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Booklet Series **D**

12PT-03

TEACHERS RECRUITMENT BOARD, CHENNAI – 6
WRITTEN COMPETITIVE EXAMINATION FOR DIRECT RECRUITMENT OF LECTURERS IN GOVERNMENT POLYTECHNIC COLLEGES – 2012

ELECTRICAL AND ELECTRONICS ENGINEERING

Time Allowed : 3 Hours] **[Total Marks : 190**

Each question carries four options namely A, B, C and D. Choose one correct option and mark in appropriate place in the OMR answer sheet.

SECTION – A

(1 mark each)

1. An FET has a gate source bias of – 2V. The *ac* input signal is ± 1·2 V. The class of operation is

   A) *A* B) *B*

   C) *C* D) *AB*.

2. For a transistor, the normal collector voltage is 12V. If actually it is found to be 28V, the trouble may be

   A) R_L is open B) R_E is open

   C) C_E is shorted D) C_E is open.

3. The Darlington pair consists of which of the following stages ?

   A) *CE* and *CC* B) *CE* and *CE*

   C) *CC* and *CC* D) *CE* and *CB*.

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4. A signal containing frequency component from 445 kHz to 465 kHz is to be amplified. Which of the following will be suitable for the purpose ?

A) Direct coupled amplifier

B) RC coupled amplifier using FETs

C) RC coupled amplifier using triodes

D) Transformer coupled tuned amplifier using transistors.

5. Barkhausen criterion for oscillator stability is

A) $A\beta = 0$ B) $A\beta = 1$

C) $-A\beta = 1$ D) $A = \frac{1}{\sqrt{\beta}}$.

6. For a full wave bridge rectifier supplied with 50 Hz *ac*, the lowest ripple frequency is

A) 50 Hz B) 100 Hz

C) 5 Hz D) 10 Hz.

7. In a 4-bit weighted-resistor DAC, the resistor value corresponding to LSB is 32 kΩ. Then the resistance corresponding to MSB will be

A) 32 kΩ B) 16 kΩ

C) 8 kΩ D) 4 kΩ.

8. A Schmitt trigger is a digital circuit that produces

A) triangular output for sinusoidal input

B) sinusoidal output for any type of input

C) trapezoidal output for any type of input

D) rectangular output for any type of input.

9. A monostable multivibrator requires

A) no driving pulse for generation of output cycles

B) one driving pulse for each output cycle

C) two driving pulses for each output cycle

D) four driving pulses for each output cycle.

D

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10. The main purpose of Accumulator register of 8085 is

A) temporary data storage B) selection of peripheral

C) storing instructions D) used as memory pointer.

11. Bode plot is used to analyse

A) all phase network B) lag lead network

C) minimum phase network D) maximum phase network.

12. A positive feedback system has $G(s) = \frac{k_1}{s+p}$ and $H(s) = k_2 s$. The loop transfer function is

A) $\frac{k_1 k_2 s}{s+p}$ B) $\frac{k_1}{k_2(s+p)}$

C) $\frac{k_2}{k_1(s+p)}$ D) $\frac{k_1}{s(s+p)-k_1 k_2}$.

13. A unity feedback control system has an open loop transfer function $G(s) = \frac{25}{s(s+8)}$. Its damping ratio is

A) 0·2 B) 0·5

C) 0·8 D) 0·99.

14. A regulator can be classified as a

A) type-0 system B) type-1 system

C) type-2 system D) type-3 system.

15. A unity feedback stable control system having $G(s) = \frac{k}{s(s+a)}$ is critically damped. Now if the gain k is increased, the system will be

A) overdamped B) underdamped

C) critically damped D) undamped.

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16. Which of the following can be extended to time-varying systems ?

A) State modules B) Bode plots

C) Nyquist criterion D) Root locus design.

17. A system is described by

$$\dot{x}(t)=\begin{bmatrix} 0 & 1 & 0 \\ 3 & 0 & 2 \\ -12 & -7 & -6 \end{bmatrix} x(t)+\begin{bmatrix} 1 \\ 0 \\ 2 \end{bmatrix} u(t)$$

$$y(t)=\begin{bmatrix} 1 & 0 & 0 \end{bmatrix} x(t)$$

Its eigenvalues are

A) 1, 2, 3 B) 2, 2, 3

C) 12, 6, 7 D) –1, –2, –3.

18. A unity feedback system has $G(s)=\frac{2}{(s+1)^3}$. The value of s for which the root locus intersects the imaginary axis will be

A) $j(\pm 1)$ B) $j(\pm\sqrt{3})$

C) $j(\pm 2)$ D) $j(\pm 4)$.

19. The Bode plot of the transfer function $G(s) = s$ is of

A) constant unit magnitude and zero phase shift

B) – 20 dB/decade and phase shift of $-\frac{\pi}{2}$

C) + 20 dB/decade and phase shift of $+\frac{\pi}{2}$

D) zero magnitude and phase shift.

20. The angular position of a shaft can be converted to electrical signal by

A) synchros B) LVDT

C) *AC* servomotor D) load cell.

