

Written Test for the post of Jr. Lab Assistant
Department of Electrical Engineering
IIT Rajasthan

08 January 2011

1 Instructions

- Each correct answer carries +1 mark and each wrong answer carries -1 mark. Hence, do not attempt a question if you are not confident.
- Please check that there are 45 Questions in total.
- Each blank in Questions 31-35 carry 1 mark. Negative marking is not applicable to these questions.
- Duration: 1 Hour
- Total Marks: 50

2 Problems

1. For a 4-pole, 2-layer, dc lap-winding with 20 slots and one conductor per layer, the number of commutator bars is
 - (a) 80
 - (b) 20
 - (c) 40
 - (d) 160
2. Lap winding is suitable for current, voltage dc generators.
 - (a) high, low
 - (b) low, high
 - (c) low, low
 - (d) high, high
3. In a dc generator, the generated emf is directly proportional to the
 - (a) field current
 - (b) pole flux
 - (c) number of armature parallel paths
 - (d) number of dummy coils
4. Which of the following dc generator can not build up on open-circuit?
 - (a) shunt
 - (b) series
 - (c) short shunt
 - (d) long shunt
5. If a self-excited dc generator after being installed, fails to build up on its first trial run, the first thing to do is
 - (a) increase the field resistance
 - (b) check the armature insulation
 - (c) reverse field connections
 - (d) increase the speed of prime mover
6. The generator has poorest voltage regulation.
 - (a) series
 - (b) shunt
 - (c) compound
 - (d) high
7. In a dc motor, unidirectional torque is produced with the help of
 - (a) brushes
 - (b) commutator
 - (c) end-plates
 - (d) both (a) and (b)
8. The induced emf in the armature conductors of a dc motor is
 - (a) sinusoidal
 - (b) trapezoidal
 - (c) rectangular
 - (d) alternating
9. The current drawn by a 120V dc motor of armature resistance 0.5 ohm and back emf 110V is ampere.
 - (a) 20
 - (b) 240
 - (c) 220
 - (d) 5
10. A 200V, 10A motor could be rewound for 100V, 20A by using as many turns per coil of wire, having the cross-sectional area.
 - (a) twice, half
 - (b) thrice, one-third
 - (c) half, twice
 - (d) four-times, one-fourth
11. The series-parallel system of speed control of series motors widely used in traction gives a speed range of about
 - (a) 1:2
 - (b) 1:3
 - (c) 1:4
 - (d) 1:6

12. The main purpose of using core in a transformer is to
- decrease iron losses
 - prevent eddy current loss
 - eliminate magnetic hysteresis
 - decrease reluctance of the common magnetic circuit
13. In performing the short circuit test of a transformer
- high voltage side is usually short circuited
 - low voltage side is usually short circuited
 - any side is short circuited with preference
 - none of the above
14. The ordinary efficiency of a given transformer is maximum when
- it runs at half full-load
 - it runs at full-load
 - its Cu loss equals iron loss
 - it runs slightly overload
15. In 3-phase Y-Y transformer connection, neutral is fundamental to the
- suppression of harmonics
 - passage of unbalanced currents due to unbalanced loads
 - provision of dual electric service
 - balancing of phase voltages with respect to line voltages
16. In a 3-phase induction motor, the relative speed of stator flux with respect to is zero.
- stator winding
 - rotor
 - rotor flux
 - space
17. An 8-pole wound rotor induction motor operating on 60 Hz supply is driven at 1800 rpm by a prime mover in the opposite direction of revolving magnetic field. The frequency of rotor current is
- 60 Hz
 - 120 Hz
 - 180 Hz
 - none of the above
18. The efficiency of a 3-phase induction motor is approximately proportional to
- $(1 - s)$
 - s
 - N
 - N_s
19. Which of the following rotor quantity in a Squirrel-Cage Induction motor (SCIM) does not depend on its slip?
- reactance
 - speed
 - induced emf
 - frequency
20. If maximum torque of an induction motor is 200 kg-m at a slip of 12%, the torque at 6% slip would be kg-m.
- 100
 - 160
 - 50
 - 40
21. Kirchoff's voltage law is concerned with
- IR drops
 - battery emfs
 - junction voltages
 - both (a) and (b)
22. According to KVL, the algebraic sum of all IR drops and emfs in any closed loop of a network is always
- zero
 - positive
 - negative
 - determined by battery emf
23. For a given line voltage, four heating coils will produce maximum heat when connected
- all in parallel
 - all in series
 - with two parallel pair in series
 - one pair in parallel with other two in series.
24. A 100W light bulb burns on an average of 10 hours a day for one week. The weekly consumption of energy will be units.
- 7
 - 70
 - 0.7
 - 0.07
25. Two similar electric charges of 1C each are placed 1m apart in air. Force of repulsion between them would be nearly newton.
- 1
 - 9×10^9
 - 4π
 - 8.854×10^{-12}
26. A capacitor that stores a charge of 0.5C at 10 volts has a capacitance of farad.
- 5
 - 20
 - 10
 - 0.05

