DO NOT OPEN THIS TEST BOOKLET UNTIL YOU ARE ASKED TO DO SO

# SCREENING TEST–2010

## ELECTRICAL ENGINEERING

**B**

**Serial No.** 000618

***Time Allowed : Two Hours***

***Maximum Marks : 120***

## INSTRUCTIONS

1. IMMEDIATELY AFTER THE COMMENCEMENT OF THE EXAMINATION, YOU SHOULD CHECK THAT THIS TEST BOOKLET ***DOES NOT*** HAVE ANY UNPRINTED OR TORN OR MISSING PAGES OR ITEMS, ETC. IF SO, GET IT REPLACED BY A COMPLETE TEST BOOKLET.
2. ENCODE CLEARLY THE TEST BOOKLET SERIES **A, B, C OR D** AS THE CASE MAY BE IN THE APPROPRIATE PLACE IN THE RESPONSE SHEET.
3. You, have to enter your Roll Number on this Test Booklet in the Box provided alongside. *DO NOT* write *anything* else on the Test Booklet.

   Your Roll No. _____
4. This Booklet contains 120 items (questions). Each item comprises *four* responses (answers). You will select *one* response which you want to mark on the Response Sheet. In case you feel that there is more than one correct response, mark the response which you consider the best. In any case, choose ***ONLY ONE*** response for each item.
5. In case you find any discrepancy, in this test booklet in any question(s) or the Responses, a written representation explaining the details of such alleged discrepancy, be submitted within three days, indicating the Question No(s) and the Test Booklet Series, in which the discrepancy is alleged. Representation not received within time shall not be entertained at all.
6. You have to mark all your responses ***ONLY*** on the separate Response Sheet provided. See directions in the Response Sheet.
7. All items carry equal marks. Attempt ***ALL*** items. Your total marks will depend only on the number of correct responses marked by you in the Response Sheet.
8. Before you proceed to mark in the Response Sheet the response to various items in the Test Booklet, you have to fill in some particulars in the Response Sheet as per instructions sent to you with your Admit Card and Instructions.
9. While writing Centre, Subject and Roll No. on the top of the Response Sheet in appropriate boxes use **"ONLY BALL POINT PEN".**
10. After you have completed filling in all your responses on the Response Sheet and the examination has concluded, you should hand over to the Invigilator only the Response Sheet. You are permitted to take away with you the Test Booklet.

DO NOT OPEN THIS TEST BOOKLET UNTIL YOU ARE ASKED TO DO SO

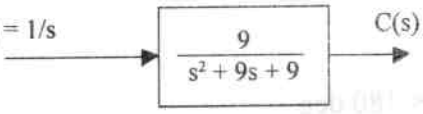
SEAL

**ROUGH WORK**

1. In the f – v analogy, Mass in the mechanical system is analogous to _____ in the electrical system ?

(A) resistor
(B) capacitor
(C) inductor
(D) transformer

2. For the system given below, the response c(t) would be classified as :




(A) Undamped
(B) Under-damped
(C) Critically damped
(D) Over-damped

3. The stability of the system is determined by :

(A) Gain Margin (GM)
(B) Phase Margin (PM)
(C) Both GM and PM
(D) Neither GM nor PM

4. Consider $G(s)=\frac{(s+1)(s+3)(s+5)}{s(s+10)}$ and unity feedback. The type and order of the system respectively are :