D

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21. As the inductance of a line increases, the transmission capacity

A) increases B) decreases

C) remains the same D) no relation.

22. Per unit impedance is equal to

A) $\frac{\text{base impedance}}{\text{actual impedance}}$ B) $\frac{\text{actual impedance}}{\text{base impedance}}$

C) $\frac{\text{base MVA}}{\text{base current}}$ D) $\frac{\text{base current}}{\text{base MVA}}$

23. If the fuel cost of one unit, operating in parallel with other units, is increased and it is desired to maintain fuel cost, the load on the unit will be

A) increased B) held constant

C) decreased D) unaffected.

24. In economic operation of a power system, the effect of increased penalty factor between a generating plant and system load current is to

A) decrease load on the generating plant

B) increase load on the plant

C) hold the plant load constant

D) increase power factor.

25. The effect of corona is

A) increased energy loss B) increased reactance

C) increased inductance D) decreased reactance.

26. The effect of wind pressure is more predominant on

A) transmission lines B) neutral wires

C) insulators D) supporting towers.

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27. ACSR means

A) All Conductors Surface treated and Realigned

B) Aluminium Conductor Steel Reinforced

C) Anode Current Sinusoidally Resisted

D) Anodised Core Smooth Run.

28. The total load transmitted through a 3-phase transmission line is 10 MW at 0·8 pf lag. The I^2R losses are 900 kW. The efficiency of transmission line is

A) 60% B) 90%

C) 95% D) 99%.

29. For a 66 kV line having a span of 200 metres between towers, the approximate sag will be

A) 0·02 m B) 0·3 m

C) 2 m D) 20 m.

30. The winding of power transformer usually develops short circuit on account of

A) insulation failure B) loose connection

C) mechanical vibration D) impulse voltage.

31. A discrete delay system is described as

A) $y(n) = x(n)$ B) $y(n) = x(n+1)$

C) $y(n) = x(n-1)$ D) $y(n) = x(2n)$.

32. The convolution of $h(t)$ and $s(t)$ implies

A) $h(t) + s(t)$ B) $\int_{\tau=-\infty}^{+\infty} h(\tau)s(t-\tau)d\tau$

C) $h(t).s(t)$ D) $\int_{t=-\infty}^{+\infty} h(t)s(t)dt$.

D

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33. An unit impulse function in continuous form is defined to be

A) $\delta(t) = t$

B) $\delta(t) = 1$

C) $\delta(t) = \begin{cases} 1, & t = 0 \\ 0, & t \neq 0 \end{cases}$

D) $\delta(t) = \begin{cases} 0, & t = 0 \\ 1, & t \neq 0 \end{cases}$

34. An LTI system will be stable, if the impulse response $h(t)$ has the restriction

A) $\int_{-\infty}^{\infty} |h(\tau)\, d\tau < \infty$

B) $\int_{-\infty}^{\infty} h(\tau).h(t-\tau)\, d\tau = 0$

C) $y(t) = h(t).x(t)$

D) $h(0) = 0.$

35. The condition $s(n) * h(n) = h(n) * s(n)$, where $*$ indicates convolution is called

A) Associative property

B) Distributive property

C) Commutative property

D) Invertibility property.

36. Parseval's relation for a periodic signal relates

A) total average power in the signal

B) total harmonic distortion

C) sum of Fourier coefficients

D) average of the Fourier coefficients.

37. The z transform of the discrete signal $x(n) = a^n u(n)$ is

A) $\frac{z}{z-a}$ for all z

B) $\frac{z}{z-a}$ for $|z| \neq |a|$

C) $\frac{z}{z-a}$ for $|z| < |a|$

D) $\frac{z}{z-a}$ for $|z| > |a|$.

38. Double integration of a unit step function would lead to

A) an impulse

B) a parabola

C) a ramp

D) a hypercube.

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39. The unit step response of a system is t^2e^{-2}. The system function $H(s)$ is

A) $\frac{2}{s^2(s+2)}$ B) $\frac{2s}{(s+2)^2}$

C) $\frac{2}{(s+2)^3}$ D) $\frac{2s}{(s+2)^3}$.

40. The power dissipation in a resistor of $10\,\Omega$ due to a current $i(t) = 5\sin\omega t + 4\sin 3\omega t + 3\sin 5\omega t$ is

A) 160 W B) 250 W

C) 500 W D) 720 W.

41. The value of the determinant $\begin{vmatrix} 1 & a & a^2 \\ 1 & b & b^2 \\ 1 & c & c^2 \end{vmatrix}$ is

A) $(a-b)(b-c)(c-a)$ B) $(a-b)(c-b)(c-a)$

C) $(a-b)(b-c)(a-c)$ D) $ab(a-b)(b-c)(c-a)$.

42. The maximum value of xy subject to $x + y = 8$ is

A) 8 B) 16

C) 20 D) 24.

43. The integration of $\int \frac{\sec x \operatorname{cosec} x}{\log(\tan x)}\,dx =$

A) $\log(\log\sec x)$ B) $\log(\log\tan x)$

C) $\log(\log\cot x)$ D) $\log(\log\cos x)$.

