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UPPSC 2020

Assistant Engineer
Prelims Exam
Electrical Engineering
Paper-II

Detailed Solution (SET-C)

Exam Date - **13th December**   Time - **02:00 PM - 04:30 PM**

SET - C

1. While deciding any question relating to the disqualification of a member of parliament, the president shall obtain the opinion of

(a) Election justice of India

(b) Chief Justice of India

(c) Attorney General

(d) Speaker of the lok Sabha

Ans. (a)

2. Soyabean seed contains

(a) 20% protection and 40% oil

(b) 40% protein and 10% oil

(c) 40% protein and 20% oil

(d) 20% protein and 20% oil

Ans. (c)

3. As per the results of 'Swachh Sarvekshan' 2020', announced by Ministry of Housing and Urban Affairs on 20th August 2020, Which is the Cleanest City in Uttar Pradesh?

(a) Agra   (b) Gaziabad

(c) Lucknow   (d) Prayagraj

Ans. (c)

4. How many teachers from Uttar Pradesh were select for 'National Award' on Teachers day 5th Sept., 2020?

(a) Six   (b) Five

(c) Four   (d) Three

Ans. (d)

5. 'Poshan Maah' was celebrated by Government of India in the year 2010, in which of the following months?

(a) September   (b) August

(c) July   (d) June

Ans. (a)

6. Match List-I with List-II and choose the correct answer using the code given below.

List-I (Text)

A. Kiratarjuniyam

B. Dashakumar Charitam

C. Buddha Charitam

D. Vikramorvashiyam

List-II (Writer)

A. Dandi

B. Kalidas

C. Bharavi

D. Ashvaghosha

Code:

	A	B	C	D
(a)	3	4	1	2
(b)	3	1	4	2
(c)	2	3	1	4
(d)	1	3	2	4

Ans. (b)

7. A large tank near Mohoba, temples at Ajaygarh and Mahoba and city of Rajavansini

(a) Nannuk   (b) Vakapati

(c) Rahil   (d) Jayashakt

Ans. (c)

8. Which of the following Rights a cultivator enjoyed on his own land during the Mughal period?

(a) Right to mortagage only

(b) Right to sell and gift

(c) Right to mortgage and gift

(d) All the above rights

Ans. **(a)**

9. Match List-I with List-II and select the correct answer using the code given below.

List-I
A. Nokrek
B. Agasthyamalai
C. Nandadevi
D. Dehang Debang

List-II
A. Uttrarakhand
B. Arunachal Pradesh
C. Kerala
D. Meghalya

Code:

	A	B	C	D
(a)	4	3	1	2
(b)	4	3	2	1
(c)	3	4	1	2
(d)	2	3	4	1

Ans. **(a)**

10. Match List-I with List-II and select the correct answer using the code given below.

List-I (Tribes)
A. Tharus
B. Todas
C. Santhal
D. Gond

List-II
A. Madhya Pradesh
B. Jharkhand
C. Uttrarakhand
D. Tamil Nadu

Code:

	A	B	C	D
(a)	1	3	4	2
(b)	4	2	1	3
(c)	2	1	3	4
(d)	3	4	2	1

Ans. **(d)**

11. State get share of the revenue from
(a) Income Tax
(b) Customes Revenue
(c) Exercise Tax
(d) Surcharge on Income Tax

Ans. **(c)**

12. Which Article of the Indian Constitution empowers Parliament to make law for implementing international agreements?
(a) Article 249   (b) Article 250
(c) Article 252   (d) Article 253

Ans. **(d)**

13. Who appoints the acting Chief Justice of India?
(a) Chief Justice of India
(b) Chief Justice of India with previous consent of the President
(c) President of India
(d) President in consulation with the Chief Justice of India

Ans. **(c)**

14. The rotation intensity of Maize-mustard-mung crop is
(a) 100%   (b) 200%
(c) 300%   (d) 400%

Ans. **(c)**

15. Which of the following is NOT a kharif crop?
(a) Soyabean   (b) Lentil
(c) Cotton   (d) Pigeon pea

Ans. **(b)**

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16. 'Five Star Village Scheme' started by Government of India in September 2020 relates to which one of the following?

(a) Electricity supply

(b) Postal Services Schemes

(c) Health Services

(d) Primary Education

Ans. **(b)**

17. Which won the US open 2020, Mens Tennis Singles Title on 14th September, 2020?

(a) Alex Zverev   (b) Dominic Thiem

(c) D.Medvedev   (d) P.C Busta

Ans. **(b)**

18. Which of the following pairs is NOT correctly matched?

Ancient name of the Cities	Modern name of the Cities
(a) Esipattan	Saranath
(b) Dashapur	Mandsor
(c) Bansvasi	Talkad
(d) Mohoday	Kannauj

Ans. **(c)**

19. The early farming site located on the bank of lake is

(a) Mehargarh   (b) Lahuradeva

(c) Chirand   (d) T-Narsipur

Ans. **(d)**

20. Author of the 'Dastane Mazahib' which discussisses about the Din-i llahi of akbar, was

(a) Mohammad Rabbanj

(b) Mohasin Faani

(c) Badauni

(d) Afif

Ans. **(b)**

21. Who was appointed the minister of 'Minster of Rehabilitation' set up on 06 September, 1947?

(a) S.P Mukerj

(b) Sardar Vallabhabhai Patel

(c) J.L Nehru

(d) K.C Niyogi

Ans. **(d)**

22. Match List-I with List-II and select the correct answer using the code given below.

List-I (States)

