



Bhavani

GOVERNMENT OF INDIA :: DEPARTMENT OF SPACE  
INDIAN SPACE RESEARCH ORGANISATION  
ISRO Centralised Recruitment Board  
Recruitment Entrance Test for Scientist/Engineer 'SC' 2014  
May 24, 2014 Saturday

Test Booklet

|  |    |
|--|----|
| Test Duration<br>(Minutes)                 | 90 |
| No of Questions                            | 80 |
| No of Pages<br>(Other than cover<br>sheet) | 13 |

ELECTRICAL

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Instructions to the candidate

1. The question paper is in the form of test booklet with **80** questions.
2. A separate **OMR** answer sheet is provided for answering.
3. Each question is provided with a text and figure wherever applicable with **multiple answer choices (a), (b), (c) and (d)**. Only one of them is correct.
4. Read the instructions on the **OMR** sheet carefully. Use only **HB pencil** for writing on OMR sheet and marking your answers.
5. All questions carry equal marks of **THREE** for a correct answer, **ZERO** for no answer and minus **ONE** for a wrong answer.
6. **Multiple answers** for a question will be regarded as a wrong answer.
7. Although the test stresses on accuracy more than speed, it is important for you to use your time as effectively as possible.
8. Do not waste time on questions, which are too difficult for you. Go on to other questions and come back to the difficult ones later.
9. Question booklets have been marked with **A** or **B** or **C** or **D** or **E** on the right hand top corner, which is mandatory to be written on the OMR sheet in the box and bubble appropriately, failing which, the answer sheet will not be evaluated.
10. Space available in the booklet could be used for rough work, if required. No separate sheet will be provided.
11. Before signing the attendance sheet, the candidate should write the Booklet Code in the attendance sheet

1. A 6 pole, 50 Hz, 3-Φ induction motor is running at 950 rpm and has rotor Cu loss of 5kW.  
Its rotor input is \_\_\_\_\_ kW

(A) 100  
(C) 95

(B) 10

(D) 5.3

$$\Rightarrow 1.5 \times 10^3$$

$$\text{rotor loss} = 5 \times 5 \times 10^3 \rightarrow \text{IP} = 0.95 \times 5 \times 10^3$$

2. In the shaded pole squirrel cage induction motor the flux in the shaded part always

- (A) Leads the flux in the un-shaded pole segment  
(C) is in out of phase with the flux in the un-shaded pole segment

- (B) lags the flux in the un-shaded pole segment  
(D) is in phase with the flux in the un-shaded pole segment

3. A saturable core reactor is basically a

- (A) variable resistor  
(C) thermal relay

- (B) step down transformer  
(D) variable impedance

4. If a body reflects entire radiation incident on it then it is known as,

- (A) Black body  
(C) White body

- (B) Grey body  
(D) Transparent body

5. The illumination is directly proportional to the cosine of the angle made by the normal to the illuminated surface with the direction of the incident flux. Above statement is associated with

- (A) Planck's law  
(C) Bunsen's law of illumination

- (B) Macbeth's law of illumination  
(D) Lambert's cosine law.

6. The concentration of minority carriers in an extrinsic semiconductor under equilibrium is

- (A) Directly proportional to the doping concentration  
(C) Directly proportional to the intrinsic concentration

- (B) Inversely proportional to the doping concentration  
(D) Inversely proportional to the intrinsic concentration

7. Reactance relay is normally preferred for protection against

- (A) Over load currents only  
(C) Earth faults only

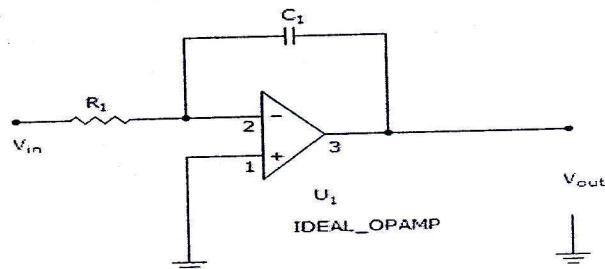
- (B) Phase faults only  
(D) High voltage protection only