44. The function $f(x) = \frac{1}{x}$ on its domain is

A) increasing B) decreasing

C) constant D) sinusoidal.

D

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45. The solution of $y'' + ty' - y = 0$ at $y(0) = 0$, $y'(0) = 1$ is

A) t B) $t + 1$

C) $t + 2$ D) $t + 3$.

46. In case of Cauchy's root test, $\sum U_n$ is convergent if $\lim_{r \to 0} (U_n)^{\frac{1}{n}}$ is

A) greater than 1 B) less than 1

C) equal to 1 D) n.

47. If $f(x) = \frac{l}{4} - x$, when $0 < x < \frac{l}{2}$

$= x - \frac{3l}{4}$, when $\frac{l}{2} < x < 1$

then the value of a_0 in the Fourier series of this function is

A) $\frac{2l}{\pi^2} \cdot \frac{1}{9}$ B) $\frac{\pi l}{6}$

C) $\frac{1}{6}$ D) 0.

48. The chance of throwing 5 with ordinary die is

A) $\frac{5}{6}$ B) $\frac{4}{6}$

C) $\frac{1}{6}$ D) 1.

49. A problem is given to three students X, Y and Z, whose chances of solving it are $\frac{1}{3}, \frac{1}{4}, \frac{2}{5}$ respectively. The possibility that the problem is solved, is

A) $\frac{5}{10}$ B) $\frac{7}{10}$

C) $\frac{8}{10}$ D) $\frac{2}{10}$.

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50. If $L\left\{\frac{\sin t}{t}\right\} = \tan^{-1}\left(\frac{1}{s}\right)$, then the value of $L\left\{\frac{\sin at}{t}\right\}$ is

A) $\sin^{-1}\left(\frac{a}{s}\right)$ B) $\cos^{-1}\left(\frac{a}{s}\right)$

C) $\tan^{-1}\left(\frac{a}{s}\right)$ D) $\cot^{-1}\left(\frac{a}{s}\right)$.

51. The average load voltage of three-phase half-wave controlled circuit using thyristors is given by

A) $\frac{3\sqrt{6}}{2\pi} E_m \cos\alpha$ B) $\frac{3\sqrt{6}}{\pi} E_m \cos\alpha$

C) $\frac{3\sqrt{3}}{\pi} E_m \cos\alpha$ D) $\frac{3\sqrt{6}}{\pi} E_m \sin\alpha$.

52. For an SCR, $\frac{di}{dt}$ protection is achieved by connecting to the SCR

A) R in series B) L in series

C) RC in parallel D) C in series.

53. A chopper has a source voltage of 100 V and load resistance of 10 Ω. For a duty cycle of 0·5, the *rms* value of output in volts will be

A) 25 B) 5

C) 70·7 D) 86·6.

54. Turn off gain of GTO, compared to its turn on gain is

A) equal B) greater

C) less D) independent.

55. In *dc* choppers, the waveforms for the input and output voltage waveforms are respectively

A) both continuous B) both discontinuous

C) continuous, discontinuous D) discontinuous, continuous.

D

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56. In a 3-phase half-wave rectifier, each diode is subjected to a PIV of

A) V_m B) $\frac{V_m}{\sqrt{2}}$

C) $\sqrt{2}\,V_m$ D) $2V_m$.

57. Snubber circuit is used in thyristors to

A) limit the current

B) limit conduction period

C) limit the rate of rise of voltage across SCR

D) limit power dissipation.

58. The holding current of a thyristor, compared to its latching current is

A) greater B) less

C) equal D) randomly varying.

59. In single-pulse-modulated PWM inverter, third harmonic is eliminated by making pulse width equal to 120°. To eliminate fifth harmonics the pulse width will be

A) 36° B) 72°

C) 144° D) 108°.

60. In a three-phase half-wave rectifier, each diode conducts for a duration of

A) 270° B) 180°

C) 120° D) 60°.

61. The deflection of an electron beam on reducing preaccelerating anode voltage to half and making deflecting plate voltage double with initial electron beam on CRT screen as 5 mm is

A) 5 mm B) 10 mm

C) 20 mm D) 2·5 mm.

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62. Current in a source follower type electronic voltmeter in FET with $g_m = 0 \cdot 005$ mho, resistance of meter = 100 Ω and input voltage of 1 V is

A) 1 mA B) 2 mA

C) 3 mA D) 4 mA.

63. A 10 mA ammeter having 100 ohm resistance, is used to measure up to 1A. The required shunt resistance is approximately

A) 1 Ω B) 12 Ω

C) 50 Ω D) 100 Ω.

64. The ratio error of a current transformer is due to

A) power factor of the main circuit B) supply voltage fluctuations

C) exciting current D) secondary reactive current.

65. *DC* potentiometer is an instrument to measure

A) unknown *emf* B) large power

C) unknown velocity D) low torque.

66. The bridge used to measure the dielectric loss of an insulator is

A) Anderson bridge B) Wien's bridge

C) Schering bridge D) Wheatstone bridge.

