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Ph.D. Entrance Examination of Electrical Engineering (EE)

1. The addition of a pole to the closed loop transfer function _____ the rise time and _____ the overshoot.
   a) decreases, decreases
   b) decreases, increases
   c) increases, reduces
   d) increases, increases

2. The frequency response of a linear system $G(j\omega)$ is provided in the tabular form below:

$\lvert G(j\omega)\rvert$	1.3	1.2	1.0	0.8	0.5	0.3
$\angle G(j\omega)$	-130°	-140°	-150°	-160°	-180°	-200°

   Gain margin and phase margin are
   a) 6 dB and 30°
   b) 6 dB and -30°
   c) -6 dB and 30°
   d) -6 dB and -30°

3. The transfer function of a system is given by $\frac{100}{s^2+20s+100}$, then the system is
   a) a critically damped system
   b) an unstable system
   c) undamped system
   d) under-damped system

4. When negative feedback is introduced into the system, the following will not decreased.
   a) Distortion
   b) Bandwidth
   c) Overall gain
   d) Stability

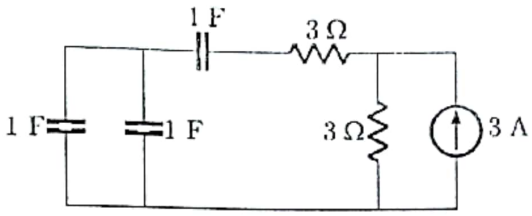
5. Two players A and B, alternately keep rolling a fair dice. The person to get a six first wins the game. It is given that player A starts the game, what is the probability that A wins the game.
   a) 5/11
   b) 6/11
   c) 7/11
   d) 1/2

6. The Laplace transform of $f(t)=e^{2t}\sin(5t)u(t)$ is
   a) $\frac{2}{s^2+3}$
   b) $\frac{5}{s^2-4s+29}$
   c) $\frac{2}{s^2-3}$
   d) $\frac{s-2}{s^2-4s+29}$

7. How many digits exist between 100 and 1000 all of whose digits are even.
   a) 100
   b) 90
   c) 80
   d) 37

8. Consider function $f(x)=(x^2-4)^2$ where x is the real number. Then the given function has,
   a) only two minima
   b) only three minima
   c) two maxima
   d) one maxima

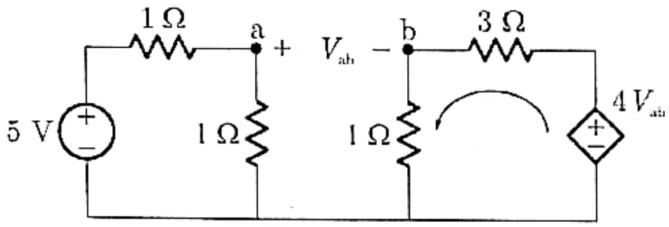
9. The time-constant for the following circuit is:



a) 2 seconds
b) 3 seconds
c) 4 seconds
d) 23.2 seconds

10. The time-constant of a series RC circuit is given as,
a) RC
b) R/C^2
c) C/R
d) R/C

11. In the following circuit, the estimated value of the current *i* is,



a) 1.50 Amperes
b) 1.25 Amperes
c) 2.25 Amperes
d) 11.2 Amperes

12. The transients currents are normally associated with
a) current in the circuit
b) voltage in the circuit
c) impedance in the circuit
d) due to change in stored energy in capacitor and inductor

13. Electric filed strength due to a charge distribution on plane sheet (ρ_s is surface charge density, and ε dielectric constant) is,
a) $\rho_s/4\varepsilon$
b) $\rho_s/2\varepsilon$
c) $\rho_s \times 2\varepsilon$
d) $\rho_s \times 4\varepsilon$

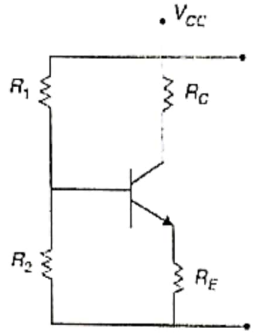
14. Intrinsic impedance of free space for a TEM wave equals
a) 377 Ω
b) 477 Ω
c) 577 Ω
d) 1 Ω

15. The electric field intensity, E and the electric potential, V are interrelated by.
a) E = - divergence of V
b) E = divergence of V
c) E = - gradient of V
d) E = gradient of V

