



**ENTRANCE EXAMINATION FOR ADMISSION, MAY 2010.**

**Ph.D. (ELECTRICAL AND ELECTRONICS ENGINEERING)**

**COURSE CODE : 141**

Register Number :

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*Signature of the Invigilator*  
(with date)

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**COURSE CODE : 141**

**Time : 2 Hours**

**Max : 400 Marks**

*Instructions to Candidates :*

1. Write your Register Number within the box provided on the top of this page and fill in the page 1 of the answer sheet using pen.
2. Do not write your name anywhere in this booklet or answer sheet. Violation of this entails disqualification.
3. Read each question carefully and shade the relevant answer (A) or (B) or (C) or (D) in the relevant box of the ANSWER SHEET using HB pencil.
4. Avoid blind guessing. A wrong answer will fetch you -1 mark and the correct answer will fetch 4 marks.
5. Do not write anything in the question paper. Use the white sheets attached at the end for rough works.
6. Do not open the question paper until the start signal is given.
7. Do not attempt to answer after stop signal is given. Any such attempt will disqualify your candidature.
8. On stop signal, keep the question paper and the answer sheet on your table and wait for the invigilator to collect them.
9. Use of Calculators, Tables, etc. are prohibited.

1. The intrinsic impedance of a lossy dielectric medium is given by

(A)  $\frac{j\omega\mu}{\sigma}$

(B)  $\sqrt{\frac{j\omega\mu}{(\sigma + j\omega\epsilon)}}$

(C)  $\sqrt{\frac{(\sigma + j\omega\epsilon)}{j\omega\mu}}$

(D)  $\sqrt{\frac{\mu}{\epsilon}}$

2. In a hollow conducting sphere

(A) Electric field is zero

(B) Electric field is a non-zero constant

(C) Electric field changes with magnitude of the charge given to the conductor

(D) Electric field changes with distance from the centre of the sphere

3. Consider the following statements regarding Maxwell's equations in differential form (symbols have the usual meanings)

1. For free space  $\nabla \times H = (\sigma + j\omega\epsilon)E$

2. For free space  $\nabla \cdot D = \rho$

3. For steady state current  $\nabla \times H = J$

4. For Static electric field  $\nabla \cdot D = \rho$

(A) 1 and 2 are correct

(B) 2 and 3 are correct

(C) 3 and 4 are correct

(D) 1 and 4 are correct

4. In a right-handed cylindrical co-ordinate system,  $a_r \times a_\theta =$

(A)  $a_z$

(B)  $-a_z$

(C)  $a_\theta$

(D)  $-a_\theta$

5. Kirchoff's current law for direct currents is implicit in the expression

(A)  $\nabla \cdot \bar{D} = \rho$

(B)  $\int \bar{J} \cdot n ds = 0$

(C)  $\nabla \cdot \bar{B} = \rho$

(D)  $\nabla \times H = J + \frac{\partial \bar{D}}{\partial t}$

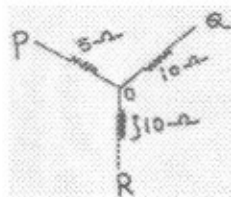
6. A circular loop has its radius increasing at a rate of 2 m/s. The loop is placed perpendicular to a constant magnetic field of  $0.1 \text{ wb/m}^2$ . When radius of the loop is 2 m, the emf induced in the loop will be

- (A)  $0.8\pi \text{ V}$                       (B)  $0.4\pi \text{ V}$                       (C)  $0.2\pi \text{ V}$                       (D) zero

7. The Fourier series expansion of a periodic function with half-wave symmetry contains only

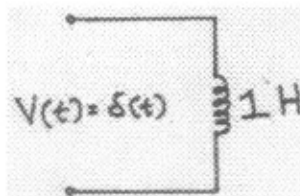
- (A) Sine terms    (B) Cosine terms  
(C) Odd harmonics                                      (D) Even harmonics

8. In the delta equivalent of the given star connected circuit,  $Z_{QR}$  is equal to



- (A)  $40 \Omega$                       (B)  $(20+j10) \Omega$                       (C)  $(10-j30) \Omega$                       (D)  $(10+j30) \Omega$

9. When a unit impulse voltage is applied to an inductor of 1 H, the energy supplied by the source is



- (A)  $\infty$                       (B) 1 J                      (C) 0.5 J                      (D) 0

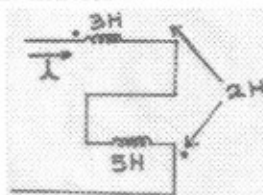
10. A water boiler at home is switched on to the a.c. mains supplying power at 230 V/50 Hz. The frequency of instantaneous power by the boiler is

