महाराष्ट्र अभियांत्रिकी सेवा (विद्युत) मुख्य परीक्षा 2021
परीक्षा दि. 2e ऑक्टोबर, 2022

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संच क्र. A

प्रश्नपुस्तिका – I
विद्युत अभियांत्रिकी पेपर – 1

प्रश्नपुस्तिका क्रमांक BOOKLET NO. 301229

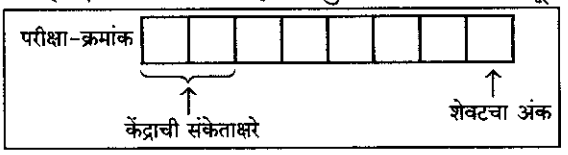
वेळ : 2 (दोन) तास

एकूण प्रश्न : 100
एकूण गुण : 200

सूचना

(1) सदर प्रश्नपुस्तिकेत **100** अनिवार्य प्रश्न आहेत. उमेदवारांनी प्रश्नांची उत्तरे लिहिण्यास सुरुवात करण्यापूर्वी या प्रश्नपुस्तिकेत सर्व प्रश्न आहेत किंवा नाहीत याची खात्री करून घ्यावी. तसेच अन्य काही दोष आढळल्यास ही प्रश्नपुस्तिका समवेक्षकांकडून लगेच बदलून घ्यावी.

(2) आपला परीक्षा-क्रमांक ह्या चौकोनांत **न विसरता बॉलपेनने** लिहावा.



(3) वर छापलेला प्रश्नपुस्तिका क्रमांक तुमच्या उत्तरपत्रिकेवर विशिष्ट जागी उत्तरपत्रिकेवरील सूचनेप्रमाणे **न विसरता नमूद करावा.**

(4) या प्रश्नपुस्तिकेतील प्रत्येक प्रश्नाला 4 पर्यायी उत्तरे सुचविली असून त्यांना 1, 2, 3 आणि 4 असे क्रमांक दिलेले आहेत. त्या चार उत्तरांपैकी सर्वात योग्य उत्तराचा क्रमांक उत्तरपत्रिकेवरील सूचनेप्रमाणे तुमच्या उत्तरपत्रिकेवर नमूद करावा. अशा प्रकारे उत्तरपत्रिकेवर उत्तर-क्रमांक नमूद करताना तो संबंधित प्रश्न-क्रमांकासमोर छायांकित करून दर्शविला जाईल याची काळजी घ्यावी. **ह्याकरिता फक्त काळ्या शाईचे बॉलपेन वापरावे, पेन्सिल वा शाईचे पेन वापरू नये.**

(5) सर्व प्रश्नांना समान गुण आहेत. यास्तव सर्व प्रश्नांची उत्तरे द्यावीत. घाईमुळे चुका होणार नाहीत याची दक्षता घेऊनच शक्य तितक्या वेगाने प्रश्न सोडवावेत. क्रमाने प्रश्न सोडविणे श्रेयस्कर आहे पण **एखादा प्रश्न कठीण वाटल्यास त्यावर वेळ न घालविता पुढील प्रश्नांकडे वळावे.** अशा प्रकारे शेवटच्या प्रश्नापर्यंत पोहोचल्यानंतर वेळ शिल्लक राहिल्यास कठीण म्हणून वगळलेल्या प्रश्नांकडे परतणे सोईस्कर ठरेल.

(6) उत्तरपत्रिकेत एकदा नमूद केलेले उत्तर खोडता येणार नाही. नमूद केलेले उत्तर खोडून नव्याने उत्तर दिल्यास ते तपासले जाणार नाही. एकापेक्षा जास्त उत्तरे नमूद केल्यास ते उत्तर चुकीचे धरले जाईल व त्या चुकीच्या उत्तराचे गुण वजा केले जातील.

(7) प्रस्तुत परीक्षेच्या उत्तरपत्रिकांचे मूल्यांकन करताना उमेदवाराच्या उत्तरपत्रिकेतील योग्य उत्तरांनाच गुण दिले जातील. तसेच ''उमेदवाराने वस्तुनिष्ठ बहुपर्यायी स्वरूपाच्या प्रश्नांची दिलेल्या चार उत्तरांपैकी सर्वात योग्य उत्तरेच उत्तरपत्रिकेत नमूद करावीत. अन्यथा त्यांच्या उत्तरपत्रिकेत सोडविलेल्या प्रत्येक चुकीच्या उत्तरांसाठी 25% किंवा 1/4 गुण वजा/कमी करण्यात येतील''.

पर्यवेक्षकांच्या सूचनेविना हे सील उघडू नये

ताकीद

ह्या प्रश्नपत्रिकेसाठी आयोगाने विहित केलेली वेळ संपेपर्यंत ही प्रश्नपुस्तिका आयोगाची मालमत्ता असून ती परीक्षाकक्षात उमेदवाराला परीक्षेसाठी वापरण्यास देण्यात येत आहे. ही वेळ संपेपर्यंत सदर प्रश्नपुस्तिकेची प्रत/प्रती, किंवा सदर प्रश्नपुस्तिकेतील काही आशय कोणत्याही स्वरूपात प्रत्यक्ष वा अप्रत्यक्षपणे कोणत्याही व्यक्तीस पुरविणे, तसेच प्रसिद्ध करणे हा गुन्हा असून अशी कृती करणाऱ्या व्यक्तीवर शासनाने जारी केलेल्या ''परीक्षांमध्ये होणाऱ्या गैरप्रकारांना प्रतिबंध करण्याबाबतचा अधिनियम-82'' यातील तरतुदीनुसार तसेच प्रचलित कायद्याच्या तरतुदीनुसार कारवाई करण्यात येईल व दोषी व्यक्ती कमाल एक वर्षाच्या कारावासाच्या आणि/किंवा रुपये एक हजार रकमेच्या दंडाच्या शिक्षेस पात्र होईल.

