

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

COMBINED COMPETITIVE (PRELIMINARY) EXAMINATION, 2012

Serial No.

ELECTRICAL ENGINEERING

Code No. 08



Time Allowed : Two Hours

Maximum Marks : 300

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. Your Roll No.
DO NOT write anything else on the Test Booklet.
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.

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ROUGH WORK

1. The approximate voltage supplied by one cell of a lead acid battery is :
 (A) 0.50 V (B) 1.11 V
 (C) 1.60 V (D) 2.00 V

2. While charging accumulators, the following care should be taken :
 (A) Connect and disconnect them when the power supply is on
 (B) Keep them in well ventilated area
 (C) Acid level should be checked
 (D) Short the cells to check if they are charged fully

3. Which one of the following acts as a depolarizer in a dry cell ?
 (A) Carbon powder (B) Manganese dioxide
 (C) Ammonium chloride (D) Zinc chloride

4. A solar cell converts directly :
 (A) Light energy into electrical energy in dc form
 (B) Light energy into electrical energy in ac form
 (C) Heat energy into electrical energy in dc form
 (D) Heat energy into electrical energy in ac form

5. Four 4 Ω resistors connected in series is connected in series with a four 4 Ω resistors connected in parallel. The effective value of resistance is :
 (A) 16 Ω (B) 15 Ω
 (C) 17 Ω (D) 1 Ω

6. The rms value of voltage shown in Fig. 1 is 20 V. The equation of voltage is :
 (A) $v = 14.14 \sin 628 t$ (B) $v = -28.28 \cos 314 t$
 (C) $v = 28.28 \cos 314 t$ (D) $v = -14.14 \cos 628 t$

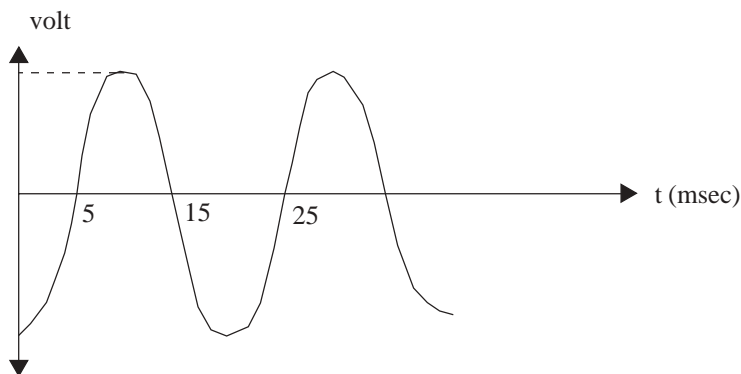


Fig. 1

10. The voltage across the coil shown in Fig. 2 is :
- (A) 20 V (B) 10 V
(C) 40 V (D) 0 V
11. When a resistor 'R' is connected to a voltage source, it consumes a power of 5 W in the circuit and when the same 'R' is connected to a current source having the same magnitude as the voltage source, the power absorbed by 'R' is 125 W. The magnitude of the voltage source is :
- (A) 5 V (B) 25 V
(C) 12.5 V (D) 62.5 V
12. A series R-L-C circuit is connected across a constant voltage and variable frequency supply. When the frequency is varied, the current is maximum and in phase with the voltage, so that the :
- (A) Voltages across R and LC are equal
(B) Voltages across R and L are equal
(C) Voltages across L and C are equal
(D) Voltages across RL and C are equal
13. In the circuit shown in Fig. 4, find the value of resistance 'R' required for the transfer of maximum power to the load R_L having a resistance of 11Ω .

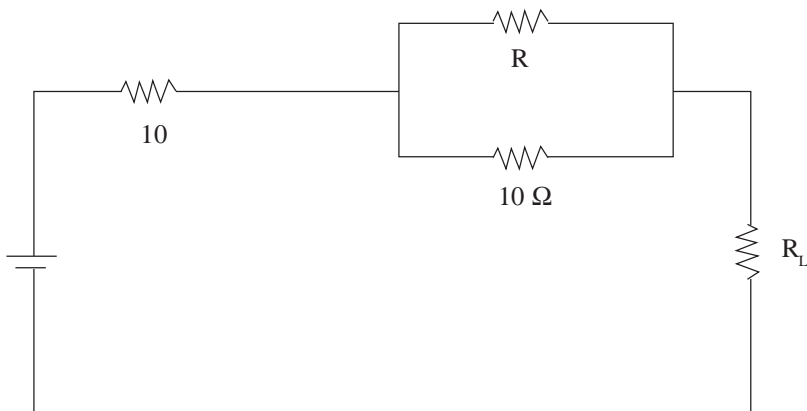


Fig. 4

- (A) $10/9 \Omega$ (B) $9/10 \Omega$
(C) $1/10 \Omega$ (D) $1/9 \Omega$

14. In a Cathode Ray Oscilloscope, the time base signal is applied to :

- (A) Y-Plates
- (B) X-Plates
- (C) either X or Y Plates
- (D) both X and Y Plates