- (A) 0 Hz                      (B) 50 Hz                      (C) 100 Hz                      (D) 150 Hz

11. The reciprocity theorem is applicable to

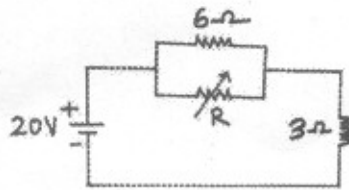
- (A) Linear networks only                                      (B) Bilateral networks only  
(C) Linear/bilateral networks                                      (D) Neither of the two

12. A sine wave voltage is applied across a capacitor; when the frequency of the voltage is increased, the current
- (A) increases (B) decreases  
(C) remains the same (D) is zero
13. For a two-port bilateral network, the three transmission parameters are given by  $A = \frac{6}{5}$ ;  $B = \frac{17}{5}$  and  $C = \frac{1}{5}$ , what is the value of D?
- (A) 1 (B)  $\frac{1}{5}$  (C)  $\frac{7}{5}$  (D)  $\frac{17}{35}$
14. For a two-port network to be reciprocal
- (A)  $Z_{11} = Z_{22}$  (B)  $y_{21} = y_{22}$   
(C)  $h_{21} = -h_{12}$  (D)  $AD - BC = 0$
15. In the first foster form, the presence of first element capacitor  $C_0$  indicates
- (A) pole at  $\omega=0$  (B) pole at  $\omega=\infty$   
(C) zero at  $\omega=0$  (D) zero at  $\omega=\infty$
16. The transient current in a loss-free LC circuit when excited from an ac source is an \_\_\_\_\_ sine wave.
- (A) undamped (B) overdamped  
(C) under damped (D) critically damped
17. Transient current in an RLC circuit is oscillatory when
- (A)  $R = 2\sqrt{\frac{L}{C}}$  (B)  $R = 0$  (C)  $R > 2\sqrt{\frac{L}{C}}$  (D)  $R < 2\sqrt{\frac{L}{C}}$
18. Two inductors are connected as shown in figure below. What is the value of the effective inductance of the combination?



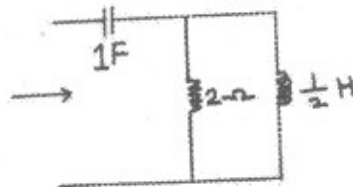
- (A) 8 H (B) 10 H (C) 4 H (D) 12 H

19. The value of the resistance  $R$  in the circuit shown in the given figure is varied in such a manner that the power dissipated in the  $3\text{ohm}$  resistor is maximum. Under this condition, the value of  $R$  will be



- (A) 3 ohms                      (B) 9 ohms                      (C) 12 ohms                      (D) 6 ohms

20. For the network shown in the figure below, what is the driving point impedance  $Z(s)$ ?



- (A)  $\frac{s^2 + s + 4}{s^2 + 4s}$                       (B)  $\frac{2s^2 + s + 4}{s^2 + 4s}$                       (C)  $\frac{2s^2 + s + 4}{s^2 + 2s}$                       (D) None of these

21. In an unsaturated dc machine armature reaction effect is

- (A) demagnetizing  
 (B) cross-magnetizing  
 (C) magnetizing  
 (D) kind of effect depends upon whether the machine is motoring or generating

22. The advantage of the double squirrel-cage induction motor over single cage rotor is that its

- (A) efficiency is higher                      (B) power factor is higher  
 (C) slip is larger                      (D) starting current is lower

23. A magnetic circuit has a linear B-H curve with  $\lambda = 1.5 \text{ WbT}$  at  $i = 10 \text{ A}$ . The energy stored in the field is

- (A) 15 J                      (B) 0.75 J                      (C) 7.5 J                      (D) 30 J

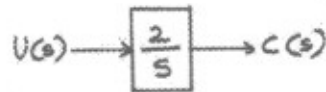
24. If the peak value of phase mmf is  $F_{\text{max}}$ , the peak value of the rotating field caused by three-phase is

- (A)  $(1/2) F_{\text{max}}$                       (B)  $F_{\text{max}}$                       (C)  $(3/2) F_{\text{max}}$                       (D)  $3 F_{\text{max}}$

25. 'Crawling' in an induction motor is due to
- (A) Time harmonics in supply
  - (B) Slip ring rotor
  - (C) Space harmonics produced by winding currents
  - (D) Insufficient starting torque

