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PAPER CODE	PAPER – II	Question Booklet Number	
22124	**ELECTRICAL AND ELECTRONICS ENGINEERING** (English)		

EEA-1222

Duration : 150 Minutes   *Max. Marks : 300*

INSTRUCTIONS TO CANDIDATES

1. Before opening the seal of the Question Booklet check whether the Paper Code printed on it is matching with the Paper Code printed on the Hall Ticket with the respective session. If it is not matching, immediately bring to the notice of the invigilator and obtain the Question Booklet with correct Paper Code.

2. Please check the Question Booklet immediately on opening and ensure that it contains all the 150 multiple choice questions printed on it.

3. Carefully note the Question Booklet No.

4. Separate Optical Mark Reader (OMR) Answer Sheet is supplied to you. The OMR Answer sheet contains boxes for filling Hall Ticket Number, Question Booklet Number, Paper Code, Signature of the Candidate and Invigilator. Fill the boxes with Blue/Black ball point pen only.

5. If there is any defect in the Question Paper Booklet or OMR answer sheet, please ask the invigilator for replacement immediately.

6. Since the answer sheets are to be scanned (valued) with Optical Mark Scanner system, the candidates have to USE BALL POINT PEN (BLUE/BLACK) ONLY for darkening the circles in the OMR Sheet including bubbling the answers. Bubbling with Pencil / Ink Pen /Gel Pen is not permitted in the examination. If any mistake is done by you on the OMR sheet, it will not be replaced.

7. The Question Booklet number is printed on right corner of the cover page of the Test Booklet. Mark your Question Booklet number on side 1 of the OMR Answer Sheet by darkening the appropriate circles with Blue/Black ball point pen.

అభ్యర్థులకు సూచనలు

1. ప్రశ్న పత్రం యొక్క సీల్సు తెరిచే ముందు దాని పైన ముద్రించి ఉన్న పేపర్ కోడ్ ను మీ హాల్‌టికెట్‌లో ముద్రింపబడిన ఆ సెషన్‌కు సంబంధించిన పేపర్ కోడ్‌తో సరిపోల్చుకోండి. ఒకవేళ ఆ రెండూ ఒక దానికొకటి భిన్నంగా ఉన్నచో ఆ విషయాన్ని ఇన్విజిలేటర్ దృష్టికి వెంటనే తీసుకెళ్ళి సరైన పేపర్ కోడ్ ఉన్న ప్రశ్న పత్రాన్ని అడిగి తీసుకోండి.

2. ప్రశ్న పత్రాన్ని తెరచిన వెంటనే అందులోని 150 ప్రశ్నలు వాటికివ్విన ఆప్షన్లు అన్నీ సరిగ్గా ముద్రింపబడ్డాయో లేదో జాగ్రత్తగా పరిశీలించండి.

3. క్వైశ్చన్ బుక్లెట్ సంబర్‌ను జాగ్రత్తగా పరిశీలించండి.

4. సమాధానాలను గుర్తించడానికి ప్రత్యేకంగా OMR సమాధాన పత్రాన్ని ఇవ్వడం జరుగుతుంది. అందులో హాల్‌టికెట్ నంబరు, క్వైశ్చన్ బుక్లెట్ నంబర్, పేపర్ కోడ్, అభ్యర్థి సంతకం, ఇన్విజిలేటర్ సంతకాలకు సంబంధించిన వివరాలు నింపడానికి గడులు కేటాయించబడి ఉంటాయి. గడులను నింపటానికి నీలి/నలుపు (బ్లూ/బ్లాక్) బాల్ పాయింట్ పెన్నులను మాత్రమే ఉపయోగించాలి.

5. ప్రశ్న పత్రంలో కానీ, OMR సమాధాన పత్రంలో కానీ ఏమైనా లోపాలుంటే వాటిని మార్చసలసిందిగా వెంటనే ఇన్విజిలేటర్‌ను కోరవచ్చు.

6. సమాధాన పత్రాలను ఆప్టికల్ మార్క్ స్కానర్ వర్క్షా పద్ధతిలో మూల్యాంకనం చేస్తారు. కాబట్టి దానిపైన ఉన్న వృత్తాలను (జవాబులకు సంబంధించిన వృత్తాలతో సహా) నింపటానికి బ్లూ/బ్లాక్ బాల్ పాయింట్ పెన్నులను మాత్రమే ఉపయోగించాలి. పెన్సిల్ లేదా ఇంకు పెన్ను లేదా జెల్ పెన్నులతో బబ్లింగ్ చేయటం పరీక్షలో అనుమతించబడదు. OMR పత్రంలో అభ్యర్థి తప్పులు రాసిన/దిద్దిన యెడల దానిని మార్చి ఇంకొకటి ఎట్టి పరిస్థితుల్లో ఇవ్వటం జరగదు.

7. ప్రశ్న పత్రం పై క్వైశ్చన్ బుక్లెట్ నంబర్ ముద్రింపబడి ఉంటుంది. ఇది ప్రశ్న పత్రం కవర్ పేజీ పై కుడి మూలన ముద్రింపబడి ఉంటుంది. ఈ క్వైశ్చన్ బుక్లెట్ నంబర్‌ను మీ సమాధాన పత్రం యొక్క సైడ్– 1 లో దానికి కేటాయింపబడిన స్థలంలో బ్లూ/బ్లాక్ బాల్ పాయింట్ పెన్నుతో జాగ్రత్తగా నింపాలి.

Example to fill up the Question Booklet number.

If your Question Booklet number is 102365, please fill as shown below :

Question Booklet No.

1	0	2	3	6	5

If you have not darkened the Question Booklet number at side 1 of the OMR Answer Sheet your Answer Sheet will be invalidated without any further notice. If it is darkened in a way that it leads to discrepancy in determining the exact Question Booklet number, then it may lead to wrong result / rejection of the Answer Sheet and candidate himself / herself will be responsible for the same.