15. The voltage and current waveforms of an element are shown in Fig. 5. The value of the element is :

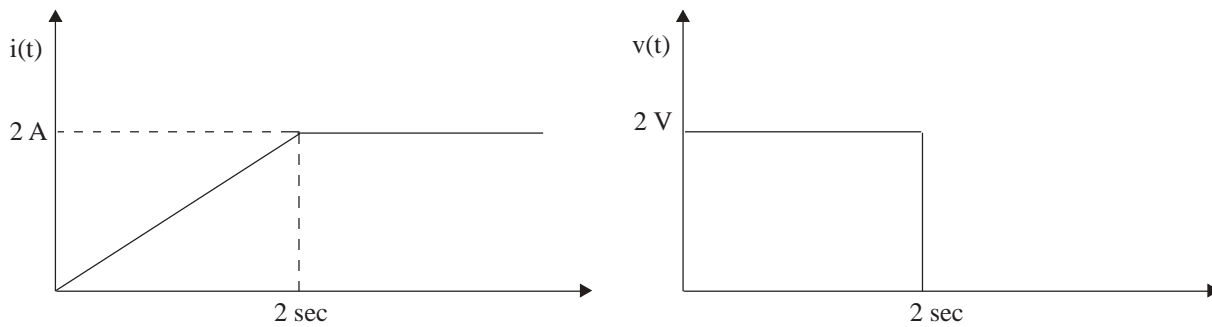


Fig. 5

- (A) 2 H
- (B) 1 H
- (C) 2 F
- (D) 1 F

21. The characteristic equation of a second order system is given by : $s^2 + 20 \zeta s + 100$. The Un-damped natural frequency is :
- (A) 100 rad/sec
 - (B) 10 rad/sec
 - (C) 1000 rad/sec
 - (D) 20 rad/sec
22. Signal flow graph is used to obtain the :
- (A) Transfer function of a system
 - (B) Stability of a system
 - (C) Controllability of a system
 - (D) Observability of a system
23. Which semi-conductor device behaves like two SCRs in anti-parallel ?
- (A) UJT
 - (B) Triac
 - (C) Diac
 - (D) FET
24. In Force-Current analogy, mass is analogous to :
- (A) Current
 - (B) Resistance
 - (C) Capacitance
 - (D) Voltage
25. Which of the following systems provides excellent transient and steady-state response ?
- (A) Proportional action
 - (B) Proportional & Differential action
 - (C) Proportional & Integral action
 - (D) Proportional & Differential & Integral action

26. The transfer function of a system is given by : $F(s) = \frac{100(1+0.25s)}{(1+0.5s)}$. The corner frequencies are :
- (A) -4 and -2 (B) 4 and 2
 (C) 0.25 and 0.5 (D) -0.25 and -0.5
27. The number of roots on the equation $s^3 - 4s^2 + s + 6 = 0$ that lie in the right half of s-plane is :
- (A) Three (B) Two
 (C) One (D) Zero
28. In phase lead compensation :
- (A) Both Bandwidth and overshoot decreases
 (B) Bandwidth decreases and overshoot increases
 (C) Bandwidth increases and overshoot decreases
 (D) Both Bandwidth and overshoot increases
29. For a feedback control systems of Type 1 and Type 2, the respective values of steady-state error for ramp input are :
- (A) Zero and infinite (B) Zero and finite
 (C) Finite and zero (D) Infinite and zero
30. The polar plot of a transfer function is shown in Fig. 7. Choose a correct statement from the following :

