SOUTHERN RAILWAY

Limited Departmental Competitive Examination for Promotion from Group-C to Group-B
Electrical Engineering Department

Date   : 04.01.2020
Time   : 10.00 Hours

Total Marks : 150
Duration   : 3 Hours

PROFESSIONAL PAPER-I

Instructions to Candidates:

1. Do not write your name or any other identification mark anywhere on the answer book.
2. Answer to all questions should be written in the answer sheet only.
3. Use of Calculator is permitted.
4. Corrections of any type to the answers to Objective Type questions (Question No.1 to 25 Under Part-A – General Knowledge and 1 to 29 Part-B Professional Subject) are not permitted. In case any correction is made, that answer shall not be evaluated at all. The correction, may be any one of the following (the list is illustrative and not exhaustive) – cutting, over-writing, erasing off a ticked answer in multiple-choice and ticking another answer & modifying the answering any way.

PART-A – GENERAL KNOWLEDGE

All the 25 questions need to be answer. Each question carrys 2 marks each

1. The most literate Union Territory in India is
   (A) Delhi   (B) Lakshadweep   (C) Chandigarh   (D) Puducherry

2. Where was electricity supply first introduced in India
   (A) Kolkata   (B) Mumbai   (C) Darjeeling   (D) Chennai

3. The biggest contributor to National Income in India is
   (A) Service Sector (B) Agriculture   (C) Trade Sector   (D) Industrial Sector

4. Who is called Father of Modern Western Education in India?
   (A) Lord Irwin   B) William Bentick   (C) Lord Dalhousie   (D) Lord Hardinge

5. Which of the following will never get the vertical rays of the sun?
   (A) Mumbai   (B) Thiruvananthapuram   (C) Kolkata   (D) Chandigarh

6. The rockcut temples of Mahabalipuram were built were built under the patronage of the
   (A) Chola Kings   (B) Pallava Kings   (C) Pandya Kings   (D) Satavahana Kings

7. Which one of the following began with the Dandi March ?
   (A)Civil Disobedience Movement   (B) Quit India Movement
   (C)Non-Cooperation Movement   (D) Home Rule Movement

8. In India State known for Sandalwood is
   (A) Karnataka   (B) Assam   (C) Meghalaya   (D) Uttar Pradesh

9. Which of the following diseases is not caused by VIRUS?
   (A) Chicken Pox   (B) Dengue   (C) Cholera   (D) Polio

10. Which among following formulates fiscal policy?
    (A) Reserve Bank of India   (B) NITI Aayog   (C) President   (D)Finance Ministry

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11. The value of Rupee in international exchange is decided by
    (A) World Bank (B) Market Forces
    (C) Reserve Bank of India (D) International Monetary Fund

12. The which country shares longest border with India?
    (A) China (B) Pakistan (C) Bangladesh (D) Nepal

13. Which state has largest urban population in India?
    (A) Kerala (B) Maharashtra (C) Uttar Pradesh (D) Tamil Nadu

14. Which of the following is not a fundamental right in the Constitution of India?
    (A) Right to Equality (B) Right to Freedom
    (C) Right to Property (D) Right to Freedom of Religion

15. What is the capital of Zimbabwe?
    (A) Zuba (B) Sophia (C) Addis Ababa (D) Harare

16. What is Currency of France?
    (A) Dollar (B) Franc (C) Euro (D) Lira

17. In which city Olympics 2020 will be held?
    (A) London (B) Tokyo (C) Berlin (D) Beijing

18. The book 'The Wealth of Nation' was written by?
    (A) George Orwell (B) Adam Smith (C) Karl Marx (D) "Che" Guevara

19. President is elected by electoral college consisting of:-
    (A) Member of Parliaments
    (B) Member of Lok Sabha
    (C) All members of parliament & state legislative?
    (D) Elected members of parliament & state legislative?

