high
    voltage side?   400/5 = 80
    A. 46.19:2.89   B. 46.19:5   C. 80:5   D. 80:2.89 $\dfrac{33/\sqrt{3}}{6.6} = 2.8$

31. RA 7832 concerns on _____.
    A. pilferage of electricity, theft of transmission materials and capping of system loss
    B. pilferage of electricity, theft of transmission materials and rationalizing of system loss
    C. pilferage of electrical energy
    D. pilferage of electricity and electrical materials
       Sec 1 - 17

32. Three resistors A, B, and C are connected in series to a 120-v supply. If the resistor A = 60 ohms and the
    voltage across resistor B = 40 v when the current is 1/2 A, what is the resistance of resistor C in ohms?
    A. 105   B. 90   C. 110   D. 100

33. Open circuit test on transformers is conducted to determine
    A. hysteresis loss   B. copper loss   C. core loss   D. eddy current loss
                                 short circuit Test

34. PDC in EPIRA means
    A. Philippine Distribution Company   C. Philippine Distribution Commission
    B. Philippine Distribution Corporation   D. Philippine Distribution Code

ELECTRICAL ENGINEERING

35. 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 Ω   B. 13 Ω   C. 20 Ω   **D. 24 Ω**

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

37. A straight conductor 100 cm long and carrying a current of 40 A lies perpendicular to a magnetic field of 1.5 Wb/m². What is the mechanical power in watt/s required to move the conductor at a uniform speed of 5 m/s? $F = BIl\sin\theta$
    A. 390 W $P = F \times r$ **B. 300 W**   C. 330 W   D. 360 W

    [handwritten: $40(1)(1.5) = 60(5) = 300$]

38. A 4-pole dc machine is wound duplex lap. Find the number of parallel paths.
    A. 4 $a = m \times P$ B. 6   **C. 8**   D. 10

39. When 3 A flows through a circuit with an input admittance of 0.4 + j0.5 S, what reactive power does the circuit consumed?
    [handwritten: $3^2 (-1.22) = -11$]
    A. 11 var   B. −8.7 var   C. 8.7 var   **D. −11 var**

    [handwritten: $\frac{1}{0.4+j0.5} = 0.976 -$]

40. 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**

41. The amount of frequency deviation from the carrier center of frequency in an FM transmitter is proportional to the _____.
    A. shape   **B. amplitude**   C. frequency   D. phase

42. Find the power factor of the impedance 5∠−25° Ω.   *[handwritten: capacitive - leading]*
    A. 0.423 lagging   **B. 0.9063 leading**   C. 0.423 leading   D. 0.9063 lagging

43. If the resistance in a series RC circuit is increased, the magnitude of the phase angle
    A. increases   **C. decreases**
    B. remains the same   D. changes in an indeterminate manner

44. Nuclear reactors generally employ
    A. fusion   **B. fission**   C. both fusion and fission   D. none of these

45. Calculate the time delay for a phase angle of 45° at a frequency of 500 Hz.
    A. 2 ms   B. 0.5 ms   C. 1.5 ms   **D. 0.25 ms**   *[handwritten: $\frac{1}{\omega(8)}$]*

46. A 20 μF capacitor is in parallel with a practical inductor represented by L = 1 mH in series with R = 7 Ω. Find the resonant frequency of the parallel circuit.
    A. 79.6 Hz   **B. 159.2 Hz**   C. 25.3 Hz   D. 500 Hz

47. The potential difference between two conductors is 110 v. How much work is done in moving a 5 coulomb charge from one conductor to the other?
    A. 2,420 J   B. 22 J   **C. 550 J**   D. 0.227 J
    [handwritten: $110(5) = 550$]

48. A 100-μF capacitor, carrying an initial charge of 500 μC is discharged through a 50 Ω resistor. Determine the time it takes the capacitor to discharge to 184-μC charge. $q = Q_0 e^{-t/RC}$
    A. 5 ms   B. 10 ms   C. 15 ms   D. 20 ms
    [handwritten: $184 = 500 e^{-t/50(100)}$]

