

Question Booklet No. :

CEEE/2024

Register  
Number

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2024

Paper – I

**ELECTRICAL ENGINEERING / ELECTRICAL AND  
ELECTRONICS ENGINEERING**

**(Degree Standard)**

Duration : Three Hours]

[Total Marks : 300

Read the following instructions carefully before you begin to answer the questions.

**IMPORTANT INSTRUCTIONS**

1. You will be supplied with this question booklet 15 minutes prior to the commencement of the examination.
2. This question booklet contains 200 questions. Before answering the questions, you shall check whether all the questions are printed serially and ensure that there are no blank pages in the question booklet. If any defect is noticed in the question booklet, it shall be reported to the invigilator within the first 10 minutes and get it replaced with a complete question booklet. If the defect is reported after the commencement of the examination, it will not be replaced.
3. Answer all the questions. All the questions carry equal marks.
4. You must write your register number in the space provided on the top right side of this page. Do not write anything else on the question booklet.
5. An answer sheet will be supplied to you separately by the room invigilator to shade the answers. Instructions regarding filling of answers etc., which are to be followed mandatorily, are provided in the answer sheet and in the memorandum of admission (Hall Ticket).
6. You shall write and shade your question booklet number in the space provided on page one of the answer sheet with **BLACK INK BALL POINT PEN**. If you do not shade correctly or fail to shade the question booklet number, your answer sheet will be invalidated.
7. Each question comprises of five responses (answers) : i.e. (A), (B), (C), (D) and (E). You have to select **ONLY ONE** correct answer from (A) or (B) or (C) or (D) and shade the same in your answer sheet. If you feel that there are more than one correct answer, shade the one which you consider the best. **If you do not know the answer, you have to mandatorily shade (E).** In any case, choose **ONLY ONE** answer for each question. If you shade more than one answer for a question, it will be treated as a wrong answer even if one of the given answers happens to be correct.
8. You should not remove or tear off any sheet from this question booklet. You are not allowed to take this question booklet and the answer sheet out of the examination room during the time of the examination. After the examination, you must hand over your answer sheet to the invigilator. You are allowed to take the question booklet with you only after the examination is over.
9. You should not make any marking in the question booklet except in the sheets before the last page of the question booklet, which can be used for rough work. This should be strictly adhered to.
10. Failure to comply with any of the above instructions will render you liable for such action as the Commission may decide at their discretion.

SEAL

[Turn over

**SPACE FOR ROUGH WORK**



1. For a  $H_2 - O_2$  cell, faradays constant

$$F = 96500 \text{ c/g mole}$$

$$\Delta G = -237191 \text{ kJ/kg mole}$$

$\Delta H = -285838 \text{ kJ/kg mole}$ . The maximum efficiency of the fuel cell will be

- (A) 0.83                      (B) 0.9  
(C) 0.93                      (D) 0.8  
(E) Answer not known

2. Power of an air mass flows in wind power generation does not depend upon

- (A) Air density                      (B) Wind speed  
(C) Area in which air passes       (D) Moisture present in air  
(E) Answer not known

3. Based on the wind energy generator the ratio of average power output of a turbine during a month or a year to the rated power output is called

- (A) Capacity factor                      (B) Capacity utilisation factor  
(C) Weibull factor                      (D) Utilisation factor  
(E) Answer not known

4. Wind energy is harnessed by using

- (A) Electron generator                       (B) Turbine generator  
(C) Vapor generator                      (D) Steam generator  
(E) Answer not known

5. Pelton turbines are suitable for high heads in the range of

- (A) 60 m – 700 m                      (B) 50 m – 600 m  
(C) 40 m – 500 m                      (D) 80 m – 900 m  
(E) Answer not known

6. Calculate the output power from a solar cell, if its efficiency (in %) is 30, and input power density is  $1000 \text{ w/m}^2$ , and area of the solar cell is  $100 \text{ cm}^2$
- (A) 30 kW (B) 300 kW  
(C) 3000 kW ~~(D) 3 W~~  
(E) Answer not known
7. Full sunlight falling on a 15% efficiency solar cell of area  $2 \text{ m}^2$  at angle of 60 degrees to the normal to the panel. The output power of the panel is
- (A) 75 W (B) 500 W  
(C) 300 W ~~(D) 150 W~~  
(E) Answer not known
8. Calculate the number of day light hours (sunshine hours) in Srinagar on January 1. The Latitude of Srinagar is  $34^\circ 05' \text{N}$
- ~~(A) 9.77 hrs~~ (B) 14.24 hrs  
(C) 8.27 hrs (D) 4.5 hrs  
(E) Answer not known
9. The level of solar intensity before entering the earth's atmosphere is called
- (A) The Boltzmann's constant ~~(B) Solar constant~~  
(C) Fermi level constant (D) Valence band constant  
(E) Answer not known
10. The earth reflects back nearly 30% of the total solar radiant energy to the space by reflection from clouds, by scattering and by reflection at the earth surface is called
- (A) Irradiance (B) Air mass  
~~(C) Albedo~~ (D) Diffuse radiation  
(E) Answer not known

11. What is the minimum number of Flip Flops required for realizing MOD 9 ripple counter?
- (A) 2 (B) 4  
(C) 6 (D) 8  
(E) Answer not known
12. The fastest logic family is
- (A) TTL (Transistor – Transistor Logic)  
(B) ECL (Emitter – Coupled Logic)  
(C) IIL (Integrated – Injection Logic)  
(D) MOS (Metal Oxide Semiconductor Logic)  
(E) Answer not known
13. The n-channel MOS conducts when its gate-to-source voltage is
- (A) Positive (B) Negative  
(C) Zero (D) Infinity  
(E) Answer not known
14. Missing heart beat is detected by
- (A) Monostable multivibrator (B) Astable multivibrator  
(C) Schmitt trigger (D) Current to voltage converter  
(E) Answer not known
15. Which one of the following is not a value rule of Boolean Algebra?
- (A)  $A + 1 = 1$  (B)  $A = \bar{A}$   
(C)  $AA = A$  (D)  $A + 0 = A$   
(E) Answer not known

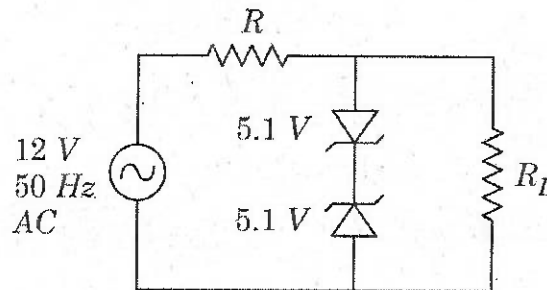
16. Any electrical device which offers a low resistance to the current in one direction but a high resistance to the current in the opposite direction is called a

- (A) Inductor
- (B) ~~Rectifier~~
- (C) Resistor
- (D) Amplifier
- (E) Answer not known

17. In a mono stable multi vibrator,  $R = 100 \text{ k}\Omega$  and time delay  $T = 100 \text{ ms}$ . Calculate the value of  $C$

- (A)  ~~$0.9 \mu\text{F}$~~
- (B)  $0.9 \rho\text{F}$
- (C)  $0.5 \mu\text{F}$
- (D)  $0.9 \text{ F}$
- (E) Answer not known

18. The output of the following circuit is



- (A) ~~Square wave with a magnitude 5.8 V to - 5.8 V~~
  - (B) Square wave with a magnitude +5.1 V to - 5.1 V
  - (C) Square wave with a magnitude +5.8 V to - 5.3 V
  - (D) Square wave with a magnitude +12 V to - 12 V
  - (E) Answer not known
19. A zener diode, when used in voltage stabilization circuits is used in
- (A) Reverse bias region below the breakdown voltage
  - (B) ~~Reverse breakdown region~~
  - (C) Forward bias region
  - (D) Forward bias constant current mode
  - (E) Answer not known

20. A 600 V, 60 KVA, single phase alternator has an effective resistance of  $0.2 \Omega$ . A field current of 10 A produces an armature current of 210 A on short circuit and emf of 480 V on open circuit. Calculate synchronous impedance and reactance
- (A)  $2.28 \Omega, 2.27 \Omega$                       (B)  $2.27 \Omega, 2.28 \Omega$   
(C)  $2.32 \Omega, 2.34 \Omega$                       (D)  $2.34 \Omega, 2.32 \Omega$   
(E) Answer not known
21. A synchronous machine with low value of short circuit ratio has
- (A) high stability limit  
 (B) lower stability limit  
(C) good voltage regulation  
(D) easier parallel operating capacity  
(E) Answer not known
22. How can the reactive power delivered by a synchronous generator be controlled?
- (A) by changing the prime mover input  
 (B) by changing the excitation  
(C) by changing the direction of rotation  
(D) by changing the prime mover speed  
(E) Answer not known
23. At zero power factor lagging armature reaction in an alternator is
- (A) wholly demagnetising                      (B) wholly magnetising  
(C) cross magnetising                      (D) not effective  
(E) Answer not known