27. A kWh meter can be classified as a/aninstrument.

- (a) deflecting (b) digital
- (c) recording (d) indicating

28. A meter that is suitable for only direct current measurement is:

- (a) moving-iron type
- (b) permanent-magnet type
- (c) electrodynamic type
- (d) hot-wire type

29. A moving coil voltmeter measures

- (a) only a.c. voltages
- (b) only d.c. voltages
- (c) both a.c. and d.c. voltages
- (d) none of the above

30. An ac current $i(t) = 14.14 \sin(\omega t + \pi/6)$ has an rms value of Amperes.

- (a) 10 (b) 14.14
- (c) 1.96 (d) 7.07

31. Let there be a modulating signal $m(t) = A \cos \omega_m t$ and a carrier signal $c(t) = B \cos \omega_c t$.

- (a) Signal _____ modulates the signal _____. Inequality relationship between ω_m and ω_c can be given as _____.
- (b) Expression of AM signal is _____ and that of FM signal is _____.
- (c) Condition of maximum modulation in terms of relationship between A and B is _____.

32. Pole(s) of $e^{2t}u(t)$ is/are located at _____.

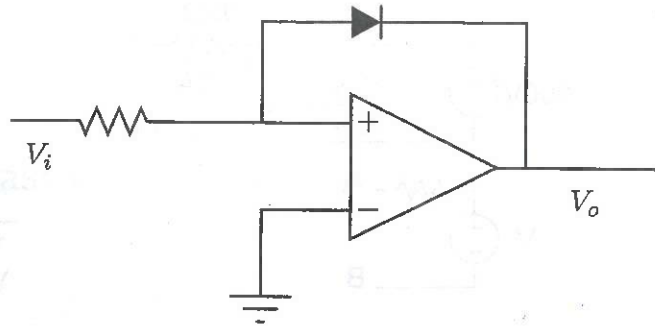
33. A FIR filter with coefficients $\{\frac{1}{2}, -\frac{1}{2}\}$ works as a _____ filter.

34. One of the most important advantages of IIR filter over FIR filter is _____.

35. Fourier transform of a rectangular pulse of amplitude 1 and duration $|t| < T_0$ is _____.

36. The circuit shown in the given figure can be used as a

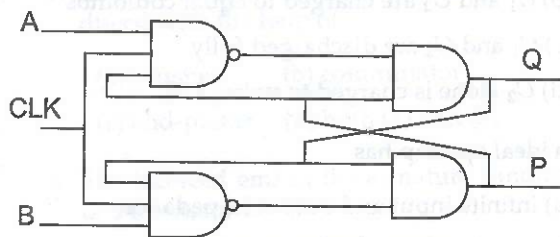
- (a) rectifier
- (b) voltage to frequency converter
- (c) frequency to voltage converter
- (d) logarithmic amplifier



37. A resistor R of 1 ohm and two inductors L_1 and L_2 of inductances 1 H and 2 H respectively, are connected in parallel. At sometime, the currents through L_1 and L_2 are 1 A and 2 A, respectively. The current through R at time $t = \infty$ will be

- (a) zero (b) 1 A
- (c) 2 A (d) 3 A

38. Given $A = 1, B = 1, Q_n = 0$ and $P_n = 1$, what will be the output Q_{n+1} and P_{n+1} when the clock input (CLK) is applied?