8. Each question is followed by 4 answer choices. Of these, you have to select one correct answer and mark it on the Answer sheet by darkening the appropriate circle for the question. If more than one circle is darkened, that answer will not be valued at all. Use Blue/Black Ball point pen to fill the circle completely. Make no other stray marks.

   e.g. : If the answer for Question No. 1 is Answer choice (2), it should be marked as follows :

   ① ● ③ ④

9. Mark your Hall Ticket No. as given in the Hall Ticket with Blue/Black Ball point pen by darkening appropriate circles in side 1 of the OMR Answer Sheet. Incorrect/ not encoding of Hall Ticket no. will lead to invalidation of your Answer Sheet and also will lead to rejection of your candidature without any further notice.
   Example : If the Hall Ticket No. is 1309102001, fill as shown below :

   Hall Ticket Number

1	3	0	9	1	0	2	0	0	1

10. Get the signature of the Invigilator affixed in the space provided in the answer sheet. Candidate should sign in the space provided in the OMR Answer Sheet.

క్వశ్చన్ బుక్లెట్ నంబర్ నింపడానికి

ఉదా : ఒకవేళ మీ క్వశ్చన్ బుక్లెట్ నంబర్ 102365 అయితే దాన్ని కింది విధంగా నింపాలి.

Question Booklet No.

1	0	2	3	6	5

OMR సమాధాన పత్రం యొక్క సైడ్–1 లో మీ క్వశ్చన్ బుక్లెట్ నంబర్ను నింపక పోయినచో ఎటువంటి నోటీసు ఇవ్వకుండానే మీ సమాధాన పత్రం మూల్యాంకనం నిలిపివేయబడును. ఒకవేళ దాని సరిగ్గా గుర్తించేలా నింపక పోయినచో ఫలితం తప్పుగా వచ్చే అవకాశం లేదా మీ సమాధాన పత్రం తిరస్కరించబడే అవకాశం వుంటుంది. దానికి అభ్యర్థే పూర్తి బాధ్యత వహించాల్సి వుంటుంది.

8. ప్రతి ప్రశ్నకు నాలుగు ఇచ్చికాలు ఇవ్వబడతాయి. వీటిలో ఒకదానిని సమాధానంగా ఎంచుకోవాలి. సమాధాన పత్రంలో దానికి సంబంధించిన వృత్తాన్ని నింపవలెను. ఒకటి కన్నా ఎక్కువ వృత్తాలను నింపినచో ఆ సమాధానం పరిగణించబడదు. వృత్తాలను పూర్తిగా నింపటానికి బ్లూ/బ్లాక్ బాల్ పాయింట్ పెన్సలను మాత్రమే ఉపయోగించాలి. మరే విధమైన గీతలు గీయటం గాని మరకలను అంటించటం గాని చేయరాదు.

   ఉదా : 1 వ ప్రశ్నకు సమాధానం (2) అయితే దాన్ని ఈ క్రింది విధంగా నింపాలి.

   ① ● ③ ④

9. హాల్టికెట్లో ఇవ్వబడిన హాల్టికెట్ నంబర్ను బ్లూ/బ్లాక్ బాల్ పాయింట్ పెన్సుతో OMR సమాధాన పత్రపు సైడ్–1 లో ఇవ్వబడిన సరియైన వృత్తాలలో నింపాలి. హాల్టికెట్ నంబర్ను తప్పుగా నింపటం లేదా అస్సలు నింపకపోయినచో మీ సమాధాన పత్రం మూల్యాంకనం చేయబడదు మరియు మీ అభ్యర్థిత్వం ఎటువంటి నోటీస్ ఇవ్వకుండానే తిరస్కరించబడును.

   ఉదా : హాల్టికెట్ నంబరు 1309102001 అయితే ఈ క్రింది విధంగా నింపాలి.

   Hall Ticket Number

 | 1 | 3 | 0 | 9 | 1 | 0 | 2 | 0 | 0 | 1 |
   |---|---|---|---|---|---|---|---|---|---|

10. సమాధాన పత్రంలో కేటాయించబడిన స్థలంలో ఇన్విజిలేటర్ సంతకం తీసుకోవాలి. అభ్యర్థి కూడా OMR సమాధాన పత్రంలో కేటాయించిన స్థలంలో తప్పనిసరిగా సంతకం చేయాలి.

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11. Rough work should be done only in the space provided for that purpose in the Question Paper Booklet. No other loose sheet of paper will be allowed into the Examination Hall except Hall Ticket.

12. Do not mark answer choices on the Question Booklet. Violation of this will be viewed seriously.

13. Use of Calculators, Mathematical Tables, Log Books, Pagers, Cell Phones or any other electronic gadgets is strictly prohibited.

14. The candidate should write the Booklet number and Sign in the space provided in the Nominal Rolls while ensuring the Bio-data printed against his/ her name is correct.

15. No candidate should leave the examination hall until completion of examination time.

16. Before leaving the examination hall, the candidate should hand over the OMR Answer Sheet to the Invigilator, failing which action will be taken for malpractice.

17. Candidates are permitted to take away the Question Paper with them after completion of the exam.

18. The OMR Answer Sheet will be invalidated, if the candidate :

    i. writes the Hall Ticket No. in any other place of OMR sheet, except in the space provided for the purpose.

    ii. writes irrelevant matter, including the religious symbols, words, prayers or any communication whatsoever, in any place of the OMR answer sheet.

    iii. uses other than Blue/ Black ball point pen to darken the circles.

    iv. forgets to bubble the Question Booklet number or bubble multiple circles in a row while filling the Question Booklet No. or bubble Hall Ticket No. other than allotted to him/ her.

    v. resorts to wrong/erroneous/incomplete bubbling of circles or using ✔ or ✗ in the circles.

    vi. uses whitener on the answer sheet.

    vii. attempts any type of tampering (rubbing the circles with chalk powder/ scratching the circles with razors etc.) on the OMR Answer Sheet.

    viii. adopts any method of malpractice.

19. No correspondence will be entertained in this matter by the commission, if the Answer Sheet is invalidated or his / her candidature is rejected due to the above reasons.

20. The digital copy of OMR Answer Sheets will be made available in the Commission's website after completion of the Image Scanning.

11. ప్రశ్నా పత్రంలో కేటాయించిన స్థలంలో మాత్రమే చిత్తు పని చేయవలెను. పరీక్ష గదిలోకి హాల్‌టికెట్ తప్ప మరే ఇతర విడి కాగితాలు అనుమతించబడవు.

12. ప్రశ్నా పత్రాలలో సమాధానాలను గుర్తుపెట్టడం తీవ్రంగా పరిగణించబడును.