24. Torque produced by  $3\phi$  induction motor becomes maximum when slip (S) is equal to
- (A)  $R_2/X_2$  (B)  $X_2/R_2$   
(C) 1 (D) 0  
(E) Answer not known
25. Condition for maximum torque under running conditions is
- (A)  $R_2 = X_2$  (B)  $R_2 = SX_2$   
(C)  $R_2 = S$  (D)  $R_2 = S^2X_2$   
(E) Answer not known
26. A 10 kVA, 500/250 V, 50 Hz. Single phase transformer has a net area of cross section  $90 \text{ cm}^2$  and maximum flux density is 1.2 T. Calculate the number of turns on primary winding
- (A) 209 (B) 250  
(C) 500 (D) 221  
(E) Answer not known
27. A 200 V DC shunt motor delivers an output of 17 kW with an input of 20 kW. The field winding resistance is  $50 \Omega$  and armature resistance is  $0.04 \Omega$ . Maximum efficiency will be obtained when the total armature copper losses are equal to
- (A) 2632 W (B) 3000 W  
(C) 3680 W (D) 5232 W  
(E) Answer not known
28. The current drawn by a 120 V DC motor with back emf of 110 V and armature resistance of  $0.4 \Omega$  is
- (A) 4 A (B) 25 A  
(C) 274 A (D) 300 A  
(E) Answer not known



29. The term PLC stands for
- (A) Personal Logic Computer
  - ~~(B)~~ Programmable Logic Controller
  - (C) Programmable Local Computer
  - (D) Personal Logic Controller
  - (E) Answer not known
30. A D/A converter has a full scale output of 3.5 V with resolution approximately 14 mV. The number of bits required for conversion is
- (A) 4
  - ~~(B)~~ 8
  - (C) 16
  - (D) 32
  - (E) Answer not known
31. For a 5 bit, R-2R ladder network Digital to analog converter, if the input levels of logic '0' is 0 volts and logic 1 is +10 volts, what is the output voltage for MSB?
- (A) 2.5
  - ~~(B)~~ 5
  - (C) 1.25
  - (D) 0.625
  - (E) Answer not known
32. An LCD requires a power of approximately
- (A) 20 W
  - ~~(B)~~ 20  $\mu$ W
  - (C) 20 mW
  - (D) 20 nW
  - (E) Answer not known
33. In a CRO, two in-phase, 50 Hz sinusoidal signals of same magnitude are connected to channel 1 and channel 2. All settings for both the channels are same. The observation on the screen is
- (A) A parabola
  - ~~(B)~~ A straight line inclined  $45^\circ$  to X-axis
  - (C) An ellipse
  - (D) A circle of unit radius
  - (E) Answer not known

34. When measuring low resistance using Kelvin double bridge, two sets of readings are taken, one with the current in one direction and the other with current reversed. This is done to
- (A) correct for changes in battery voltage
  - (B) eliminate the effect of contact resistance
  - (C) eliminate the effect of resistance of leads
  - ~~(D)~~ eliminate the effect of thermo-electric emfs
  - (E) Answer not known
35. The smallest change in a measured variable to which an instrument will respond is
- (A) Accuracy
  - ~~(B)~~ Resolution
  - (C) Precision
  - (D) Sensitivity
  - (E) Answer not known
36. 100 numbers of  $5\ \Omega$  resistors connected in parallel. Find the effective resistance.
- (A)  $5\ \Omega$
  - ~~(C)~~  $0.05\ \Omega$
  - (B)  $0.5\ \Omega$
  - (D)  $0.005\ \Omega$
  - (E) Answer not known
37. A 53 Hz reed type frequency meter is polarized with dc. The new range of frequency meter is
- ~~(A)~~ 106 Hz
  - (B) 26.5 Hz
  - (C) 53 Hz
  - (D) 79.5 Hz
  - (E) Answer not known

38. In the measurement of power on balanced load by two-wattmeter method in a 3-phase circuit, the readings of the watt meters are 3KW and 1KW respectively, the latter being obtained after reversing the connections of the current coil. The power factor of the load is

- (A) 0.277                      (B) 0.554  
(C) 0.625                      (D) 0.866  
(E) Answer not known

39. A moving coil instrument gives a full scale deflection with a current of  $40 \mu\text{A}$ , while the internal resistance of the meter is  $500 \Omega$ . It is to be used as a voltmeter to measure a voltage range of (0-10)V. Calculate the multiplier resistance needed.

- (A)  $0.249 \text{ k}\Omega$                       (B)  $24.9 \text{ k}\Omega$   
 (C)  $249.5 \text{ k}\Omega$                       (D)  $2.49 \text{ k}\Omega$   
(E) Answer not known

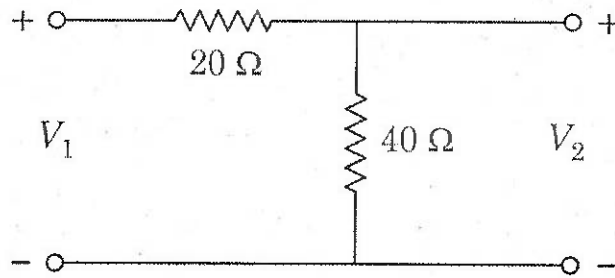
40. The dead zone in a certain pyrometer is 0.125 percent of span. The calibration is  $400^\circ\text{C}$  to  $1000^\circ\text{C}$ . What temperature change might occur before it is detected?

- (A)  $0.75^\circ\text{C}$                       (B)  $-0.75^\circ\text{C}$   
(C)  $600^\circ\text{C}$                       (D)  $-600^\circ\text{C}$   
(E) Answer not known

41. The power factor of a load with active power 120 W and reactive power 100 VAR (inductive) is

- (A) 0.64 lag                      (B) 0.64 lead  
 (C) 0.768 lag                      (D) 0.768 lead  
(E) Answer not known

42. Find H parameter for the two port network as shown in the figure



(A)  $\begin{bmatrix} 25 & 1 \\ -1 & 20 \end{bmatrix}$

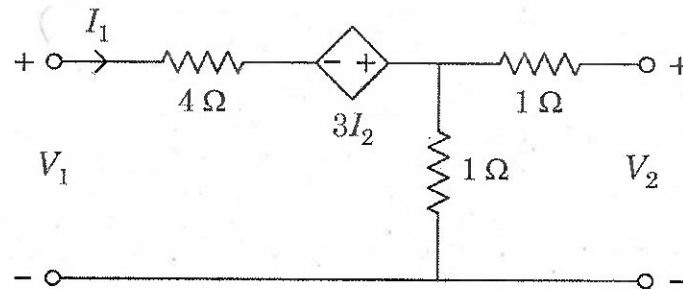
(B)  $\begin{bmatrix} 20 & -1 \\ 1 & 25 \end{bmatrix}$

~~(C)~~  $\begin{bmatrix} 20 & 1 \\ -1 & 25 \end{bmatrix}$

(D)  $\begin{bmatrix} 25 & -1 \\ 1 & 20 \end{bmatrix}$

(E) Answer not known

43. Find the Z parameters of the two-port network shown below are



(A)  $Z_{11} = 5, Z_{12} = 2, Z_{21} = 1, Z_{22} = -2$

(B)  $Z_{11} = 5, Z_{12} = -2, Z_{21} = -1, Z_{22} = 2$

(C)  $Z_{11} = -5, Z_{12} = -2, Z_{21} = 1, Z_{22} = 2$

~~(D)~~  $Z_{11} = 5, Z_{12} = -2, Z_{21} = 1, Z_{22} = 2$

(E) Answer not known

44. Q factor at resonance in parallel circuit is

~~(A)~~  $\frac{2\pi f_r L}{R}$

(B)  $\frac{R}{2\pi f_r L}$

(C)  $\frac{2\pi}{R f_r L}$

(D)  $\frac{R f_r L}{2\pi}$

(E) Answer not known

45. A resistor having a resistance of  $R = 10\Omega$  and an unknown capacitor are in series. The voltage across the resistor is  $V_R = 50 \sin(1000t + 45^\circ)$  volts. If the current leads the applied voltage by  $\tan^{-1} 1.73 = 60^\circ$ . Find the unknown capacitance C?