11. In a nuclear power station, moderator is used to,

- (A) absorb neutrons      (B) reduce the speed of neutrons  
(C) accelerate the speed of neutrons      (D) stop chain reactions

12. What is the output waveform when  $V_{in}$  is given square wave?






13. A pony motor is used for the starting of which of the following motor

- (A) Squirrel cage Induction motor      (B) Schrage Motor  
(C) Synchronous Motor ✓      (D) Hysteresis Motor



14. A PWM switching scheme is used with three phase inverter to

- (A) ~~reduce low order harmonics and increase high order harmonics~~ (B) minimize the load on the DC side.
- (C) increase the life of the batteries. (D) reduce the total harmonic distortion with modest filtering

15. The earth wire should not be thinner than a

- (A) 20 SWG wire (B) 16 SWG wire  
 (C) 10 SWG wire (D) ~~8 SWG wire~~

16. The ripple factor of a full-wave rectifier circuit compared to that of a half wave rectifier circuit without filter is

- (A) half of that for a half wave rectifier (B) less than half that for a half-wave rectifier circuit  
 (C) equal to that of a half wave rectifier (D) more than half that for a half-wave rectifier circuit

17. In a highly inductive circuit , a small capacitance is added in series. Then the angle between applied voltage and resultant current will be

- (A) increase (B) decrease  
 (C) remains absolutely unaltered (D) alter insignificantly

18. The inertia constant of the two machines which are not swinging together are M<sub>1</sub> and M<sub>2</sub>. The equivalent inertia constant of the system is:

- (A) M<sub>1</sub>-M<sub>2</sub> (B) M<sub>1</sub>+M<sub>2</sub>  
 (C) M<sub>1</sub>M<sub>2</sub>/(M<sub>1</sub>+M<sub>2</sub>) (D) M<sub>1</sub>M<sub>2</sub>/(M<sub>1</sub>-M<sub>2</sub>)

19. A voltage source inverter is used to control the speed of a three-phase, 50 Hz squirrel cage induction motor. Its slip for rated torque is 4%. The flux is maintained at rated value. If the stator resistance and rotational losses are neglected, then the impressed voltage to obtain twice the rated torque at starting should be

- (A) 10 Hz (B) 5Hz  
 (C) 2 Hz (D) ~~4 Hz~~

20. The charge on an electron is known to be  $1.6 \times 10^{-19}$  coulomb. In a circuit the current flowing is 1 A. How many electrons will be flowing through the circuit in a second?

- (A)  $1.6 \times 10^{19}$   
 (C)  $0.625 \times 10^{19}$

- (B)  $1.6 \times 10^{-19}$   
 (D)  $0.625 \times 10^{12}$ .

$$\frac{1.6 \times 10^{-19}}{1} \times 1 = 1.6 \times 10^{-19}$$

21. A thermal protection switch is used to provide protection against:

- (A) Over load  
 (C) Short circuit

- (B) Temperature  
 (D) Over voltage

22. With V/F ratio keeping constant, if the frequency is decreased below the base value and the voltage is decreased proportionally, is fed to an Induction motor, its starting torque and the peak torque for variable frequency & voltages will be

- (A) both starting torque and peak torque will remain constant

- (C) starting torque will remain constant and peak torque will vary and the

- (B) Starting torque will increase and the peak torque remains constant

- (D) both starting torque and peak torque will decrease

23. A function  $f$  from the set of natural numbers to integers defined by

$$f(n) = \begin{cases} \frac{n-1}{2}, & \text{when } n \text{ is odd} \\ -\frac{n}{2}, & \text{when } n \text{ is even} \end{cases}$$

- (A) one-one and but not onto

- (C) one-one and onto both

- (B) onto but not one-one

- (D) neither one-one nor onto

24. If the sum of the roots of the quadratic equation  $ax^2 + bx + c = 0$  is equal to the sum of the squares of their reciprocals, then  $\frac{a}{c}, \frac{b}{a}$  and  $\frac{c}{b}$  are in