A. Tamil Nadu

B. Rajasthan

C. Nagaland

D. Madhya Pradesh

List-II (Highest Peaks)

A. Dhoopgarh

B. Saramati

C. Guru Shikhar

D. Doda Betta

Code:

	A	B	C	D
(a)	3	4	1	2
(b)	1	2	4	3
(c)	4	3	2	1
(d)	2	1	3	4

Ans. **(c)**

23. 'Leopold Matrix' is associated with

(a) Weather Forecasting

(b) Disaster Management

(c) Environmental Impact Assessment Method

(d) Environmental Law

Ans. **(c)**

24. The joint Sitting of the Indian Parliament for transacting a legislative business is president over by

(a) The President of India

(b) The senior most Member of Parliament

(c) The Chairman of the Rajya Sabha

(d) The speaker of the Lok Sabha

Ans. (d)

25. The term 'Office of Profit' has been defined by the

(a) Consitution

(b) Parliament

(c) Supreme Court

(d) Union Council of Minsters

Ans. (b)

26. Consider the following statements related to induction motor drives:

1. Power to weight ratio is high

2. Suitable for operation at high voltage

3. Suitable for high speed operation.

4. Power converter is simple and economical.

5. Speed control is easy and of low cost.

6. Reliability is good

Out of these statements

(a) 1, 2, 4 and 6 are correct

(b) 2, 3, 5 and 6 are correct

(c) 1, 2, 3 and 5 are correct

(d) 1, 2, 3 and 6 are correct

Ans. (d)

27. In constant V/F speed control of a 3-phase induction motor, if frequency is increased from low value to the rated value, the maximum torque (T_{max}) and slip corresponding to the maximum torque (S_m) varies as

(a) T_{max} increases, S_m decreases

(b) T_{max} increases, S_m Increases

(c) T_{max} constant, S_m decreases

(d) T_{max} constant S_m increases

Ans. (c)

Sol. $S_{max} = \dfrac{R_2'}{X_2'}$

$S_{max} \propto \dfrac{1}{f}$

$T = \dfrac{3V^2}{2\omega_{sm}X_2'} \qquad (\because V \propto f)$

T = frequency independent

28. The drive has following equations of motor and load torques in terms of speed

$$T = \dfrac{2}{\omega} + 2, \; T_L = \dfrac{4}{\omega}$$

The equilibrium point is

(a) Unstable

(b) Stable

(c) Marginally

(d) Nothing can be said

Ans. (b)

29. In a non-circulating current mode dual converts, the circulating current is avoided by

(a) Connecting a series reactor

(b) Maintaing $\alpha_1 + \alpha_2 = 180°$

(c) Operating only converter

(d) Adding an extra SCR

Ans. (c)

30. An SCR is made up of silicon because

(a) Silicon has larger leakage current than germanium

(b) Silicon has small leakage current than germanium

(c) Silicon has small leakage voltage than germanium

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(d) Silicon has larger leakage voltage than germanium

Ans. (b)

31. For an application which requires smooth and precise control over the wide range at low cost, the motor preferred is

(a) Squirrel cage induction motor

(b) Synchronous motor

(c) D.C motor

(d) Wound rotor induction motor

Ans. (c)

32. In adjustable frequency 3-phase induction motor drives, for constant power application the slip speed is kept

(a) Constant

(b) Proportional to synchornous speed

(c) Inversely proportional to synchronous speed

(d) Proportional to square of synchronous speed

Ans. (a)

33. The output of logic gate is 1 when all of its input are at logic 0. The gate is either

(a) a NAND or an EX-OR

(b) a OR or an EX-NOR

(c) an AND or an EX-OR

(d) a NOR or an EX-NOR

Ans. (d)

34. Hamming code is capable of

(a) Only detects single bit error

(b) Only corrects single bit error

(c) Detects and corrects single bit error

(d) None of the above

Ans. (c)

35. A D-flip-flop can be made from a J-K flip-flop by making

(a) $J = K$ (b) $J = K = 1$

(c) $J = 0, K = 1$ (d) $J = \bar{K}$

Ans. (d)

36. The complement of $\left[(A \cdot \bar{B} + \bar{C}) \cdot D + \bar{E})\right] \cdot F$ is

(a) $\left[(A + \bar{B}) \cdot \bar{C} + D \cdot \bar{E}\right] + F$

(b) $\left[(\bar{A} + B) \cdot \bar{C} + D + \bar{E}\right] \cdot F$

(c) $\left[(\bar{A} + B) \cdot C + \bar{D}\right] \cdot E + \bar{F}$

(d) $\left[(A + \bar{B}) \cdot C + \bar{D}\right] \cdot \bar{E} + F$

Ans. (c)

Sol. Component of function :

$$= \overline{\overline{[(A \cdot \bar{B} + \bar{C}) \cdot D + \bar{E}]} \cdot F}$$

$$= \overline{\overline{[(A \cdot \bar{B} + \bar{C}) \cdot D + \bar{E}]}} + \bar{F}$$

$$= \overline{[(A \cdot \bar{B} + \bar{C}) \cdot D]} \cdot E + \bar{F}$$

$$= \left(\overline{(A \cdot \bar{B}) + \bar{C}} + \bar{D}\right) \cdot E + \bar{F}$$

$$= \left(\overline{(A \cdot \bar{B})} \cdot C + \bar{D}\right) \cdot E + \bar{F}$$

$$= \left((\bar{A} + B) \cdot C + \bar{D}\right) \cdot E + \bar{F}$$

37. A combination circuit has inputs A, B and C, its K-map is given below. The output of circuit is given by

AB \ C	00	01	11	10
0		1		1
1	1		1	

(a) $(\bar{A}B + A\bar{B})C$ (b) $(\bar{A}B + A\bar{B})\bar{C}$

(c) $\bar{A}\bar{B}\bar{C}$ (d) $A \oplus B \oplus C$

Ans. (d)

Sol.