26. In the bode-plot of a unity feedback control system, the value of phase of  $G(j\omega)$  at the gain cross over frequency is  $125^\circ$ . The phase margin of the system is
- (A)  $-125^\circ$
  - (B)  $-55^\circ$
  - (C)  $55^\circ$
  - (D)  $125^\circ$

27. Consider a system shown in the given figure



If the system is disturbed so that  $c(0)=1$ , then  $c(t)$  for a unit step input will be

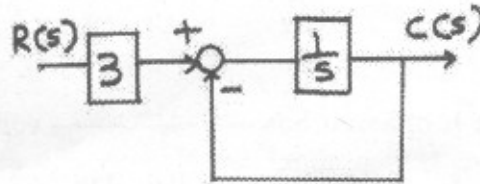
- (A)  $1+t$
  - (B)  $1-t$
  - (C)  $1+2t$
  - (D)  $1-2t$
28. The transfer function of a control system is given as  $T(s) = \frac{K}{s^2 + 2s + K}$  where  $K$  is the gain at the system in radians/ramp. For this system to be critically damped, the value of  $K$  should be
- (A) 1
  - (B) 2
  - (C) 3
  - (D) 4
29. The ac motor used in servo applications is a
- (A) Single-phase induction motor
  - (B) Two-phase induction motor
  - (C) Three phase induction motor
  - (D) Synchronous motor
30. Signal flow graph is used to find
- (A) Stability of the system
  - (B) Controllability of the system
  - (C) Transfer function of the system
  - (D) Poles of the system

31. The eigen values of matrix given below is

$$\begin{pmatrix} 0 & 1 & 0 \\ 0 & 0 & 1 \\ -6 & -11 & -6 \end{pmatrix}$$

- (A) -1,-2,-3
- (B) 1,2,3
- (C) 1,-2,-3
- (D) -1,2,-3

32. The matrix of any state-space equations for the transfer function  $C(s)/R(s)$  of the system shown below in the figure is



- (A)  $\begin{pmatrix} -1 & 0 \\ 0 & -1 \end{pmatrix}$       (B)  $\begin{pmatrix} 1 & 0 \\ 0 & -1 \end{pmatrix}$       (C)  $(-1)$       (D)  $(3)$
33. A linear discrete-time system has the characteristic equation,  $z^3 - 0.81z$ . The system
- (A) is stable  
 (B) is marginally stable  
 (C) is unstable  
 (D) stability cannot be assessed from the given information
34. For the transfer function  $G(s)H(s) = \frac{1}{s(s+1)(s+0.5)}$ . The phase cross-over frequency is
- (A) 0.5 rad/sec      (B) 0.707 rad/sec  
 (C) 1.732 rad/sec      (D) 2 rad/sec
35. For a unit step, a system with forward path transfer function  $\frac{20}{s^2}$  and the feedback path transfer function  $H(s) = (s+5)$ , has a steady state output of
- (A) 0      (B) 0.5      (C) 0.2      (D) zero
36. The root locus plot of the system having the loop transfer function  $G(s)H(s) = \frac{K}{s(s+4)(s^2+4s+5)}$  has
- (A) No breakaway point  
 (B) Three real breakaway point  
 (C) Only one breakaway point  
 (D) One real and two complex breakaway point





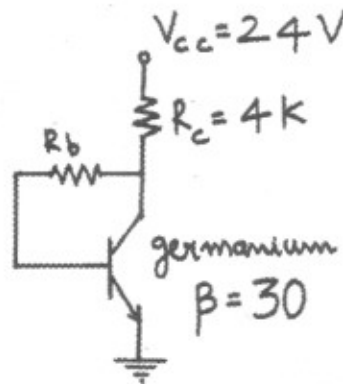
45. A repulsion motor is equipped with  
 (A) a commutator (B) slip rings  
 (C) a repeller (D) cogging
46. If, in an alternator, chording angle for fundamental flux wave is  $\alpha$ , its value for 5<sup>th</sup> harmonic is  
 (A)  $5\alpha$  (B)  $\alpha/5$  (C)  $25\alpha$  (D)  $\alpha/25$
47. The register used in the control unit of the CPU to indicate the next instruction which is to be executed is  
 (A) accumulator (B) index register  
 (C) instruction (D) program counter
48. The register used as a working area in CPU is  
 (A) Program counter (B) Instruction register  
 (C) Instruction decoder (D) Accumulator
49. A 32-bit microprocessor has word length equal to  
 (A) 2 bytes (B) 1 byte (C) 4 bytes (D) 8 bytes
50. To represent number 33 in binary, number of bits required is  
 (A) 6 (B) 5 (C) 4 (D) 7
51. Short transmission line is represent by the lamped parameters  
 (A) R and L (B) R and C (C) C and L (D) R, L and C
52. If  $R_1$  and  $R_2$  are the radius of sheath and conductor of a cable, then optimal ratio of the radius of the cable to the radius of the conductor is  
 (A)  $R_2/R_1$  (B)  $R_1/R_2$  (C)  $R_1 * R_2$  (D)  $R_1 = R_2$
53. The dielectric loss in the insulation of the cable occurs due to  
 (A) Leakage current (B) Leakage voltage  
 (C) Both (A) and (B) (D) None of the these