49. Which of the following is not a factor in calculating the feeder conductor size?
    A. ambient temperature   C. voltage drop
    B. branch-circuit protection   D. demand factors

50. A 4-pole, 3-phase induction motor has a wye-connected stator winding and runs on a 220 v, 60 Hz supply. The rotor resistance and standstill leakage reactance are 0.1 and 0.9 ohm/phase, respectively. The ratio of rotor to stator turns/phase is 2/3. Calculate the torque developed in N-m when running with a slip of 4%.
    [handwritten: $P_m =$]
    A. 40.4   B. 38.2   C. 44.7   D. 49.5

51. Between no-load and full-load, _____ motor develops the least torque.
    A. series   *[handwritten: high]*   **B. shunt**   C. cumulative-compound   D. dfferential-compound

----

ELECTRICAL ENGINEERING

$W_{max} = \dfrac{V_m^2 C}{2} = \dfrac{240^2 (3)}{2} = 86.4 mJ$

52. A 3-µF capacitor is initially 50% charged. What will be the maximum possible energy stored if connected across a 240 volt source?

A. 43.2 mJ   B. 86.4 mJ   C. 172.8 mJ   D. 1,122.2 mJ

53. A 240 v dc generator supplies 100 amperes at maximum operating efficiency. If the constant losses are 950 watts at rated output, what is the maximum efficiency?

$\eta_{max} = \dfrac{P_o}{P_o' + 2(const. loss)} \times 10$, $\rightarrow V_T \times I_L$

A. 90.7%   B. 91.7%   C. 92.7%   D. 93.7%

54. One KW is equal to _____ gram-cal/sec. $1kW \left[\dfrac{1 cal}{4.186 WS}\right] \times 1g$

A. 2,388   B. 238.8   C. 23.88   D. 2.388

55. Voltage resonance means _____.

A. series resonance   B. parallel resonance   C. current magnification   D. gain magnification

56. Calculate the force developed per meter length between two current-carrying conductors 10 cm apart and carrying 1,000 A and 1,500 A currents respectively.

A. 1 N   B. 2 N   C. 3 N   D. 4 N $F = 2 \times 10^{-7} \dfrac{I_1 I_2}{d}$

57. A barrier voltage at a PN junction for germanium is about _____.

A. 0   B. 0.7 v   C. 0.3 v   D. 7 v

58. A 34.5 kV feeder line is 5 miles long. The conductors are spaced 4-feet horizontally. If the inductive reactance of the line is 3.46 ohms per phase, what is the self GMD of each conductor?

A. 0.168 ft   B. 0.0168 ft   C. 0.0618 ft   D. 0.0816 ft

59. This is the device function number for DC power circuit breaker.

A. 82   B. 52 AC ckt breaker   C. 92   D. 72

60. A diversity factor of 1.5 gives a saving of _____ % in generating equipment. $saving = 1 = \dfrac{1}{Div Factor}$

A. 75   B. 67   C. 50 $1 - \dfrac{1}{Div. Factor}$ D. 33

61. Three 1φ transformers are bank in Δ/Y to supply a 3φ load from a 400 v, 3φ source. The line voltage on the load side is 3,464 volts. What is the ratio of transformation of each transformer?

A. 5:1   B. 1:5   C. 8.66:1   D. 1:8.66

62. What is the rotor frequency of an induction motor if the rotor speed is 1,145 rpm?

A. 2.75 Hz   B. 5.5 Hz   C. 1.25 Hz   D. 60 Hz

63. A two-pole alternator is running at 1,500 rpm, what is the angular velocity? $f = \dfrac{PN}{170}$

A. 251.3 rad/sec   B. 188.5 rad/sec   C. 157.1 rad/sec   D. 314.2 rad/sec $W = 2\pi f$

64. In case the field of a synchronous motor is underexcited, the power factor will be

A. leading   B. lagging   C. zero   D. unity

65. If stator voltage of a SCIM is reduced by 25 percent of its rated voltage, torque developed is reduced by _____ percent of its full-load value. $0.75^2 = 0.5625$

A. 25   B. 56   C. 50   D. 44

66. The field system of a 50 Hz alternator has a sinusoidal flux per pole of 0.1 Wb. The emf generated in one turn of coil is 19.2 v. What is the span of the coil?