67. In an energy meter, the steady speed of disc is obtained when

A) braking torque is zero

B) operating torque is greater than half the braking torque

C) operating torque is zero

D) operating torque is equal to braking torque.

68. The phenomenon of 'creeping' occurs in

A) ammeters B) voltmeters

C) potentiometers D) watt-hour meters.

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69. What can be the maximum reading in a $3\frac{1}{2}$ digit meter ?

A) 1000 B) 9999

C) 999·5 D) 1999.

70. In case of two wattmeter method of measurement of 3-phase power measurement of balanced load, the power factor angle is

A) $\tan^{-1}\left(\frac{w_1 + w_2}{w_1 - w_2}\right)$ B) $\tan^{-1}\left(\frac{\sqrt{3}(w_1 - w_2)}{w_1 + w_2}\right)$

C) $\tan^{-1}\left(\frac{w_1 - w_2}{w_1 + w_2}\right)$ D) $\tan^{-1}\left(\frac{\sqrt{3}(w_1 + w_2)}{w_1 - w_2}\right)$.

71. The stability of a power system is not affected by

A) line losses B) generator reactance

C) generator excitation D) line reactance.

72. The contact resistance of a circuit breaker is approximately

A) 2 Ω B) 20 μΩ

C) 0·2 Ω D) 20 mΩ.

73. Undervoltage relays are generally used for

A) busbar protection B) feeder protection

C) transformer protection D) motor protection.

74. The relation between travelling voltage wave and current wave is

A) $\frac{e}{i} = \sqrt{LC}$ B) $e \cdot i = \sqrt{\frac{L}{C}}$

C) $\frac{e}{i} = \sqrt{\frac{L}{C}}$ D) $ei = \sqrt{LC}$.

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75. For earth fault, the preferred relay is

A) overcurrent relay B) impedance relay

C) directional relay D) reactance relay.

76. Back to back HVDC is used to

A) decrease line losses

B) increase the transmission capability

C) reduce voltage drop

D) give stable interconnection.

77. A 10 MVA generator operates at 0·866 pf lag. The reactive power produced is

A) 10 MVA B) 8 MVA

C) 5 MVA D) 8·66 MVA.

78. In terms of *A, B, C, D* constants for short transmission line

A) $A = B = 1$ B) $B = D = 0$

C) $A = C = 1$ D) $C = D = 0$.

79. Which device automatically interrupts the supply in the event of surges ?

A) Earthing switch B) Series Reactor

C) Isolator D) Circuit breaker.

80. In case of transmission line conductors with increase in temperature,

A) length increases but stress decreases

B) both the length and stress decreases

C) both the length and stress increases

D) length decreases but stress increases.

D

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81. In lap winding of a P pole dc machine, the number of brushes are equal to

A) 2 B) 4

C) P D) $2P$.

82. When B_m is the maximum flux density, then eddy current loss varies as

A) B_m B) $B_m^{1.6}$

C) B_m^2 D) $B_m^{-1.6}$.

83. A 1600 kVA, 200 Hz transformer is operated at 50 Hz. Its kVA rating should be restricted to

A) 800 B) 400

C) 200 D) 100.

84. The phase difference of the induced voltages across the primary and secondary windings of a transformer is

A) 0° B) 90°

C) 180° D) between 30° and 60°.

85. The torque speed characteristic of a repulsion motor resembles that of the dc type of

A) separately excited motor B) shunt motor

C) series motor D) compound motor.

86. A 3-phase induction motor connected in star draws 5 amps. When connected in delta, it will draw a current of

A) 5A B) $5\sqrt{3}$ A

C) $\frac{5}{\sqrt{3}}$ A D) $\frac{5}{\sqrt{2}}$ A.

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87. Salient poles are generally used on prime movers of

A) high speed type only
B) medium speed type only
C) low speed type only
D) low and medium speed types.

88. In Potier triangle, the Potier reactance drop is 22 volts per phase at full load current of 88 amps per phase. The Potier reactance per phase is

A) 0·02 Ω
B) 0·25 Ω
C) 0·43 Ω
D) 0·7 Ω.

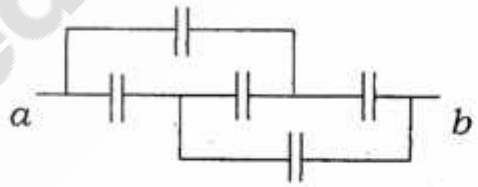
89. A synchronous motor is said to be 'floating' when it operates

A) on no load and without losses
B) on constantly varying load
C) on pulsating load
D) on high load and variable power supply.

90. The space angle between the axis of the stator revolving magnetic field and the rotor pole axis, both locked and running at synchronous speed is known as

A) angle of lead
B) power angle
C) power factor angle
D) reactive power angle.

91. The equivalent capacitance across '*ab*' given each value is 0·1 μF will be



A) 0·2 μF
B) 0·1 μF
C) 0·5 μF
D) 1 μF.

92. The frequency modulated (FM) radio frequency range is nearly

A) 250 - 300 MHz
B) 150 - 200 MHz
C) 90 - 105 MHz
D) 30 - 70 MHz.