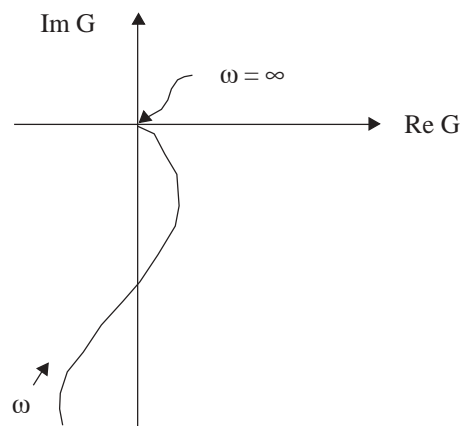


Fig. 7

- (A) The finite zero is closer to the origin than the finite pole
 (B) The finite pole is closer to the origin than the zero
 (C) The system is unstable
 (D) None of the above

31. A dc generator has 8 poles. A mechanical brush shift of 4° means a brush shift of :
- (A) 4° (B) 8°
(C) 12° (D) 16°
32. If a 200 V dc generator is run at full speed without any excitation, then its induced emf is :
- (A) 190 V to 200 V (B) 90 to 100 V
(C) 2 V to 5 V (D) Zero volt
33. In a dc series motor, at high armatures torques after saturation, the armature current is proportional to :
- (A) Torque^{0.5} (B) Torque
(C) Torque^{1.5} (D) Torque²
34. In dc motors, the electric braking which consumes negative power is :
- (A) Plugging (B) Counter-current braking
(C) Dynamic braking (D) Regenerative braking
35. A dc series motor drives a load whose torque varies as square of the speed. When the speed is 1000 rpm, the line current is 10 A. If the speed is halved, then the line current is :
- (A) 5 A (B) 10 A
(C) 14.14 A (D) 20 A
36. A 220 V dc shunt motor runs at a speed of 800 rpm. If this machine is run as a generator and takes same line current from 220 V, then the speed will be :
- (A) Equal to 800 rpm (B) Slightly greater than 800 rpm
(C) Slightly less than 800 rpm (D) Equal to 400 rpm
37. The losses that are proportional to frequency are (a) Eddy current loss (b) Armature copper loss (c) Field copper loss (d) Hysteresis loss :
- (A) (a) and (b) are true (B) (b) and (c) are true
(C) (c) and (d) are true (D) (d) and (a) are true

44. If the power factor of an alternator is zero lagging, then the armature reaction is :
- (A) Demagnetizing only (B) Magnetizing only
(C) Cross-magnetizing only (D) Both demagnetizing and cross-magnetizing
45. In a 3-phase induction motor at full load, the ratio of frequency of rotor current to frequency of stator current is equal to :
- (A) unity (B) 1-slip
(C) 2-slip (D) Slip
46. At slip equal to zero and slip equal to nearly zero, the torques developed by a 3-phase induction motor are :
- (A) Starting torque and full load torque respectively
(B) Starting torque and zero torque respectively
(C) Zero torque and full load torque respectively
(D) Zero torque and starting torque respectively
47. The equivalent rotor resistance of a 3-phase, 4 pole, 50 Hz induction motor referred from stator side is 0.2Ω at a full load speed of 1450 rpm. The electrical equivalent of mechanical load is :
- (A) 5.8Ω (B) 6.0Ω
(C) 3.0Ω (D) 2.9Ω
48. A 2000 kVA, 200 Hz transformer is operated at 50 Hz. At constant flux operation, its kVA rating should be restricted to :
- (A) 8000 (B) 1000
(C) 500 (D) 2000
49. A 3-phase, star connected, 440 V, 50 Hz induction motor is to be operated at 30 Hz. If air-gap flux is to be maintained constant, then the approximate per phase voltage that should be applied is :
- (A) 440 V (B) 254 V
(C) 152 V (D) 264 V

50. The running current of a 3-phase induction motor is lower than starting current because :
- (A) Voltage is low (B) Impedance is low
(C) Slip is high (D) Impedance is high
51. Which one of the following is Maxwell-Faraday's equation ?
- (A) $\nabla \times \mathbf{D} = \rho_f$ (B) $\nabla \times \mathbf{B} = 0$
(C) $\nabla \times \mathbf{E} = -\frac{\partial \mathbf{B}}{\partial t}$ (D) $\nabla \times \mathbf{H} = \mathbf{J}_f + \frac{\partial \mathbf{D}}{\partial t}$
52. Conductance is analogous to :
- (A) Flux (B) Reluctance
(C) Permeance (D) Flux density
53. A magnetic circuit requires 1000 AT to produce a certain quantity of flux. If the exciting coil of the magnetic circuit has 100 turns and 10Ω resistance, the voltage to be applied to the exciting coil is :
- (A) 1000 V (B) 1 V
(C) 10 V (D) 100 V
54. A collapsing field around a coil :
- (A) Opposes flow of current (B) Aids flow of current
(C) Opposes decay of current (D) Aids decay of current
55. The line integral of the vector potential \mathbf{A} around the boundary surface S represents :
- (A) Flux through surface S (B) Flux density in the surface S
(C) Magnetic density (D) Current density
56. In a uniform electric field, field lines and equi-potentials :
- (A) Do not intersect (B) Intersect at 45°
(C) Intersect at 90° (D) Intersect at 135°
57. Lightning arrester is located near to a :
- (A) generator (B) transformer
(C) bus-bar (D) circuit-breaker