(A) 2 and 3
(B) 1 and 3
(C) 3 and 2
(D) 1 and 2

5. The eigen values of matrix $A=\begin{bmatrix} -3 & 1 \\ 1 & -3 \end{bmatrix}$ are :

(A) 1 and –3
(B) 3 and –1
(C) –2 and –4
(D) 2 and 4

6. The phase shift between input and output voltages in a CE amplifier is :

(A) 0 deg
(B) 90 deg
(C) 270 deg
(D) 180 deg

7. Low frequency voltage gain of a CS amplifier is :

(A) $-g_m/R_L$
(B) $-g_m R_L$
(C) $R_L/g_m$
(D) $R_L^2 g_m$

8. Identify high input impedance circuit :

(A) CE amplifier
(B) CS amplifier
(C) Cascode amplifier
(D) Darlington pair

9. In hybrid-π model, $g_m$ is given by :

(A) $-I_C/V_T$ (B) $V_T/I_C$

(C) $I_C V_T$ (D) $V_T^2/I_C$

10. If $h_{fe} = 7.5$ at f = 100 MHz, $f_T$ is :

(A) 75 Hz (B) 750 MHz

(C) 7.5 MHz (D) 0.075 MHz

11. For class AB operation, the conduction angle is :

(A) 180 deg (B) < 180 deg

(C) 180 deg to 360 deg (D) 360 deg

12. For class B amplifier, the maximum conversion efficiency is :

(A) 25% (B) 50%

(C) 75% (D) 78.5%

13. The unit of thermal resistance is :

(A) Siemens (B) ohms

(C) W/deg centigrade (D) deg centigrade/W

14. In 7824 regulator, the output voltage is :

(A) 12 V (B) 8 V

(C) 24 V (D) 2.4 V

15. The hole density in n-type semiconductor :

(A) $n_i^2 / N_D$ (B) $n_i^2 / N_A$

(C) $n_i^2$ (D) $1/N_D$

16. PIV of a diode in bridge rectifier is :

(A) $V_m$ (B) $V_m/2$

(C) $2 V_m$ (D) $3 V_m$

17. Expression for ripple factor of L-filter is :

(A) $\frac{R_L}{4\sqrt{3}\varpi L}$ (B) $\frac{R_L}{\sqrt{3}\varpi L}$

(C) $\frac{4\sqrt{3}\varpi L}{R_L}$ (D) $\frac{4\varpi L}{R_L}$

18. The fastest ADC is :
(A) flash type
(B) counter type
(C) dual slope
(D) successive approximation type

19. Settling time of DAC is :
(A) ±LSB
(B) ±MSB
(C) ± ½LSB
(D) ± ¼LSB

20. The number of states in a twisted ring counter with N flip flops is :
(A) N : 1
(B) N/2 : 1
(C) 2N : 1
(D) N/4 : 1

21. Identify the material which does not exhibit piezo electricity :
(A) Germanium
(B) Quartz
(C) Tourmaline
(D) Lithium sulphate

22. Geiger-Muller counter is used for the measurement of :
(A) nuclear radiation
(B) persistence
(C) fluorescence
(D) high temperature

23. Wein's bridge is used for measurement of :
(A) resistance
(B) frequency
(C) capacitance
(D) inductance

24. The transducer with positive temperature coefficient of resistance is :
(A) thermistor
(B) sensistor
(C) hall effect sensor
(D) hygrometer

25. One gauss is equal to :
(A) $10^{-1}$ wb/sq.m
(B) $10^{-2}$ wb/sq.m
(C) $10^{-3}$ wb/sq.m
(D) $10^{-4}$ wb/sq.m

26. The criterion relating to oscillations :
(A) Barkhausen
(B) Hartley-Shannon
(C) Weiner
(D) Reiner

27. Device used as a voltage variable resistor is :
(A) diode
(B) SCR
(C) BJT
(D) FET

28. Schmitt trigger is :
(A) bistable
(B) astable
(C) monostable
(D) none of the above

29. IC used for frequency synthesis is :
(A) Opamp
(B) timer
(C) PLL
(D) Regulator

30. The circuit which produces a sweep waveform :
(A) CE amplifier
(B) CS amplifier
(C) SCR
(D) UJT relaxation oscillator

31. An electro static field is said to be conservative when :
(A) gradient of field is zero
(B) divergence of field is zero
(C) curl of field is zero
(D) laplacian of field is zero

32. An electro static potential is given by V = 2 V in the Cartesian coordinate system. The magnitude of the electric field intensity in (V/m) is :
(A) 0
(B) ½
(C) 1
(D) 2

33. An air filled parallel plate capacitor consists of two circular plates of radius A each, separated by a distance d. Its capacitance is :

(A) $\varepsilon_0 \frac{A}{d}$
(B) $\varepsilon_0 \frac{\pi A^2}{d}$
(C) $\varepsilon_0 \frac{\pi d^2}{A}$
(D) $\varepsilon_0 \frac{d}{A}$

34. On either side of interface between two media, on which there is a surface charge :
(A) the normal components of electric flux density are equal
(B) the tangential components of electric flux density are equal
(C) the normal components of electric field intensity are equal
(D) the tangential components of electric field intensity are equal

35. The energy density of an electrostatic field is given by :

(A) $\frac{1}{2}\varepsilon_0 E^2$
(B) $\frac{1}{2}\varepsilon_0 D^2$
(C) $\frac{1}{2}\varepsilon_0 E$
(D) $\frac{1}{2}\varepsilon_0 D$