- (A) arithmetic progression

- (C) arithmetic-geometric-progression

- (B) geometric progression

- (D) harmonic progression

25. If  $\left(\frac{1+i}{1-i}\right)^x = 1$ , then

- (A)  $x = 2n + 1$ , where  $n$  is any positive integer

- (C)  $x = 4n + 1$ , where  $n$  is any positive integer

- (B)  $x = 2n$ , where  $n$  is any positive integer

- (D)  $x = 4n$ , where  $n$  is any positive integer



26. If a vertex of a triangle is  $(1, 1)$  and the mid-points of two sides through this vertex are  $(-1, 2)$  and  $(3, 2)$ , then the centroid of the triangle is

- (A)  $(-1, 7/3)$   
(B)  $(-1/3, 7/3)$   
(C)  $(1, 7/3)$   
(D)  $(1/3, 7/3)$

27. Let  $A = \begin{pmatrix} 0 & 0 & -1 \\ 0 & -1 & 0 \\ -1 & 0 & 0 \end{pmatrix}$ . The only correct statement about the matrix A is

- (A) A is a zero matrix  
(B)  $A^2 = I$   
(C)  $A^{-1}$  does not exist  
(D)  $A = (-1)I$ , where I is a unit matrix

28. If one root of the equation  $x^2 + px + 12 = 0$  is 4, while the equation  $x^2 + px + q = 0$  has equal roots, then the value of 'q' is

- ~~(A)  $\frac{49}{4}$~~   
(B) 4  
(C) 3  
(D) 12

29. A person standing on the bank of a river observes that the angle of elevation of the top of a tree on the opposite bank of the river is  $60^\circ$  and when he retires 40 meter away from the tree the angle of elevation becomes  $30^\circ$ . The breadth of the river is

- (A) 60 m  
(B) 30 m  
(C) 40 m  
(D) 20 m

30. A particle moves towards east from a point A to a point B at the rate of 4 km/h and then towards north from B to C at the rate of 5 km/h. If  $AB = 12$  km and  $BC = 5$  km, then its average speed for its journey from A to C and resultant average velocity direct from A to C are respectively

- ~~(A)  $\frac{17}{4}$  km/h and  $\frac{13}{4}$  km/h~~  
(B)  $\frac{13}{4}$  km/h and  $\frac{17}{4}$  km/h  
(C)  $\frac{17}{9}$  km/h and  $\frac{13}{9}$  km/h  
(D)  $\frac{13}{9}$  km/h and  $\frac{17}{9}$  km/h



31. If  $\tan \theta = 8 / 15$  and  $\theta$  is acute, then cosec  $\theta$

- (A)  $8 / 17$   
 (C)  $17 / 8$

- (B)  $8 / 15$   
 (D)  $17 / 15$

32. A student is to answer 10 out of 13 questions in an examination such that he must choose at least 4 from the first five questions. The number of choices available to him is

- (A) 140  
 (C) 280

- (B) 196  
 (D) 346

33. A Meter has a full scale deflection of  $90^\circ$  at a current of 1A. The response of the meter is square law. Assuming spring control, the current for a deflection at  $45^\circ$  will be

- (A) 0.25  
 (C) 0.707

- (B) 0.50  
 (D) 0.67

34. A Single-phase Energy meter is operating on 230V, 50 Hz supply with a load of 20A for two hours at UPF. The meter makes 1380 revolutions in that period. The meter constant is

- (A) 695 rev/kWh  
 (C) 0.15 rev/kWh

- (B) 150 rev/kWh  
 (D) 1/150 rev/kWh

35. In case of power measurements by two wattmeter method in a balanced 3-phase system with pure inductive load

- (A) both wattmeters will indicate the same value but with opposite signs  
 (B) both wattmeters will indicate zero  
 (C) both the wattmeters will indicate the same value same sign  
 (D) one wattmeter will indicate zero and the other will indicate some non-zero value