16. Electric displacement current density is measured in
a) Coulombs/m
b) Coulombs/m^2
c) Amp/m^2
d) Volts/m

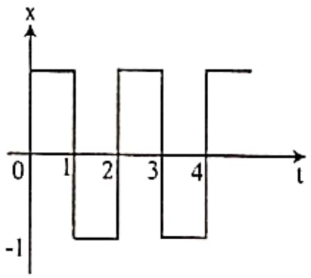
17. How can the electric load be shifted from a DC shunt generator running in parallel with another one?
    a) Using an equalizer
    b) adjusting the field winding rheostat
    c) adjusting the speed of connected prime-mover
    d) Inserting the resistance in both field and armature
18. In a single-phase transformer, the following winding has more area of cross-section
    a) Both high-voltage and low-voltage windings
    b) High-voltage winding
    c) Low-voltage winding
    d) Primary winding and secondary windings
19. The pitch factor for the winding having 36 stator slots, 4-poles, coil spans 1 to 8 is given by,
    a) cos 20°
    b) cos 30°
    c) cos 40°
    d) 1.2 cos 20°
20. A single-phase transformer connected to a 230 V, 50 Hz supply. The net cross sectional area of the core is 60 cm^2, the number of primary and secondary turns are 500 and 100, respectively. The maximum value of flux density of the core is:
    a) 100 T
    b) 1.2 T
    c) 0.245 T
    d) 0.345 T
21. A transformer is rated at 11 kV/0.4 kV, 500 kVA, 5% reactance. What is the short-circuit MVA of the transformer when connected to an infinite bus?
    a) 10 MVA
    b) 1 MVA
    c) 1.2 MVA
    d) 1.35 MVA
22. For an IDMT relay, plug setting is 50% and CT ratio is 400/5. Fault current is 3000 A. Then the plug setting multiplier is
    a) 1.5 b) 15
    c) 2.5 d) 25.5
23. The maximum short-circuit current exist in the case of
    a) single line to ground fault
    b) three-phase bolted fault
    c) double line to ground fault
    d) line to line fault
24. Which of the following electric power plant follows the principle of Rankine cycle?
    a) Thermal power plant
    b) Hydro-electric power plant
    c) Nuclear power plant
    d) Both solar and wind power plants.
25. Five thyristors each of 2000 V rating are connected in series with a power circuit of 5 kV. The derating factor in percentage is
    a) 80 b) 25
    c) 50 d) 92.5
26. A step-up chopper is fed with 200 V. The conduction time of the thyristor is 200 μs and the required output is 600 V. If the frequency of operation is kept constant and the pulse width is halved, the new output voltage is,
    a) 25 V
    b) 100 V
    c) 200 V
    d) 300 V

27. The fastest switching device amongst following is
    a) BJT
    b) MOSFET
    c) JFET
    d) Triode
28. TRIAC is
    a) 2 SCRs connected in series
    b) 2 SCRs connected in parallel
    c) 2 SCRs connected in anti-parallel
    d) 2 SCRs connected in series with a diode
29. A common-emitter amplifier (Refer figure below) has a potential divider bias using V_{CC}=12 V. If R_c=4 kΩ, R_E=1 kΩ, R_1=20 kΩ, R_2=5 kΩ, V_{BE}=0.6 V, β=100, then the operating point is given by,



    a) 3.41 V and 1.71 mA
    b) 5.41 V and 2.71 mA
    c) 1 V and 5.42 mA
    d) 7.8 V and 3.42 mA
30. Simplify the expression and choose the corrected answer: $Y = A(A+B)+B(\overline{A}+B)$
    a) AB
    b) B
    c) $A+B$
    d) $A-B$
31. For the expression, $f=A+BC$, the number of NOR gates required to implement f are,
    a) 10
    b) 4
    c) 5
    d) 3
32. An amplifier has an open loop gain of 100 with 10% harmonic distortion at output. If 40 dB of negative feedback is applied, the distortion with feedback is
    a) 10%
    b) 0.1%
    c) 100%
    d) None of these
33. In majority of the measuring instruments, the damping is provided by
    a) springs
    b) fluid friction
    c) eddy currents
    d) None of these
34. The pressure coil of a wattmeter must be connected to supply side of the current coil when
    a) load impedance is low
    b) load impedance is high
    c) supply voltage is low
    d) supply voltage is high

35. Hay's bridge is most suitable for the measurement of
    a) Inductance with Q<10
    b) Capacitor with low dielectric loss
    c) Inductance with Q>10
    d) Capacitor with high dissipation factor
36. Which instrument measure DC quantity only?
    a) moving coil
    b) moving iron
    c) thermocouple
    d) All of the above
37. What are the two types of Fourier series?
    a) trigonometric and logarithmic
    b) exponential and logarithmic
    c) trigonometric and exponential
    d) logarithmic only
38. The z-transform of unit step function is,
    a) $\frac{z}{z-1}$
    b) $\frac{z}{z(z-1)}$
    c) $\frac{z}{z+1}$
    d) 1
39. What is the nature of Fourier representation of a discrete and aperiodic signal?
    a) discrete and periodic
    b) discrete and aperiodic
    c) continuous and periodic
    d) continuous and aperiodic
40. Consider a following periodic square wave:



What is the (approximate) ratio of power in the 7^{th} harmonic to the power in the 5^{th} harmonic for the above waveform?
    a) 200
    b) 300
    c) 1.5
    d) 0.5

ANSWER KEY Electrical Engineering (EE)

1. c	2. a	3. a	4. b	5. b	6. d
7. a	8. a	9. c	10. a	11. b	12. d
13. b	14. a	15. c	16. b	17. b	18. c
19. a	20. d	21. a	22. b	23. d	24. a
25. c	26. d	27. b	28. c	29. a	30. c
31. d	32. b	33. c	34. b	35. c	36. a
37. c	38. a	39. c	40. d		