36. The line integral of the vector magnetic potential $\overline{A}$ around the boundary of a surface S represents :

(A) flux through S
(B) flux density on S
(C) field intensity on S
(D) current through S

37. Which one of the following equations indicate that free magnetic charges do not exist ?

(A) $\nabla \times \overline{A} = B$
(B) $\nabla \times \overline{H = J}$
(C) $\nabla \bullet \overline{B} = 0$
(D) $\nabla \times \overline{B} = 0$

38. A small circular loop of radius a, carrying a current I lies in the XY-plane with its centre at the origin. Its magnetic dipole moment is :

(A) $\frac{I}{\pi a^2}(\hat{x} + \hat{y})$
(B) $\frac{I}{\pi a^2}\hat{x}$
(C) $\frac{I}{\pi a^2}\hat{y}$
(D) $\pi a^2 I\hat{z}$

39. For diamagnetic material :

(A) $\mu_r \leq 1$
(B) $\mu_r \geq 1$
(C) $\mu_r = 1$
(D) $\mu_r >> 1$

40. A time changing magnetic flux is linking with stationary closed conducting path. Then there will be :

(A) motional induced emf
(B) transformer induced emf
(C) both motional and transformer induced emf
(D) no induced emf

41. A 220 V, 10 A, 1000 rpm dc series motor is connected to 220 V ac supply. When drawing a current of 10 A (rms) its speed would be :

(A) more than 1000 rpm
(B) less than 1000 rpm
(C) equal to 1000 rpm
(D) 2000 rpm

42. An electric locomotive is travelling down the gradient in its run. The braking mode which is useful during this period is :

(A) plugging
(B) rheostatic braking
(C) regenerative braking
(D) mechanical braking

43. The following lamp has highest power efficiency, for the same rating :
(A) Sodium vapour lamp
(B) Mercury vapour lamp
(C) Neon lamp
(D) Fluorescent lamp

44. The motor used for Escalators is :
(A) dc series motor
(B) synchronous motor
(C) 3-phase induction motor
(D) universal motor

45. The unit for solid angle is :
(A) degrees
(B) steridian
(C) meridian
(D) weber

46. A synchronous machine is synchronised to bus-bars and floating on the bus. The mechanical input taken under this condition is to compensate :
(A) armature copper loss
(B) iron losses
(C) mechanical losses
(D) iron losses + mechanical losses

47. A synchronous generator is supplying rated power at rated terminal voltage for a resistive load. Its regulation would be :
(A) negative
(B) positive
(C) zero
(D) negative or positive

48. Two identical equally excited generators are sharing a load of 5000 kW 0.8 pf lagging. The mechanical input given to machines is in the ratio 2 : 3. The real power supplied by machines would be respectively :
(A) 2500 kW, 2500 kW
(B) 1500 kW, 3500 kW
(C) 3500 kW, 1500 kW
(D) 2000 kW, 3000 kW

49. The starting method which provides highest starting torque for single phase induction motor, is :
(A) split phase-capacitor starting
(B) shaded pole starting
(C) repulsion starting
(D) split phase-inductor starting

50. A 3-phase induction motor has a standstill rotor impedance of (0.2 + j0.6) ohm/ph. The resistance required to be connected in series with rotor per phase, to get maximum torque at starting, would be :
(A) 0.4 ohm
(B) 0.8 ohm
(C) 0.2 ohm
(D) 0.6 ohm

51. The circle diagram of 3-phase induction motor is :
(A) locus of rotor current
(B) locus of no load current
(C) locus of stator current
(D) locus of stator voltage

52. Two slip-ring induction motors having 8 poles and 6 poles respectively are connected in cascade. The first motor (8 pole) is connected to 50 Hz supply. The speed of the set would be :

(A) 600 rpm
(B) 1000 rpm
(C) 3000 rpm
(D) 400 rpm

53. A transformer has zero voltage regulation at full load. The load power factor would be :

(A) lagging
(B) leading
(C) upf
(D) may be lagging or leading

54. A single phase two winding transformer is connected as an auto transformer for stepping down the voltage. If two winding transformer has transformation ratio as k and rating as Q. The output VA of auto transformer is :

(A) $\frac{k-1}{k}Q$
(B) $\frac{k}{k-1}Q$
(C) $\frac{k^2-1}{k}Q$
(D) $\frac{k^2-1}{k}Q$