36. It is required to measure temperature in the range of  $1300^\circ\text{C}$  to  $1500^\circ\text{C}$ . The most suitable thermocouple to be used as transducer would be

- (A) Chromel - constantan  
 (C) Chromel - alumel

- (B) Iron-constantan  
 (D) Platinum-rhodium

37. Which dc motor will have highest percentage increase in input current for given percentage increase in torque

- (A) Series motor  
 (C) cumulatively compound motor

- (B) shunt motor  
 (D) separately excited motor

38. In a three phase delta transformer, one phase burns up. The transformer will supply

- (A) 57.7% of its rating /
- (B) zero output
- (C) 63% of its output rating
- (D) at full output rating

39. In an auto transformer, power is transferred through

- (A) conduction process alone
- (B) induction process alone
- (C) both conduction and induction processes
- (D) mutual coupling

40. Buchholz relay is a

- (A) voltage sensitive device
- (B) current sensitive device
- (C) frequency sensitive device
- (D) gas actuated device

41. In Scott connection, if the ratio of the main transformer is  $k$ , then the teaser transformer has transformation ratio of

- (A)  $2k/\sqrt{3}$
- (B)  $\sqrt{3}k/2$
- (C)  $K/\sqrt{3}$
- (D)  $K/2$

42. With core type transformers, the limbs are stepped so as to

- (A) reduce the iron material and therefore iron loss
- (B) provide better cooling
- (C) reduce the conductor material and therefore  $I^2 R$  loss
- (D) provide more mechanical strength to the core

43. In alternator, during hunting when the speed becomes super synchronous, the damper bars develop

- (A) reluctance torque
- (B) pseudo-stationary torque
- (C) eddy current torque
- (D) induction generator torque

44. It is never advisable to connect a stationary alternator to live bus-bar because it

- (A) is likely to run as a synchronous motor
- (B) will get short circuited
- (C) will decrease bus-bar voltage though momentarily
- (D) will disturb generated emfs of other alternators connected in parallel



45. Under no load condition, the angle between the induced voltage and the supply voltage in synchronous motor is

- (A) zero
- (B)  $45^\circ$
- (C)  $90^\circ$
- (D)  $180^\circ$

46. Synchronous motors are not self starting because

- (A) Stator not used
- (B) Starting winding not provided
- (C) There is no slip
- (D) The direction of instantaneous torque on the rotor reverses after half cycle

47. A three phase induction motor running at 1440 rpm on rated supply will run at the following rpm when fuse of one phase gets burnt

- (A) 1440
- (B) 1380
- (C) 1500
- (D) zero

48. Dispersion coefficient  $\sigma$  is the ratio of

- (A) magnetizing current to supply voltage
- (B) open circuit voltage to short circuit current for the same excitation
- (C) magnetizing current to ideal short circuit current
- (D) short circuit current to magnetizing current

49. In the circle diagram for a 3-phase induction motor, the diameter of the circle is determined by

- (A) total stator current
- (B) exciting current
- (C) rotor current
- (D) rotor current referred to stator

50. While conducting short-circuit test on a transformer the following side is short circuited

- (A) High voltage side
- (B) low voltage side
- (C) primary side
- (D) secondary side

51. Thrust developed by a linear induction motor depends on

- (A) synchronous speed
- (B) rotor input
- (C) rotor input and synchronous speed
- (D) number of poles



52. The crawling in an induction motor is caused by

- (A) improper design of machine
- (B) low voltage supply
- (C) high loads
- ~~(D) harmonics developed in the motor~~

53. The main disadvantages of using short pitch winding in alternators is that it

- ~~(A) reduces harmonics in the generated voltage~~
- ~~(B) reduces the total voltage around the armature coils~~
- ~~(C) produces asymmetry in the three phase windings~~
- (D) Increases Cu of end connections.