58. Divergence of the three dimensional radial vector field \vec{F} is :
- (A) $1/r$ (B) 3
 (C) $3(\hat{i} + \hat{j} + \hat{k})$ (D) 3
59. An emf of 10 V is induced in a coil of inductance 5 H. The rate of change of current is :
- (A) 50 A/sec (B) 0.5 A/sec
 (C) 2.0 A/sec (D) 5.0 A/sec
60. An electro-magnetic field is radiated from :
- (A) A stationary point charge (B) A capacitor with a dc voltage
 (C) A conductor carrying a dc current (D) An oscillating dipole
61. An 0 – 10 A ammeter has a guaranteed accuracy of 1% of full scale deflection. The limiting error while reading 2.5 A is :
- (A) 1% (B) 2%
 (C) 4% (D) None of the above
62. The difference between the measured value and the true value is called :
- (A) Gross error (B) Relative error
 (C) Probable error (D) Absolute error
63. If the instrument is to have a wide range, the instrument should have :
- (A) Linear scale (B) Square law scale
 (C) Logarithmic scale (D) Exponential scale
64. For measuring rms values of any ac current at high frequency, the instrument that can be used is :
- (A) Moving iron instrument (B) Moving coil instrument
 (C) Thermo-couple instrument (D) Electro-static instrument
65. A switched mode power supply operating at 20 kHz to 100 kHz range uses _____ as the main switching element.
- (A) Thyristor (B) Triac
 (C) UJT (D) MOSFET

66. In a Megger, controlling torque is provided by :
- (A) Spring (B) Gravity
(C) Coil (D) Eddy current
67. For measurement of frequency, the suitable bridge is :
- (A) Schering bridge (B) Maxwell's bridge
(C) Wein bridge (D) All the above
68. The material used for shunts in ac instruments is :
- (A) Manganin (B) Constantan
(C) Copper (D) Silver
69. The pressure coil of an induction type energy meter is :
- (A) Highly inductive (B) Highly resistive
(C) Purely inductive (D) Purely resistive
70. The braking torque produced by a permanent magnet in a single phase energy meter is proportional to :
- (A) Square of the flux of the permanent magnet
(B) Speed of the meter
(C) Distance of permanent magnet from the center of the revolving disc
(D) All the above
71. An energy meter disc makes 10 revolutions in 100 seconds when a load of 500 W is connected to it. The meter constant is :
- (A) 1000 rev/kWh (B) 500 rev/kWh
(C) 1440 rev/kWh (D) 720 rev/kWh
72. A CRO screen has ten divisions on the horizontal scale. If a voltage signal $v = 10 \sin (314 t + 30^\circ)$ is examined with a time base setting of 10 msec/division, the number of cycles of signal displayed on the screen will be :
- (A) 1 cycle (B) 5 cycles
(C) 2.5 cycles (D) 10 cycles

73. The X plate and Y plate inputs to a CRO are $10 \cos (100 t + \theta)$ and $10 \sin (100 t + \theta)$ respectively. The resulting Lissajous pattern is :
- (A) An inclined straight line (B) An inclined ellipse
(C) A circle (D) A horizontal line
74. The amplifier used in an electronic voltmeter is :
- (A) Differential amplifier (B) Buffer amplifier
(C) Power amplifier (D) Wideband amplifier
75. An integrating digital voltmeter measures :
- (A) peak value (B) average value
(C) rms value (D) all the above
76. Power factor of a synchronous motor can be varied by varying :
- (A) applied voltage (B) supply frequency
(C) excitation (D) load
77. In 180° mode conduction of 3-phase inverter feeding a 3-phase induction motor, at any given time :
- (A) Only one device conduct and current flows through two phases
(B) Only two devices conduct and current flows through two phases
(C) Three devices conduct and current flows through three phases
(D) Four devices conduct and current flows through three phases
78. A dc chopper feeds a voltage of 230 V to a separately excited dc motor. The back emf of the motor is 210 V and armature current is discontinuous. During the time the armature current is zero, the armature voltage equal to _____.
- (A) 230 V (B) 210 V
(C) 20 V (D) 440 V
79. A single-phase half wave converter dc drive operates in :
- (A) First & fourth quadrants (B) First quadrant only
(C) First & second quadrants (D) Second quadrant only