13. పరీక్ష గదిలో కాలిక్యులేటర్లు, మాథమాటికల్ టేబుల్స్, లాగ్ బుక్స్, పేజర్స్, సెల్ ఫోన్స్ లేదా ఏ ఇతర ఎలక్ట్రానిక్ వస్తువులను ఉపయోగించడం నిషిద్ధం.

14. నామినల్ రోల్స్‌లో ముద్రించబడిన తన వ్యక్తిగత వివరాలు సరియైనవని ధృవీకరించుకున్న తర్వాత అభ్యర్థి తనకివ్వబడిన ప్రశ్నాపత్రం యొక్క క్వశ్చన్ బుక్‌లెట్ నంబర్‌ను నామినల్ రోల్స్‌లో దానికై కేటాయించబడిన స్థలంలో రాసి సంతకం చెయ్యాలి.

15. పరీక్ష పూర్తయ్యే వరకు ఏ ఒక్క అభ్యర్థి కూడా పరీక్ష గదిని విడిచి వెళ్ళటానికి అనుమతించబడదు.

16. పరీక్ష అనంతరం పరీక్ష గది నుండి బయటకు వెళ్ళే ముందు ప్రతి అభ్యర్థి OMR సమాధాన పత్రాన్ని ఇన్విజిలేటర్‌కు తప్పనిసరిగా అప్పగించి వెళ్ళాలి. లేనిచో అతని పై మాల్ ప్రాక్టీస్ కింద చర్యలు తీసుకోబడును.

17. పరీక్ష అనంతరం ప్రశ్నా పత్రాన్ని అభ్యర్థులు తమ వెంట తీసుకొని వెళ్ళవచ్చు.

18. ఒక అభ్యర్థి క్రింది ఏ చర్యలకు పాల్పడినను అతని సమాధాన పత్రం మూల్యాంకనం చేయబడదు.

    i. OMR సమాధాన పత్రం పై హాల్‌టికెట్ నంబరును దానికి కేటాయించిన స్థలంలో కాకా ఏ ఇతర స్థలంలో రాసినను,

    ii. పరీక్షకు ఏమాత్రం సంబంధం లేని విషయం ఉదా : మత సంబంధ చిహ్నాలు, పదాలు, ప్రార్థనలు లేదా ఏ ఇతర సమాచారాన్నైనా జవాబు పత్రం పై రాసినట్లయితే,

    iii. వృత్తాలను నింపటానికి బ్లూ/బ్లాక్ బాల్ పాయింట్ పెన్నులను కాకా ఏ ఇతర పెన్నులను ఉపయోగించినను,

    iv. క్వశ్చన్ బుక్‌లెట్ నంబర్ లేదా హాల్‌టికెట్ నంబర్లను బబ్లింగ్ చేయటం మరచిపోయినను లేదా క్వశ్చన్ బుక్‌లెట్ నంబర్‌ను నింపే సమయంలో ఒక వరసలోనే ఒకటి కన్నా ఎక్కువ వృత్తాలను నింపినను. అభ్యర్థి తనకు కేటాయించిన హాల్‌టికెట్ నంబర్ కాక ఇతర హాల్‌టికెట్ నంబరును కానీ బబ్లింగ్ చేసినచో,

    v. సమాధాన పత్రం పై వృత్తాలను తప్పుగా/అసంపూర్ణంగా నింపినచో లేక ✔ లేదా ✗ వంటి గుర్తులను వృత్తాలలో గీసినచో,

    vi. సమాధాన పత్రంలో తెల్ల సిరా (వైట్‌నర్)ను ఉపయోగించినచో,

    vii. సమాధాన పత్రం పై వృత్తాలను చాక్ పీస్ పౌడర్‌తో రుద్దటం, బ్లేడ్‌తో గీయటం వంటి చర్యలకు పాల్పడినట్లయితే,

    viii. ఏ విధమైన మాల్ ప్రాక్టీస్ పద్ధతులను అవలంబించినను,

19. పై ఏ కారణంవల్లనైనను అభ్యర్థుల యొక్క సమాధాన పత్రాలు మూల్యాంకనం చేయబడకపోయినా లేదా వారి అభ్యర్థిత్వం రద్దు చేయబడినా, ఈ విషయంలో కమిషన్‌తో ఏ విధమైన ఉత్తర ప్రత్యుత్తరములకు అనుమతించబడదు.

20. పరీక్షకు హాజరైన అందరి అభ్యర్థుల OMR సమాధాన పత్రాల యొక్క డిజిటల్ కాపీలు, ఇమేజ్ స్కానింగ్ అయిన తర్వాత కమిషన్ వెబ్‌సైట్‌లో అందుబాటులో ఉంచబడును.
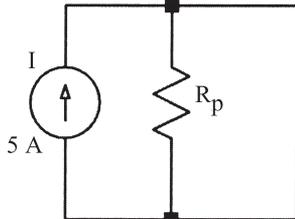
P.T.O.

1. Consider a circuit shown below with DC supply ($V_S = 5$ V). The series resistance (R_S) of 5 Ω is connected as shown. Maximum power dissipated in the R_L is
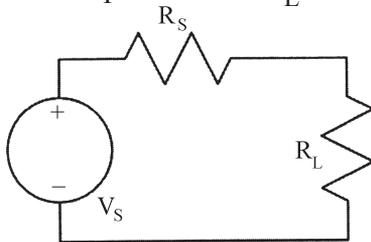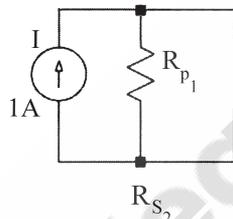

(1) 0.0125 W 　　　(2) 0.125 W
(3) 1.25 W 　　　　(4) 0.00125 W

2. Consider a circuit below with $R_p = 5$ Ω.

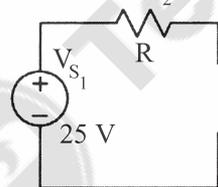It is equivalent to which one of the following ?