54. Armature reaction in an alternator mainly affects

- (A) rotor speed
- (B) terminal voltage per phase
- (C) frequency of armature current
- ~~(D) generated voltage per phase~~

55. A universal motor is one which

- ~~(A) is available universally~~
- ~~(B) can be marketed internationally~~
- ~~(C) can be operated either on dc or ac supply~~
- (D) runs dangerously high speed on no load

56. If the field of a synchronous motor is under excited, the power factor will be

- ~~(A) lagging~~
- ~~(B) leading~~
- (C) Unity
- ~~(D) more than unity~~

57. Synchronous capacitor is

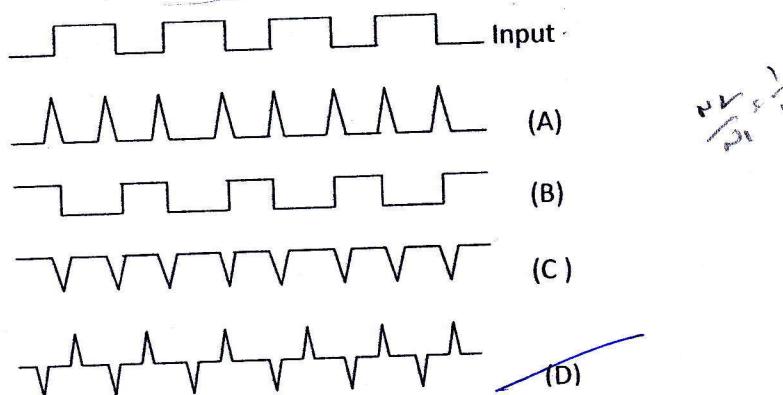
- ~~(A) An over excited synchronous motor running without mechanical load~~
- ~~(B) An over excited synchronous motor driving mechanical load~~
- ~~(C) An ordinary static capacitor bank~~
- (D) A rotating dynamic capacitor bank

58. Two bulbs, one 250V, 100 W and second 250V, 25 W are connected in series and 440V AC, 50Hz is applied across the two bulbs. Which of the following will happen,

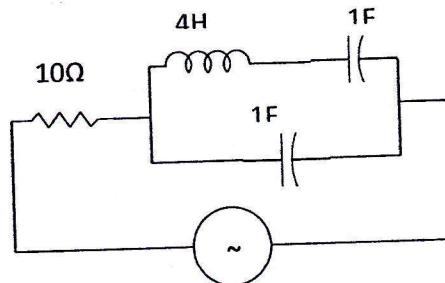
- ~~(A) 100 W bulb glows bright compare to 25 W bulb~~
- ~~(B) both 100 W bulb & 25 W bulb will glow normal~~
- ~~(C) 25W bulb will burn-out~~
- ~~(D) 25 W bulb glows bright compare to 100 W bulb~~



59. A wave form shown as Input is applied across primary of a pulse transformer which has 1:1 turns ratio. The output on the secondary side will be as shown in the Figure---



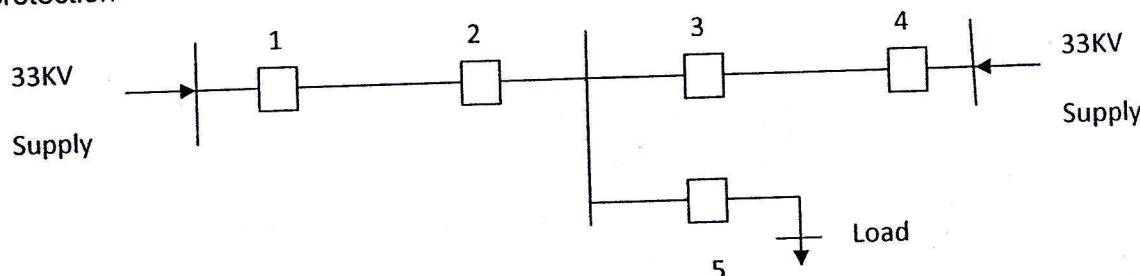
60. The following circuit (shown in Figure) resonates at