D

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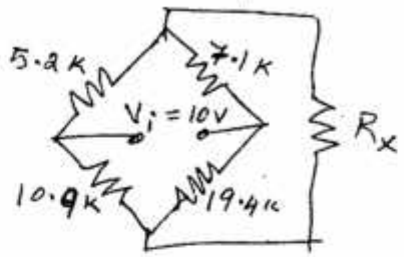
93. The value of R_X in the circuit shown for maximum power dissipation in it is



A) 33·4 k B) 17·6 k

C) 10 k D) 5 k.

94. Which law is synonymous to the occurrence of diamagnetism ?

A) Ampere's law B) Maxwell's law

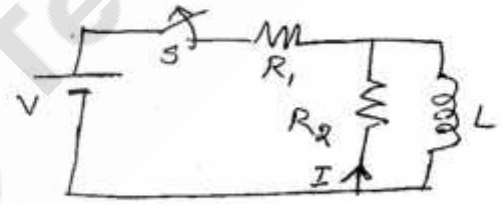
C) Coulomb's law D) Lenz's law.

95. By inserting a plate of dielectric between the plates of a parallel plate capacitor, the energy stored is increased 5 times. The dielectric constant is

A) 0·04 B) 0·2

C) 5 D) 25.

96. The circuit shown in the figure has been in steady state when the switch S is opened.



The current I after the switch is opened, is given by

A) $\frac{V}{R_2}e^{\frac{-R_1 t}{L}}$ B) $\frac{V}{R_1}e^{\frac{-R_2 t}{L}}$

C) $\frac{V}{R_1+R_2}e^{\frac{-(R_1+R_2)}{L}t}$ D) $\frac{V}{R_1+R_2}e^{\frac{R_1-R_2}{L}t}$.

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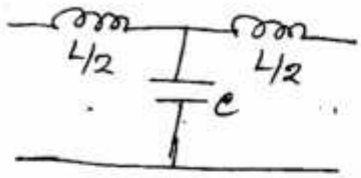
97. For the design of low pass prototype filter shown below, the value of L and C for a load resistance R_L and angular frequency $\omega = 1$ rad/sec are respectively



A) 1H and 1F

B) 1H and 2F

C) 2H and 1F

D) 2H and 2F.

98. For an RC driving point, impedance, function at the poles and zeros

A) should alternate along real axis

B) should alternate only on the negative real axis

C) should alternate on imaginary axis

D) can lie anywhere.

99. The type of time variation $\left(\frac{\partial}{\partial t}\right)$ implied with reference to the field quantities in Maxwell's equation is

A) sinusoidal

B) non-sinusoidal

C) both sinusoidal and non-sinusoidal

D) exponential.

100. The value of series inductance L in henris per km for minimum attenuation in the loading of the transmission line is given by (G = shunt capacitance per km and R = series resistance per km)

A) $L = \frac{CR}{G}$

B) $L = \frac{G}{CR}$

C) $L = \sqrt{\frac{CR}{G}}$

D) $L = \sqrt{\frac{1}{GCR}}$.

D

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101. In which district is Adichanallur which had been the habitat of human race during 1000-2000 BC located ?

A) Ariyalur B) Ramanathapuram

C) Tirunelveli D) Virudhunagar.

102. Which of the following is measured on the Richter scale ?

A) Density of liquids B) Intensity of earthquakes

C) Velocity of tornadoes D) Height of mountains.

103. Who got the Nobel Prize for Peace in the year 2011 ?

A) Thomas Sargent

B) Christopher Sims

C) Ellen Johnson Sirleaf, Leymah Gbowee and Tawakkol Karman

D) Domas Transtroma.

104. Which country won the Kabaddi World Cup, 2011 ?

A) United Kingdom B) India

C) Canada D) Germany.

105. The Raman effect is used in the study of

A) *X*-rays B) Cells

C) Chromosomes D) Molecular energy.

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106. Green India Programme is the National Action plan on

A) Pollution B) Climate change

C) Rainfall D) Environment.

107. What is zero hour ?

A) When matters of utmost importance are raised

B) When money bill is introduced in the Lok Sabha

C) When proposals of opposition are considered

D) Interval between morning and evening sessions.

108. Which of the following is a direct tax ?

A) Excise duty B) Sales tax

C) Income tax D) Both (B) & (C).

109. Which work is known as an encyclopaedia of social life in the Eleventh Century ?

A) Dasakumaracharita by Dandin

B) Kathasaritsagara by Somadeva

C) Karpuramanjari by Rajasekhara

D) Rajatarangini by Kalhana.

110. Who led the French forces during the battle of Waterloo ?

A) Duke of Wellington

B) Duke of Cornwall

C) Napoleon Bonaparte

D) Duke of Scotland.