(1) $R_{p_1} = 1$ Ω
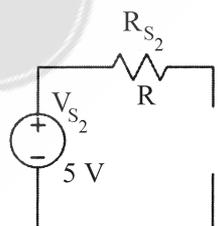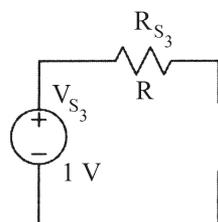

(2) $R_{S_2} = 5$ Ω
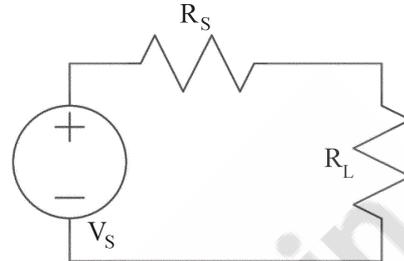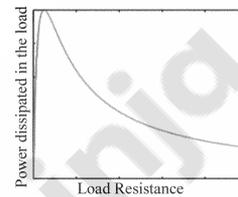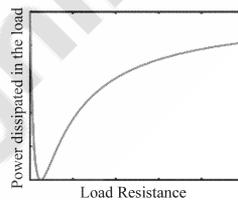

(3) $R_{S_2} = 5$ Ω

(4) $R_{S_3} = 1$ Ω

3. In the circuit below, the power dissipated in the R_L as a function of R_L is schematically represented by which of the graph ?
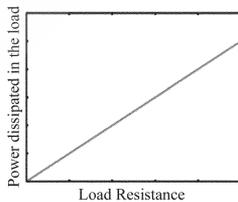

(1)
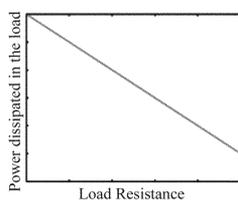

(2)

(3)

(4)

4. Any periodic function f(x) with a period of 2L can be written as

$$f(x) = k + \sum_{i=1}^{\infty} \left(a_i \cos\left(\frac{i\pi}{L}x\right) + b_i \sin\left(\frac{i\pi}{L}x\right) \right).$$

Given that f(x) is an even function. Which of the following option is correct ?
(1) $k = 0$
(2) $a_i = 0$
(3) $b_i = 0$
(4) $k \neq 0$, $a_i \neq 0$, $b_i \neq 0$

5. The Fourier series of a function described below

$f(x) = x + \pi; \quad -\pi < x < \pi$

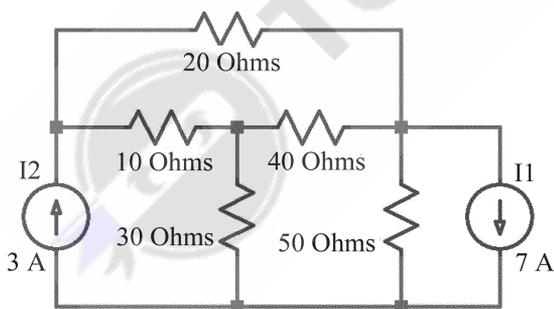$f(x + 2\pi) = f(x)$

is given by which of the following options ?

(1) $\pi + \sum_{n=1}^{\infty} \left(-\dfrac{2}{n}\cos(n\pi)\right)\sin(nx)$

(2) $\dfrac{\pi}{2} + \sum_{n=1}^{\infty} \left(-\dfrac{2}{n}\cos(n\pi)\right)\sin(nx)$

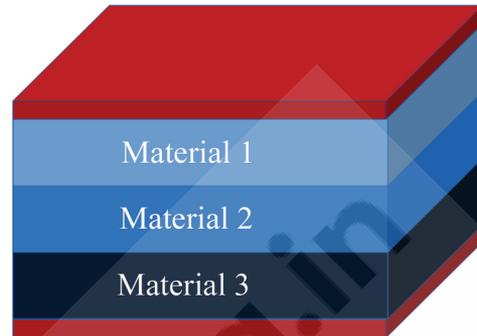(3) $\pi + \sum_{n=1}^{\infty} \left(-\dfrac{2}{n}\sin(n\pi)\right)\cos(nx)$

(4) $\dfrac{\pi}{2} + \sum_{n=1}^{\infty} \left(-\dfrac{2}{n}\sin(n\pi)\right)\cos(nx)$

6. Consider a circuit below. The voltage across the 3 A current source is

(1) 52.35 V

(2) 5.235 V

(3) 26.17 V

(4) 2.617 V

7. A parallel plate capacitor is made with three dielectrics placed between two metal electrodes.

The thickness of Material 1, Material 2 and Material 3 is d_1, d_2, d_3 respectively. The dielectric constant for Material 1, Material 2 and Material 3 is ε_1, ε_2, ε_3 respectively. The capacitance per unit area of this system is given by

(1) $C = \left[\dfrac{d_1}{\varepsilon_1} + \dfrac{d_2}{\varepsilon_2} + \dfrac{d_3}{\varepsilon_3}\right]^{-1}$

(2) $C = \dfrac{d_1}{\varepsilon_1} + \dfrac{d_2}{\varepsilon_2} + \dfrac{d_3}{\varepsilon_3}$

(3) $C = \left[\dfrac{d_1}{\varepsilon_1} + \dfrac{d_3}{\varepsilon_3}\right]^{-1}$

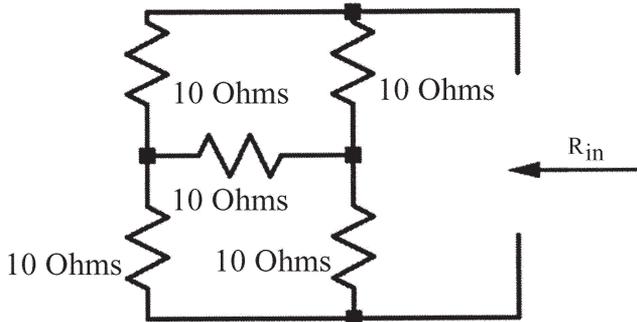(4) $C = \dfrac{d_1}{\varepsilon_1} + \dfrac{d_3}{\varepsilon_3}$

8. Initially the switch is closed, and steady state has been reached. At $t = 0$ the switch is opened. What is the voltage across the capacitor at $t = 0^+$?
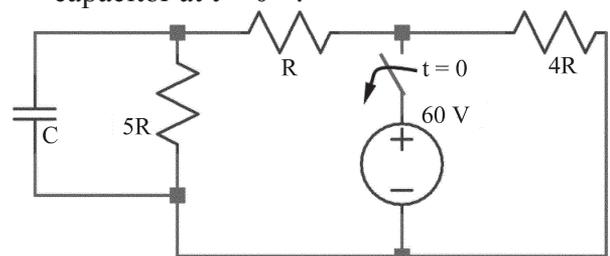
(1) 10 V