20. The non-permanent members of Security Council are elected for period of:
    (A) 1 year (B) 2 year (C) 3 year (D) 4 year

21. How many trailing zeros will be there in rightmost non-zero digit in value of 25!?
    (A) 25 (B) 8 (C) 6 (D) 5

22. In a class of 40 students, 12 enrolled for both Physics and Chemistry. 22 enrolled for Chemistry. If the students of the class enrolled for at least one of the two subjects, then how many students enrolled for only Physics and not Chemistry?
    (A) 30 (B) 10 (C) 18 (D) 28

23. If the cost price of 20 articles is equal to the selling price of 25 articles, what is the % profit or % loss made by the merchant?
    (A) 25% loss (B) 25% profit (C) 20% loss (D) 20% profit

24. A wheel of a train of radius 50cm is rotating at 300 RPM. What is the speed of the train in km/hr?
    (A) 79.2 km/hr (B) 56.5 km/hr (C) 7.92 km/hr (D) 39.6 km/hr

25. 10 skilled workers can build a wall in 10 days; 8 semi-skilled workers can build a wall in 25 days; 20 unskilled workers can build a wall in 15 days. If a team has 2 skilled, 6 semi-skilled and 5 unskilled workers, how long will it take to build the wall ?
    (A) 20 days (B) 18 days (C) 16 days (D) 15 days

day
$sL - 10 - \frac{2}{10 \times 10} wall, \frac{1}{50}$

$10 \ sw \ 10 \ day \quad \frac{1}{10 \times 10} = \frac{1}{100} w$

Question No.1 to 30 are Objective Type each carries 2 marks. All questions need to be answered.

1. A Manganin swap resistance is connected in series with a moving coil ammeter consisting of a milli-ammeter and a suitable shunt in order to
   (A) minimise the effect of temperature variation
   (B) obtain large deflecting torque
   (C) reduce the size of the meter
   (D) minimise the effect of stray magnetic fields

2. Thin laminations are used in a machine in order to reduce:
   (A) Eddy current losses   (B) Hysteresis losses   (C) Stray Losses   (D) Copper losses

3. A parallel plate capacitor has an electrode area of 100 mm2, with spacing of 0.1 mm between the electrodes. The dielectric between the plates is air with a permittivity of 8.85×10^{-12} - F/m. The charge on the capacitor is 100 V. The stored energy in the capacitor is
   (A) 8.85 pJ   (B) 440 Pj   (C) 22.1 Nj   (D) 44.3 nJ

4. If Field winding of DC Shunt Motor get open circuited:
   (A) It will rotate at the same speed as that with its field winding closed
   (B) It will rotate at less speed as that with its field winding closed
   (C) It will rotate at dangerously high speed
   (D) It will stop running

5. A 4-pole induction motor, supplied by a slightly unbalanced three-phase 50 Hz source, is rotating at 1440 rpm. The electrical frequency in Hz of the induced negative sequence current in the rotor is
   (A) 100   (B) 98   (C) 52   (D) 48

6. An ammeter has a current range of 0-5 A, and its internal resistance is 0.2 Ω. In order to change the range to 0-25 A, we need to add a resistance of
   (A) 0.8 W in series with the meter
   (B) 1.0 W in series with the meter
   (C) 0.04 W in parallel with the meter
   (D) 0.05 W in parallel with the meter

7. Two wattmeters, which are connected to measure the total power on a three-phase system supplying a balanced load, read 10.5 kW and -2.5 kW, respectively. The total power and the power factor, respectively, are
   (A) 13.0 kW, 0.334
   (B) 13.0 kW, 0.684
   (C) 8.0 kW, 0.52
   (D) 8.0 kW, 0.334

8. Inter pole winding is connected in-------------------------- ?
   (A) series with armature
   (B) series with main poles
   (C) parallel with armature
   (D) parallel with main poles

9. A 4 pole lap wound dc generator has 4 brushes, if one of the brush is damaged, what will be the change in V, I and P ratings
   (A) V, I and P
   (B) V/2, I/2 and P/4
   (C) V/2, I and P/2
   (D) V, I/2 and P/2

10. If terminal voltage of one 1000 rpm shunt motor is reduced to half the speed of the motor will be
    (A) 500 rpm   (B) 250 rpm   (C) 1000 rpm   (D) 2000 rpm

11. Hunting phenomenon is observed in which motor?
    (A) Synchronous motor   (B) DC motor   (C) Induction motor   (D) Both A and C