D

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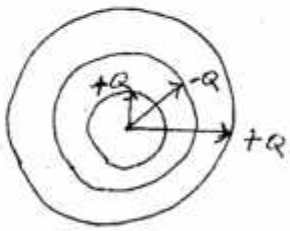
SECTION – B

(2 marks each)

111. An infinite number of concentric rings carry a charge Q each alternately positive and negative. Their radii are 1, 2, 4, 8 ... metres in geometric progression as shown below :



The potential at the centre is

A) 0

B) $\frac{Q}{12\pi \epsilon_0}$

C) $\frac{Q}{8\pi \epsilon_0}$

D) $\frac{Q}{6\pi \epsilon_0}$.

112. The transfer function $\frac{4(s^2+25)}{s^2+2{\cdot}5s+100}$ is of

A) low-pass notch filter

B) low Q band-pass filter

C) high Q band-pass filter

D) high-pass notch filter.

113. A choke coil having a resistance of R ohms and an inductance of L henries is shunted by a capacitor of C farads. The dynamic impedance of the circuit at resonance will be

A) $\frac{R}{LC}$

B) $\frac{C}{RL}$

C) $\frac{L}{RC}$

D) $\frac{1}{RLC}$.

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114. The impulse response of a system described by the difference equation $y(n)-\frac{1}{2}y(n-1)=x(n)$ is

A) $u(n)$ B) $\left(\frac{1}{2}\right)^n u(n)$

C) $\left(\frac{1}{5}\right)^n u(n)$ D) 1.

115. The convolution of two continuous time functions e^{-t^2} and $3t^2$ is

A) $3t^2e^{-t^2}$ B) $8\cdot7t^2+4\cdot7t+1$

C) $1\cdot31t^2+2\cdot66$ D) $4\cdot7t^2+8\cdot7t+1$.

116. A power plant has two units. Their incremental costs in Rs./MWhr are as follows :

$$\frac{dC_1}{dP_1}=2P_1+400\ ,\quad \frac{dC_2}{dP_2}=4P_2+300$$

Their generation limits are as follows :

$30\ \text{MW} \le P_1 \le 175\ \text{MW}$

$20\ \text{MW} \le P_2 \le 125\ \text{MW}$

The incremental cost in Rs./MWhr, for $50 \le P_D \le 70$, where P_D is the total demand, is

A) $2P_D+400$ B) $4P_D+300$

C) $3P_D+370$ D) $4P_D+180$.

D

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117. A 3-phase transmission line operates at 33 kV. It has a resistance of 5 Ω and reactance of 15 Ω. It is connected to busbar of an alternator through a 5 MVA step up transformer which has a reactance of 0·05 pu. Two alternators rated 10 MVA, $X_s = 0 \cdot 08$ pu and 5 MVA, $X_s = 0 \cdot 06$ pu are connected to busbars. A fault between phases at HV terminals of the transformer occurs. The MVA of the fault will be

A) 34·6 B) 67·6

C) 81·2 D) 91·5.

118. A single core cable used on a 3·3 kV, 50 Hz system has conductor diameter 10 mm and internal diameter of sheath 25 mm. Permittivity of insulator of sheath, k = 3·5. Power factor on open circuit is 0·03. The capacitance of cable per km will be

A) 0·212 μF B) 0·414 μF

C) 0·667 μF D) 0·512 μF.

119. A 400 HP (300 kW), 3-phase, 2400 V, 50 Hz star connected motor works at a lagging power factor of 0·7 and draws a current of 120·65 A. A bank of mesh connected condensers is used to raise the power factor to 0·93 lagging. The efficiency of the motor is 85%. The condensers available are of 600 V, 50 Hz rating. They are to be connected in delta to meet the requirement of power factor improvement. The capacitance of each capacitor is

A) 54 μF B) 108 μF

C) 162 μF D) 216 μF.

120. A short circuit test on 3-pole, 132 kV circuit breaker gave results as fault power factor 0·4, recovery voltage 90% full time value, symmetrical breaking current, the frequency of oscillations of restriking voltage 16 kHz. Neutral is grounded, and fault is ungrounded. The instantaneous value of recovery voltage will be

A) 134 kV B) 151 kV

C) 247 kV D) 763 kV.

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121. The product of the binary numbers 1011 and 1101 is

A) 11111111 B) 10001111

C) 10101010 D) 10111101.

122. The trigger circuit of an SCR has a source voltage of 15 V. The load line has a slope of – 100V/amp. Minimum gate current to turn on the SCR is 40 mA. The required value of the source resistance in the gate circuit is

A) 25 Ω B) 60 Ω

C) 75 Ω D) 100 Ω.

123. A three-phase half-wave converter is operated from a 3-phase star connected 220 V, 50 Hz supply. Its load resistance R_L = 10 Ω. The average output voltage is 25% of maximum possible average voltage. Its delay angle will be

A) 64·5° B) 94·5°

C) 124·5° D) 155·5°.

124. A *dc* chopper is turned on for 30 μ sec and turned off for 10 μ sec. The chopping frequency is

A) 52 Hz B) 5 Hz

C) 25 kHz D) 50 kHz.