55. An amorphous core is used for transformer to :

(A) reduce inrush current
(B) reduce no load current
(C) improve regulation
(D) improve power factor

56. Pumped storage plant works generally in combination with _____ station.

(A) hydel
(B) nuclear
(C) thermal
(D) all

57. According to the mode of heat transfer from flue gases to steam, super heaters are classified into _____ types.

(A) one
(B) two
(C) three
(D) four

58. If the coolant used is in liquid form then it must have _____ boiling point.

(A) low
(B) very low
(C) moderate
(D) high

59. In _____ method, low depreciation charges are made in the late years when the maintenance and repair charges are quite heavy.

(A) straight line
(B) sinking fund
(C) diminishing value
(D) none

60. The value of diversity factor is always :
(A) = 1
(B) > 1
(C) < 1
(D) 0

61. Line voltage at the consumer side of distribution transformer is :
(A) 440 V
(B) 11 kV
(C) 230 V
(D) 33 kV

62. The purpose of ground wires on the top of the towers is to :
(A) transmit reactive power
(B) provide balance for tower
(C) transmit real power
(D) protect tower and conductors from lightning

63. In pin type insulators _____ number of petticoats are provided.
(A) 1
(B) 2
(C) 3
(D) many

64. When power factor is improved _____ power is unchanged.
(A) reactive
(B) apparent
(C) real
(D) all

65. In Newton-Raphson method the nonlinear equations are approximated to a set of linear equations using _____ series.
(A) Fourier
(B) Geometric
(C) Harmonic
(D) Taylors

66. Generator generates _____ sequence voltages.
(A) negative
(B) zero
(C) both negative and zero
(D) positive

67. Fault analysis is carried out for finding _____ current.
(A) steady state
(B) transient
(C) sub-transient
(D) all the three

68. At infinite bus-bar _____ are constant.
(A) voltage and current
(B) voltage and frequency
(C) voltage and power factor
(D) none

69. The unit of capacitive reactance is :
(A) ohms
(B) farads
(C) siemens
(D) mho

70. For a lossless line the value of conductance is :
(A) 1.732
(B) 0.707
(C) 1.414
(D) None of the above

71. For a current wave the value of refraction factor when the line is short circuited is :
(A) 1
(B) 0
(C) 2
(D) $-1$

72. Which equipment provides most effective protection for the line against direct lightning stroke ?
(A) Surge diverter
(B) Earthing screen
(C) Overhead ground wires
(D) All

73. Burden is expressed in _____ for ac circuits.
(A) volts
(B) amperes
(C) watts
(D) volt amperes

74. _____ relay is used at the sending end of the transmission line.
(A) Directional
(B) Over current
(C) Over voltage
(D) Harmonic restrain

75. In V-I characteristics of impedance relays the initial bend is due to :
(A) spring torque
(B) internal defect
(C) residual magnetism
(D) all the three

76. In 3 zone distance protection _____ zone is high speed zone.
(A) second
(B) third
(C) first
(D) all

77. _____ can protect the CB from its inadequate rating.
(A) HRC fuse
(B) Relay
(C) Current transformer
(D) Current limiting reactor

78. For stable operation of the power system the critical clearing angle should be :
(A) 90°
(B) 75°
(C) 40°
(D) 60°

[Turn over

79. Asynchronous tie line connects two control areas operating at :
(A) different voltages
(B) different frequencies
(C) different loads
(D) different power factors

80. Steady State Power Limit in a transmission line can be improved by using :
(A) series compensation
(B) shunt reactors
(C) series resistors
(D) none

81. The power circuit used for converting ac to ac with reduction in frequency is :
(A) Controlled rectifier
(B) Chopper
(C) Cyclo-converter
(D) Inverter

82. The energy loss during the starting of dc motor with load is equal to :
(A) energy lost in shunt field winding
(B) energy lost in armature copper loss
(C) energy lost in windage loss
(D) energy lost in series field loss

83. The motor used in electric traction locomotive is :
(A) dc shunt motor
(B) universal motor
(C) dc series motor
(D) Schrage motor

84. The problem of 'cogging' is encountered in induction motors due to :
(A) insufficient loading
(B) insufficient magnetizing current
(C) insufficient voltage
(D) the presence of harmonic fluxes