12. The large number of narrow slots in stator of an a.c. motor is preferred because
    (A) It is easier to make narrow slots than wide open slots
    (B) Large number of narrow slots reduces motor noise
    (C) Large number of narrow slots reduces noise and tooth pulsation losses
    (D) It helps in uniform distribution of flux

13. For a three phase induction motor, maximum torque is double the full load torque and starting torque is 1.6 times the full load torque. To get a full load slip of 5%, percentage reduction in the rotor resistance should be:
    (A) 63%   (B) 75%   (C) 50%   (D) 35%

14. Substance having permeability less than the permeability of free space, are known as
    (A) Ferromagnetic.   (B) Bipolar.   (C) Paramagnetic.   (D) Diamagnetic.

15. A 400 V, 50 Hz 30 hp, three-phase induction motor is drawing 50 A current at 0.8 power factor lagging. The stator and rotor copper losses are 1.5 kW and 900 W respectively. The friction and windage losses are 1050 W and the core losses are 1200 W. The air-gap power of the motor will be:
    (A) 23.06 kW   (B) 24.11 kW   (C) 25.01 kW   (D) 26.21 Kw

16. Division of reactive and active powers in two generators operating in parallel depends upon
    (A) Voltage load curve
    (B) Speed load curve
    (C) Speed load and voltage load curves respectively
    (D) Voltage load and speed load curves respectively

17. In a synchronous machine, if the field flux axis ahead of the armature field axis in the direction of rotation, the machine is working as
    (A)Asynchronous generator   (B)Asynchronous motor
    (C)Synchronous generator   (D) Synchronous motor

18. If fault occurs near an impedance relay, the V I ratio is
    (A) Constant for all the locations of fault
    (B) Lower thàn the value if fault occurs away from the relay
    (C) Higher than the value if fault occurs away from the relay
    (D) May be lower or higher than the value if fault occurs away from the relay

19. The topmost conductor in HV transmission line is
    (A) B-phase conductor   (B) Y- phase conductor
    (C)R- phase conductor   (D)Earth conductor

20. The dielectric strength of air under normal conditions is around
    (A) 30 kV/cm.   (B) 150 kV/cm.   (C) 100 kV /cm.   (D) 20 kV/cm

21. The voltage across the circuit breaker pole after final current zero is
    (A) Restriking voltage   (B) Supply voltage   (C) Recovery voltage   (D) None of these

22. Single phase preventers are used for
    (A) Transmission lines   (B) Transformers   (C) Motors   (D) Underground cables

23. The ROM programmed during manufacturing process itself is called
    (A) MROM   (B) PROM   (C)EPROM   (D)EEPROM

24. Which section in the IE Act deals with the 'theft of energy'?
    (A) Section 39   (B) Section 40   (C) Section 43   (D) Section 44

25. The Intel 8086 microprocessor is a _____ processor
    (A) 4 bit   (B) 8 bit   (C) 16 bit   (D) 32 bit

26. Which parts of a sinusoidal carrier can be modulated?
    (A)only amplitude   (B) only frequency
    (C)its amplitude, frequency and direction (D) its amplitude, frequency and phase angle

27. At an industrial sub-station with a 4 MW load, a capacitor of 2 MVAR is installed to maintain the load power factor at 0.97 lagging. If the capacitor goes out of service, the load power factor becomes
    (A) 0.85 lag   (B) 1.00   (C) 0.80 lag   (D) 0.90 lag

28. In S.I, unit one ton of refrigeration is equal to
    (A) 210 KJ/min   (B) 21 KJ/min   (C) 42 KJ/min   (D) 420 KJ/min

29. Differential relays are used for protection of equipment against
    (A) Internal faults   (B) Over current   (C) Reverse current   (D) Reverse power

30. A balanced 3-phase system consists of
    (A) zero sequence currents only   (B). positive sequence currents only
    (C) negative and zero sequence currents   (D). zero, negative and positive sequence currents

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PART-B – Section – II

Questions No. 31 to 39 are Descriptive Type each carries 5 marks. **Answer any Five questions.**