(A)  $58.7 \mu\text{F}$

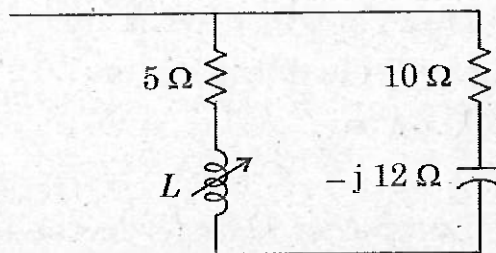
~~(B)~~  $57.7 \mu\text{F}$

(C)  $50.7 \mu\text{F}$

(D)  $55.7 \mu\text{F}$

(E) Answer not known

46. Find the value of L at which the circuit resonates at a frequency of 1000 rad/sec.



(A) 18.98 H or 1.32 H

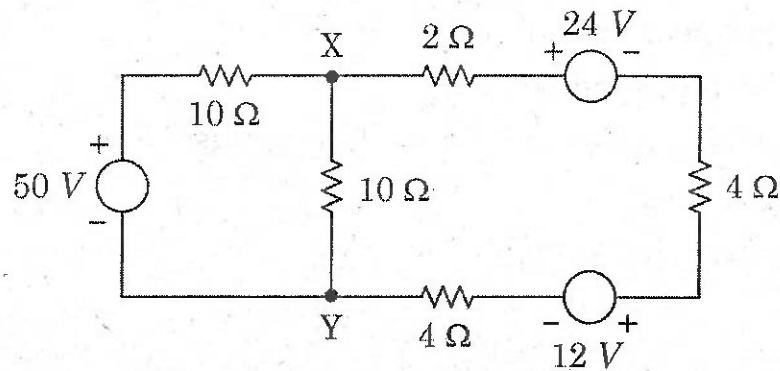
~~(B)~~ 18.98 mH or 1.32 mH

(C) 1.898 mH or 13.2 mH

(D) 1.898 H or 13.2 H

(E) Answer not known

47. Thevenin's resistance across the terminals X and Y of the following circuit is



- (A)  $20\Omega$  (B)  $15\Omega$   
~~(C)  $5\Omega$~~  (D)  $10\Omega$   
 (E) Answer not known
48. A  $0.1\mu F$  capacitor is charged to 200V before being connected across a  $4k\Omega$  resistor. Determine the initial discharge current.
- (A) 5A ~~(B) 0.05A~~  
 (C) 0.5A (D) 0.005A  
 (E) Answer not known
49. While thevenizing a circuit between two terminals  $V_{TH}$  equals
- (A) short circuit terminal voltage  
~~(B) open-circuit terminal voltage~~  
 (C) emf of the battery nearest to the terminals  
 (D) net voltage available in the circuit  
 (E) Answer not known
50. When does maximum power transfer to the load in an electrical circuit?  
 $R_S$  and  $R_L$  are source and load resistances respectively
- ~~(A)  $R_L = R_S$~~  (B)  $R_L = 2R_S$   
 (C)  $R_L = \frac{R_S}{2}$  (D)  $R_L = R_S^2$   
 (E) Answer not known

51. Double sided suppressed carrier modulation in which transmitted wave consists of
- (A) only lower side bands
  - (B) only upper side bands
  - ~~(C)~~ only the upper and lower side bands
  - (D) middle bands
  - (E) Answer not known
52. A symmetric even sequence is such that  $x(n)$  is equal to
- ~~(A)~~  $x(-n)$
  - (B)  $-x(-n)$
  - (C)  $x^*(-n)/2$
  - (D)  $-x^*(-n)/2$
  - (E) Answer not known
53. PIC is an acronym for
- (A) Programmable Interrupt Controller
  - ~~(B)~~ Peripheral Interface Controller
  - (C) Programmable Interval Controller
  - (D) Programmable Interrupt Communication
  - (E) Answer not known
54. Which one of the following filter is stable?
- (A)  $H(z) = (5 - 4z)/(1 + z^{-1})$
  - (B)  $H(z) = (5 + 3z)/(1 - z^{-1})$
  - ~~(C)~~  $H(z) = 5 + 3z^{-1} - 4z^{-2}$
  - (D)  $H(z) = 1/(5 + 3z^{-1} + 4z^{-2})$
  - (E) Answer not known
55. Find the fourier transforms of  $\delta(n)$  is
- (A) 0
  - ~~(B)~~ 1
  - (C)  $u(n)$
  - (D)  $u(n - 1)$
  - (E) Answer not known

56. Find the contents of the control word of intel 8255 for mode 0 (operation) and for the following ports configuration.

Port A – Output, Port B – Output, Port C Lower – Output,  
Port C Upper - Input

- (A) 85H (B) 86H  
(C) 87H ~~(D) 88H~~  
(E) Answer not known

57. When a program is being executed in an 8085 microprocessor, its program counter contains

- ~~(A)~~ Memory address of the instruction that is to be executed next.  
(B) Memory address of the instruction that is being currently executed.  
(C) The number of instructions in the current program that have already been executed  
(D) The total number of instructions in the program being executed.  
(E) Answer not known

58. In intel 8085 A microprocessor ALE signal is made high to

- ~~(A)~~ enable the data bus to be used as low order address bus  
(B) to latch data  $D_0 - D_7$  from data bus  
(C) to disable the data bus  
(D) to achieve all functions listed above  
(E) Answer not known



59. Show the status of the CY, AC and P flags after the addition of 9CH and 64 H in the following instructions.

*MOV A, #9CH*

*ADD A, #64H*

- ~~(A)~~  $CY = 1, AC = 1, P = 0$                       (B)  $CY = 0, AC = 0, P = 1$   
(C)  $CY = 1, AC = 0, P = 0$                       (D)  $CY = 1, AC = 1, P = 1$   
(E) Answer not known
60. The chopper used for ON-OFF control of a dc separately excited motor has supply voltage of 230Vdc, an on time of 10 msec and OFF time of 15 msec. The chopper duty cycle will be
- (A) 0.6    ~~(B)~~ 0.4  
(C) 0.8    (D) 1  
(E) Answer not known
61. For an inverter-fed induction motor drive, calculate the drop in speed from no-load to 1100 rpm. Assume the number of poles are 4 and its frequency is 40Hz.
- (A) 1200 rpm                                      (B) 200 rpm  
~~(C)~~ 100 rpm                                      (D) 1100 rpm  
(E) Answer not known
62. A boost regulator has an input voltage of 5V and the average output voltage of 15V. The duty cycle is
- (A)  $3/2$     ~~(B)~~  $2/3$   
(C)  $5/2$     (D)  $15/2$   
(E) Answer not known

63. Consider the following statements switched mode power supply is preferred over the continuous type, because they are
1. Suitable for use in both AC and DC
  2. More efficient
  3. Suitable for low-power circuits
  4. Suitable for high-power circuits
- of these statements
- (A) 1 and 2 are correct                      (B) 1 and 3 are correct  
~~(C) 2 and 3 are correct~~                      (D) 2 and 4 are correct  
 (E) Answer not known
64. A step-up chopper has ' $E_{dc}$ ' as the source voltage and ' $\alpha$ ' as the duty cycle. The output voltage for this chopper is given by,
- ~~(A)  $E_0 = \frac{E_{dc}}{1 - \alpha}$~~                       (B)  $E_0 = \frac{E_{dc}}{1 + \alpha}$   
 (C)  $E_0 = E_{dc}(1 - \alpha)$                       (D)  $E_0 = E_{dc}(1 + \alpha)$   
 (E) Answer not known
65. If the pulses of different widths and heights are superimposed to produce a resultant wave with reduced harmonic content then it is called as
- ~~(A) Harmonic reduction by stepped wave inverters~~  
 (B) Harmonic reduction by transformer connections  
 (C) Harmonic reduction by PWM  
 (D) Harmonic reduction by multiple commutation in Each Half-cycle  
 (E) Answer not known
66. Select the incorrect statement of switched mode power supplies (SMPS)
- (A) SMPS is less sensitive to changes in input voltage  
~~(B) SMPS has low output ripple~~  
 (C) SMPS is smaller in size  
 (D) SMPS is a radio interference source  
 (E) Answer not known

67. A converter which can operate both in 3 pulse and 6 pulse modes is a
- (A) 1  $\phi$  full converter (B) 3 phase half wave converter  
~~(C)~~ 3 phase semi converter (D) 3 phase full converter  
 (E) Answer not known
68. TRIAC cannot be used in
- (A) AC voltage regulators (B) Cyclo converters  
~~(C)~~ Solid state type of switch (D) Inverter  
 (E) Answer not known
69. The thyristor circuit that directly converts AC voltages from one frequency to another frequency is called
- (A) AC voltage controller ~~(B)~~ Cyclo converter  
 (C) Inverter (D) Chopper  
 (E) Answer not known
70. An inductor L is connected in series with the thyristor for
- (A) Reducing switching loss (B) Reducing conduction loss  
 (C)  $\frac{dv}{dt}$  protection ~~(D)~~  $\frac{di}{dt}$  protection  
 (E) Answer not known
71. Form factor ratio is defined as
- (A)  $\frac{V_{ac}}{V_{dc}}$  ~~(B)~~  $\frac{V_{rms}}{V_{av}}$   
 (C)  $\frac{V_{rms}}{V_{ac}}$  (D)  $\frac{V_{dc}}{V_{ac}}$   
 (E) Answer not known

72. Choose the wrong :

Current transients can lead to serious damage mainly to

- (A) Circuit breakers                      (B) Circuit switches  
(C) Current transformers                ~~(D) Potential transformers~~  
(E) Answer not known

73. Which type of distance protection relay is used for long transmission lines?

- (A) Reactance type relay                ~~(B) Mho type relay~~  
(C) Impedance relay                      (D) Resistance type relay  
(E) Answer not known

74. Consider the following statements :

- (1) It is easier to construct the Y-Bus matrix as compared to Z-Bus
- (2) Z bus is a full matrix while Y bus is sparse
- (3) Y Bus can be easily modified whenever the network changes as compared to the Z Bus

Choose the correct statement

- (A) (1) and (2)                              (B) (2) and (3)  
(C) (1) and (3)                              ~~(D) (1), (2) and (3)~~  
(E) Answer not known

75. The critical clearing time of a faults in power systems is related to

- (A) Reactive power limit                (B) Short circuit current limit  
(C) Steady state stability limit        ~~(D) Transient stability limit~~  
(E) Answer not known

76. Using nominal  $\pi$  method, find the sending end voltage of a 250 km, 3 phase, 50 Hz transmission line delivering 25 MVA at 0.8 lagging power factor to a balanced load at 132 KV. The line conductors are spaced equally 3m apart the conductor resistance  $0.11 \Omega/\text{km}$  and its effective diameter is 1.6 cm neglect leakage