A. 150°   B. 135°   C. 120°   D. 90°

67. The voltage drop, for constant voltage transmission is compensated by installing

A. inductors   B. capacitors   C. synchronous motors   D. all of these

68. A power plant consumes 100,000 lbs of coal per hour. The heating value of the coal is 12,000 BTU per lb. The overall plant efficiency is 30%. What is the kW output of the plant? $\dfrac{(100 \times 10^3)(12 \times 10^3)l}{3412}$

A. 175,000 kW   B. 205,000 kW   C. 142,500 kW   D. 105,500 kW

69. A uniform source of light gives 1,884 lumens and is suspended 4 m above the center of a floor 3 meter square. Find the illumination in lm/m² at the floor level immediately below the lamp.

A. 9.4   B. 16.7   C. 117.8   D. 209.3

$I = \dfrac{\Phi}{4\pi} = 150 \, Cd$ $\dfrac{1884/4\pi}{}$ $E = \dfrac{I \cos\phi}{r^2} = \dfrac{150 \cos\phi^1}{4^2} = \boxed{9.4}$

ELECTRICAL ENGINEERING

70. A 25 Ω resistor connected in series with a coil of 50 Ω resistance and 150 mH inductance. What is the power factor of the circuit?
   A. 75%   B. 80%   C. 85%   D. 90%

71. What is the effective value of a semi-circular wave which has a maximum value of 20 A?   0.816 (20)
   A. 14.14 A ✗   B. 10 A   C. 8.16 A   ✓   D. 16.32 A   = 16.32A

72. If a certain conductor has an area of 336,400 circular mils, what is the radius of this conductor in cm?
   A. 0.737 /   B. 0.663   C. 0.921   D. 0.810

73. A shorted resistor has
   A. infinite current through it   C. infinite voltage across it
   B. zero voltage across it ✗   D. zero current through it

74. Materials whose permeabilities are slightly greater than that of free space are called _____.
   A. diamagnetic   B. paramagnetic   C. ferromagnetic   D. non-magnetic

75. At a certain point of the system network the positive, negative, and zero sequence impedances are 0.25 pu, 0.25 pu, and 0.3 pu, respectively. The base MVA is 100. The level at that point is 34.5 kV. Determine the zero sequence current for a one line to ground fault.
   A. 2,091 A   B. 6,275 A   C. 3,622 A   D. 7,244 A

76. For eliminating 7th harmonic from the emf wave of an alternator, the fractional pitch must be
   A. 2/3   B. 5/6   C. 6/7   D. 7/8

77. Two(2), 1φ, 25-KVA transformers are connected in V-V 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%

78. A real current source has
   A. zero internal resistance   C. a small internal resistance ✗
   B. infinite internal resistance ✓   D. a large internal resistance

79. One ampere-turn is equal to
   A. 1.26 Gilberts   B. 1.36 Gilberts   C. 1.46 Gilberts   D. 1.56 Gilberts

80. A 15 hp, 460 v, 60 Hz, 6 pole, 3-phase induction motor has full-load slip of 4%. Find the full-load torque in N-m.
   A. 85   B. 88   C. 90   D. 93

81. A solenoid is 20 cm long and is wound with 500 turns of wire. What current will be required to set up a field strength of 3000 AT/m inside the solenoid?   300A/500 = 6 × 0.2
   A. 1.2 A   B. 1.4 A   C. 1.6 A   D. 1.8 A

82. Three-phase alternators are invariably Y-connected because
   A. magnetic losses are minimized   C. smaller conductors can be used
   B. less turns of wire are required   D. higher terminal voltage is obtained