125. A *dc* motor generates a back *emf* of 200 V. It is controlled by a pair of thyristors in a single phase full wave centre tapped circuit. The voltage between the centre tap and each anode is 175 V *ac*. For firing angle 90° and R_a = 0·8 Ω, the armature current will be

A) 7·88 A B) 12·52 A

C) 14·14 A D) 3·5 A.

D

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126. A speed regulator has the values K_g = 100 V/field amp, K_T = 0·015 Nm/V, H = 0·02 V/rpm, F = 0·0015 Nm/rpm. No load speed of the motor is 1200 rpm. The change in speed for closed loop system for an input reference voltage of 20 V is

A) 600 rpm B) 995 rpm

C) 1200 rpm D) 10 rpm.

127. The state space model of a system is

$$\begin{bmatrix}\dot{x}_1\\ \dot{x}_2\end{bmatrix}=\begin{bmatrix}1 & 0\\ 1 & 1\end{bmatrix}\begin{bmatrix}x_1\\ x_2\end{bmatrix}+\begin{bmatrix}1\\ 1\end{bmatrix}u(t)$$

$$x^T(0)=\begin{bmatrix}1 & 0\end{bmatrix}$$

The response for a step input will be

A) $\begin{bmatrix}e^t & 0\\ te^t & e^t\end{bmatrix}$ B) $\begin{bmatrix}2e^t-1\\ 2te^t\end{bmatrix}$

C) $\begin{bmatrix}e^{-t} & 0\\ te^{-t} & e^{-t}\end{bmatrix}$ D) $\begin{bmatrix}2-e^{-t}\\ te^{-t}\end{bmatrix}$.

128. The state space model of a system has

$$A=\begin{bmatrix}-4 & -1\\ 2 & -1\end{bmatrix},\quad B=\begin{bmatrix}3\\ 2\end{bmatrix},\quad C=\begin{bmatrix}2 & 3\end{bmatrix},\quad D=0$$

Its transfer function will be

A) $\dfrac{12s+44}{(s+2)(s+3)}$ B) $\dfrac{6}{(s+2)(s+3)}$

C) $\dfrac{6s+22}{(s+2)(s+3)}$ D) $\dfrac{22}{(s+2)(s+3)}$.

129. A thermometer is calibrated from 150°C to 200°C. The accuracy is specified within ± 0·25%. The maximum static error will be

A) 0·25 °C B) + 0·725 °C

C) ± 0·5 °C D) ± 0·125 °C.

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130. In a deflection frequency meter working on the principles of electrical resonance, there are two parallel circuits. Each circuit consists of an inductance and a capacitance in series. One circuit has $C_1 = 1\,\mu F$, $R_1 = 100\,\Omega$ and is tuned to a frequency of $f_1 = 60$ Hz. The other circuit has $C_2 = 1{\cdot}5\,\mu F$, $R_2 = 100\,\Omega$ and is tuned to a frequency f_2. The value of inductance in first circuit will be

A) 3·7 H B) 7·05 H

C) 11·37 H D) 11·82 H.

131. The moving coil of a voltmeter has 100 turns wound on a square former which has a length of 30 mm and the flux density in the air gap is 6×10^{-6} tesla. The coil is carrying a current of 12 mA. The turning moment on the coil is

A) $5{\cdot}2\times10^{-5}$ Nm B) $6{\cdot}48\times10^{-9}$ Nm

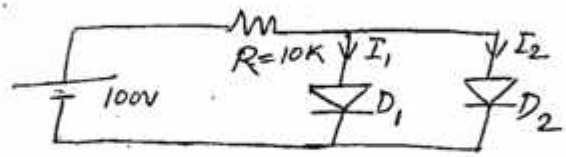
C) $19{\cdot}44\times10^{-9}$ Nm D) 19·44 Nm.

132. A 5-bit encoder is used. Each level represents 1 V. On account of modulation, voltage involved is 27·39 V. The quantization error is

A) 0·39 V B) 0·6 V

C) 0·09 V D) 0 V.

133. The diodes D_1 and D_2 of the circuit shown in the figure is such that D_1 is of Germanium ($V_r = 0{\cdot}2$ V, $r = 20\,\Omega$) and D_2 is of Silicon ($V_r = 0{\cdot}6$ V, $r = 15\,\Omega$).



The diode currents I_1 and I_2 are respectively

A) 4·25 mA, 5·67 mA B) 8·15 mA, 6·75 mA

C) 2·67 mA, 6·42 mA D) 7·79 mA, 4·23 mA.

D

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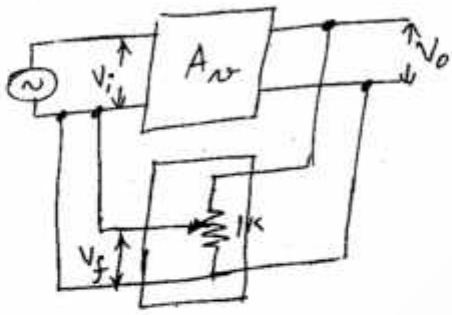
134. In the circuit shown in the figure



A_v =

A) -20 B) -50

C) -80 D) -100.