- ~~(A)~~ 143 KV (B) 147 KV  
 (C) 150 KV (D) 152 KV  
 (E) Answer not known

77. For a given receiving end voltage in a long transmission line, the sending end voltage is more than the actual value calculated by

- ~~(A)~~ Nominal  $\pi$  method (B) Nominal T method  
 (C) Load end capacitance method (D) Nominal  $\pi$  and T method  
 (E) Answer not known

78. The percentage voltage regulation of a short transmission line at lagging power factor is given by

$I$  = Current per phase

$V_R$  = Receiving end phase voltage

$R$  and  $X_L$  = resistance and inductive reactance per phase

$\phi_R$  = power factor angle

- ~~(A)~~  $\frac{I \cdot R \cos \phi_R + I \cdot X_L \cdot \sin \phi_R}{V_R}$  (B)  $\frac{I \cdot R \cos \phi_R - I \cdot X_L \cdot \sin \phi_R}{V_R}$   
 (C)  $\frac{I \cdot R \sin \phi_R + I \cdot X_L \cdot \cos \phi_R}{V_R}$  (D)  $\frac{I \cdot R \sin \phi_R - I \cdot X_L \cdot \cos \phi_R}{V_R}$   
 (E) Answer not known

79. The rated voltage of a 3 phase power system is given as
- (A) RMS line to line voltage
  - (B) RMS phase voltage
  - (C) Peak phase voltage
  - (D) Peak line to line voltage
  - (E) Answer not known
80. The typical values of a modern thermal power plant having 34% overall efficiency are  $\eta_{boil} = 0.42$ ,  $\eta_{cycle} = 0.44$ ,  $\eta_{Turbine(mesh)} = 0.95$  and  $\eta_{Generator} = 0.93$ . The power consumed by the auxiliaries of the plant is
- (A) 3% (B) 4%
  - (C) 5% (D) 6%
  - (E) Answer not known
81. PID controllers are tuned based on the frequency response of the closed loop system by
- (A) Using the open loop gain corresponding to the marginal stability
  - (B) Using the maximum amplitude of response
  - (C) Using maximum value of phase
  - (D) Using minimum value of phase
  - (E) Answer not known
82. Static error constant  $K_v$  \_\_\_\_\_ number of system.
- (A) 0 type (B)  1 type
  - (C) 2 type (D) 3 type
  - (E) Answer not known

83. If the open-loop transfer function has one pole in the right half of S-plane. The closed loop system will be stable if the nyquist plot of GH is
- (A) Does not encircle the  $(-1+j0)$  point
  - ~~(B)~~ Encircles the  $(-1+j0)$  point once in the counterclock wise direction
  - (C) Encircles the  $(-1+j0)$  point once in the clock wise direction
  - (D) Encircles the origin one in the counterclock wise direction
  - (E) Answer not known

84. A system is stable if
- ~~(A)~~ All the poles of the characteristic equation are towards the left hand side of the S-plane
  - (B) One of the poles of the characteristic equation is in the left hand side of S-plane and remaining poles in the right hand side of S-plane
  - (C) One of the poles of the characteristic equation is towards the right hand side of S-plane
  - (D) One of the poles of the characteristic equation lies on the origin
  - (E) Answer not known

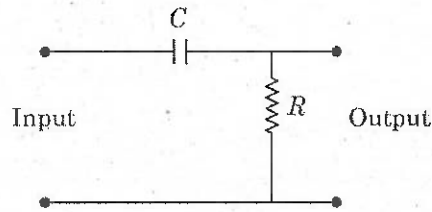
85. Consider the unity feedback system whose open loop transfer function is  $G(s) = \frac{k}{s(s+1)(s+4)}$ . Design a lag-lead compensator  $G_c(s)$  such that the static velocity error constant is  $10 \text{ sec}^{-1}$ . The phase margin is  $50^\circ$  and the gain margin is 10 dB or more

- (A)  $G_c(s) = (2.5s+1)(50s+1)/(50s+1)(0.25s+1)$
- ~~(B)~~  $(2.5s+1)(5s+1)/(0.25s+1)(50s+1)$
- (C)  $(0.25s+1)(50s+1)/(2.5s+1)(5s+1)$
- (D)  $(50s+1)(0.25s+1)/(25s+1)(5s+1)$
- (E) Answer not known

86. Steady state error of type 1 system is
- (A) 1
  - ~~(B)~~ 0
  - (C) 2
  - (D) 4
  - (E) Answer not known

87. A second order control system is described by the following differential equation  $4 \frac{d^2 c(t)}{dt^2} + 8 \frac{dc(t)}{dt} + 16 c(t) = 16 u(t)$ . The damping ratio and natural frequency for this system are respectively
- (A) 0.25 and 2 rad/s                      ~~(B) 0.5 and 2 rad/s~~  
 (C) 0.25 and 4 rad/s                      (D) 0.50 and 4 rad/s  
 (E) Answer not known

88. The transfer function of the circuit shown



- (A)  $\frac{1}{1 + SRC}$                       ~~(B)  $\frac{SRC}{1 + SRC}$~~   
 (C)  $\frac{SRC}{1 - SRC}$                       (D)  $1 + SRC$   
 (E) Answer not known
89. In a control systems, the use of negative feedback
- (A) Eliminates the chances of instability  
 (B) Increases the reliability  
~~(C) Reduces the effects of disturbance and noise signals in the forward path~~  
 (D) Increases the influence of variations of component parameters on the system performance  
 (E) Answer not known
90. The open loop transfer function of a system is  $G(s) = \frac{k}{s(s + A)}$ , where 'k' and 'A' are constants. How many poles and zeros are there in transfer function?
- (A) One, Zero                      ~~(B) Two, Zero~~  
 (C) Three, One                      (D) Zero, Two  
 (E) Answer not known





91. In a ramp DVM, the sample rate multivibrator determines the rate at which
- (A) It oscillates
  - (B) The clock pulses are generated
  - (C) Its amplitude varies
  - (D) The measurement cycles are initiated
  - (E) Answer not known
92. The open circuit and short circuit impedances of a line are  $100 \Omega$  each. The characteristic impedance of the line is
- (A)  $100\sqrt{2} \Omega$
  - (B)  $100 \Omega$
  - (C)  $\frac{100}{\sqrt{2}} \Omega$
  - (D)  $50 \Omega$
  - (E) Answer not known
93. According to Faraday's law, the abbreviation for EMF is
- (A) Electromagnetic Force
  - (B) Electromagnetic Field
  - (C) Electromagnetic Friction
  - (D) Electromotive Force
  - (E) Answer not known
94. Which one of the following gives the correct relationship of coefficient of coupling ( $k$ ) and self inductances ( $L_1$  and  $L_2$ ) and mutual inductance ( $M$ ) of inductively coupled coils?
- (A)  $\frac{M}{\sqrt{L_1 L_2}}$
  - (B)  $M\sqrt{L_1 L_2}$
  - (C)  $\frac{M}{L_1 L_2}$
  - (D)  $M \cdot L_1 L_2$
  - (E) Answer not known
95. The following equation is not Maxwell's equation for a static electromagnetic field in a linear homogeneous medium
- (A)  $\nabla \cdot B = 0$
  - (B)  $\nabla \times D = 0$
  - (C)  $\oint_s D \cdot ds = Q$
  - (D)  $\nabla^2 A = \mu_0 J$
  - (E) Answer not known

96. A parallel plate capacitor has an area of  $0.8 \text{ m}^2$ . Separation of  $0.1 \text{ mm}$  with a dielectric for which  $\epsilon_v = 1000$  and a field of  $10^6 \text{ V/m}$ . Determine the capacitance of the parallel plate

- (A)  $60.59 \mu\text{F}$  (B)  $65.13 \mu\text{F}$   
 (C)  $68.02 \mu\text{F}$  (D)  $70.83 \mu\text{F}$   
 (E) Answer not known

97. A charge  $Q$  is uniformly distributed throughout a sphere of radius  $a$ . Taking the potential at infinity as zero, the potential at  $r = b < a$  is

- (A)  $-\int_{\infty}^b \frac{Qr}{4\pi\epsilon_0 a^3} dr$  (B)  $-\int_{\infty}^b \frac{Q}{4\pi\epsilon_0 r^2} dr$   
 (C)  $-\int_{\infty}^a \frac{Q}{4\pi\epsilon_0 r^2} dr - \int_a^b \frac{Qr}{4\pi\epsilon_0 a^3} dr$  (D)  $-\int_{\infty}^a \frac{Q}{4\pi\epsilon_0 r^3} dr$   
 (E) Answer not known

98. A High-Q circuit is a resonant circuit in which the quality factor is

- (A)  $> 5$  (B)  $\geq 5$   
 (C)  $\leq 5$  (D)  $< 5$   
 (E) Answer not known

99. \_\_\_\_\_ is the Poisson's equation.

$V =$  Electrical potential

$\rho =$  Charge density

$\epsilon_0 =$  Permittivity

- (A)  $\nabla^2 V = \frac{-\rho}{\epsilon_0}$  (B)  $\nabla V = \frac{-\rho}{\epsilon_0}$   
 (C)  $\nabla^2 V = \frac{\rho}{\epsilon_0}$  (D)  $\nabla V = \frac{\rho}{\epsilon_0}$   
 (E) Answer not known

100. The finite sheet  $0 \leq x \leq 1$ ,  $0 \leq xy \leq 1$  on the  $z = 0$  plane has a charge density  $P_s = xy(x^2 + y^2 + 25)^{3/2} \text{ nc/m}^2$ . Find total charge on the sheet.