54. Factor affecting the sag are/is  
 (A) length of span (B) working tensile strength  
 (C) temperature (D) all the above
55. The relation between traveling voltage  
 (A)  $\frac{e}{i} = \sqrt{LC}$  (B)  $ei = \sqrt{\frac{L}{C}}$  (C)  $\frac{e}{i} = \sqrt{\frac{L}{C}}$  (D)  $ei = \sqrt{LC}$
56. The equipment which is provided with arc horn is  
 (A) Air break switch (B) Isolator  
 (C) Oil switch (D) None of the above
57. For a 1 m long conductor, the value of internal inductance will be  
 (A) 0 (B)  $0.05 \mu\text{H}$  (C)  $0.1 \mu\text{H}$  (D)  $0.05 \text{mH}$
58. An insulator has 3 units and  $K = 1/8$ . The string efficiency will be  
 (A)  $100/8 \%$  (B)  $100/3 \%$  (C)  $66.7 \%$  (D)  $84.3 \%$
59. Which of the two generalized constant in a transmission are equal?  
 (A) B and C (B) A and D (C) A and B (D) B and D
60. The coefficient of reflection of current for an open ended line is  
 (A) 1 (B) 0.5 (C) -1 (D) 0
61. Total induction of magnetically non coupled series inductor is calculated the same as  
 (A) Resistances in parallel-series (B) Resistances in parallel  
 (C) Resistances in series (D) None of the above
62. Coefficient of coupling expresses  
 (A) a relationship to flux density and magnetizing force  
 (B) a fractional value of the total flux linking one circuit to another  
 (C) a percentage  
 (D) none of the above

63. If the phase angle of a parallel RL circuit is  $-36^\circ$ , the circuit is
- (A) more resistive than reactive                      (B) more reactive than resistive  
 (C) equally resistive and reactive                      (D) none of the above
64. In a series capacitive circuit, the smallest capacitance has
- (A) the lowest voltage drop  
 (B) the highest voltage drop  
 (C) the same voltage drop as all other capacitors  
 (D) none of the above
65. Series or parallel resonant circuits can be used to create
- (A) Low pass filters                                      (B) Low pass and high pass filters  
 (C) Band-pass and band-stop filters                      (D) All the above
66. In complex number, resistance is a real term, while reactance a/an
- (A) j term    (B) Imaginary term  
 (C) Value appearing on the vertical axis                      (D) All the above
67. When current dramatically increases, the voltage point on the diode forward  $V-I$  characteristic curve is called the
- (A) Breakdown voltage                                      (B) Knee voltage  
 (C) Barrier voltage    (D) Both (B) and (C) are true
68. Which point on the dc load line result in an  $I_C = V_{CC}/R_C$  and  $V_{CE} = 0$  V ?
- (A) Saturation point                                      (B) Cutoff point  
 (C) Q point    (D) None of the above
69. Why is the D-MOSFET ideal as a preamplifier?
- (A) It can be mid-load line when 0 V is applied  
 (B) It has a high input impedance  
 (C) It has low noise properties  
 (D) All the above

70. Which of the following circuits is connected in an open-loop mode?  
 (A) Comparator (B) Inverting amplifier  
 (C) Non-inverting amplifier (D) All the above
71. What is the lower frequency limit of an op-amp?  
 (A) 20 Hz (B) 6 Hz (C) DC (D) 7.36 Hz
72. The feedback loop in a closed-loop op-amp circuit provides  
 (A) Positive feedback (B) Negative feedback  
 (C) Degenerative feedback (D) Both (A) and (B)