135. A bridge rectifier circuit has r_f = 50 Ω, for each diode. If the supply voltage is 100 V and R_L = 2·5 k Ω, the ripple voltage at the output is

A) 86·6 V B) 12·7 V

C) 56·7 V D) 43·3 V.

136. If $a \neq b \neq c$, then value of x which satisfies the equation

$$\begin{vmatrix} 0 & x-a & x-b \\ x+a & 0 & x-c \\ x+b & x+c & 0 \end{vmatrix} = 0$$ is given by

A) $x = a$ B) $x = b$

C) $x = c$ D) $x = 0$.

137. There exists a function $f(x)$ satisfying $f(0) = 1$, $f'(0) = -1$, $f(x) > 0$ for all x. Then

A) $f''(x) < 0$ B) $-1 < f''(x) < 0$

C) $-2 \leq f''(x) \leq -1$ D) $f''(x) < -2$.

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138. The curve $\frac{x^n}{a^n}+\frac{y^n}{b^n}=2$ touches the line $\frac{x}{a}+\frac{y}{b}=2$ at the point

A) (b, a) B) (a, b)

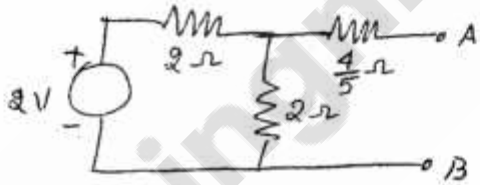
C) $(1, 1)$ D) $\left(\frac{1}{b}, \frac{1}{a}\right)$.

139. The auxiliary equation of $\frac{d^3y}{dt^3}+2\frac{d^2y}{dt^2}+4\frac{dy}{dt}+8y=x$ is given by

A) $m^3+2m^2+4m+8=0$ B) $(D^3+2D^2+4D+8)y=x$

C) $(D^3+2D^2+4D+8)x=y$ D) $m^3+2m^2=4m+8$.

140. The Norton's equivalent of the circuit given below is



A) 2·5 A, 2 Ω B) 2·5 A, 1 Ω

C) 0·4 A, 2 Ω D) 0·4 A, 1 Ω.

141. A 10 kV alternator is protected by the balanced circulating current system. It is grounded through a 10 Ω resistance. The protective relay operates at 1·8 A in the pilot wires, which are connected to the secondary windings of 1000/5 CT. The percentage winding which remains unprotected will be

A) 20% B) 31%

C) 62% D) 76%.

142. A bipolar, two terminal HVDC link has a 12-pulse converter per pole at each end. The system rating is 1200 MW at ± 500 kV at rectifier end. Line resistance per pole is 4 Ω. The link current will be

A) 600 A B) 900 A

C) 1200 A D) 1600 A.

D

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143. A 11 kV, 10 MVA alternator has $X_d'' = 15\%$, $X_d' = 25\%$, $X_d = 80\%$. It is connected to a load through a 2-cycle circuit breaker and a transformer. At no load 3-phase short circuit fault occurs between transformer and circuit breaker. If the voltage rating of the breaker is 11 kV, its interrupting kVA is

A) 46·7 MVA B) 93·4 MVA

C) 140·1 MVA D) 186·2 MVA.

144. A closed loop control system has an open loop gain of 100. Its feedback loop has a negative feedback gain of 0·005. Its sensitivity will be

A) 0·67 B) 0·866

C) 1·4 D) 2.

145. A phase advance circuit has a transfer function $G_c(s) = \frac{(1+0\cdot2s)}{(1+0\cdot02s)}$. Its maximum phase lag is

A) 10·2° B) 39·3°

C) 54·9° D) 66·7°.

146. The Fourier transform of $\frac{2}{1+t^2}$ is

A) $2\pi e^{-2|\omega|}$ B) $2\pi e^{2|\omega|}$

C) $\pi e^{-|\omega|}$ D) $\pi e^{|\omega|}$.

147. A 100 kVA, 6600/400 V, 50 Hz single phase transformer has 80 turns on LV side. At 25 Hz its flux increases by 10%. The HV and kVA rating at 25 Hz will be respectively

A) 3630 V, 55 kVA B) 6600 V, 100 kVA

C) 7260 V, 100 kVA D) 6600 V, 55 kVA.

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148. A 250 V dc shunt motor has $R_f = 125\ \Omega$ and $R_a = 0{\cdot}5\ \Omega$. The motor operates on no load with full field flux at rated speed 1000 rpm with $I_a = 5$ A. Neglect saturation and armature reaction. The motor drives a load torque of 100 Nm. The armature current of the motor is

A) 80 A

B) 42·2 A

C) 67·8 A

D) 59·3 A.

149. A 3-phase induction motor has a starting torque of 100% and a maximum torque of 200% of the full load torque. The slip at maximum torque will be

A) 0·268

B) 0·579

C) 0·707

D) 0·07.

150. A 500 kVA, 2300 V, 3-phase star connected alternator has a full load armature resistance drop of 50 V per phase and an effective reactance drop of 500 V per phase. The percentage regulation at UPF is

A) 1·05

B) 10·5

C) 21·8

D) 28·7.

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