85. Compounding curves are drawn for :
(A) dc motor
(B) induction motor
(C) split phase motor
(D) synchronous motor

86. Capacitor banks are connected in the power system on :
(A) generation side
(B) transmission side
(C) both on transmission and generation side
(D) at fag end of distribution line

87. Gapless surge arresters use nonlinear blocks made of :
(A) silicon carbide
(B) zinc oxide
(C) iron oxide
(D) magnesium oxide

88. The area of transformer tank depends on :

(A) amount of heat generated in transformer

(B) specific heat of dissipation due to convection

(C) specific heat of dissipation due to radiation

(D) all the above

89. The specific electric loading of rotating electrical machine means :

(A) average flux density

(B) armature ampere conductors per meter

(C) total flux

(D) armature ampere conductors

90. The Intel 8086 processor has :

(A) 8-bit address bus

(B) 16-bit address bus

(C) 20-bit address bus

(D) 32-bit address bus

91. The instruction XCHG belongs to :

(A) data transfer group

(B) string manipulation group

(C) program transfer group

(D) processor control group

92. The race-around condition is experienced in :

(A) D-flip flop

(B) shift register

(C) JK flip flop

(D) ring counter

93. Ring main distribution is mainly used :

(A) ease out load for load shedding

(B) provide continuity of supply

(C) to maintain voltage profile

(D) for balanced lading of lines

94. The type of generator used in gas based generating stations is :

(A) salient pole synchronous machines

(B) cylindrical pole synchronous machines

(C) slip-ring induction machines

(D) squirrel-cage induction machines

95. The sequence of magnitudes of the different types of reactances of synchronous machine is :

(A) $X_d < X'_d < X''_d$

(B) $X_d < X'_d > X''_d$

(C) $X_d > X'_d > X''_d$

(D) $X_d > X'_d < X''_d$

96. For a given current density, the drop due to resistance of the transmission line is :

(A) constant

(B) increase with voltage increase

(C) decrease with voltage increase

(D) increase with voltage decrease

97. For AC transmission, whether overhead or underground, the most unsuitable system is :

(A) 3-phase, 3-wire
(B) 3-phase, 4-wire
(C) single phase, 2-wire
(D) 2-phase, 3-wire

98. The ampere hour capacitor of a battery depends on :

(A) the thickness of plates
(B) the area of plates
(C) the strength of electrolyte
(D) the distance between the plates

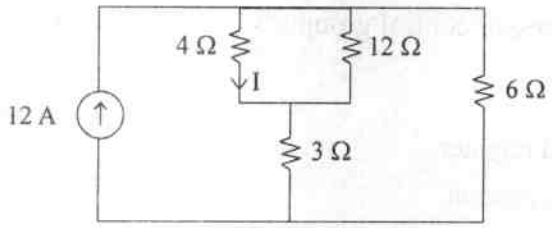
99. The lagging flux density behind the applied magnetizing force is known as :

(A) coercivity
(B) remanence
(C) flux
(D) hysteresis

100. The unit of Illumination is :

(A) lux
(B) candela
(C) lumen
(D) steridian

101. The current I in the circuit is :




(A) 4.5 A
(B) 6 A
(C) 1.5 A
(D) 3 A

102. The most appropriate fuse for electric furnace having a power rating of 3 kW, connected to 240 V supply is :

(A) 2 A
(B) 5 A
(C) 10 A
(D) 13 A

103. Eight cells each with internal resistance of 0.2 ohm and an emf of 2.2 V are connected in parallel. The internal resistance of battery so formed is :

(A) 1.6 ohm
(B) 0.025 ohm
(C) 0.2 ohm
(D) 11 ohms

104. A direct current of 4 A flows into a previously uncharged capacitor of 20 μF for 3 mSec. The p.d. across the plates is :

(A) 240 V
(B) 20/3 V
(C) 600 V
(D) 80/3 V

105. Resonance can be obtained in a series RLC circuit by varying :

(A) Capacitance
(B) Inductance
(C) Frequency
(D) Any of the above

106. The type of the capacitor which has highest capacity for the same size is :

(A) Ceramic capacitor
(B) Paper capacitor
(C) Mica capacitor
(D) Electrolytic capacitor

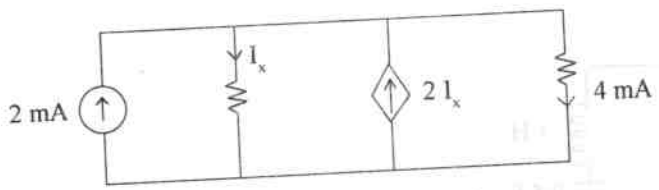
107. Weber/sq.m. is also known as :