~~(A)~~  $33.15 \text{ nc}$

(B)  $30 \text{ nc}$

(C)  $13.15 \text{ nc}$

(D)  $131 \text{ nc}$

(E) Answer not known

101. Point charges  $30 \text{ nc}$ ,  $-20 \text{ nc}$  and  $10 \text{ nc}$  are located at  $(-1, 0, 2)$ ,  $(0, 0, 0)$  and  $(1, 5, -1)$  respectively. The total flux leaving a cube of side 6 m centered, at the origin is

(A)  $-20 \text{ nc}$

~~(B)~~  $10 \text{ nc}$

(C)  $20 \text{ nc}$

(D)  $30 \text{ nc}$

(E) Answer not known

102. Plane  $z = 10 \text{ m}$  carries charge  $20 \text{ nc/m}^2$ . The electric field intensity at the origin is

(A)  $-10 a_z \text{ V/m}$

(B)  $-18\pi a_z \text{ V/m}$

(C)  $-72\pi a_z \text{ V/m}$

~~(D)~~  $-360\pi a_z \text{ V/m}$

(E) Answer not known

103. If total charge ( $Q$ ) occupies a Volume ( $V$ ) then volume charge density ( $\rho$ ) is,

(A)  $\frac{Q}{2V}$

(B)  $\frac{Q}{V^2}$

(C)  $Q \cdot V$

~~(D)~~  $\frac{Q}{V}$

(E) Answer not known

104. Chemical energy is converted to \_\_\_\_\_ energy by a fuel cell.
- (A) Solar (B) Potential  
~~(C)~~ Electrical (D) Mechanical  
(E) Answer not known
105. The type of battery which is commonly used in modern electric vehicles due to its high energy density and efficiency is
- (A) Nickel – Cadmium (B) Lead – Acid  
~~(C)~~ Lithium – Ion (D) Alkaline  
(E) Answer not known
106. The ion exchange membrane in fuel cell is permeable to
- (A) all gases (B) oxygen ions  
~~(C)~~ hydrogen ions (D) both oxygen and hydrogen ions  
(E) Answer not known
107. Ethanol is a
- (A) Inflammable Coloured Bio Fuel  
~~(B)~~ Flammable Colourless Bio Fuel  
(C) Flammable Coloured Bio Fuel  
(D) Inflammable Colourless Bio Fuel  
(E) Answer not known
108. The operating temperature of Molten Carbonate Fuel Cells (MCFCs) is around
- ~~(A)~~ 650°C (B) 750°C  
(C) 850°C (D) 950°C  
(E) Answer not known

109. A community requires 60 kw of power output to meet their daily electricity needs it indicates 100 m of gross head to be available what design discharge is require community's electricity needs? Assume an overall efficiency of 55%

- (A) 0.011 m<sup>3</sup>/s  
(B) 0.111 m<sup>3</sup>/s  
(C) 0.001 m<sup>3</sup>/s  
(D) 0.010 m<sup>3</sup>/s  
(E) Answer not known

110. Power Extracted by the turbine of a wind energy conversion system is directly proportion to

(V-velocity of the wind)

- (A) V<sup>2</sup>  
(B) V<sup>3</sup>  
(C) V <sup>$\frac{1}{2}$</sup>   
(D) V <sup>$\frac{1}{3}$</sup>   
(E) Answer not known

111. Five measured wind speeds are 2, 4, 7, 8 and 9 m/s. Find the standard deviation.

- (A) 6 m/s  
(B) 2.92 m/s  
(C) 7 m/s  
(D) 8.56 m/s  
(E) Answer not known

112. At Nagpur, the following observations were made. Theoretical maximum possible sunshine hours = 9.5 h, average measured length of a day during April = 9.0 h, Solar Radiation for a clear day, H<sub>0</sub> = 2100 kJ/m<sup>2</sup>/day.

Constant a = 0.27, b = 0.50

The average daily global radiation will be :

- (A) 1554 kJ/m<sup>2</sup>/day  
(B) 1695 kJ/m<sup>2</sup>/day  
(C) 1955 kJ/m<sup>2</sup>/day  
(D) 1454 kJ/m<sup>2</sup>/day  
(E) Answer not known

113. The materials most commonly used for solar cells are

- (A) Rubidium
- (B) ~~Silicon~~
- (C) Nickel
- (D) Chromium
- (E) Answer not known

114. The drawback of SR-FF is

- (A) No change in next state
- (B) Change in next state
- (C) Present and next states are same
- (D) ~~Indeterminate in next state~~
- (E) Answer not known

115. Choose the right :

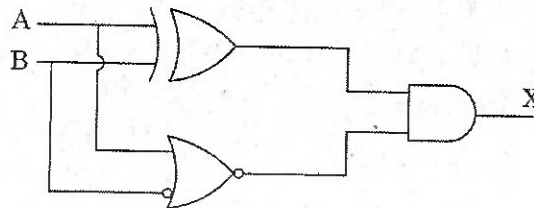
Use Demorgans laws find the complement of  $(A' + B')C'$

- (A)  ~~$AB' + C$~~
- (B)  $A + BC'$
- (C)  $A' + BC$
- (D)  $AB + C'$
- (E) Answer not known

116. Simplify  $Z = (\bar{A} + B)(A + B)$

- (A)  $AB$
- (B)  $\bar{A}\bar{B}$
- (C)  $A$
- (D)  ~~$B$~~
- (E) Answer not known

117. The output X of the circuit shown in the figure will be



- (A)  $AB$
- (B)  ~~$\bar{A}B$~~
- (C)  $A\bar{B}$
- (D)  $\bar{A}\bar{B}$
- (E) Answer not known

118. Unit of measurement of slew rate in an operational amplifier is

$$V = VOHS$$

S = Seconds

- (A) V/S (B) V/mS  
~~(C)~~ V/ $\mu$ S (D) V/nS  
(E) Answer not known

119. In a common emitter-amplifier current gain  $\beta = 100$  and collector current is 2 mA. The approximate base current value will be

- (A)  $2 \mu A$  (B)  $50 \mu A$   
~~(C)~~  $20 \mu A$  (D)  $5 \mu A$   
(E) Answer not known

120. The frequency at which amplifier gain is 0 dB is called \_\_\_\_\_ frequency.

- ~~(A)~~ unity gain (B) midrange  
(C) break (D) corner  
(E) Answer not known

121. RC Amplifier has

- (A) Excellent impedance matching  
~~(B)~~ Excellent frequency response  
(C) Less number of components  
(D) Maximum power output  
(E) Answer not known

122. In which of the following oscillator, frequency cannot be varied?

- (A) Phase shift oscillator ~~(B)~~ Crystal oscillator  
(C) Hartley oscillator (D) Colpitt's oscillator  
(E) Answer not known

123. After  $V_{DS}$  reaches pinch-off value  $V_P$  in a JFET, drain current  $I_D$  becomes
- (A) Zero
  - (B) Low
  - ~~(C) Saturated~~
  - (D) Reversed
  - (E) Answer not known
124. \_\_\_\_\_ configuration of BJT is used as a buffer.
- (A) Common Emitter
  - ~~(B) Common Collector~~
  - (C) Common Base
  - (D) Common Emitter and Common Base
  - (E) Answer not known
125. A synchronous motor is operating on no-load at unity power factor. If the field current is increased, the power factor will become
- (A) Leading and the current will decrease
  - (B) Lagging and the current will increase
  - (C) Lagging and the current will decrease
  - ~~(D) Leading and the current will increase~~
  - (E) Answer not known
126. A motor that uses electronic commutator is known as
- (A) Stepper Motor
  - ~~(B) Brushless DC Motor~~
  - (C) Permanent Magnet Synchronous Motor
  - (D) Induction Motor
  - (E) Answer not known



127. Pitch factor for 5/6 short pitch is

- (A) 0.966
- (B) 0.833
- (C) 1.0
- (D) 3.454
- (E) Answer not known

128. For an induction motor operating at a slips, the ratio of gross power output to air gap power is equal to

- (A)  $(S - 1)$
- (B)  $(1 - S)$
- (C)  $(1 - S)^2$
- (D)  $\sqrt{(1 - S)}$
- (E) Answer not known

129. The use of higher flux density in the transformer design

- (A) reduces the weight per KVA
- (B) increases the weight per KVA
- (C) has no relation with the weight of transformer
- (D) increases the weight per kW
- (E) Answer not known

130. What is the frequency of rotor current of a 50 Hz induction motor operating at 2% slip?

- (A) 1 Hz
- (B) 100 Hz
- (C) 2 Hz
- (D) 50 Hz
- (E) Answer not known

131. The Lamination reduces the

- (A) Magnetic reluctance and core losses at low flux densities
- (B) Magnetic reluctance and core losses at high flux densities
- (C) Magnetic reluctance and copper losses at low flux densities
- (D) Magnetic reluctance and copper losses at high flux densities
- (E) Answer not known

132. Choose the right matches :

The effect of armature reaction in alternators

- |                               |   |                    |
|-------------------------------|---|--------------------|
| 1. Under unity PF load        | – | Cross magnetises   |
| 2. Under unity PF load        | – | Demagnetises       |
| 3. Under zero PF lagging load | – | Demagnetises       |
| 4. Under zero PF lagging load | – | Cross Demagnetises |
- (A) 1 and 3 are correct                      (B) 1 and 2 are correct  
(C) 2 and 3 are correct                      (D) 3 and 4 are correct  
(E) Answer not known

133. A 4 pole DC generator runs at 750 r.p.m and generates an emf of 240 V. The armature is wave-wound and has 792 conductors. If the total flux from each pole is 0.0145 Wb, what is the leakage coefficient?