73. In the below circuit, the required value of  $R_b$  is,



- (A) 97 K (B) 10 K (C) 117 K (D) 120 K
74. Super- $\beta$  transistor is a  
 (A) Cascade configuration (B) Darlington configuration  
 (C) Matched-pair (D) None of the above
75. For an ideal noise free transistor amplifier, the noise factor is  
 (A) zero (B) 1 dB  
 (C) depends upon circuit parameters (D) zero dB
76. A NAND circuit with positive logic will operate  
 (A) NOR with negative logic (B) AND with negative logic  
 (C) OR with negative logic input (D) AND with negative logic input

77. In full adder, there are
- (A) Two binary number inputs and two outputs
  - (B) Three binary digit inputs and two binary outputs
  - (C) Three binary digit inputs and three binary digit outputs
  - (D) None of the above
78. How many illegitimate states have a synchronous mod-6 counter?
- (A) 3
  - (B) 2
  - (C) 1
  - (D) 0
79. An AND gate is a
- (A) Sequential circuit
  - (B) Memory circuit
  - (C) Relaxation circuit
  - (D) Combinational circuit
80. A device with slowest switching speed is
- (A) LCD
  - (B) LED
  - (C) Nixie tubes
  - (D) None of the above
81. The instrument with null output is
- (A) Bourdon gage
  - (B) Manometer
  - (C) A platform weighing scale
  - (D) Light meter
82. A spurious signal that modifies the output of the instrument is called
- (A) Noise
  - (B) Spurious output
  - (C) Either (A) or (B)
  - (D) Modulating signal
83. In shunt type ohmmeter the maximum deflection point is marked
- (A) 100 K $\Omega$
  - (B) 1 M $\Omega$
  - (C) 10 M $\Omega$
  - (D) Infinite
84. Normally absolute encoder are used for
- (A) continuous speed
  - (B)  $2\pi$  revolutions
  - (C) one revolution
  - (D) both (A) and (B)
85. Multirange ammeter uses
- (A) Universal shunt
  - (B) Series shunt
  - (C) Parallel shunt
  - (D) All of the above

86. An LED require a power of  
 (A) 20 nW                      (B) 20  $\mu$ W                      (C) 20 mW                      (D) 20 W
87. The phenomena of creeping occurs in  
 (A) Ammeters    (B) Voltmeters  
 (C) Wattmeters    (D) Watt-hour meters
88. Half effect transducer are used for measuring  
 (A) Magnetic field    (B) Current  
 (C) Electrical field    (D) Pressure
89. Loss of charge method is utilized for measurement of  
 (A) high L                      (B) high R                      (C) low L                      (D) low R
90. The range of a d.c. millimeter can be extended by utilizing a  
 (A) Series high resistance    (B) Series low resistance  
 (C) Shunt of high resistance    (D) Shunt of low resistance
91. \_\_\_\_\_ are very popular in switched mode power supplies.  
 (A) Power MOSFET    (B) BJT  
 (C) IGBT    (D) None of the above
92. In IGBT, the tine between the instants of forward blocking to forward on-state is called  
 (A) Delay time    (B) Rise time  
 (C) Turn-on time    (D) Turn-off time
93. For the operation of Zener diode as a voltage regulator  
 (A) it must be reverse biased with a voltage greater its breakdown  
 (B) a series resister  
 (C) necessary to limit the reverse current  
 (D) all the above

94. The device having high voltage-blocking capability  
 (A) FCT (B) RCT (C) MCT (D) ASCR
95. In resistance firing circuit of SCR,  $\alpha$  can be controlled upto  
 (A)  $45^\circ$  (B)  $90^\circ$  (C)  $135^\circ$  (D)  $180^\circ$
96. Mc Murray inverter uses  
 (A) Voltage commutation (B) Current commutation  
 (C) Natural commutation (D) Input commutation
97. A three phase voltage source inverter operates with  $180^\circ$  mode, whose input DC voltage is kept  $V_s$ . What would be the output fundamental rms voltage per phase if the load connected to the inverter is star connected?  
 (A)  $\sqrt{(2/3)} V_s$  (B)  $\sqrt{2/3} V_s$  (C)  $\sqrt{6/\pi} V_s$  (D)  $\sqrt{2/\pi} V_s$
98. Chopper control for DC motor provides variation in  
 (A) Input voltage (B) Frequency  
 (C) Current (D) None of the above
99. Identify the constant flux operated variable speed drive  
 (A) E/f controlled I.M. drive  
 (B) Slip power recovery drive  
 (C) (A) and (B)  
 (D) AC voltage controlled I.M. drive
100. Duty cycle in a chopper circuit with switching frequency 100 Hz and  $T_{on}$  time as 2 ms  
 (A) 0.2 (B) 0.4  
 (C) 0.8 (D) None of the above