83. In a sine wave AC circuit with R and C in series, the
   A. voltage across R and C are in phase
   B. voltage across R leads the voltage across C by 90°
   C. voltages across R and C are 180° out of phase
   D. voltage across R lags the voltage across C by 90°

84. A 75 kVA, single phase transformer has secondary winding impedance of $Z_s = 0.02 + j0.08$ ohm. Calculate the secondary induced voltage in volts when the transformer is supplying full load at unity power factor and 240 v.
   A. 242.6   B. 244.7   C. 247.5   D. 248.3

85. A 60 Hz, 4 pole, 3 phase wound rotor induction motor has rotor resistance and standstill leakage reactance of 0.1 and 0.8 ohm/phase respectively. How much additional resistance must be inserted in the rotor in ohms/phase so that the motor has maximum starting torque?
   A. 0.6   B. 0.7   C. 0.06   D. 0.07

ELECTRICAL ENGINEERING

86. The essential condition for stable parallel operation of two dc generators having similar characteristics is that they should have
    A. same kilowatt output ratings
    B. drooping voltage characteristics
    C. same percentage regulation
    D. same no-load and full-load speeds

87. Large currents in dc circuits are almost always measured with a/an
    A, ammeter and multiplier
    B. millivoltmeter and shunt
    C. millivoltmeter and multiplier
    D. current transformer and ammeter

88. The voltage induced in a loop of wire rotating in a strong and steady magnetic field is
    A. pulsating dc   B. dc   C. rectified ac   D. ac

89. The power delivered to a loud speaker of an amplifier is 30 dB above 10 mW. It is equivalent to _____ watt.
    A. 10   B. 0.3   C. 3   D. 300

    $30 = 10 \log_{10} \left[\dfrac{P_O}{10mW} \right]$

90. Which of the following insulators is most affected by heat?
    A. glass   B. paper   C. porcelain   D. PVC

91. Two 500-W lamps connected in series across a 220-v line draw 1 A. The total power consumed is _____ watts.
    A. 1,000   B. 220   C. 250   D. 500

    $P_T = V_T I_L$

92. A short 230 kV transmission line has an impedance of 10 cis 80° Ω. The sending end power is 150 MW at 230 kV and 82% power factor. What is the voltage at the other end?
    A. 222.45 kV   B. 223.45 kV   C. 224.45 kV   D. 225.45 kV

93. In a balanced three-phase system, the Y-connected impedances are 10 ohms with 30 degrees angle. If V_{bc} is equal to 416 volts with 240 degrees angle, determine I_{cn}. Assume that phase sequence is ABC.
    A. 12 + j20.8 A   B. 20.8 – j12 A   C. 12 – j20.8 A   D. 20.8 + j12 A

94. What effect or principle those of a microphone operates?
    A. photoelectric   B. thermoelectric   C. audioelectric   D. piezoelectric

95. A circuit has a resistance of R Ω in series with an inductance of L henries. With a supply of 240 v, 50 Hz, the power in the circuit is 300 w and the voltage across R is 100 v. Find the value of L.
    A. 0.132 H   B. 0.231 H   C. 0.312 H   D. 1.32 H

96. Fixtures that transmit 60% to 90% of the light downward are classified as _____.
    a. Semi-indirect   B. Semidirect   C. Indirect   D. Direct

97. 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?   8760
    A. 67,500   B. 1,314,000   C. 24,637   D. 591,300

98. A 2 MVA, 13.2 kV/440 V, 60 Hz, 3-phase transformer has a per unit impedance of 0.01 + j0.08. Calculate the percent efficiency at full-load and 0.8 p.f. lagging if core loss is 8 kW.
    A. 97.25   B. 96.92   C. 98.28   D. 97.72

99. 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

100. The size of conductor on EHV lines is obtained based on
    A. current density   B. voltage drop   C. corona   D. both A and B

*** E N D ***