- (A) 4.6     (B) 1.2  
(C) 2    (D) 3  
(E) Answer not known

134. The most economical method of finding no load losses of a large dc shunt motor is ————— test.

- (A) Swinburne's                                      (B) Hopkinson's  
(C) Retardation                                      (D) Field  
(E) Answer not known

135. Due to armature reaction, the armature magnetic field has following effects.

- (i) It demagnetics the main flux  
(ii) It magnetics the main flux  
(iii) It crossmagnetics the main flux  
(iv) It does not have any effect on main flux
- (A) (i) and (ii)                                      (B) (i), (ii), (iii) and (iv)  
 (C) (i) and (iii)                                      (D) (ii) and (iv)  
(E) Answer not known

136. Capacitive transducers

- (A) are used for dynamic measurements
- (B) act as high pass filters
- ~~(C)~~ both (A) and (B)
- (D) are used for both static and dynamic measurements and act as notch filter
- (E) Answer not known

137. The tape receives 12,000 number per second. The tape speed is 1.5 m/s. Determine the number density of the tape.

- ~~(A)~~ 8 Numbers/mm
- (B) 3 Numbers/mm
- (C) 5 Numbers/mm
- (D) 10 Numbers/mm
- (E) Answer not known

138. Piezo meter is used for measuring

- ~~(A)~~ Gauge pressure
- (B) Vacuum
- (C) Absolute pressure
- (D) Pressure difference between two fields
- (E) Answer not known

139. Match the following :

- |                          |                               |
|--------------------------|-------------------------------|
| (a) Hay's bridge         | 1. Capacitance                |
| (b) Anderson bridge      | 2. Low resistance             |
| (c) Wien bridge          | 3. Inductance of high Q coils |
| (d) Kelvin double bridge | 4. frequency                  |

- |                |                  |     |     |     |
|----------------|------------------|-----|-----|-----|
|                | (a)              | (b) | (c) | (d) |
| (A)            | 4                | 1   | 3   | 2   |
| (B)            | 2                | 3   | 4   | 1   |
| <del>(C)</del> | 3                | 1   | 4   | 2   |
| (D)            | 3                | 1   | 2   | 4   |
| (E)            | Answer not known |     |     |     |

140. Turns compensation is used in current transformer primarily for reduction of
- (A) Phase angle error
  - (B) Both ratio and phase angle error
  - (C) Ratio error, reduction in phase angle error is incidental
  - (D) None of the above
  - (E) Answer not known
141. The static error band of an instrument implies the
- (A) Accuracy of an instrument
  - (B) Irrepeatability of an instrument
  - (C) Error caused when the pen is stopped at some deflection
  - (D) Error introduced in low varying inputs
  - (E) Answer not known
142. Major cause of creeping in a energy meter is due to
- (A) Vibrations
  - (B) Overcompensation for friction
  - (C) Excessive voltage across the potential coil
  - (D) Stray magnetic field
  - (E) Answer not known
143. The minimum number of watt meter (s) required to measure 3 phase, 3 wire balanced or unbalanced power is
- (A) 1
  - (B) 2
  - (C) 3
  - (D) 4
  - (E) Answer not known

144. The impedance of each branch of a delta connected circuit is  $\sqrt{3} \bar{Z}$ . What will be the branch impedances of equivalent star-connected circuits?

~~(A)~~  $\frac{\bar{Z}}{\sqrt{3}}, \frac{\bar{Z}}{\sqrt{3}}, \frac{\bar{Z}}{\sqrt{3}}$

(B)  $\frac{2\bar{Z}}{\sqrt{3}}, \frac{2\bar{Z}}{\sqrt{3}}, \frac{2\bar{Z}}{\sqrt{3}}$

(C)  $\frac{3\bar{Z}}{\sqrt{3}}, \frac{3\bar{Z}}{\sqrt{3}}, \frac{3\bar{Z}}{\sqrt{3}}$

(D)  $\frac{4\bar{Z}}{\sqrt{3}}, \frac{4\bar{Z}}{\sqrt{3}}, \frac{4\bar{Z}}{\sqrt{3}}$

(E) Answer not known

145. The power readings of two watt meters are +15kW and -4kW for a three phase load. If the supply voltage is balanced 440V, the true power drawn by the load is

(A) 60 kW

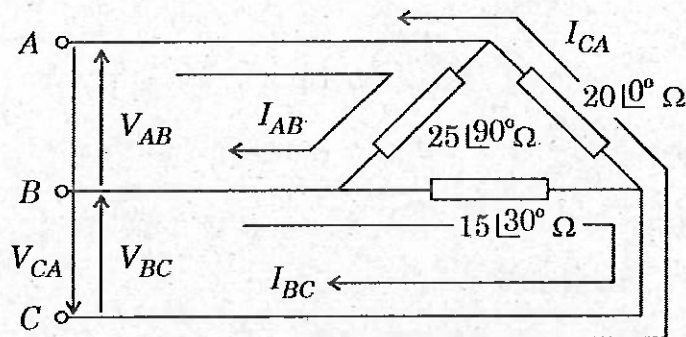
~~(B)~~ 11 kW

(C) 19 kW

(D) 3.75 kW

(E) Answer not known

146. An unbalanced load is connected to a three phase supply with line voltage of 240V as in figure below. The effective values of phase currents are



~~(A)~~  $I_{AB} = 9.6A, I_{BC} = 16A, I_{CA} = 12A$

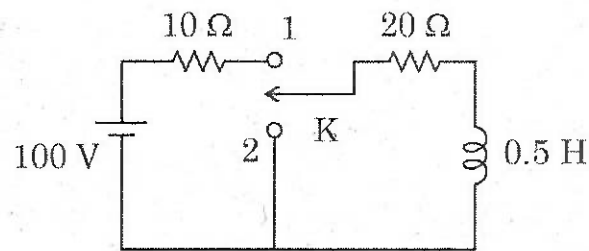
(B)  $I_{AB} = 13.6A, I_{BC} = 22.6A, I_{CA} = 17A$

(C)  $I_{AB} = 6.8A, I_{BC} = 11.3A, I_{CA} = 8.5A$

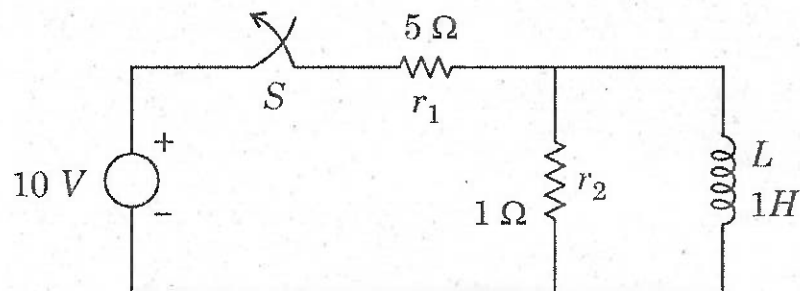
(D)  $I_{AB} = 16.6A, I_{BC} = 27.7A, I_{CA} = 20.8A$

(E) Answer not known

147. In the following figure the switch K is kept first at position 1 and steady state condition is reached. At  $t=0$  the switch is moved to position 2. The current in both cases are

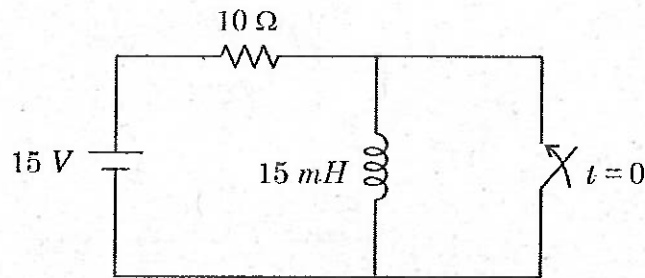


- (A) 10 A and  $10e^{-40t}$  (B) 3.33 A and  $3.33e^{-20t}$   
 (C) 10 A and  $10e^{-20t}$  (D) 3.33 A and  $3.33e^{-40t}$   
 (E) Answer not known
148. In fig. find the expression for current at  $t=0+$ , following switching (opening of S). Assume steady state when S was closed.



- (A)  $2e^{-t}$  Amps (B)  $3e^{-2t}$  Amps  
 (C)  $5e^{-3t}$  Amps (D)  $2e^{-2t}$  Amps  
 (E) Answer not known
149. At the time of switching of an inductor to a source, a current  $I_0$  was already flowing through the inductor. Then, the inductor will behave as
- (A) an open circuit (B) a short circuit  
 (C) a current source of  $I_0$  Ampere (D) a voltage source of  $V_0$  volts  
 (E) Answer not known

150. The circuit shown in figure is in steady state, when the switch is closed at  $t = 0$  assuming ideal inductance. The current through inductor at  $t = 0^+$  is



- (A) 0.5 A                      ~~(B) 1.5 A~~  
 (C) 1 A                         (D) 0 A  
 (E) Answer not known
151. A sinusoidal current has peak value of 12 A. What is its average value?
- (A) 24 A                      ~~(B) 7.64 A~~  
 (C) 8.48 A                    (D) 12 A  
 (E) Answer not known
152. In a series R-L-C circuit, the voltage across inductance will be maximum
- (A) At resonant frequency  
~~(B) Just after resonant frequency~~  
 (C) Just before resonant frequency  
 (D) Just before and after resonant frequency  
 (E) Answer not known
153. In a certain series RC circuit,  $V_R = 4V$  and  $V_C = 6V$ . What is the magnitude of the total voltage?
- ~~(A) 7.2 V~~                      (B) 4 V  
 (C) 6 V                         (D) 52 V  
 (E) Answer not known

154. Determine the PCM transmission data rate for a single-channel PCM system employing a sample rate 8000 samples per second and an 8-bit compressed PCM code.