तसेच ह्या प्रश्नपत्रिकेसाठी विहित केलेली वेळ संपण्याआधी ही प्रश्नपुस्तिका अनधिकृतपणे बाळगणे हा सुद्धा गुन्हा असून तसे करणारी व्यक्ती आयोगाच्या कर्मचारीवृंदापैकी, तसेच परीक्षेच्या पर्यवेक्षकीयवृंदापैकी असली तरीही अशा व्यक्तीविरुद्ध उक्त अधिनियमानुसार कारवाई करण्यात येईल व दोषी व्यक्ती शिक्षेस पात्र होईल.

पुढील सूचना प्रश्नपुस्तिकेच्या अंतिम पृष्ठावर पहा

कच्च्या कामासाठी जागा / SPACE FOR ROUGH WORK

1. Consider the following statements :
Skewing of rotor slots in a 3-phase induction motor (cage rotor) may

a. Introduce additional leakage reactance

b. Eliminate slot harmonics

Which of these statements is/are correct ?

Answer options :

(1) a only (2) b only

(3) Both a and b (4) Neither a nor b

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2. In ac motor control $^{V}/_{f}$ is kept constant to

(1) make maximum use of the magnetic circuit

(2) make minimum use of the magnetic circuit

(3) maximize the current drawn

(4) make the power constant

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3. If stator voltage is reduced by 10 %, the torque of a squirrel-cage induction motor will

(1) Decrease by 20% approximately

(2) Decrease by 100% approximately

(3) Not change for such small change in voltage

(4) None of the above

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4. In shaded pole motor shading coil usually consist of

(1) Single turn copper ring in series with stator winding

(2) Multiple winding copper wire

(3) Single turn copper ring short circuited and carried induced current

(4) None of the above

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5. The power input to a 3 ph. Induction motor is 75 kW. The stator losses total are 2 kW. Find the total rotor copper loss if motor is running at slip of 4%.

(1) 2.12 kW (2) 2.92 kW

(3) 3.32 kW (4) 2.82 kW

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6. When a 3-ph induction motor undergoes crawling
   (1) It runs at a very high speed of about twice of normal speed
   (2) It runs at a very low speed of about $1/7^{th}$ of normal speed
   (3) It starts from rest with gradual rise in speed and reaches upto rated speed
   (4) It do not run at all and makes humming sound

7. In terms of air gap power 'Pg', the rotor copper loss and the mechanical power developed in a 3-phase induction motor are given by
   (1) sP_g and $(1-s)P_g$ respectively
   (2) $(1-s)P_g$ and sP_g respectively
   (3) s^2P_g and $\frac{P_g}{s}$ respectively
   (4) $\frac{P_g}{s}$ and $\frac{P_g}{(1-s)}$ respectively

8. If both the voltage and frequency of squirrel-cage induction motor are increased by 50% of their original value, the torque/speed curve shifts to the (Assuming ideal conditions of insulation)
   (1) Left of standstill
   (2) Up in positive torque region
   (3) Down in negative torque region
   (4) Right away from standstill

9. The starting torque of a three-phase induction motor can be increased by increasing
   (1) The rotor resistance
   (2) The rotor reactance
   (3) The stator resistance
   (4) The stator reactance

10. The rotor of an induction motor cannot run at synchronous speed because
   (1) Lenz's law would be violated
   (2) Air friction prevents it to do so
   (3) Rotor torque would then become zero
   (4) Induction motor would then become synchronous motor

11. With a vector control, an induction motor can operate as
    (1) Self-excited dc motor
    (2) Separately excited dc motor
    (3) Normal squirrel cage induction motor
    (4) Synchronous motor

12. If the load resistance of the capacitor filtered full wave rectifier is reduced, the ripple voltage
    (1) increases (2) decreases
    (3) is not affected (4) has a different frequency

13. If the selected diode cannot match the required current rating, then
    (1) several diode can be connected in series
    (2) several diode can be connected in parallel
    (3) the resistance is connected in series with diode
    (4) none of these

14. The effective channel length of a MOSFET in saturation decreases with increase in
    (1) gate voltage (2) drain voltage
    (3) source voltage (4) body voltage

15. The functions of DC-DC converters are
    (1) To convert a dc input voltage into dc output voltage
    (2) To regulate the dc output voltage against the load and line variation
    (3) Both (1) and (2)
    (4) None of these

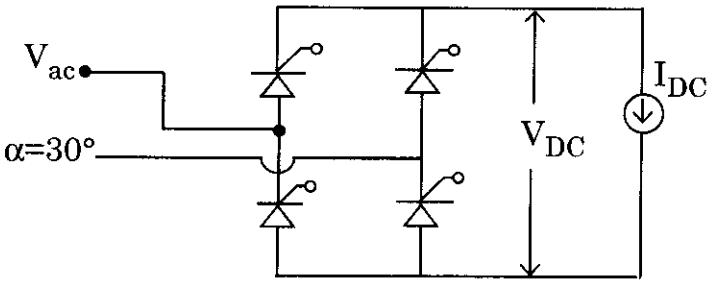
16. In a single pulse modulation of PWM inverters if pulse width is 72° then
    (1) third harmonic will be eliminated
    (2) fifth harmonic will be eliminated
    (3) seventh harmonic will be eliminated
    (4) none of these