(2) 50 V

(3) 0 V

(4) 60 V

9. What is the Thevenin equivalent resistance of the network shown below ?

(1) R_{in} = 40 Ohms

(2) R_{in} = 30 Ohms

(3) R_{in} = 20 Ohms

(4) R_{in} = 10 Ohms

10. The resonance frequency, ω_0, for the circuit shown below is
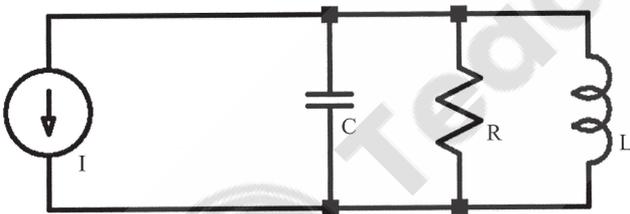
(1) $\omega_0 = \dfrac{1}{RC}$ Hz

(2) $\omega_0 = \dfrac{R}{L}$ Hz

(3) $\omega_0 = \dfrac{1}{\sqrt{LC}}$ Hz

(4) $\omega_0 = \dfrac{1}{RC} + \dfrac{R}{L} + \dfrac{1}{\sqrt{LC}}$ Hz

11. Consider a series RL circuit shown below
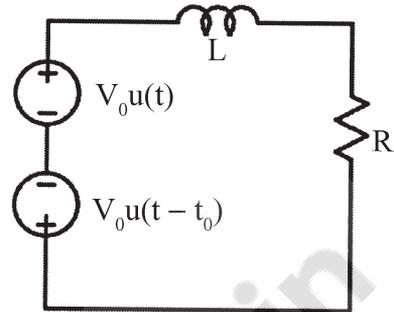
u(t) and $u(t - t_0)$ are unit step functions. The current flowing through the resistance R at time t > 0 is given by

(1) $i(t) = \dfrac{V}{R} e^{-Rt/L} \left(e^{Rt_0/L} - 1 \right)$

(2) $i(t) = \dfrac{V}{R} e^{-Rt/L} \left(e^{-Rt_0/L} - 1 \right)$

(3) $i(t) = \dfrac{V}{R} e^{Rt_0/L} \left(e^{-Rt/L} - 1 \right)$

(4) $i(t) = \dfrac{V}{R} e^{-Rt_0/L} \left(e^{-Rt/L} - 1 \right)$

12. What should be the value of the capacitance so that the resonance frequency of the circuit below is 314.16 rad/sec ?
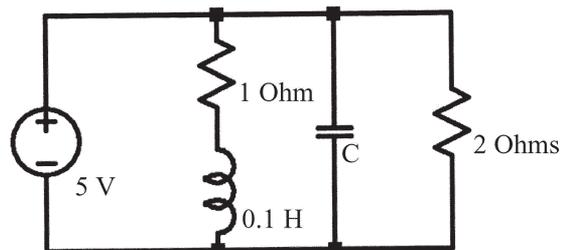
(1) C = 1 mF

(2) C = 10 mF

(3) C = 0.1 mF

(4) C = 0.01 mF

13. The output of the circuit is taken across the resistance. The bandwidth of the circuit shown is
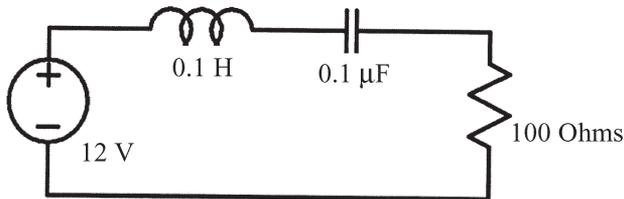
(1) 1k rads

(2) 100k rads

(3) 1M rads

(4) 10M rads

14. A two port network has the following impedance parameters (all in Ω)

$$z = \begin{bmatrix} 10^2 & 1 \\ -10^5 & 10^3 \end{bmatrix}$$

The input is connected to a sinusoidal voltage source V_s, having 50 Ω of series resistance. A 1k Ω load resistance is connected. Calculate the voltage gain of the network.

(1) $G_v = -\dfrac{1000}{3}$

(2) $G_v = \dfrac{1000}{3}$

(3) $G_v = 10^5$

(4) $G_v = -10^5$

15. Which of the following transformation between the z (impedance) and h (hybrid) parameters is correct ?

(1) $z = \begin{bmatrix} \dfrac{h_{11}h_{22} - h_{12}h_{21}}{h_{22}} & \dfrac{h_{12}}{h_{22}} \\ \dfrac{-h_{21}}{h_{22}} & \dfrac{1}{h_{22}} \end{bmatrix}$

(2) $z = \begin{bmatrix} \dfrac{h_{11}h_{22} - h_{12}h_{21}}{h_{22}} & \dfrac{h_{12}}{h_{22}} \\ \dfrac{-h_{21}}{h_{22}} & \dfrac{-1}{h_{22}} \end{bmatrix}$

(3) $z = \begin{bmatrix} \dfrac{h_{11}h_{22} - h_{12}h_{21}}{h_{22}} & \dfrac{-h_{12}}{h_{22}} \\ \dfrac{-h_{21}}{h_{22}} & \dfrac{1}{h_{22}} \end{bmatrix}$

(4) $z = \begin{bmatrix} \dfrac{h_{11}h_{22} - h_{12}h_{21}}{h_{22}} & \dfrac{h_{12}}{h_{22}} \\ \dfrac{h_{21}}{h_{22}} & \dfrac{1}{h_{22}} \end{bmatrix}$

16. A set of 4-point charges of 3μC are placed at (1, 1, 0), (–1, 1, 0), (–1, –1, 0) and (1, –1, 0) in a space with relative permittivity of 2. Calculate the resultant electric field at the (1, 1, 1).

(1) $\vec{E} = -3.41\hat{x} - 3.41\hat{y} + 16.4\hat{z} \text{ kV} / \text{m}$

(2) $\vec{E} = 3.41\hat{x} + 3.41\hat{y} + 16.4\hat{z} \text{ kV} / \text{m}$

(3) $\vec{E} = 16.4\hat{x} + 16.4\hat{y} + 3.41\hat{z} \text{ kV} / \text{m}$

(4) $\vec{E} = -16.4\hat{x} - 16.4\hat{y} + 3.41\hat{z} \text{ kV} / \text{m}$

17. Consider an infinite uniform line charge of 5 nC/m along the x axis in free space. Calculate the electric field at a distance of 2 m from the line charge along the z axis.