31. In the circuit shown in the figure, the current source $I = 1A$, the voltage source $V = 5$ V,$R1 = R2 = R3 = 1\overset{\frown}{W}$, $L1 = L2 = L3 = 1H$,$C1 = C2 = 1$ F
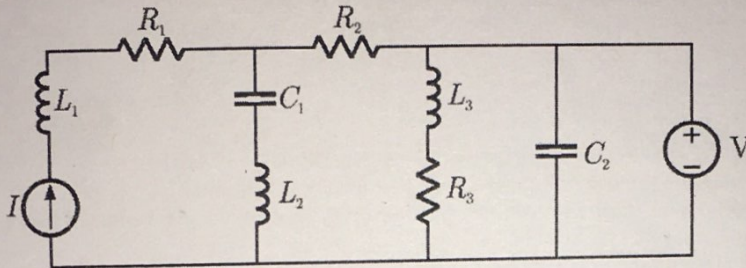
Find the current supplied by Voltage source and current flowing through resistance $R3$.

32. (a) What are breaking capacity and making capacity of circuit breaker? (2)
    (b) In a short circuit test on a circuit breaker, following readings were obtained on single frequency transient:
    time to reach the peak re-striking voltage- 50 micro second, the peak restriking voltage- 100 kV
    Determine average rate of rise of re-striking voltage and frequency of oscillation. (3)

33. A 120 kVA, 6000 V/400V, star/star, 3 phase 50 Hz transformer has iron loss of 1800W. The maximum efficiency occur at ¾ full load. Find the efficiency of the transformer at (a) full load and 0.8 pf (b) maximum efficiency at unity pf.

34. A balanced delta connected load of $(8 + j6)$W per phase is connected to a 400 V, 50 Hz, 3-phase supply lines. If the input power factor is to be improved to 0.9 by connecting a bank of star connected capacitor , what is the required kVAR of the of the bank ? (5)

35. Briefly describe the functions of Electrical Inspector to Government (EIG) in Railways. (3)
    What are the qualifications required for EIG? (1)
    Who works as EIG of Railways. (1)

36. A suburban electric train has a maximum speed of 80 kmph. The schedule speed including a station stop of 35 seconds is 50 kmph. If the acceleration is 1.5 kmphps, find the value of retardation when the average distance between stops is 5 km.

37. What is purpose of ballast in tube light? (2)
    Calculate the number of 1000-W floodlight projectors required to illuminate the up per 75 m of one face of a 96 m tower of width 13 m if approximate initial average luminance is to be 6.85 cd/m2 . The projectors are mounted at ground level 51m from base of the tower. Utilization factor is = 0.2; reflection factor of wall = 25% and efficiency of each lamp = 18 lm/W. (3)

38. Draw the circuit symbol of IGBT. Compare its advantages over MOSFET.

39. What is Flip Flop? (1)
    Explain its type and write truth table of any one of Flip Flop. (4)

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Questions No. 40 to 42 are Descriptive Type each carries 15 marks. **Answer any one questions.**

40. Draw the typical torque-speed characteristics of Induction motor indicating stable, unstable and operating region. How this characteristics is modified if (i) Rotor resistance is doubled (ii) Frequency is halved.   10
A 500 V, 50Hz, 3 phase induction motor while running at 975 rpm takes 40 KW. If stator losses are 2 kW and friction and windage losses total 2.5 kW. Find efficiency of motor.   5

41. What do you understand by Steady State Stability and Transient Stability and which one is lower? (5)
Find the steady state power limit of a system consisting of a generator equivalent reactance 0.50 pu connected to an infinite bus through a series reactance of 1.0 pu. Terminal voltage of the generator is held at 1.20 pu and voltage of infinite bus is 1.0 pu.   (10)

42. Official Language:
    i.   Which part of the Constitution contains provisions regarding Official Language?   (2)
    ii.   How many members are there in Parliament Committee of Official language?   (2)
    iii.   In terms of the Official Language Rules who are all the employees who can be classified as having proficiency in Hindi?   (3)
    iv.   Which States and Union Territories fall under Region 'B'   (4)
    v.   Explain the Check Points prescribed for the effective implementation of Hindi as Official Language?   (4)

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