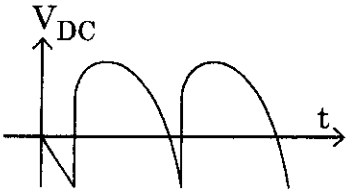
17. In SPWM, triangular carrier of 5V, 1KHz and sinusoidal reference of 1V, 50Hz are used. If zeroes of carrier and reference sinusoidal coincide, the modulation index and order of significant harmonics are
(1) 0.2, 17 and 19 (2) 0.2, 9 and 11 (3) 0.4, 9 and 11 (4) none of these

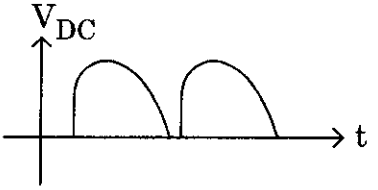
18. DC to dc converter or chopper can
(1) only step-down d.c. voltage
(2) only step-up d.c. voltage
(3) step-up or step-down d.c. voltage
(4) input d.c. voltage is equal to output d.c. voltage

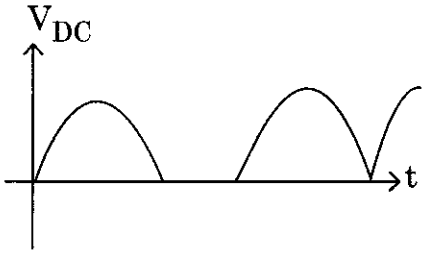
19. Due to lower switching losses, soft-switched power converter require gate drives with
(1) higher power rating (2) lower power rating
(3) lower resistance (4) none of these

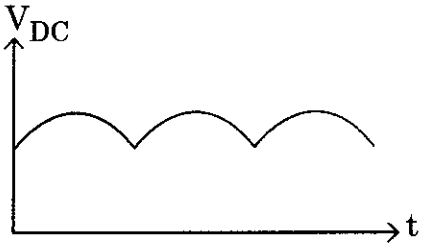
20. A phase-controlled half-controlled single-phase converter is shown in figure. The control angle $\alpha = 30°$. The output dc voltage wave shape will be as shown in



(1)


(2)


(3)


(4)


कच्च्या कामासाठी जागा / SPACE FOR ROUGH WORK

21. Find the period of $x(t) = \cos(\pi t + 60)$.

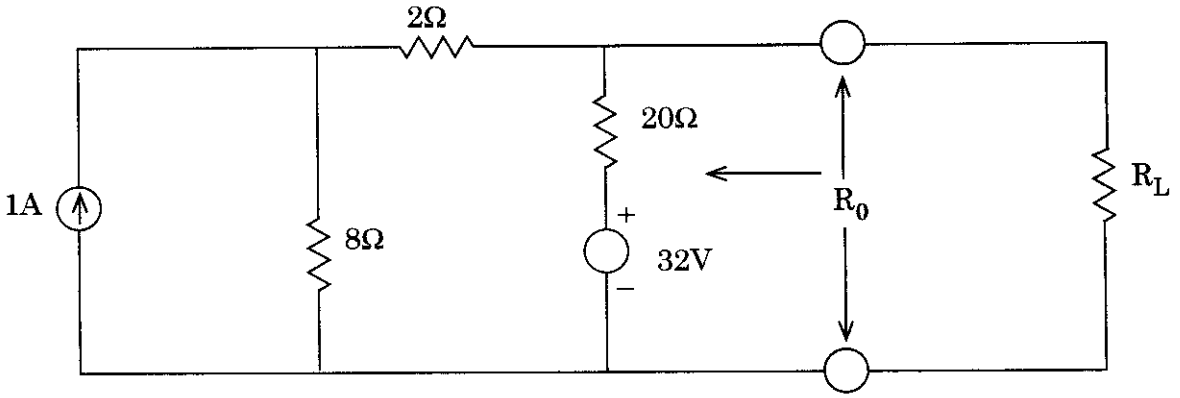
(1) 4 (2) 2 (3) 1/2 (4) 1

22. Step voltage response of R-C series circuit is obtained from the differential equation governing the capacitance voltage,

(1) $Ri + C\frac{dV_c}{dt} = V, t > 0$ (2) $C\frac{dV_c}{dt} = V, t > 0$

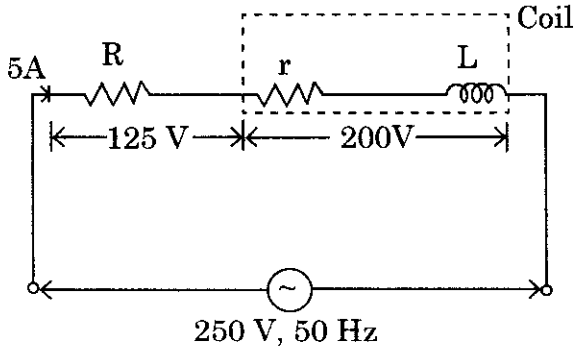
(3) $RC\frac{dV_c}{dt} + V_c = V, t > 0$ (4) None of the above

23. Thevenin's equivalent resistance R_0 of the following network will be,



(1) 5 Ω (ohm) (2) 20/3 Ω (ohm) (3) 8 Ω (ohm) (4) 10 Ω (ohm)