Output = $A \oplus B \oplus C$

38. Find out the integrating type analog to digital converter from the following.

(a) flash type converter

(b) tracking converter

(c) successive approximation type converter
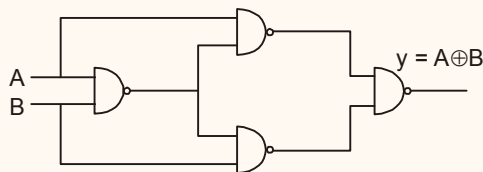
(d) dual-slope analog to digital converter

Ans. (d)

39. The minimum number of 2-input NAND gates required to realize the logic function $Y = A\bar{B} + \bar{A}B$ is

(a) 5   (b) 3

(c) 6   (d) 4

Ans. (d)

Sol. $y = A\bar{B} + \bar{A}B = A \oplus B$

4 NAND gate require

40. Find the cut-off frequency for an RC low pass filter of $R = 8.2\,\Omega$ and $C = 0.0033\,\mu F$.

(a) 6 kHz   (b) 5.88 kHz

(c) 4.26 kHz   (d) 7.91 kHz

Ans. (*)

Sol. Cut of frequency

$$f_c = \frac{1}{2\pi RC}$$

$$f_c = \frac{1}{2\pi \times 8.2 \times 0.0033 \times 10^{-6}}$$

$$= \frac{10^6}{0.1699} = 5.88 \text{ MHz}$$

41. Why synchronous transmission is preferred more?

(a) it has no start and stop bit

(b) it is cheaper than asynchronous

(c) it is easier to implement

(d) less complex

Ans. (a)

Sol. In synchronous transmission both sender and receiver access the data according to same clock. It has no start & stop bits & thus it has more efficient.

42. A 400 W carrier is amplitude modulated with m = 0.75. The total power in AM is

(a) 400 W   (b) 512 W

(c) 588 W   (d) 650 W

Ans. (b)

Sol.
$$P = P_c\left(1 + \frac{m^2}{2}\right)$$

$$= 400\left[1 + \frac{(0.75)^2}{2}\right]$$

$$= 512.5 \text{ W}$$

43. An air filled rectangular waveguide has inner dimensions of 3cm × 2cm. The wave impedance of the TE_{20} mode of propagation in the waveguide at a frequency of 30 GHz is _____. (free space impedance $\eta_0 = 377\,\Omega$)

(a) $308\,\Omega$ (b) $355\,\Omega$

(c) $400\,\Omega$ (d) $461\,\Omega$

Ans. (c)

Sol. Inner dimension of waveguide in 3cm × 2cm free space impedance, $\eta_o = 377\,\Omega$

Wave impedance η for the TE_{20} mode at f =

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30 GHz is given by

$$\eta = \frac{\eta_o}{\sqrt{1-\left(\frac{f_c}{f}\right)^2}}$$

$$f_c \text{ for } TE_{20} = \frac{C}{2}\sqrt{\left(\frac{2}{3}\right)^2 + 0} = \frac{C}{2} \times \frac{2}{3} = \frac{3 \times 10^8}{3}$$

$f_c = 10$ GHz

So, $\eta = \dfrac{377}{\sqrt{1-\left(\frac{10}{30}\right)^2}} = \dfrac{377}{0.943} \approx 400\,\Omega$

44. Noise temperature of Sun is more than _____K.

(a) 1000   (b) 5000

(c) 100000   (d) 500

Ans. **(c)**

45. A cavity magnetron uses strapping to

(a) prevent mode jumping

(b) precevent cathode back heating

(c) ensure bunching

(d) improve the phase focussing effect

Ans. **(a)**

46. A microwave tube amplifier uses an axial magnetic field and a radial electric field. This is a

(a) Reflex klystron

(b) Co-axial magnetron

(c) Travelling wave magnetron

(d) CFA

Ans. **(d)**

Sol. CFA $\rightarrow$ Cross field amplifier

47. In a circular waveguide, the dominated mode is

(a) TE_{01} (b) TE_{11}

(c) TE_{20} (d) TE_{21}

Ans. **(b)**

48. A hollow rectangular waveguide can NOT propagate TEM wave because

(a) Of the existance of only one conductor

(b) Of the losses caused

(c) It is dependent on the type of the material used

(d) None of the above

Ans. **(a)**

49. The most commonly used method for the protection of three phase feeder is

(a) Time graded protection

(b) Differential protection

(c) Reverse power protection

(d) None of these

Ans. **(b)**

50. Discrimination between main and backup protection is provided by the use of relays which are

(a) Fact   (b) Scrisitive

(c) Slow   (d) None of these

Ans. **(c)**

51. Which of the following statements is correct?

(a) Station batteries are used to operate relay only

(b) The lightning arrestors have surge divertors

(c) An impedance relay has maximum fault current near the relay

(d) A high speed relay has an operation of 1-2 cycles

Ans. **(b)**

52. With the use of high speed circuit breakers, which among the following stability is increased?

(a) Steady-state stability

(b) Transient stability

(c) Frequency stability

(d) All of the above

Ans. (b)

53. The arcing contacts in a circuit breaker is made of

(a) Copper tungsten alloy

(b) Porcelain

(c) Electrolytic copper

(d) Aluminium alloy

Ans. (a)