    (1) $22.5\,\hat{z}$ V/m

    (2) $11.25\,\hat{z}$ V/m

    (3) $45\,\hat{z}$ V/m

    (4) $90\,\hat{z}$ V/m

18. Calculate the amount of the point charge at the origin given that the potential at (–2, 3, 1) is 36 V and reference is taken to be at infinity.

    (1) Q = 15 nC

    (2) Q = 30 nC

    (3) Q = 7.5 nC

    (4) Q = 1.5 nC

19. Consider a coaxial capacitor having inner radius of 0.1045 m and outer radius of 0.68 m and having a length of 0.3048 m. Assume the dielectric to be air. The capacitance is

    (1) 9.05 pF

    (2) 90.5 pF

    (3) 9.05 nF

    (4) 90.5 nF

20. Consider three infinite uniform charge sheets located in a free space as follows : 1) $3 nC/m^2$ at z = –2 m, 2) $6 nC/m^2$ at z = 0.5 m, 3) $–8 nC/m^2$ at z = 4 m. The electric field at (2, 5, –5) is

    (1) $-56.5\,\hat{z}$ V/m

    (2) $+56.5\,\hat{z}$ V/m

    (3) $-5.65\,\hat{z}$ V/m

    (4) $+5.65\,\hat{z}$ V/m

21. Laplace transform of f(t) is $\dfrac{s}{s^2 - 4}$. Then the f(t) is

    (1) f(t) = cosh(2t)

    (2) f(t) = sinh(2t)

    (3) f(t) = cos(2t)

    (4) f(t) = sin(2t)

22. The Laplace transform of the differential equation $y'' + ay' + by = f(t)$. Assume that $y(0) = 5, y'(0) = 10, Y(s)$ and $F(s)$ are the Laplace transforms of y(t) and f(t) respectively

    (1) $s^2 Y - 5s - 10 + a(sY - 5) + bY = R(s)$

    (2) $s^2 Y - 10s - 5 + a(sY - 10) + bY = R(s)$

    (3) $s^2 Y + 5s + 10 + a(sY + 5) + bY = R(s)$

    (4) $s^2 Y + 10s + 5 + a(sY + 10) + bY = R(s)$

23. Calculate the magnetic field intensity, H, at (0.4, 0.3, 0) due to the 8 A filamentary current directed from outward from origin to the infinity along the positive x axis and inward from the infinity to origin along the positive y axis as shown below.
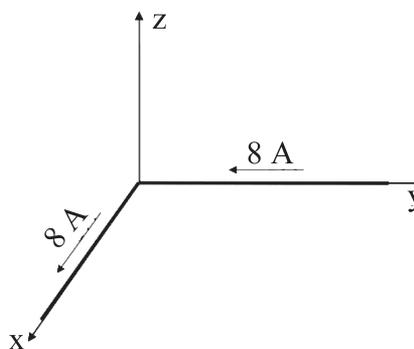
    (1) $6.37\,\hat{z}$ A/m

    (2) $-6.37\,\hat{z}$ A/m

    (3) $63.7\,\hat{z}$ A/m

    (4) $-63.7\,\hat{z}$ A/m

24. An infinitely long current filament carrying 28.1 A of current in the positive z direction. The magnetic field intensity, H, at $(\sqrt{20}, 0, 4)$ is

   (1) $1\hat{y}$ A/m

   (2) $0.5\hat{y}$ A/m

   (3) $0.1\hat{y}$ A/m

   (4) $10\hat{y}$ A/m

25. Consider a coaxial cable having inner radius of 0.8 mm and outer radius of 4 mm and filled with a material having a relative permeability of 50. The self-inductance will be

   (1) 16.1 µH/m

   (2) 16.1 µH

   (3) 32.2 µH/m

   (4) 32.2 µH

26. Which among the following is an example for a voltage bidirectional two-quadrant switch ?

   (1) BJT

   (2) Diode

   (3) MOSFET

   (4) SCR

27. The minimum value of anode current in an SCR that is required to sustain conduction in a thyristor with zero gate current is called

   (1) Latching current

   (2) Holding current

   (3) Base current

   (4) Fundamental current

28. Which of the following is the function of an R-C snubber circuit connected in parallel to an SCR ?

   (1) Triggering the SCR

   (2) Preventing over voltages across the SCR

   (3) Forced commutation of the SCR

   (4) Limiting the di/dt through the SCR

29. A three-phase diode bridge rectifier supplied from a three-phase, 400 V, 50 Hz ac supply delivers power to a resistive load of 50 Ω. The peak value of the instantaneous load voltage would be

   (1) $400\sqrt{2}$ V

   (2) 400 V

   (3) $400\sqrt{(2/3)}$

   (4) $400/\sqrt{3}$

30. A step up chopper delivers an average output voltage of 100 V from an input supply of 60 V when operating with a continuous source current. What is the operating duty ratio for the switch ?

   (1) 0.6

   (2) 0.4

   (3) 2/3

   (4) 1/3

31. Consider the following statements about a triac :

    A. A triac has bidirectional current carrying capability as well as bidirectional voltage blocking capability.

    B. A triac is functionally equivalent to two antiparallel connected thyristors.

    C. The triac can be turned on with both positive and negative gate currents.

    Which of the above statements is/are true ?

    (1) A and B only

    (2) A and C only

    (3) B and C only

    (4) A, B and C

32. Consider the following statements about a phase controlled single-phase full-bridge converter using SCRs :

    A. The average output voltage at the dc side varies linearly with the firing angle.

    B. The power factor at the ac input side depends on the converter firing angle.

    C. The converter cannot be operated with firing angle greater than 90 degrees.

    Which of the above statements is/are true ?