24. A non-inductive resistance R, connected in series with a choking coil as shown in figure below. The values of R and impedance of the coil will be,



(1) $R = 25\ \Omega$; $Z_{coil} = 50\ \Omega$ (2) $R = 25\ \Omega$; $Z_{coil} = 40\ \Omega$

(3) $R = 50\ \Omega$; $Z_{coil} = 50\ \Omega$ (4) $R = 40\ \Omega$; $Z_{coil} = 40\ \Omega$

25. Which of the following statements are correct ?

a. Resistors show a change in their resistance value when subjected to ac voltages.

b. Wire wound resistors typically exhibit decrease in their impedance with frequency.

c. Film resistors have the most stable high frequency performance.

d. The frequency effect on resistance does not vary with the resistor construction.

Answer options :

(1) a and c are correct

(2) b and d are correct

(3) a is incorrect, b is correct

(4) c is incorrect and d is correct

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26. A de-icing equipment fitted to a radio aerial consists of a length of a resistance wire so arranged that when a current is passed through it, parts of the aerial become warm. The resistance wire dissipates 1250 W when 50 V is maintained across its ends. It is connected to a D.C. supply by 100 meters of this copper wire each conductor of which has resistance of 0.006 Ω /mtr. Calculate :

a. Current in the resistance wire.

b. Power lost in the connecting copper wire.

c. Supply voltage required to maintain 50V across the heater itself.

Answer options :

(1) a = 2.5 A, b = 75 W, c = 80 V

(2) a = 25 A, b = 7.5 W, c = 50 V

(3) a = 25 A, b = 75 W, c = 75 V

(4) a = 25 A, b = 750 W, c = 80 V

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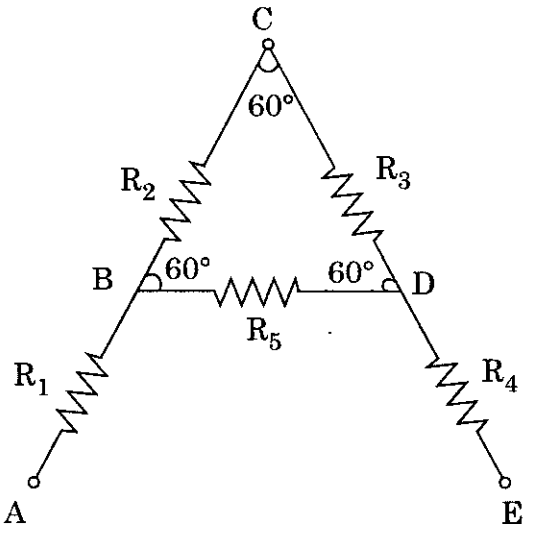
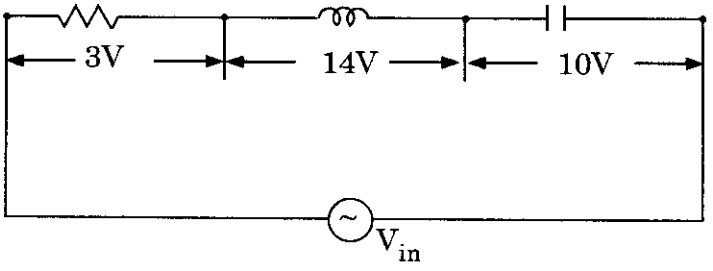
27. A letter 'A' consists of a uniform wire of resistance 1 Ω/cm. The sides of the letter are each 20 cm long and the cross piece in the middle is 10 cm long while the apex angle is 60°. Find the resistance of the letter between the two ends of the legs (A and E).



(1) 40 Ω (2) 23.33 Ω (3) 26.67 Ω (4) 13.33 Ω

28. Average power is given by, $P_{(av)}$ =
(Assuming T = time in which energy W flows)
(1) $W \times T$ (2) W/T (3) $W \times e^T$ (4) W/e^T

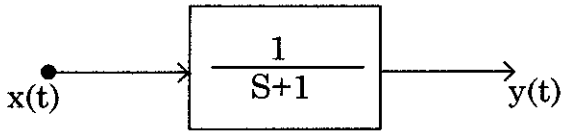
29. The source in the circuit shown is a sinusoidal source. The voltage drop across various elements are marked as shown in the figure. The input supply voltage is



(1) 10 V (2) 5 V (3) 27 V (4) 24 V

30. The magnetic flux density in an air cored coil is 10^{-2} Wb/m^2 with a cast iron core of relative permeability 100 inserted, the flux density will become
(1) 10^{-2} Wb/m^2 (2) 10^{-4} Wb/m^2 (3) 1 Wb/m^2 (4) 10^{-3} Wb/m^2

31. In the system shown in figure x(t) = (sint)u(t). In steady-state, the response y(t) will be



(1) $\frac{1}{\sqrt{2}}\sin\left(t-\frac{\pi}{4}\right)$ (2) $\frac{1}{\sqrt{2}}\sin\left(t+\frac{\pi}{4}\right)$

(3) $\frac{1}{\sqrt{2}}e^{-t}\sin t$ (4) sint – cost

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32. Which of the following sentences are true ?

a. The turbine flow meters are volumetric flow meters.

b. The electromagnetic flow meters are suitable for flow measurement of slurries and electrically conducting liquids.

c. In electromagnetic flow meters there is obstruction to flow that may cause pressure drops.

d. The output in electromagnetic flow meter is affected by changes in characteristics of liquid.