54. A shunt reactor at 100 MVAr is operated at 98% of its rated voltage and at 96% of its rated frequency. The reactive power absorbed by reactor is

(a) 98 MVAr   (b) 104.02 MVAr

(c) 96.04 MVAr   (d) 100.04 MVAr

Ans. (d)

Sol. (Reactive power)$_1$ = $\dfrac{V^2}{X_S}$ = 100 MVA$_r$

(Reactive power)$_2$ = $\dfrac{(0.98)^2 V^2}{0.96\,X_S}$

= 100.04 MVAr

55. Protective relays can be designed to respond to

(a) Light intensity, impedance

(b) Temperature, resistance, reactance

(c) Voltage and current

(d) All of these

Ans. (d)

56. Which one of the following methods used for solution of ordinary differential equations is conditionally stable?

(a) Euler's method

(b) Milne's method

(c) Taylor's series method

(d) Adams-Bashforth method

Ans. (a)

57. Which one of the following methods used for solving non-linear algebraic equations has rate of convergence 2.0?

(a) Bisection method

(b) Secant method

(c) Newton-Raphson method

(d) Muller's method

Ans. (b)

58. Which one of the following methods is NOT used for solution of non-linear algebraic equations?

(a) Regula-Falsi Method

(b) Milne's-Predictor-Corrector Method

(c) Secant Method

(d) Bisection Method

Ans. (b)

59. In a Triclinic crystal, a lattice plane makes intercepts at a length a, 2b and $-\dfrac{3c}{2}$. The Miller indices of the plane are

(a) 3 : 6 : 4   (b) 6 : 3 : 4

(c) 6 : 3 : –4   (d) 6 : 3 : –2

Ans. (d)

Sol.

Intercept	a : 2b : $-\dfrac{3C}{2}$
Coefficient of intercepts	1 : 2 : $-\dfrac{3}{2}$
Reverse the coefficient	1 : $\dfrac{1}{2}$: $-\dfrac{2}{3}$
Miller indices	6 : 3 : –2

60. The critical field needed to destroy super conductivity, is known as

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Total
60
Tests

(a) $H_o\left(T_c/T_)\right)$

(b) $H_o(T/T_c)^2$

(c) $H_o\left[1-\left(\dfrac{T_o}{T_c}\right)^2\right]$

(d) $H_o\left[1-\left(\dfrac{T_c}{T_o}\right)^2\right]$

Ans. **(c)**

Sol. $H_C = H_o\left[1-\left(\dfrac{T_o}{T_C}\right)^2\right]$

61. The instruction for startign the computer are housed in

(a) Random Access Memory

(b) CD - ROM

(c) Read Only Memory Chip

(d) All of the above

Ans. **(c)**

62. When memory write or I/O read are active, data remains _____ of the processor.

(a) Input

(b) Output

(c) Processor

(d) None of these

Ans. **(b)**

63. While performing read operation, one must taken care that much current should NOT be

(a) Sourced from data lines

(b) Sinked from data lines

(c) Sourced or sinked from data lines

(d) Sinked from address lines

Ans. **(c)**

64. A three phase induction motor has shaft output of 16 kW. The constant losses are 1 kW. If the slip be 4%, the rotor copper losses would be

(a) 600 W

(b) 625 W

(c) 667 W

(d) 720 W

Ans. **(c)**

Sol. I.M. shaft output = 16 kW

Copper losses = $\dfrac{s}{(1-s)} \times P_d$

$= \dfrac{0.04}{(1-0.04)} \times 16$ = 667W

65. In a three stack 12/8 pole variable reluctance motor, rotor pole pitch is

(a) 15°

(b) 30°

(c) 45°

(d) 60°

Ans. **(a)**

66. The condition of a three phase induction motor at no-load resembles those of a transformer whose secondary

(a) Short circuited

(b) Open circuited

(c) Supplying a variable resistive load

(d) Supplying an inductive load

Ans. **(b)**

Sol. • The operation of an induction motor under the no-load condition is similar to a transformer under open circuit conditon.

• Similarly, a three phase induction motor with its rotor blocked behaves similarly to a transformer under short circuit conditon.

67. The torque angle 'δ' is the angle between

(a) Rotor field axis and resultant field axis

(b) Stator field axis and rotor field axis

(c) Stator field axis and mutual field axis

(d) Stator field axis and resultant field axis

Ans. **(b)**

Sol. Torque angle S is the angle between rotor flux & stator flux.

68. In case of the air gap in an induction motor is increased

(a) The magnetizing current of the rotor will decrease

(b) The power factor will decrease

(c) The speed of motor will increase

(d) The windage losses will increase

Ans. **(b)**

69. A stepper motor having a resoltuion of 300 steps/revolution and runnign at 2400 rpm has a pulse rate of _____pps.

(a) 4000   (b) 8000

(c) 6000   (d) 10000

Ans. **(c)**

70. A 3-phase, 6-pole, 50 Hz, squirrel cage induction motor is runnign at a slip of 5%. The speed of stator magnetic field to rotor magnetic field and speed of rotor with respect to stator magnetic field are

(a) Zero, − 50 rpm

(b) Zero, 955 rpm

(c) 1000 rpm, − 50 rpm

(d) 1000 rpm, 955 rpm

Ans. **(a)**

Sol.

- The speed of stator magnetic field to rotor magnetic field is zero, because both field rotating at synchronous speed.