    (1) A and B only

    (2) B and C only

    (3) B only

    (4) A only

33. Consider the following devices and their characteristics :

    A. Schottky Diode   1. Current controlled turn-on and turn-off

    B. Silicon Controlled Rectifier   2. Majority carrier device

    C. IGBT   3. Voltage controlled turn-on and turn-off

    D. BJT   4. Four layer device structure

    Choose the option in which all the items are correctly matched.
    (1) A – 1, B – 2, C – 3, D – 4
    (2) A – 2, B – 4, C – 3, D – 1
    (3) A – 4, B – 2, C – 1, D – 3
    (4) A – 2, B – 1, C – 3, D – 4

34. Consider the following statements about three-phase voltage source inverters :

    A. They require voltage-bidirectional two quadrant devices to realise the switches.

    B. PWM techniques are used to reduce the frequency of the harmonics in the output.

    C. In the $180°$ conduction mode, a new switch is gated in every $60°$ duration.

    Which of the above statements is/are true ?
    (1) A and B only
    (2) B and C only
    (3) A only
    (4) C only

35. A voltage source inverter is most suitable in applications where
   (1) Source has a large inductance and the load has a small inductance
   (2) Source has a small inductance and load inductance is large
   (3) Both source and load have large inductances
   (4) Both source and load have small inductances

36. Which of the following is a characteristic of an ideal transformer ?
   (1) Large magnetising current
   (2) Zero core flux
   (3) Infinite core reluctance
   (4) Zero stored magnetic energy

37. In a transformer, the load current is kept constant, while the power factor is varied. Under this situation, zero voltage regulation will be observed
   (1) load power factor is leading
   (2) load power factor is lagging
   (3) at power factor equal to unity
   (4) independent of load power factor

38. If P_e and P_h denote the eddy current loss and hysteresis loss in a magnetic core operating with an alternating flux density waveform of frequency f, then
   (1) P_e is proportional to f and P_h is proportional to f^2
   (2) P_e is proportional to f^2 and P_h is proportional to f
   (3) P_e and P_h are both proportional to f^2
   (4) The total loss (P_e+P_h) is proportional to f

39. In a single-phase transformer supplied from a constant input voltage, the magnitude of the load current is kept constant while the power factor is varied. Under this condition
   (1) the maximum efficiency occurs at power factor of 0.5 (lead)
   (2) the maximum efficiency occurs at power factor of 0.5 (lag)
   (3) the maximum efficiency occurs at unity power factor
   (4) the power factor where maximum efficiency occurs depends on the leakage inductance values

40. For the parallel operation of 2 single-phase transformers with same voltage ratio and different kVA ratings, the load is shared by these transformers in proportion to their kVA ratings when the transformers have
   (1) the same leakage reactance in ohms.
   (2) the same magnetising reactance in ohms.
   (3) leakage reactance in ohms inversely proportional to their ratings.
   (4) equal per unit impedances on their respective ratings.

41. A DC shunt motor with an armature resistance of 0.15 Ω is supplied from 230 V input supply. If the back emf of the motor is 200 V, then the armature current will be equal to
   (1) 100 A
   (2) 200 A
   (3) 150 A
   (4) 250 A

42. Which of the following is the reason behind the inability of an ideal synchronous motor to develop any starting torque ?

(1) The rotor is extremely heavy in these machines.

(2) The relative velocity between stator and rotor mmf is large at starting.

(3) The rotor winding has a very high reactance.

(4) The stator winding are concentrated windings.

43. In a grid-connected synchronous generator working at unity power factor, increasing the field excitation has the effect of

(1) Increasing only the active power supplied to the grid.

(2) Increasing only the reactive power supplied to the grid.

(3) Increasing both active power and reactive power supplied to the grid.

(4) Increasing the operating frequency of the grid.

44. The stator of a three-phase, 4-pole squirrel cage induction motor rated for 1450 rpm at 50 Hz, is rewound to have six poles without any change made on the rotor. This motor would then

(1) operate with speed slightly below 1000 rpm at 50 Hz.

(2) fail to develop any torque.

(3) operate with speed slightly above 1800 rpm at 50 Hz.

(4) run at the same speed with higher torque rating.

45. Reducing the speed in a three-phase induction motor by using stator voltage control while supplying a constant torque load would result in

(1) Reduction in rotor slip

(2) Increased peak torque capability

(3) Higher airgap flux within the machine

(4) Reduced efficiency

46. The maximum efficiency of a single phase transformer operating at unity power factor is found to be 90 % under full load conditions. The efficiency at half load at the same power factor would be

(1) 84.5 %

(2) 87.8 %

(3) 88.3 %

(4) 90 %

47. At low values of operating slip, the torque developed in a three-phase induction motor is

(1) linearly proportional to slip

(2) independent of slip

(3) inversely proportional to slip

(4) proportional to the square of slip

48. The speed of an induction motor is increased by increasing the frequency by 20 %. If the magnetising current of the machine is to remain constant, then

(1) supply voltage must be increased by 20 %

(2) supply voltage must be decreased by 20 %

(3) supply voltage must be increased by 10 %

(4) slip must be increased by 20 %

49. If the magnetic circuit in a dc machine is operating under saturated conditions, then the armature reaction in the machine results in

   (1) increase in the value of flux per pole

   (2) no change in the value of flux per pole

   (3) decrease in the value of flux per pole

   (4) increase or decrease depending on motoring or generating mode of operation

50. A synchronous generator rated 11 kV, 50 MVA has a per unit impedance of 0.2 pu on its own base. Then its impedance referred to a 22 kV, 150 MVA base would be

   (1) 0.2 pu

   (2) 0.1 pu

   (3) 0.15 pu

   (4) 0.133 pu

51. A three phase induction motor with a 6-pole winding is rotating at 1200 rpm. The speed of rotation in electrical and mechanical radians per second are respectively

   (1) 120π, 40π

   (2) 40π, 120π

   (3) 40π, $40\pi/3$

   (4) $40\pi/3$, 40π

52. Consider the following statements about the operation of a synchronous machine :

   A. The armature reaction in the generating mode aids the field flux when supplying a leading current.

   B. The armature reaction opposes the field flux for a motor that draws a leading power factor current.

   C. Armature reaction in motoring mode always opposes the field excitation irrespective of the power factor.

   Which of the above statements is/are true ?

   (1) A only

   (2) B and C only

   (3) B only

   (4) A and B only

53. Consider the following statements about a dc series motor :

   A. The developed torque in the machine is directly proportional to the current in the machine.

   B. The motor is suitable only for loads having a small starting torque.

   C. The machine can run even when a single phase ac supply is applied across its terminals.

   Which of the above statements is/are true ?