80. A three-phase semi-converter can work as :
- (A) Converter for firing angle $\alpha = 0$ to 180°
 - (B) Converter for firing angle $\alpha = 0$ to 90°
 - (C) Inverter for firing angle $\alpha = 90^\circ$ to 180°
 - (D) Inverter for firing angle $\alpha = 0$ to 90°
81. If a step-up chopper has a output voltage of 100 V and the duty ratio is 75%, then the input voltage is :
- (A) 75 V
 - (B) 133 V
 - (C) 400 V
 - (D) 25 V
82. A voltage source inverter is normally employed when :
- (A) Source impedance is large and load impedance is small
 - (B) Source impedance is small and load impedance is large
 - (C) Source impedance is large and load impedance is large
 - (D) Source impedance is small and load impedance is small
83. A three-phase induction is fed from a 3-phase inverter which contain predominant 5th and 7th harmonics. Choose a correct statement from the following :
- (A) Both the 5th & 7th harmonics contribute positive sequence torques
 - (B) Both the 5th & 7th harmonics contribute negative sequence torques
 - (C) 5th & 7th harmonics contribute negative & positive sequence torques
 - (D) 5th & 7th harmonics contribute positive & negative sequence torques
84. The approximate value of slip of a 3-phase induction motor is unity for (a) fundamental voltage (b) fifth harmonic voltage (c) seventh harmonic voltage :
- (A) (a) and (b) are true
 - (B) (b) and (c) are true
 - (C) (c) and (a) are true
 - (D) (a), (b) and (c) are true
85. A 200 V, single-phase input ac voltage controller gives an output voltage of 128 V with a resistive load. The input power factor is :
- (A) 0.80
 - (B) 0.64
 - (C) 0.5
 - (D) 1.00

86. For a lossless line, the characteristics impedance is :
- (A) $\sqrt{C/L}$ (B) \sqrt{LC}
(C) $\sqrt{L/C}$ (D) $\sqrt{1/LC}$
87. The surge impedance of a 3-phase 400 kV transmission line is 400 Ω . The surge impedance loading is :
- (A) 400 MW (B) 100 MW
(C) 1600 kW (D) 400 kW
88. In a overhead transmission line :
- (A) $\text{Sag}^2/\text{Span} = \text{constant}$ (B) $\text{Sag}/\text{Span}^2 = \text{constant}$
(C) $\text{Sag}/\text{Span} = \text{constant}$ (D) $\text{Sag} \times \text{Span} = \text{constant}$
89. Equal area criteria is applicable for :
- (A) Single-machine system (B) Two-machine system
(C) Multi-machine system (D) All the above
90. The transient stability limit of a power system can be appreciably increased by :
- (A) Series inductance (B) Shunt inductance
(C) Series capacitance (D) Shunt capacitance
91. Reactance relay is normally preferred for protection against :
- (A) Phase faults (B) Open circuit faults
(C) Earth faults (D) None of the above
92. Resistance switching is normally employed in :
- (A) Bulk oil breakers (B) Air-blast circuit breakers
(C) Minimum oil breakers (D) All the above
93. In dc circuit breakers, arc quenching is done by :
- (A) Zero current interruption (B) Low resistance interruption
(C) High resistance interruption (D) Normal resistance interruption
94. The rupturing capacity of a circuit breaker is measured by :
- (A) Current (B) Voltage
(C) Active power (D) Apparent power