- Speed of rotor with respect to stator magnetic field = SN_s

$$= 0.05 \times \frac{120 \times 50}{6}$$

$$= 50$$

71. In a commutation circuit used to turn-off an SCR, satisfactory turn-off is obtained, when

(a) Circuit turn-off time < device turn-off time

(b) Circuit turn-off time > device turn-off time

(c) Circuit time constant > device turn-off time

(d) Circuit time constant < device turn-off time

Ans. **(b)**

72. A TRIAC is a

(a) 2-terminal switch

(b) 2-terminal bilateral switch

(c) 3-terminal unidirectional switch

(d) 3-terminal bidirectional switch

Ans. **(d)**

73. Two thyristors of same rating and same specifications

(a) Will have equal turn-on and turn-off periods

(b) Will have equal turn-on, but unequal turn-off periods

(c) May have equal or unequal turn-on and turn-off periods

(d) Will have unequal turn-on and turn-off periods

Ans. **(c)**

74. **Assertion (A):** Inverter and choppers use fast switching thyristors.

Reason (R): Fast switching SCR has low turn-off time

(a) Both (A) and (R) are correct and (R) is the correct explanation of (A)

(b) Both (A) and (R) are correct but (R) is not the correct explanation of (A)

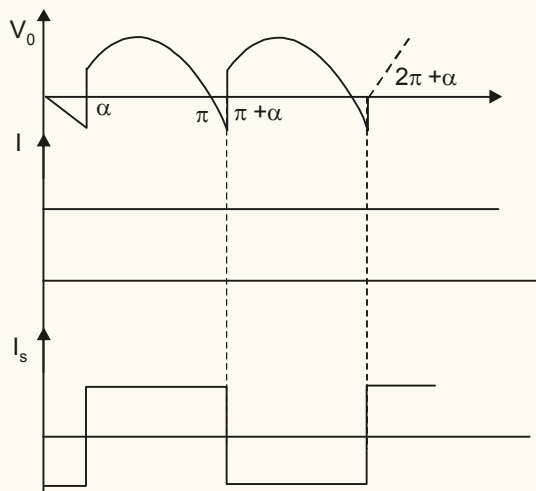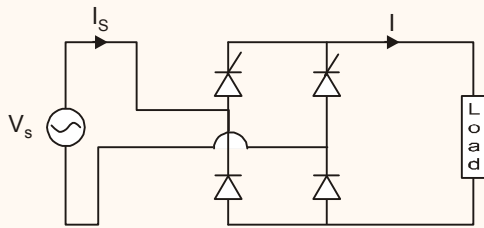(c) (A) is correct but (R) is wrong

(d) (A) is wrong but (R) is correct

Ans. **(a)**

75. In a single phase fully controlled bridge rectifier, the output load current I is ripple free. The r.m.s. value of source current would be

(a) $2\sqrt{2}\ I/\pi$ (b) I

(c) I/2   (d) I/4

Ans. **(b)**

Sol. Single phase fully controlled bridge rectifier

r.m.s value of source wave form is I

76. Consider the following statements related to dc drives:

1. Wide speed control range
2. High starting torque
3. High power to weight ratio
4. Fast transient response
5. No limit on highest operating voltage

Out of these statements

(a) 1, 2 and 3 are correct

(b) 2, 3, and 4 are correct

(c) 1, 2 and 4 are correct

(d) 3, 4 and 5 are correct

Ans. (c)

77. A 20 kW electric motor has heating time constant 60 min. Iron loss is equal to full load copper loss. The short time rating of the motor for 15 minute is

(a) 43.5 kW   (b) 56.7 kW

(c) 60.0 kW   (d) None of above

Ans. (c)

78. A 220 V, 20 A, 1000 rpm, separately excited d.c. motor has armature resistance of 1 ohm. The motor is supplied from 250 V dc supply via a step down chopper, for operation of motor at 500 rpm at the rated torque, the duty ratio of the chopper should be

(a) 0.40   (b) 0.44

(c) 0.48   (d) 0.50

Ans. (a)

Sol. For motor

$$E_b = V - I_a R_a$$
$$= 220 - 20 \times 1 = 200 \text{ V}$$

Rated torque

$$\tau_{rated} = \frac{200 \times 20}{2\pi \times 1000} \times 60$$
$$= 38.2165 \text{ N-m}$$

Now motor supplied from 250 V dc supply via a step down chopper

$$E_{b_2} = 250\alpha - 20$$

Here $\alpha \rightarrow$ duty ratio

motor at 500 rpm at the rated torque (rated current)

$$38.2165 = \frac{(250\alpha - 20) \times 20}{2\pi \times 500} \times 60$$

$$\alpha = 0.48$$

79. The consideration involved in the selection of the type of electric drive for a specific application depends upon

(a) Speed control range and its nature

(b) Starting nature

(c) Environmental condition

(d) All the above

Ans. (d)

80. A single phase half-wave rectifier circuit has free-wheeling diode, the free-wheeling diode will conduct only if

(a) load is purely resistive

(b) load is purely inductive

(c) load is combination of R and L

(d) load is purely inductive or combination of R and L

Ans. (d)

81. Find the expression for peak capacitor voltage in case of current commuted chopper circuit.

(a) $I_o \sqrt{\dfrac{L}{C}}$

(b) $V_s + \sqrt{\dfrac{L}{C}}$

(c) $V_S + I_o \sqrt{\dfrac{L}{C}}$

(d) O (Zero)

Ans. (c)

82. Which one of the following is NOT inherently constant torque motor?

(a) DC series motor

(b) DC shunt motor

(c) Three phase induction motor

(d) Single phase induction motor

Ans. (a)

83. A 4-bit R/2R digital to analog converter (DAC) has a reference of 5 Volts. What is the analog output for input code 0101?