Answer options :

(1) a and b are true (2) c and d are true

(3) All are true (4) None of the above

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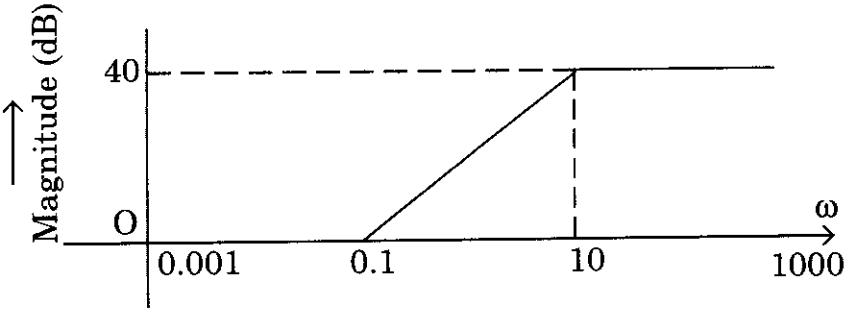
33. For the asymptotic Bode magnitude plot shown in figure, the system transfer-function can be



(1) $\frac{10s+1}{0.1s+1}$ (2) $\frac{100s+1}{0.1s+1}$ (3) $\frac{100s}{10s+1}$ (4) $\frac{0.1s+1}{10s+1}$

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34. A current transformer has a phase error of 3°. The phase angle between the primary and secondary current is

(1) 3° (2) 177°

(3) 180° (4) 183°

35. Number of intersect of the asymptotes of the complete root loci is

(1) unknown (2) two

(3) three (4) one

36. The output of LVDT is connected to 5 V, voltmeter through an amplifier whose amplification factor is 250, output of 2 mV appears across the terminal of LVDT when the core moves through a distance of 0.5 mm. Calculate the sensitivity of LVDT and that of whole set up.

(1) 40 mV/mm, 1000 V/mm (2) 4 mV/mm, 1 V/mm

(3) 4 V/mm, 1V/mm (4) 4 V/mm, 1 mV/mm

37. The transfer function of a system is given as $\frac{100}{s^2+20s+100}$. The system is

(1) an over-damped system

(2) an under-damped system

(3) a critically damped system

(4) an unstable system

38. Which of the following sentences are true ?

a. The non feedback system is activated by single signal at the input.

b. Feedback system is driven by two signals.

c. Due to feedback the controlled variable follows the desired value.

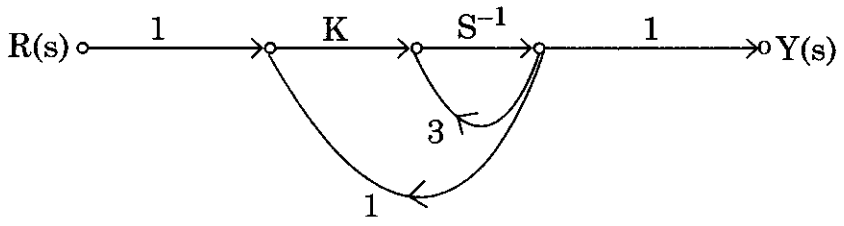
d. Primary purpose of feedback is to reduce sensitivity of system to parameter variations.

Answer options :

(1) Only a is true (2) Only a and b are true

(3) All are true (4) None of the above

39. The system shown in figure remains stable when



(1) $K < -1$ (2) $-1 < K < 1$

(3) $1 < K < 3$ (4) $K < -3$

---

40. Which of the following sentences are true ?

a. Maximum overshoot is defined as the largest deviation of output over the step input during steady state.

b. Delay time is defined as time required for step response to reach 63% of its final value.

c. Rise time is defined as time required for step response to rise from 10% to 80% of its final value.

d. Settling time is the time required for the step response to decrease and stay with specified percentage of final value.

Answer options :

(1) Only a is true

(2) a and b are true

(3) a, b, c are ture

(4) Only d is true

---

41. A small system consists of four identical 500 MVA generating units feeding a total load of 1020 MW. The inertia constant of each unit is 5.0 on 500 MVA base. The load varies by 1.5% for 1% change in frequency, when there is a sudden drop in load by 20 MW. Determine the constants H and D expressed on 2000 MVA base.

(1) H = 5, D = 0.75% (2) H = 1, D = 0.5% (3) H = 5, D = 0.5% (4) H = 1, D = 0.75%

---

42. For load flow solutions, what are the quantities specified at load bus ?

(1) P and |v|

(2) P and Q

(3) P and δ

(4) Q and |v|

43. A round rotor generator with an internal voltage $|E_g| = 2.0$ pu, $X_{dg} = 1.1$ pu is connected to a synchronous motor with internal voltage $|E_m| = 1.3$ pu; $X_{dm} = 1.1$ pu. The reactance of line connecting the two is 0.4 pu. If the generator is supplying 0.5 pu power, the angle difference between E_g and E_m is

(1) 0°

(2) 30°

(3) 90°

(4) 60°

44. A maximum demand on power station is 600 MW. The annual load factor is 60% and capacity factor is 45%. Find the reserve capacity of the plant.