(A) 16 kbps

~~(B) 64 kbps~~

(C) 1 kbps

(D) 8 kbps

(E) Answer not known

155. Bandwidth of pulse code modulation (PCM) depends on the following

(i) highest frequency of analog signals

(ii) lowest frequency of analog signals

(iii) Number bits of PCM

Which one of the statements is true?

(A) (i)

(B) (ii)

~~(C) (i) and (iii)~~

(D) (iii)

(E) Answer not known

156. The \_\_\_\_\_ layer uses data compression to reduce the number bits to be transmitted.

~~(A) presentation~~

(B) data link

(C) network

(D) application

(E) Answer not known

157. The \_\_\_\_\_ layer changes bits into electromagnetic signal.

~~(A) physical~~

(B) data link

(C) transport

(D) presentation

(E) Answer not known



158. Determine the Z-transform  $x(n) = (1 + n) \cup (n)$

~~(A)~~  $x(z) = \frac{1}{(1 - z^{-1})^2}$

(B)  $x(z) = \frac{1}{(1 + z^{-1})^2}$

(C)  $x(z) = \frac{1}{(1 - z^{-1})^{-2}}$

(D)  $x(z) = \frac{1}{(1 - z^{-1})}$

(E) Answer not known

159. Number and types of machine cycles are needed to execute push PSW by an intel 8085 A microprocessor

(A) 2, fetch and memory write

~~(B)~~ 3, fetch and 2 memory write

(C) 3, fetch and 2 memory read

(D) 3, fetch, memory read and memory write

(E) Answer not known

160. The number of I/O pins in 8255A is

(A) 8

(B) 16

~~(C)~~ 24

(D) 30

(E) Answer not known

161. When high speed data transfer is required, which I/O technique is most widely used?

(A) Memory mapped I/O

(B) I/O mapped I/O

(C) Status check I/O

~~(D)~~ Direct Memory Access

(E) Answer not known

162. For the 8085 microprocessor-assembly language program given below, the content of the accumulator after execution of the program is

8000 MVI A, 45H

8002 MOV B, A

8003 STC

8004 CMC

8005 RAR

8006 XRA B

(A) 00H

(B) 45H

~~(C)~~ 67H

(D) E7H

(E) Answer not known

163. In 8085 microprocessors, the signal is used to insert wait state is

~~(A)~~ Ready

(B) ALE

(C) CLK (OUT)

(D) INTR

(E) Answer not known

164. Determine how many times the following loop will be executed?

MOV R6, # 200

BACK: MOV R5, #100

HERE: DJNZ R5, HERE

DJNZ R6, BACK

RET

(A) 100

(B) 200

~~(C)~~ 20000

(D) 300

(E) Answer not known

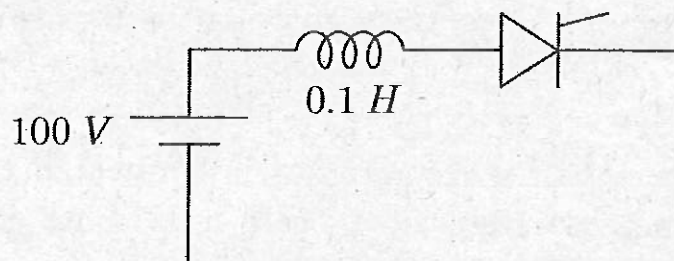
165. In a DC chopper :

- I. The waveform of input voltage is continuous.
- II. The waveform of output voltage is discontinuous.
- III. Per unit ripple current is maximum when duty cycle is 0.5.
- IV. The output can be controlled by PWM by varying the chopping period keeping  $T_{on}$  constant.

Which of the following combination of statements are true?

- (A) I, II and III
- (B) II, III and IV
- (C) I, III and IV
- (D) I, II and IV
- (E) Answer not known

166. The latching current in given circuit is 4mA. The minimum width of the gate pulse required to properly turn on the thyristor is



- (A)  $6 \mu s$
- (B)  $4 \mu s$
- (C)  $2 \mu s$
- (D)  $1 \mu s$
- (E) Answer not known

167. A boost regulator has an input voltage of 5V. The average output voltage 15V, average load current of 0.5A. The switching frequency is 25 KHz. If  $L = 150 \mu H$  and  $C = 220 \mu F$ . Determine the ripple current of inductor (AI).

- (A) 1A
- (B) 1.5 A
- (C) 0.89 A
- (D) 0.99 A
- (E) Answer not known

168. A single phase full converter bridge is connected to RLE load. The source has a rms voltage of 230 V and the average load current is 10 A. Find the firing angle for which the power flows from AC source to the DC load. Consider firing angle delay for  $E = 120 \text{ V}$ ,  $R = 0.4 \Omega$ .
- (A)  $29.31^\circ$  (B)  $72.72^\circ$   
~~(C)  $53.21^\circ$~~  (D)  $45.62^\circ$   
 (E) Answer not known
169. A single phase fully controlled bridge converter supplies an inductive load. Assuming that output current is virtually constant, determine average output voltage if the supply voltage is 230V and firing angle is maintained at  $\pi/6$  radians.
- ~~(A) 179.33 V~~ (B) 126.80 V  
 (C) 153.27 V (D) 143.86 V  
 (E) Answer not known
170. A single phase half wave rectifier is connected to a 240V supply. The load resistance  $R = 10\Omega$ ,  $L = 0.5\text{mH}$  and firing angle  $\alpha = 30^\circ$ . Find the average output voltage.
- (A) 50 V ~~(B) 100 V~~  
 (C) 150 V (D) 200 V  
 (E) Answer not known
171. A single phase semi-converter is supplying an RL load with a firing angle of  $\alpha$ . When the mode of operation is discontinuous, the conduction and free wheeling period of each cycle are respectively.
- (A)  $\alpha - \pi, \alpha$  (B)  $\alpha - \pi, \alpha - \beta$   
 (C)  $\pi - \alpha, \beta$  ~~(D)  $\pi - \alpha, \beta - \pi$~~   
 (E) Answer not known

172. When anode is positive with respect to cathode with gate circuit open. The SCR is set to be in the

- (A) Forward blocking mode      (B) Forward conduction mode  
(C) Reverse conduction mode      (D) Reverse blocking mode  
(E) Answer not known

173. The company which is responsible for transmission of Electrical Energy is called as

- (A) Genco       (B) Transco  
(C) Discom      (D) Retailcos  
(E) Answer not known

174. The energy audit strategy consists of

- (A) General considerations, preliminary studies and detailed study  
(B) Detailed study only  
(C) General considerations only  
(D) Preliminary study only  
(E) Answer not known

175. If the inductance and capacitance of power system are respectively 1H and  $0.01 \mu F$  and the instantaneous value of interrupted current is 10A, then the voltage across the breaker contact will be

- (A) 50 KV      (B) 57 KV  
(C) 60 KV       (D) 100 KV  
(E) Answer not known

176. The loss of excitation of a generator may result in

- (A) Increased generator speed  
(B) Reduced generator speed  
(C) Speed of the generator is constant  
(D) Generator speed is zero  
(E) Answer not known

177. Assertion [A] : The Bus admittance matrix ( $Y_{Bus}$ ) used in load-flow studies is a sparse matrix.

Reason [R] : The elements of  $Y_{Bus}$  exhibit the physical inter connection of nodes of the power system.