(a) 0.3125 V

(b) 3.125 V

(c) 0.78125 V

(d) -3.125 V

Ans. (d)

Sol. $V_o = -\dfrac{V_r}{2^{n-1}}$ (Decimal equivalent of binary number)

$= -\dfrac{5}{8}(5) = -3.125V$

84. Which of the following equations satisfy the J-K flip-flop?

(a) $Q_{n+1} = J_n \bar{Q}_n + \bar{K}_n Q_n$

(b) $Q_{n+1} = \bar{J}_n \bar{Q}_n + K_n Q_n$

(c) $Q_{n+1} = J_n Q_n + K_n Q_n$

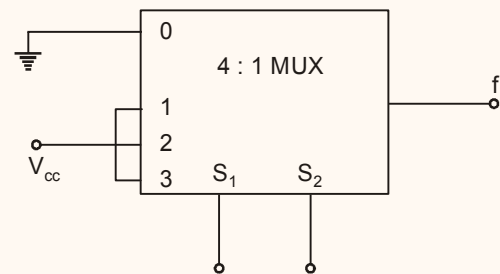(d) $Q_{n+1} = \bar{J}_n \bar{Q}_n + \bar{K}_n \bar{Q}_n$

Ans. (a)

Sol. $Q_{n+1} = J_n \bar{Q}_n + \bar{k}_n Q_n$

85. POS form of Boolean expression is suitable for circuit implementation, using
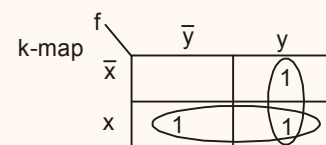
(a) XOR

(b) NAND

(c) AND

(d) NOR

Ans. (d)

86. The output f of the 4 : 1 MUX shown in figure. is

(a) $x\bar{y} + x$

(b) $x + y$

(c) $\bar{x} + \bar{y}$

(d) $xy + \bar{x}$

Ans. (b)

Sol. $f = (\bar{x}\,\bar{y}.0 + \bar{x}\,y.1 + x\,\bar{y}.1 + x\,y.1)$

$= \bar{x}\,y + x\bar{y} + xy$

$f = x + y$

87. The Boolean function A + BC is a reduced form of

(a) AB + BC

(b) (A + B) (A + C)

(c) A′B + AB′C

(d) (A +C)B

Ans. **(b)**

Sol.

$$f = A + BC$$

Using law

$$f = (A + B)(A + C)$$

88. A 10-bit D/A converter gives a maximum output of 10.23 V. The resolution is

(a) 10 mV   (b) 20 mV

(c) 15 mV   (d) 25 mV

Ans. **(a)**

Sol. Resolution $= \dfrac{10.23}{2^{10}-1} = 10$ mV

89. Which of the following expressions does NOT represent exclusive NOR of x and y?

(a) $xy + \overline{xy}$ (b) $x \oplus \overline{y}$

(c) $\overline{x} \oplus y$ (d) $\overline{x} \oplus \overline{y}$

Ans. **(d)**

Sol. Option (a) $xy + \overline{x}\,\overline{y} = \overline{x} \odot y$

Option (b) $x \oplus \overline{y} = \overline{x}\,\overline{y} + x\overline{\overline{y}}$

     $= \overline{x}\,\overline{y} + xy = x \odot y$

Option (c) $\overline{x} \oplus y = \overline{\overline{x}}\,y + \overline{x}\,\overline{y} = xy + \overline{x}\,\overline{y}$

     $= x \odot y$

Option (d) $\overline{x} \oplus \overline{y} = \overline{\overline{x}}\,y + \overline{x}\,\overline{\overline{y}} = x\overline{y} + \overline{x}\,y$

                $= x \oplus y$

Option (d) is false

90. A ripple counters speed is limited by the propagation delay of

(a) each flip-flop

(b) all flip-flop and gates

(c) flip-flops only with gates

(d) only circuit gates

Ans. **(a)**

91. When aliasing take place

(a) Sampling signals less than Nysuist rate

(b) Sampling signals more than Nyquist rate

(c) Sampling signals equal to Nyquist rate

(d) Sampling signals at a rate which is twice of Nyquist rate

Ans. **(a)**

92. Consider sinusoidal modulation in an AM system. Assuming no over modulation, the modulation index (μ) when the maximum and minimum values of the envelope, respectively are 3V and 1V is

(a) 0.7   (b) 0.5

(c) 0.3   (d) 0.8

Ans. **(b)**

Sol. $\mu = \dfrac{V_{max} - V_{min}}{V_{max} + V_{min}}$

     $= \dfrac{3-1}{3+1}$

$\mu = 0.5$

93. The Q-factor of a waveguide resonator is given by (ω_0 is resonant frequency, U is energy storage and ω_L is power loss)

(a) $Q = \dfrac{\omega_0 U}{\omega_L}$ (b) $Q = \dfrac{\omega_0 \omega_L}{U}$

(c) $Q = \omega_0 U \omega_L$ (d) $Q = \dfrac{U\omega_L}{\omega_0}$

Ans. **(a)**

Sol. $Q = \omega_0 \times \dfrac{\text{max. energy stored}}{\text{Power loss}}$

$Q = \dfrac{\omega_0 U}{\omega_L}$

94. A speech signal is sampled at 8 kHz and encodes in PCM format using 8-bit/sample PCM data is transmitted through a baseband channel via 4-level PAM. Minimum Bandwidth required for transmission is