(1) 500 MW

(2) 250 MW

(3) 200 MW

(4) 100 MW

45. For a power system we can improve the steady state stability limit by

(1) Single pole switching

(2) Reducing fault clearing time

(3) Using double circuit line instead of single circuit line

(4) Decreasing the generator inertia

46. The knowledge of maximum sag is primarily essential in determining the

(1) Ground clearance of the conductor

(2) Maximum span of the conductor

(3) Maximum stress on the conductor

(4) None of the above

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47. Current limiting reactors should be of
(1) High resistance and low inductive reactance
(2) Low resistance and high inductive reactance
(3) Low resistance and low reactance
(4) High resistance and high reactance

48. For economical division of load between units within a plant, the criterion is
(1) All units must operate at the same incremental fuel cost
(2) All units must operate at the lowest incremental fuel cost
(3) At least 50% units must operate at the same incremental fuel cost
(4) At least 50% units must operate at the lowest incremental fuel cost

49. The injection of VARs is required mainly to
(1) compensate for line losses
(2) get a good voltage profile
(3) increase the efficiency of transmission
(4) all of the above

50. The steady state stability limit of a two machine system depends on
(1) Per unit reactance of the power system
(2) Power input
(3) Power factor of the system
(4) Per unit power input of the system

51. A synchronous motor will deliver maximum power when
(1) Load angle is equal to internal angle θ
(2) Input power factor is unity
(3) Load angle is $45°$
(4) Load angle is $0°$

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52. A synchronous condenser is
(1) An over-excited synchronous motor driving a mechanical load
(2) An ordinary capacitor bank
(3) An over-excited synchronous motor with no shaft extension
(4) An over-excited synchronous motor without a mechanical load

53. The pull-out torque of a practical synchronous motor will occur when the torque angle is about
(1) 0° (2) 30° (3) 45° (4) 75°

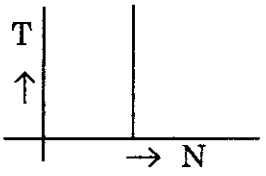
54. The power factor of a synchronous motor
(1) Improves with increase in excitation and may even become leading at high excitations
(2) Decreases with increase in excitation
(3) Is independent of its excitation
(4) Increases with loading for a given excitation

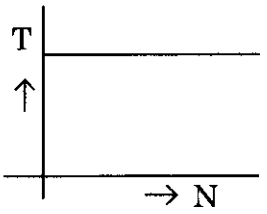
55. A synchronous generator connected to an infinite bus is overexcited. Considering only the reactive power from the point of the system, the machine acts as
(1) a capacitor (2) an inductor
(3) a resistor (4) none of these

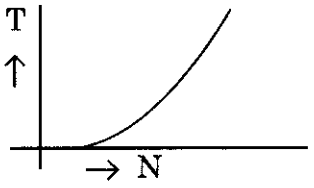
56. In a synchronous motor hunting can be reduced to minimum possible by
(1) Providing damper widing in the rotor pole faces
(2) Using a flywheel
(3) Designing the motor for adequate synchronizing power
(4) Any of the above methods

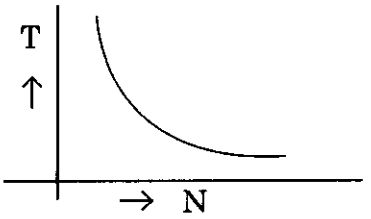
57. In a synchronous machine, the stator frame is made of
(1) Stainless steel
(2) CRGOS
(3) Cast iron or welded steel plates
(4) Laminated silicon steel

58. Which of the following graphs represents the speed-torque characteristics of a synchronous motor ?

(1) 

(2) 

(3) 

(4) 

59. Which of the following will change in a 3-phase synchronous motor as a consequence of excitation variation ?

(1) Pull-out torque only

(2) Torque angle only

(3) Output power only

(4) Pull-out torque, torque angle, magnitude and power factor of stator current

60. Which one of the following statement is correct ?
In a salient pole synchronous machine the air gap is

(1) Uniform under the whole pole shoe

(2) Least under the middle of the pole shoe and increases onwards

(3) Largest under the middle of the pole shoe and decreases onwards

(4) Least at one end of the pole shoe and increased to the maximum value at the other end

61. According to Coulomb's law of electrostatics the magnitude of force of attraction or repulsion between any two charged bodies is

(1) directly proportional to the square of product of their charges

(2) directly proportional to the square of distance between them

(3) inversely proportional to the square of distance between them

(4) not dependent on the nature of medium between the charges

62. Potential difference across a capacitor of capacitance of 20 μF is increased uniformly from 0 to 240 V in 1 second. The charging current will be

(1) 12 mA (2) 4.8 mA (3) 1.2 mA (4) 9.6 mA

63. The inductance of a coil is 2H. The coil is carrying a current of 2A. How much work (in Joule) is to be done to increase the current value to 3A ?