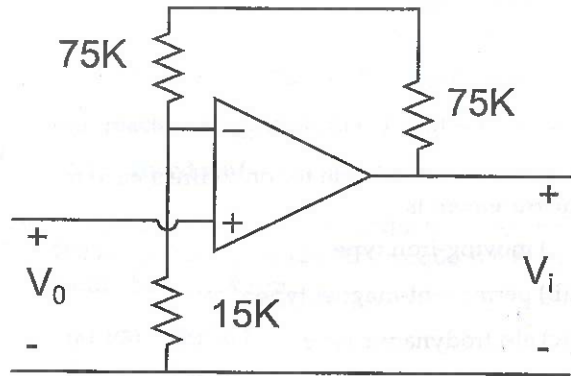
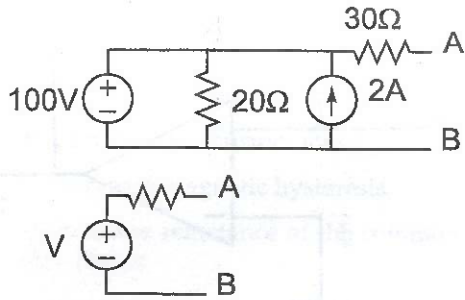
- (a) $Q_{n+1} = 0, P_{n+1} = 0$
- (b) $Q_{n+1} = 0, P_{n+1} = 1$
- (c) $Q_{n+1} = 1, P_{n+1} = 0$
- (d) $Q_{n+1} = 1, P_{n+1} = 1$

39. The difference between sequential and combinational circuits is that

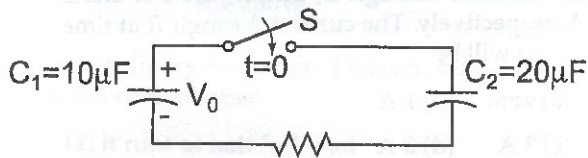
- (a) combinational circuits store bits
- (b) combinational circuits have memory
- (c) sequential circuits store bits
- (d) sequential circuits have memory

40. If the two networks shown in the following figure are equivalent at terminals A and B, then the values of V (in volts) and Z (in Ohms), will be respectively.

- (a) 100 and 12 (b) 60 and 12
- (c) 100 and 30 (d) 60 and 30



41. In the network shown in the following figure, the capacitor C_1 is initially charged to a voltage V_0 before the switch S in the circuit is closed. In the steady state,



45. Consider the units: (1) sec^{-1} (2) m^2s^{-2} (3) sec (4) ohm. The units of R/L , $1/LC$, LC and $\sqrt{L/C}$ respectively

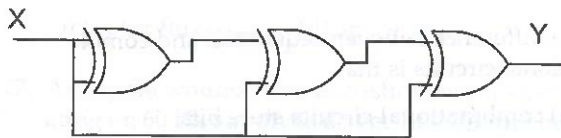
- (a) C_1 and C_2 are charged to equal voltages
- (b) C_1 and C_2 are charged to equal coulombs
- (c) C_1 and C_2 are discharged fully
- (d) C_2 alone is charged to voltage V_0

- (a) 1,2,4 and 3
- (b) 3,2,1 and 4
- (c) 2,4,1 and 3
- (d) 1,2,3 and 4

42. An ideal op-amp has

- (a) infinite input and output impedance
- (b) very low input and output impedance
- (c) low input impedance and infinite output impedance
- (d) infinite input impedance and zero output impedance

43. The output Y of the given circuit is



- (a) 1 (b) zero
- (c) X (d) \bar{X}

44. The circuit diagram of an op-amp based amplifier is shown in the following figure. The ratio $\frac{V_{out}}{V_i}$ is equal to

- (a) 9 (b) 11
- (c) 10 (d) 21