- (A) all frequencies  
(C) 5 rad / sec

- (B) 0.5 rad / sec  
(D) 1 rad / sec

61. The distribution system shown in Figure is to be protected by over current system of protection



For proper fault discrimination directional over current relays will be required at locations

- (A) 1 and 4  
(C) 1, 4 and 5

- (B) 2 and 3  
(D) 2, 3 and 5

62. A 50 Hz bar primary CT has a secondary with 500 turns. The secondary supplies 5 A current into a purely resistive burden of  $1 \Omega$ . The phase angle between the primary and secondary current is

- (A)  $4.6^\circ$   
(C)  $94.6^\circ$

- (B)  $85.4^\circ$   
(D)  $175.4^\circ$

63. The moving coil in a dynamometer wattmeter is connected
- (A) the two input terminals are directly shorted internally
  - (B) the open loop gain of the OPAMP is infinity and CMRR is infinity
  - (C) the input impedance of the OPAMP is infinity
  - (D) slew rate is very high

64. For an unbalanced fault with paths for zero sequence currents, at the point of fault

- (A) the negative & zero sequence voltages are minimum
- (B) the negative sequence voltage is maximum & zero sequence voltage is minimum
- (C) the negative sequence voltage is minimum & zero sequence voltage is maximum
- (D) the negative & zero sequence voltages are maximum

65. An ideal OPAMP is used to make an inverting amplifier. The two input terminals of the OPAMP are at the same potential because,

- (A) the two input terminals are directly shorted internally
- (B) the input impedance of the OPAMP is infinity and CMRR is infinity
- (C) the open loop gain of the OPAMP is infinity
- (D) slew rate is very high

66. What is the "swamping" resistance which is connected in series with the working coil of a voltmeter to drastically reduce the error in measurement caused due to variation in temperature is made up of?

- (A) Constantan
- (B) Eureka
- (C) Manganin
- (D) Nichrome

67. If the poles of a system lie on the imaginary axis, the system will be:

- (A) Stable
- (B) Conditionally stable
- (C) Marginally stable
- (D) Unstable

68. Which one of the following is the most likely reason for large overshoot in a control system

- (A) High gain in a system
- (B) Presence of dead time delay in a system
- (C) High positive correcting torque
- (D) High retarding torque



69. Which of the following correctly represents the sequence of operations of isolator circuit breaker and earthing switch while opening a circuit

- (A) Open circuit breaker - open isolator - close earthing switch
- (B) Open isolator - close circuit breaker - open earthing switch
- (C) Close earthing switch - open circuit breaker open isolator
- (D) Close circuit breaker - close isolator - open earthing switch.

70. A comparator circuit is used to

- (A) Mark the instant when an arbitrary waveform attains some reference level
- (B) Mark the instant when the input voltage becomes constant
- (C) Switch ON and OFF a circuit alternately at a particular rate
- (D) Switch OFF a circuit when output becomes zero

71. Out of the following methods of heating the one which is independent of supply frequency is

- (A) electric arc heating
- (B) induction heating
- (C) electric resistance
- (D) dielectric heating

72. An SCR triggered by current pulse applied to gate-cathode can be turned OFF

- (A) by applying a pulse to cathode
- (B) by applying a pulse to the anode
- (C) by applying another pulse of opposite polarity to the gate-cathode
- (D) by reversing the polarity of the anode and cathode voltage



73. In the loaded-frequency control system with tree governor action, the increase in load demand under steady condition is met,

- (A) only by decrease of load demand due to drop in system frequency
- (B) only by increased generation due to opening of steam valve
- (C) partly by increased generation and partly by decrease of load demand
- (D) partly by increased generation and partly by increased generator excitation

74. Power transmission lines are transposed to reduce

- (A) skin effect
- (B) Ferranti effect
- (C) Transmission loss
- (D) Interference with neighboring communication lines