(1) 1 Joule (2) 4 Joules

(3) 9 Joules (4) 5 Joules

64. A straight conductor of length l moving with a velocity v in the presence of magnetic field of flux density B, directed at an angle θ with the direction of V, experiences a force. Which of the following statement/s is/are true for the magnitude of force ?

a. It is independent of θ

b. It is proportional to l^2

c. It is proportional to B

d. It is independent of V

Answer options :

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

65. If the transformers which are operated in parallel are not connected with regard to correct polarity then,

(1) The transformers will not share the load in proportion to their KVA rating

(2) Dead short circuit will take place

(3) The transformer of lower rating will be put of operation

(4) None of the above

66. The rating of transformers is in kVA and not in kW because,

(1) Calculations in kVA are easier than in kW

(2) Cu loss and Iron loss depends on current and voltage respectively

(3) All losses are dependent on power factor

(4) None of the above

67. Total inductance of a group of two series connected and unshielded inductances when the flux produced by one opposes the flux produced by the other is equal to

(1) $L_1 + L_2$ (2) 2M

(3) $L_1 + L_2 + 2M$ (4) $L_1 + L_2 - 2M$

68. During short circuit test on transformer, iron losses are negligible because

(1) the current on the secondary side is negligible

(2) the voltage on the secondary side does not vary

(3) the voltage applied on primary side is low

(4) full load current is not supplied to the transformer

69. The exciting current was found to be 3A when measured on the LV side of a 20 kVA, 2000/200V transformer. Choose the transformer rating as base rating. The exciting current in per unit on LV side will be

(1) 0.03 p.u. (2) 0.003 p.u.

(3) 0.3 p.u. (4) None of the above

70. The no-load primary current I_o, in an actual transformer

(1) is in phase with V_1

(2) leads V_1 by 90°

(3) lags behind V_1 by 90°

(4) lags V_1 by an angle lying between 0° and 90°

71. The amount of energy available in the wind at any instant is proportional to _____ of the wind speed.

(1) Square root power of two (2) Square root power of three

(3) Square power (4) Cube power

72. The characteristics impedance of a transmission line is given by

(1) $2\pi\sqrt{\frac{L}{C}}$ (2) $\sqrt{LC}$

(3) $\sqrt{\frac{L}{C}}$ (4) LC

73. For low head with large quantity of flow water, following hydro turbine is used in hydro plant

(1) Kaplan turbine (2) Fransis turbine

(3) Impulse turbine (4) Radial flow turbine

74. The efficiency of chimney at thermal power station is approximately

(1) 20% (2) 90% (3) 70% (4) 65%

75. Electro Static Precipitator (ESP) is used in thermal power station to

(1) Reduce the air pollution (2) Heat the coal

(3) Heat the water (4) Reduce the possibility of fire

76. A 50 MVA, 10 kV, synchronous generator has $X_d = 0.4$ pu. The X_d value (in pu) to a base of 100 MVA, 20 kV is

(1) 0.4 pu (2) 0.04 pu (3) 1.6 pu (4) 0.2 pu

77. Which of the following sequence networks are invoked in case of single line to ground fault ?

(1) Negative sequence network

(2) Zero sequence network

(3) Positive sequence network

(4) Positive, negative and zero sequence network

78. Which is the State with the highest energy consumption in India ?

(1) Andhra Pradesh (2) Gujrat

(3) Maharashtra (4) Tamil Nadu

79. The sequence components of the fault current are as follows :

$I_1 = I_{positive} = j\ 1.5$ pu

$I_2 = I_{Negative} = -j\ 0.5$ pu

$I_0 = I_{zero} = -j\ 1$ pu

The type of fault in the system is

(1) LG (2) LL (3) LLG (4) LLLG

80. Admittance matrices are sparse because of

(1) Small number of lines connected to substation nodes

(2) Small number of substation nodes in the power system

(3) Large number of substation nodes in the power system

(4) Large number of transmission lines connected to substation nodes

81. The number of states in a decade counter is

(1) 4 (2) 8 (3) 10 (4) 16

82. Which of the following sentences are true ?

a. Operational amplifier is a direct coupled low gain amplifier.

b. Operational amplifier is used to amplify a.c. as well as d.c. signals.

c. The output stage of operational amplifier is generally a push pull circuit.

d. Operational amplifier is not available in single integrated package.

Answer options :

(1) Only d is true

(2) a, b and c are true

(3) b and c are true

(4) a and d are true

83. In a 4-stage ripple counter, the propagation delay of a flip flop is 50 ns. If the pulse width of the strobe is 30 ns. The maximum frequency at which the counter operates reliably is

(1) 4.35 MHz (2) 2.0 MHz

(3) 5.0 MHz (4) 1.66 MHz

84. The SOP form of logical expression is most suitable for designing logic circuit using only

(1) NOR gates (2) NAND gates

(3) AND gates (4) EX-OR gates

85. Which of the following sentences are true ?

a. In OR gate output voltage is high if any or all the input voltages are high.

b. AND gate has high output, only when all inputs are high.

c. In NOR gate all the inputs must be low to get low output.

d. In NAND gate all the inputs must be high to get low output.

Answer options :

(1) Only c is true

(2) b and c are true

(3) a, c and d are true

(4) a, b and d are true

---

86. Which of the following statements are true ?

a. Analog circuits are designed for use with small signals.

b. Digital circuits are generally used with large signals.

c. Analog circuits made to work in non linear fashion.

d. Digital circuits are considered as linear one.