(a) 16 kHz   (b) 8 kHz

(c) 24 kHz   (d) 10 kHz

Ans. **(a)**

Sol. Speech signal frequency of sampling

= 8 kHz = f_s

No. of levels M = 4

No. of bits = n = 8 bits/sample

bit rate R_b = nfs

$\quad R_b = 8 \times 8 = 64$ kbps

Minimum bandwidth = $\dfrac{R_b / 2}{\log_2 M} = \dfrac{64 / 2}{\log_2 4}$

$[B.W]_{min}$ = 16 kHz

95. For best low level noise performance in the X-band, an amplifier should use

(a) A bipolar transistor

(b) a gunn diode

(c) A step recovery diode

(d) An IMPATT diode

Ans. **(c)**

96. A lossless line of characteristic impedance z_0 is terminated in pure reactance of $-jz_0$, Voltage Standing Wave Ratio (VSWR) is

(a) 10   (b) 2

(c) 1   (d) infinity

Ans. **(d)**

Sol. VSWR = $\dfrac{1+|R|}{1-|R|}$

Here R = the reflection coefficient

$R = \dfrac{Z_L - Z_0}{Z_L + Z_0} = \dfrac{Z_o - jZ_o}{Z_o + jZ_o}$

97. In colour TV receiver, varactor diode is used for

(a) Deflection   (b) Rectification

(c) Tuning   (d) Both (a) and (b)

Ans. **(c)**

98. FDM is an analog multiplexing technique used to combine

(a) Analog signals

(b) Digital signals

(c) Both analog and digital signals

(d) Alternatively passes analog and digital signal

Ans. **(a)**

99. Large internal faults in transformer are protected by

(a) Merz-price percentage differential protection

(b) Mho and ohm relays

(c) Horn gaps and temperature relays

(d) Earth fault and positive sequence relays

Ans. **(a)**

100. If the fault current is 2000 A, the relay setting is 50% and CT ratio is 400 : 5, the PSM will be

(a) 25   (b 15

(c) 50   (d) 10

Ans. **(d)**

Sol. PSM = $\dfrac{\text{Fault current in relay coil}}{\text{Pick up current} \times \text{CT ratio}}$

PSM = $\dfrac{2000}{400 \times 0.5}$

PSM = 10

101. An ideal circuit breaker should offer

(a) Zero and infinite impedances before and after arc interruption respectively

(b) Infinity and zero impedances before and after arc interruption respectively

(c) Equal impednace before and after arc interruption

(d) None of these

Ans. (a)

102. A three-phase, 33 kV, oil circuit breaker is rated 1200 A, 2000 MVA, 3 sec. The symmetrical breaking current will be

(a) 1200 A (b) 3600 A

(c) 35 kA (d) 104.8 kA

Ans. (c)

Sol. Breaking capacity = $\sqrt{3}$ × rated voltage × symmetrical breaking current.

2000 = $\sqrt{3}$ × 33 × symmetrical breaking current (in kA)

$$I_{BK} = \frac{2000}{\sqrt{3} \times 33}$$

I_{BK} = 35 kA

103. With the help of reactive compensator, it is possible to have

(a) Constant voltage operation only

(b) Unity p.f. operation only

(c) Both constant voltage and unit p.f.

(d) Either constant voltage operation or unity p.f. operation.

Ans. (d)

104. The most efficient torque producing actuating structure for the induction type relays

(a) Shaded pole structure

(b) Watt hour meter structure

(c) Induction cup structure

(d) Single induction loop structure

Ans. (c)

105. Why are the ternary lead cables used near the railway track?

(a) Because they have high tensile strength

(b) Have a low coefficient of thermal expansion

(c) Have low specific gravity

(d) Can withstand shocks and vibrations

Ans. (c)

106. Given that $\dfrac{dy}{dx} = x^2 + y$, with y(0) = 1, when x = 0, taking h = 0.2. The value of y after 1 iteration using Euler's modified method is

(a) 1.2 (b) 1.224

(c) 1.228 (d) 1.232

Ans. (*)

Sol. y' = x^2 + y ; y(0) = 1, x = 0, h = 0.2

f(x, y) = x^2 + y

$f(x_o, y_o)$ = f(0, 1) = 1

$$x_o + \frac{1}{2}h = 0 + \frac{1}{2} \times 0.2 = 0.1$$

$$y_o + \frac{1}{2}hf(x_o, y_o) = 1 + \frac{1}{2} \times 0.2 \times 1$$

$$= 1.1$$

Modified Euler method.

$$y_{m+1} = y_m + hf\left(x_m + \frac{1}{2}h, y_m + \frac{1}{2}hf(x_m, y_m)\right)$$

m = 0,

$$y_1 = y_o + hf\left(x_o + \frac{1}{2}h, y_o + \frac{1}{2}hf(x_o, y_o)\right)$$

= 1 + 0.2 × f(0.1, 1.1)

= 1 + 0.2 (0.1² + 1.1)

$\boxed{y_1 = 1.222}$

107. The points where Newton-Raphson method falls are called

(a) Floating

(b) Continuous

(c) Non-Stationary

(d) Stationary

Ans. (d)

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Sol. The point where the function f(x) approaches infinite are called as stationary points. At stationary points Newton Raphson fails.