(A) Tesla
(B) Lux
(C) Siemen
(D) Henry

108. The induced emf in a coil of 200 turns when there is a change of flux of 30 mWb linking with it in 40 mSec, is :

(A) 150 V
(B) –150 V
(C) –800/3 V
(D) 800/3 V

109. $I_x$ in the circuit shown is :

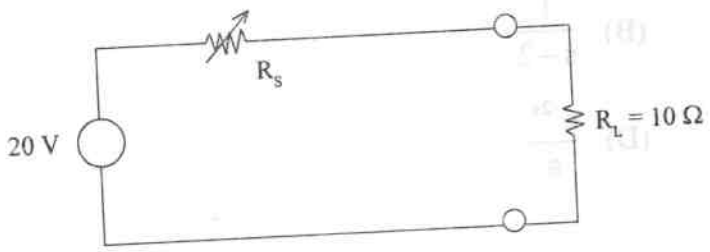



(A) 2 mA
(B) 6 mA
(C) 4 mA
(D) 8 mA

110. The form factor of a sine wave is :

(A) 1.414
(B) 1.11
(C) 0.901
(D) 0.707

111. The maximum power the load can receive in the circuit is :




(A) 2.5 W
(B) 10 W
(C) 5 W
(D) None of the above

112. If the voltage applied to the circuit is $(100 + j200)$ V and the current flowing is $(10 - j5)$ A, the active power in the circuit is :

(A) 2500 W

(B) 2000 W

(C) 0 W

(D) 1000 W

113. The quantity which has dimension of time is :

(A) R/L

(B) R/C

(C) RC

(D) RL

114. If a two port network is reciprocal, which of the following relations holds in terms of two port paramerts ?

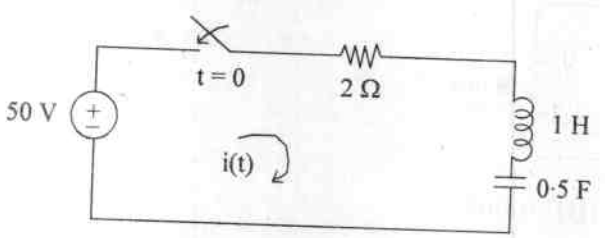
(A) $h_{11}h_{22} - h_{12}h_{21} = 1$

(B) $AD - BC = 1$

(C) $A = D$

(D) $h_{12} = h_{21}$

115. In the RLC circuit shown I(s) given by :




(A) $\frac{50}{s(s^2+2s+2)}$

(B) $\frac{50}{2s^2+s+0.5}$

(C) $\frac{50}{0.5s^2+s+2}$

(D) $\frac{50}{s^2+2s+2}$

116. The Laplace transform of $u(t-2)$ is :

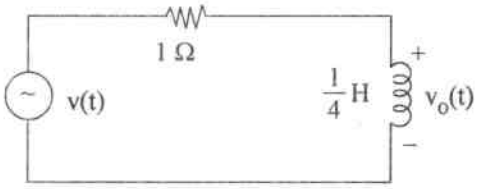
(A) $\frac{1}{s+2}$

(B) $\frac{1}{s-2}$

(C) $\frac{e^{2s}}{s}$

(D) $\frac{e^{-2s}}{s}$

117. The frequency at which the output voltage $v_o(t)$ will equal to v(t), in the circuit shown is :




(A) 0 rad/sec
(B) 1 rad/sec
(C) 4 rad/sec
(D) ∞ rad/sec

118. A series RC circuit has $V_R = 12$ V and $V_C = 5$ V. The supply voltage is :

(A) – 7 V
(B) 7 V
(C) 13 V
(D) 17 V

119. A system is represented by :

$$\frac{dc(t)}{dt} + 2c(t) = r(t)$$

The unit step response of the system assuming zero initial conditions is :

(A) $0.5\,(1 - e^{-2t})$
(B) $(1 + 2t)$
(C) $(2 + t)$
(D) $0.5\,(1 + e^{-2t})$

120. The transfer function $\frac{\theta(s)}{T(s)}$ of an armature controlled dc motor with $L_a << R_a$ has :

(A) one time constant
(B) two time constants
(C) three time constants
(D) depends on actual values of motor parameters

## ROUGH WORK