Answer options :

(1) a and b are true

(2) b and c are true

(3) c and d are true

(4) d and a are true

---

87. The resolution of _____ bit D/A converter is approximately 0.4%.

(1) 8 (2) 10 (3) 11 (4) 12

---

88. In an S-R Flip-Flop, the S-R inputs must not be

(1) S = R = 1

(2) S = R = 0

(3) S = 0, R = 1

(4) S = 1, R = 0

---

89. Find the output voltage from a five bit ladder that has digital input of 11010. Assume that 0 = 0V and 1 = +10V.

(1) 8.125 Volts

(2) 8.00 Volts

(3) 1.25 Volts

(4) None of the above

---

90. The minimum no. of samples to be taken for sampling of sinusoidal waveform of frequency 1kHz to digital form in 1ms are

(1) 2 (2) 4 (3) 10 (4) 20

91. A DC motor having full load speed of 750 rpm and speed regulation of 10% (as a % of full load speed) will have no load speed of

(1) 825 rpm (2) 675 rpm (3) 800 rpm (4) 700 rpm

92. DC shunt motor should not be stopped by forcing the starter handle back to the OFF position by hand to avoid

(1) Heavy sparking at all the studs as handle travels to OFF position

(2) Dangerous sparking at the last stud as handle travels to OFF position

(3) Dangerous to operator due to heavy sparking

(4) Both 1 and 2

93. Which of the following braking is fastest but highly inefficient ?

(1) Plugging

(2) Rheostatic braking

(3) Regenerative braking

(4) Dynamic braking

94. DC generators are usually designed to develop armature voltages not exceeding 650 V because of the limitations imposed by

(1) Field winding

(2) Armature winding

(3) Commutator

(4) Starters

95. Regenerative braking of separately excited dc motor takes place when

(1) Back emf and supply voltage are equal

(2) Back emf is less than supply voltage

(3) Back emf is more than supply voltage

(4) None of the above

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96. The electromagnetic torque developed in any physical system and with magnetic saturation neglected, acts in such a direction as to tend to

(1) decrease both the reluctance and inductance

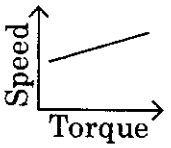
(2) increase both the reluctance and inductance

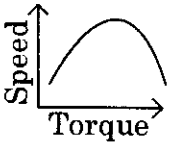
(3) decrease the reluctance and increase the inductance

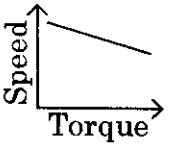
(4) increase the reluctance and decrease the inductance

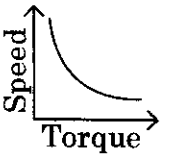
---

97. Which figure represent the speed-torque characteristic of a DC shunt motor ?

(1) 

(2) 

(3) 

(4) 

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98. A four-pole dc generator runs at 1500 rpm. The frequency of current in the armature winding is

(1) 25 Hz (2) 50 Hz

(3) Zero Hz (4) 100 Hz

---

99. A DC shunt generator fails to build it's voltage to an appreciable value even when driven by prime mover at normal speed. The probable reason is

(1) Residual magnetism in the field poles is absent

(2) Resistance of field winding is less than critical resistance

(3) Rotor speed is more than critical speed

(4) All of the above

---

100. A dc series motor drawing an armature current I_a is operating under saturated magnetic conditions. The torque developed in the motor is proportional to

(1) $\frac{1}{I_a}$ (2) $\frac{1}{I_a^2}$

(3) I_a^2 (4) I_a

सूचना – (पृष्ठ 1 वरून पुढे.....)

(8) प्रश्नपुस्तिकेमध्ये विहित केलेल्या विशिष्ट जागीच कच्चे काम (रफ वर्क) करावे. प्रश्नपुस्तिकेव्यतिरिक्त उत्तरपत्रिकेवर वा इतर कागदावर कच्चे काम केल्यास ते कॉपी करण्याच्या उद्देशाने केले आहे, असे मानले जाईल व त्यानुसार उमेदवारावर शासनाने जारी केलेल्या "परीक्षांमध्ये होणाऱ्या गैरप्रकारांना प्रतिबंध करण्याबाबतचे अधिनियम-82" यातील तरतुदीनुसार कारवाई करण्यात येईल व दोषी व्यक्ती कमाल एक वर्षाच्या कारावासाच्या आणि/किंवा रुपये एक हजार रकमेच्या दंडाच्या शिक्षेस पात्र होईल.

(9) सदर प्रश्नपत्रिकेसाठी आयोगाने विहित केलेली वेळ संपल्यानंतर उमेदवाराला ही प्रश्नपुस्तिका स्वत:बरोबर परीक्षाकक्षाबाहेर घेऊन जाण्यास परवानगी आहे. **मात्र परीक्षाकक्षाबाहेर जाण्यापूर्वी उमेदवाराने आपल्या उत्तरपत्रिकेचा भाग-1 समवेक्षकाकडे न विसरता परत करणे आवश्यक आहे.**

नमुना प्रश्न

Pick out the correct word to fill in the blank :

Q. No. 201. I congratulate you _____ your grand success.

(1) for (2) at

(3) on (4) about

ह्या प्रश्नाचे योग्य उत्तर "(3) on" असे आहे. त्यामुळे या प्रश्नाचे उत्तर "(3)" होईल. यास्तव खालीलप्रमाणे प्रश्न क्र. **201** समोरील उत्तर-क्रमांक "③" हे वर्तुळ पूर्णपणे छायांकित करून दाखविणे आवश्यक आहे.

प्र. क्र. **201.** ① ② ● ④

अशा पद्धतीने प्रस्तुत प्रश्नपुस्तिकेतील प्रत्येक प्रश्नाचा तुमचा उत्तर-क्रमांक हा तुम्हाला स्वतंत्ररीत्या पुरविलेल्या उत्तरपत्रिकेवरील त्या त्या प्रश्न-क्रमांकासमोरील संबंधित वर्तुळ पूर्णपणे छायांकित करून दाखवावा. **ह्याकरिता फक्त काळ्या शाईचे बॉलपेन वापरावे, पेन्सिल वा शाईचे पेन वापरू नये.**

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