- (A) Both [A] and [R] are true and [R] is a correct explanation of [A]
- (B) Both [A] and [R] are true but [R] is not a correct explanation of [A]
- (C) [A] is true but [R] is false
- (D) [A] is false but [R] is true
- (E) Answer not known

178. In a balanced three phase system, which one of the following statement is true?

- (i) Positive sequence currents are zero
  - (ii) Negative sequence currents are zero
  - (iii) Zero sequence currents are zero
- (A) (i) (B) (ii)
- (C) (ii) and (iii) (D) (i) and (ii)
- (E) Answer not known

179. If a 75 MVA, 10 KV synchronous generator has  $\chi_d = 0.4 p.u.$ . Then  $\chi_d$  value (in p.u) to a base of 100 MVA, 11 KV is

- (A) 5.78 (B) 0.279
- (C) 0.412  (D) 0.44
- (E) Answer not known

180. In a three unit insulator string, voltage across the lowest unit is 17.5 KV and string efficiency is 84.28%. The total voltage across the string will be equal to
- (A) 8.825 KV ~~(B) 44.25 KV~~  
 (C) 88.25 KV (D) 442.5 KV  
 (E) Answer not known

181. Match the following :
- |                               |   |
|-------------------------------|---|
| (a) Pin type insulator        | 1. Used for low voltage over head lines |
| (b) Suspension type insulator | 2. Used at dead ends and anchor towers  |
| (c) Strain type insulator     | 3. Used upto 80 KV                      |
| (d) Shackle type insulator    | 4. Flexibility of the line is improved  |

- |                | (a)              | (b) | (c) | (d) |
|----------------|------------------|-----|-----|-----|
| (A)            | 4                | 2   | 1   | 3   |
| (B)            | 1                | 3   | 2   | 4   |
| <del>(C)</del> | 3                | 4   | 2   | 1   |
| (D)            | 2                | 1   | 3   | 4   |
| (E)            | Answer not known |     |     |     |

182. Current density is higher at the surface of the conductor compared to the current density at its center. This is called
- (A) Proximity effect ~~(B) Skin effect~~  
 (C) Ferranti effect (D) Coulomb's Law  
 (E) Answer not known

183. A 3 phase alternator rated at 50 MVA, 22 KV has a synchronous reactance per phase of 5 P.U on its thermal rating. The P.U value of this reactance on a base of 100 MVA and 220 KV is
- (A) 25 P.U (B) 12.5 P.U  
 (C) 1 P.U ~~(D) 0.1 P.U~~  
 (E) Answer not known

184. The open-loop transfer function of a feedback system is  $G(s)H(s) = \frac{K}{s(s+4)(s^2+4s+20)}$ . The open loop poles for the system are

- (i)  $s = 0, s = -4$
- (ii)  $s = -2 - j4$  and  $s = -2 + j4$
- (iii)  $s = -3 - j4$  and  $s = -3 + j4$
- (iv)  $s = -4 - j4$  and  $s = -4 + j4$

- (A) (i) and (iii) only
- (B) (i) and (iv) only
- ~~(C)~~ (i) and (ii) only
- (D) (ii) and (iii) only
- (E) Answer not known

185. The magnitude criterion of root-locus is given by

- ~~(A)~~ The ratio of the product of the magnitude of vectors of open loop zeros and product of the open-loop gain and magnitude of vectors of open loop poles must be equal to unity
- (B) The ratio of the product of the magnitude of vectors of open loop poles and open loop zeros must be equal to unity
- (C) The product of the magnitude of vectors of open-loop poles and zeros must be equal to unity
- (D) The product of the magnitude of vectors of open-loop poles and zeros must be equal to zero
- (E) Answer not known

186. Phase margin is used to specify

- (A) Absolute stability
- ~~(B)~~ Relative stability
- (C) Time response
- (D) Frequency response
- (E) Answer not known



187. A unity feedback (negative) system has open loop transfer function

$$G(s) = \frac{k}{s(s+2)}$$

Calculate the value of gain  $k$  so that the closed loop system has a steady state unit ramp error of 0.1

- (A) 0.5 (B) 10  
~~(C)~~ 20 (D) 100  
(E) Answer not known

188. The transfer function of a system is  $\frac{100(1+0.25s)}{(1+0.5s)}$ . The phase angle of the system at  $\omega = 0$  and  $\omega = \infty$  are

- ~~(A)~~  $0^\circ$  and  $0^\circ$  (B)  $0^\circ$  and  $90^\circ$   
(C)  $90^\circ$  and  $-90^\circ$  (D)  $90^\circ$  and  $180^\circ$   
(E) Answer not known

189. Signal flow graph is used to obtain the

- (A) Observability of a system (B) Controllability of a system  
~~(C)~~ Transfer function of a system (D) Stability of a system  
(E) Answer not known

190. An open loop system represented by the transfer function

$$G(s) = \frac{(s-2)}{(s+1)(s+3)}$$
 is

- (A) Unstable and of non minimum phase type  
(B) Unstable and of minimum phase type  
(C) Stable and of minimum phase type  
~~(D)~~ Stable and of non minimum phase type  
(E) Answer not known

191. The closed loop transfer function of a second order system is  $(s + 1)/(s + 2)(s + 3)$ . The steady state output of the system to a step input of 5 is

(A)  $\frac{-10}{3} + \frac{5}{3}e^{-2t} + 5e^{-3t}$

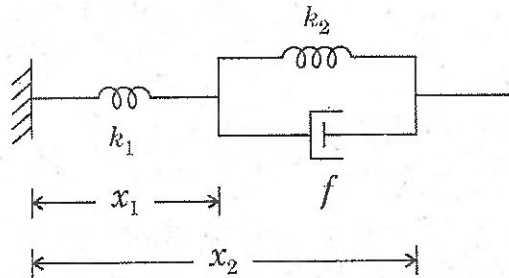
(B)  $\frac{8}{6} + \frac{9}{2}e^{-2t} + \frac{5}{3}e^{-3t}$

~~(C)~~  $\frac{5}{6} + \frac{5}{2}e^{-2t} - \frac{10}{3}e^{-3t}$

(D)  $\frac{9}{2} + \frac{5}{3}e^{-2t} + \frac{8}{6}e^{-3t}$

(E) Answer not known

192. The transfer function  $\frac{x_1(s)}{x_2(s)}$  for the following mechanical system is



~~(A)~~  $(k_2 + sf)/(k_1 + k_2 + sf)$

(B)  $(k_1 + sf)/(k_1 + k_2 + sf)$

(C)  $(k_1 + k_2 + sf)/(k_1 + k_2)$

(D)  $(k_1 + k_2 + sf)/(k_1 + sf)$

(E) Answer not known

193. Consider a type-1 system with open loop transfer function of

$$G_f(s) = \frac{k}{s(s+1)(s+4)} \text{ with damping ratio } \rho = 0.5$$

settling time  $t_s = 10$  sec. Find the undamped natural frequency.

(A) 0.5 rad/sec

(B) 0.7 rad/sec

~~(C)~~ 0.8 rad/sec

(D) 0.6 rad/sec

(E) Answer not known

194. Assertion [A] : A Capacitor can store charge.

Reason [R] : The plates of the condenser are conductive.

- (A) Both [A] and [R] are true and [R] is a correct explanation of [A]  
~~(B)~~ Both [A] and [R] are true but [R] is not a correct explanation of [A]  
(C) [A] is true but [R] is false  
(D) [A] is false but [R] is true  
(E) Answer not known

195. A capacitor is made with a dielectric having  $\epsilon_r = 1.98$  and dielectric breakdown strength of 40 kv/cm.  $\epsilon_0 = 8.8 pF/m$ . The capacitor plates have a length of 60 cm and width of 30 cm, then maximum electric charge in the capacitor is

- (A) 8.232  $\mu c$  (B) 4.862  $\mu c$   
~~(C)~~ 12.545  $\mu c$  (D) 10.46  $\mu c$   
(E) Answer not known

196. A wire of length  $L$  is bent in the form of circular loop and current is passed through the loop. The magnetic field induction at the centre of the loop is  $B$ . Find the current passing through the loop

- (A)  $\frac{B\pi L}{\mu_0}$  ~~(B)~~  $\frac{BL}{\pi \mu_0}$   
(C)  $\frac{B\pi}{L\mu_0}$  (D)  $\frac{BL}{\pi}$   
(E) Answer not known

197. A multilayer coil of 3000 turns of fine wire is 10 mm long and has thickness of 5 mm winding. If the coil carries a current of 5 mA, the mmf generated is

- (A) 750 AT ~~(B)~~ 15 AT  
(C) 600 AT (D) 5000 AT  
(E) Answer not known

198. The divergence of a vector in rectangular coordinates is given as  
 $div A = \nabla \cdot A$

$$= \frac{\partial A_x}{\partial x} + \frac{\partial A_y}{\partial y} + \frac{\partial A_z}{\partial z}$$

The operator  $\nabla$  is

- (A)  $\frac{\partial}{\partial x} + \frac{\partial}{\partial y} + \frac{\partial}{\partial z}$       ~~(B)~~  $\frac{\partial}{\partial x} \hat{a}_x + \frac{\partial}{\partial y} \hat{a}_y + \frac{\partial}{\partial z} \hat{a}_z$   
 (C) Both (A) and (B)      (D) Zero  
 (E) Answer not known

199. Match List I with List II and select the correct answer using the codes given below the lists.

List I  
 (Law / Quantity)

- (a) Gauss's Law  
 (b) Ampere's law  
 (c) Faraday's law  
 (d) Poynting vector

List II  
 (Mathematical expression)

1.  $\nabla \cdot \bar{D} = \rho$   
 2.  $\nabla \times \bar{E} = -\frac{\partial \bar{B}}{\partial t}$   
 3.  $\bar{S} = \bar{E} \times \bar{H}$   
 4.  $\nabla \times \bar{H} = \bar{J}_c + \frac{\partial \bar{D}}{\partial t}$   
 5.  $\bar{F} = q(\bar{E} + \bar{V} \times \bar{B})$

Codes :

- |                | (a) | (b) | (c) | (d) |
|----------------|-----|-----|-----|-----|
| (A)            | 1   | 2   | 4   | 3   |
| (B)            | 3   | 5   | 2   | 1   |
| <del>(C)</del> | 1   | 4   | 2   | 3   |
| (D)            | 3   | 2   | 4   | 1   |
- (E) Answer not known

200. Gauss's Law is an alternative statement of

- (A) Stoke's Theorem      ~~(B)~~ Coulomb's Law  
 (C) Faraday's Law      (D) Green's Theorem  
 (E) Answer not known

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