108. Newton-Raphson method is used to compute a root of the equation $x^2 - 13 = 0$ with 3.5 as initial value. The approximation after one iteration is

(a) 3.575 (b) 3.676

(c) 3.667 (d) 3.607

Ans. **(d)**

Sol. Given, $f(x) = x^2 - 13 = 0$

$x_o = 3.5$

As per Newton-Raphson method,

$$x_1 = x_o - \frac{f(x_o)}{f'(x_1)} \quad \{\because f'(x) = 2x\}$$

$$x_1 = 3.5 - \frac{(3.5)^2 - 13}{2(3.5)}$$

$$\boxed{x_1 = 3.607}$$

So, the value after one iteration = 3.607

109. Which one of the following materials is a diamagnetic material?

(a) Copper (b) Nickel

(c) Iron (d) Aluminium

Ans. **(a)**

110. The structure sensitive property of a super conductor is

(a) Critical magnetic field

(b) Transition temperature

(c) Critical current density

(d) None of the above

Ans. **(c)**

111. The 2's complement representation of decimal number [-17] is

(a) [100110] (b) [101111]

(c) [111110] (d) [110001]

Ans. **(b)**

Sol. $[17] = 010001$

$[-17] = 1\,1\,0\,0\,0\,1$
$\qquad\quad\uparrow$ (sign bit)

2's complement of $[-17]$ = [1 0 1 1 1 1]

112. The smallest integer that can be represented by an 8-bit number in 2's complement form is

(a) −256 (b) −128

(c) −127 (d) 0

Ans. **(b)**

Smallest integer = $-2^{n-1} = -128$

113. In a single phase induction motor, the reaction for having high resistance rotor is to achieve

(a) Reduced size

(b) Low starting torque

(c) High efficiency

(d) High aceleration

Ans. **(d)**

114. BLDC motor is analogous to

(a) Permanent magnet synchronous motor

(b) DC motor

(c) Rotating transformer

(d) Single phase induction motor

Ans. **(d)**

115. In a squirrel cage rotor, the bars are NOT placed parallel to the shaft, but are skewed to have

(a) Greater mechanical strength

(b) Less rotor losses

(c) Uniform torque

(d) None of the above

Ans. **(c)**

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Sol. Skewed by one slot pitch to reduce cogging torque, and this allows the motor to run quietly.

116. The presence of a dominant 7th harmonics in the winding distribution of 3-phase, 6-pole, 50 Hz, induction motor may cause the motor to crawl at a speed of about

(a) 750 rpm (b) 143 rpm

(c) 243 rpm (d) 500 rpm

Ans. (b)

Sol. Synchronous speed,

$$N_S = \frac{120 \times 50}{6} = 1000 \text{ rpm}$$

7th harmonics speed = $\frac{N_S}{7} = \frac{1000}{7} \approx 143$ rpm

117. A synchronous motor installed at the receiving end substation operates with such an excitation that it takes power at lagging power factor. Now if the applied voltage of the synchronous motor goes down, the power factor of synchronous motor will

(a) Remain constant

(b) Get down

(c) Be improved

(d) None of the above

Ans. (c)

118. Slip of an induction motor increases with

(a) Increase in current and decrease in torque

(b) Increase in current and torque

(c) Decrease in current and torque

(d) Decrease in current and increase in torque

Ans. (b)

Sol. $I = \dfrac{V}{\sqrt{\left(\dfrac{R'_2}{S}\right)^2 + (X'_2)^2}}$

When slip increases means speed decreases, then supply current and torque increases.

119. The slip of an induction motor normally does NOT depend on

(a) Rotor speed

(b) Synchronous speed

(c) Shaft torque

(d) Core-loss component

Ans. (d)

Sol. Slip independent on core-loss component.

120. A precise phase control for an A.C load can be controlled by a (an)

(a) Triac (b) SCR

(c) Transformer (d) Trigger pulse

Ans. (a)

121. UJT is known as

(a) Voltage controlled device

(b) Current controlled device

(c) Relaxation oscillator

(d) A transistor

Ans. (c)

122. In a step-up chopper, if V_s is the source voltage and a is duty cycle, then the output voltage is

(a) $V_s/(1+\alpha)$

(b) $V_s(1+\alpha)$

(c) $V_s(1-\alpha)$

(d) $V_s/(1-\alpha)$

Ans. (d)

Sol. $V_o = \dfrac{V_S}{1-\alpha}$

123. A modern power semi-conductor device that combines the characteristics of both BJT and MOSFET

(a) GTO   (b) FCT

(c) IGBT   (d) MCT

Ans. (c)

124. In a single phase full wave converter (M-2 connection) feeding a highly inductive load, the firing angle for each thyristor is a in the respective half cycle. This period of conduction of each thyristor is

(a) $\pi - a$ (b) π

(c) $\pi + a$ (d) $\pi - 2a$

Ans. (b)

125. In a 3-phase voltage source inverter used for speed control of induction motor anti parallel diodes are used across each switching device as shown in figure. The main purpose of diodes is to
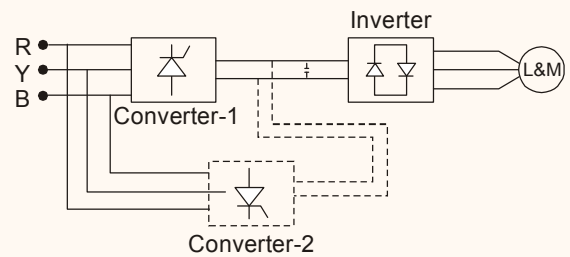
(a) Protect the switching device against over voltage

(b) Provide the path for free wheeling current

(c) Allow the motor to return energy during regeneration

(d) Help in switching off the devices.

Ans. (c)

Sol. The main purpose of diodes is to allow the motor to return energy during regeneration.

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