95. A power system is subjected to a fault which makes the zero sequence component of current equal to zero. The nature of fault is :
- (A) Double line to ground fault
 - (B) Double line fault
 - (C) Line to ground fault
 - (D) Three-phase to ground fault
96. With positive feedback in an amplifier circuit, the gain will :
- (A) Increase
 - (B) Decrease
 - (C) Remain constant
 - (D) Decreases first and then remains constant
97. The phenomena of converting mechanical energy into electrical energy and vice-versa using crystals is called :
- (A) Piezo-conductivity effect
 - (B) Piezo-magnetic effect
 - (C) Piezo-electric effect
 - (D) Piezo-photo effect
98. In the saturation region, the JFET transfer characteristics are :
- (A) Exponential
 - (B) Linear
 - (C) Parabolic
 - (D) Hyperbolic
99. The common base configuration is useful when a _____ is required.
- (A) High current gain
 - (B) Low output resistance
 - (C) Low input resistance
 - (D) High voltage gain
100. Cascading of amplifier stages to obtain high power gain is done with :
- (A) Common emitter stages
 - (B) Common base stages
 - (C) Common collector & common emitter stages
 - (D) Common base & common collector stages
101. Vacuum diode can be used as :
- (A) Detector and rectifier
 - (B) Rectifier and oscillator
 - (C) Oscillator and Amplifier
 - (D) Amplifier and detector
102. Triode can be used as an amplifier only for :
- (A) High frequencies
 - (B) Low frequencies
 - (C) Very high frequencies
 - (D) All the above

103. An intrinsic semi-conductor at absolute zero :
- (A) Behaves like a metallic conductor (B) Behaves like an insulator
 (C) Has a large number of holes (D) Has a large number of electrons
104. Junction breakdown of a semi-conductor occurs :
- (A) Because of manufacturing defect (B) Because of high temperature
 (C) During forward bias (D) During reverse bias
105. For every 10°C rise in temperature, reverse current of a Germanium diode practically :
- (A) Remains constant (B) Becomes half
 (C) Doubles (D) Triples
106. A positive clipper circuit always clips :
- (A) Some part of upper portion of the input signal
 (B) Time period input signal
 (C) Lower portion of input signal
 (D) Both upper and lower portions of input signal
107. In a centre tapped full-wave rectifier, if the peak voltage between the centre tap and one end of secondary is 160 V, then the maximum voltage across the reverse biased diode is :
- (A) 80 V (B) 160 V
 (C) 226 V (D) 320 V
108. The ripple factor of a full-wave rectifier without filter is :
- (A) 0.482 (B) 1.11
 (C) 1.21 (D) 1.57
109. The function of the base in the transformer is analogous to _____ in the triode.
- (A) Plate (B) Cathode
 (C) Grid (D) Heater
110. For transistor operation :
- (A) Emitter-base is forward biased and Collector-base is reverse biased
 (B) Emitter-base is reverse biased and Collector-base is forward biased
 (C) Both Emitter-base and Collector-base are forward biased
 (D) Both Emitter-base and Collector-base are reverse biased

111. The 'On state' MOSFET switch is equivalent to a :
- (A) Resistor (B) Inductor
(C) Capacitor (D) Battery
112. The Q-point in a voltage amplifier is selected in the middle of the active region so that :
- (A) It gives distortion—free output
(B) It needs a small dc voltage
(C) The operating point becomes very stable
(D) Power loss is minimum
113. The input signal to an amplifier having a gain of 100 is given by $0.5 \sin 314t$. The output signal is :
- (A) $100 \sin (314 t - 180^\circ)$ (B) $100 \cos (314 t + 180^\circ)$
(C) $200 \sin (314 t - 180^\circ)$ (D) $50 \sin (314 t + 180^\circ)$
114. A transformer audio amplifier is found to have an overall efficiency of the order of 70% is a :
- (A) Class A push-pull amplifier (B) Class B push-pull amplifier
(C) Single-stage class C amplifier (D) Direct coupled amplifier
115. For tuned radio-frequency, the amplifier that can be used is :
- (A) Class A amplifier (B) Class B amplifier
(C) Class C amplifier (D) Class AB amplifier
116. The Silicon controlled rectifier is a :
- (A) Three junction, three terminal & three layer device
(B) Three junction, three terminal & four layer device
(C) Four junction, three terminal & three layer device
(D) Four junction, four terminal & four layer device
117. If an audio signal of 2 kHz is used to modulate a carrier of 500 kHz, the bandwidth of AM transmission is :
- (A) 2 kHz (B) 1 MHz
(C) 250 kHz (D) 4 kHz

118. In frequency modulation, if depth of modulation is doubled, then power transmitted will become :

- (A) Double
- (B) Remain unchanged
- (C) One & half times
- (D) 1.41 times

119. The most stable sine-wave oscillator is :

- (A) Colpitts oscillator
- (B) Armstrong oscillator
- (C) Phase-shift oscillator
- (D) Crystal oscillator

120. The number of flip-flops required in a decade counter is :

- (A) Two
- (B) Three
- (C) Four
- (D) Ten

ROUGH WORK

ROUGH WORK