   (1) A and B only

   (2) B and C only

   (3) A, B and C

   (4) C only

54. Consider the following statements about the armature mmf wave in a dc machine

   A. The mmf waveform has a sinusoidal shape.

   B. The mmf waveform has a triangular shape.

   C. The mmf waveform rotates with respect to the armature.

   D. The armature waveform rotates with respect to the stator.

Which of the above statements is/are true ?

(1) A and C only

(2) A and D only

(3) B and C only

(4) B and D only

55. Consider the following statements made about short-pitched windings in ac rotating machines :

   A. Short-pitching the windings results in reduced fundamental emf compared to full-pitched windings.

   B. Short-pitching increases the harmonic voltage content in the induced emf.

   C. Short-pitched coils have smaller length for the overhang portion.

Which of the above statements is/are true ?

(1) A and C only

(2) A and B only

(3) A only

(4) C only

56. Consider the following lists regarding speed control methods for dc motors :

   A. Armature voltage control   1. Poor efficiency

   B. Field current control   2. Speeds below base speed

   C. Use of diverter resistor   3. Speeds above base speed

   D. Rheostatic voltage control   4. DC series motor

Choose the option in which all the items are correctly matched.

(1) A – 2, B – 3, C – 4, D – 1

(2) A – 2, B – 3, C – 1, D – 4

(3) A – 4, B – 2, C – 1, D – 3

(4) A – 2, B – 1, C – 3, D – 4

57. In a single-phase SCR based full-converter with continuous conduction operating with firing angle α, what is the angle duration of conduction for each pair of SCRs in radians ?

(1) $\pi - \alpha$

(2) $\pi + \alpha$

(3) π

(4) α

58. Consider the following statements about a linear system that has a transfer function given as $G(s) = \dfrac{1-s}{1+s}$:

   A. G(s) is a minimum-phase system.

   B. The system is BIBO stable.

   C. It is an all pass system.

Which of the above statements is/are true ?

(1) A and B only

(2) B and C only

(3) A, B and C

(4) B only

59. Which of the following represents the transfer function of a zero-order hold with sample period T ?

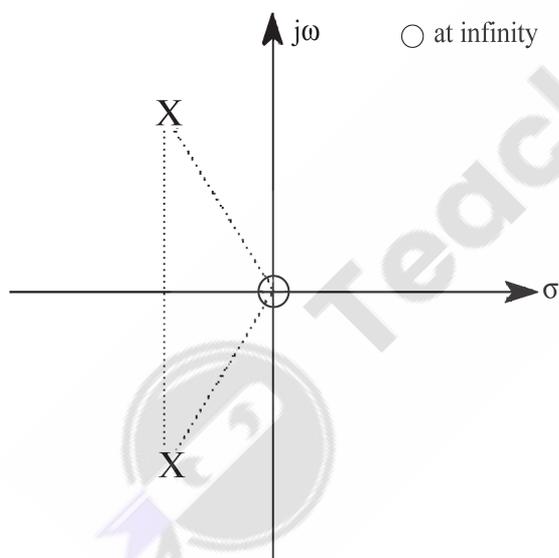(1) $\dfrac{1-e^{-sT}}{s}$

(2) $\dfrac{1+e^{-sT}}{s}$

(3) $s(1-e^{-sT})$

(4) $s(1+e^{-sT})$

60. The pole zero plot shown below represents a system whose frequency response is approximately that of a
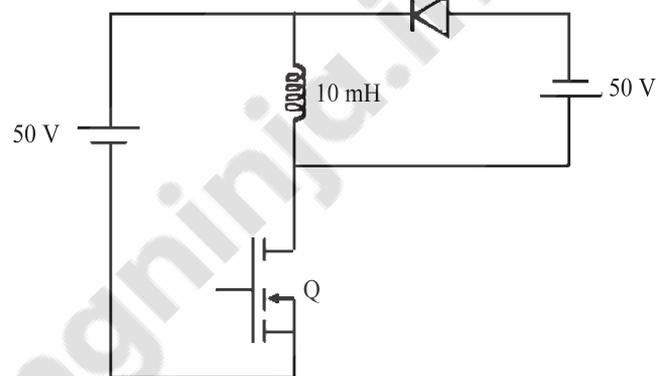

(1) Low pass filter

(2) High pass filter

(3) Notch filter

(4) Bandpass filter

61. The MOSFET in the circuit shown below is operated as a switch at a frequency of 10 kHz and duty ratio of 0.6. The initial inductor current is zero. If all the components can be assumed to be ideal, what would be the energy stored in the inductor at the end of 10 switching cycles ?

(1) 0.005 J

(2) 0.001 J

(3) 0.01 J

(4) 0.008 J

62. Which of the following represents an expression for the damping factor in a series R-L-C circuit ?

(1) $\dfrac{R\sqrt{C}}{2\sqrt{L}}$

(2) $\dfrac{R\sqrt{C}}{2L}$

(3) $\dfrac{RC}{2L}$

(4) $R\sqrt{LC}$

63. A unity feedback closed loop system has an output given as $y(t) = e^{-2t} u(t)$ when the input to the system is a unit impulse. Which of the following denotes the transfer function of the open loop system ?

    (1) $1/(s + 3)$

    (2) $1/(s + 2)$

    (3) $1/(s + 1)$

    (4) $s/(s + 1)$

64. The dynamics of a system is defined by the relation $\ddot{x} + 6\dot{x} + 5x = 10(1 - e^{-t})$. What will be the steady state value of the system output $x(t)$?

    (1) 1

    (2) 2

    (3) 3/2

    (4) 5/3

65. The characteristic polynomial of a linear system is given as $s^4 + 3s^3 + 5s^2 + 6s + K + 10 = 0$. What should be the condition on K so that the system is stable ?

    (1) $K > 10$

    (2) $K > -4$

    (3) $K > -10$

    (4) $-10 < K < -4$

66. Consider a linear system represented in state space form as shown below :

$$\dot{x} = \begin{bmatrix} 0 & 1 \\ -3 & -6 \end{bmatrix} x + \begin{bmatrix} 1 \\ 0 \end{bmatrix} u$$

$$y = \begin{bmatrix} 1 & 0 \end{bmatrix} x$$

Which of the following is true for this system ?

    (1) The system is stable and controllable but not observable

    (2) The system is controllable and observable, but unstable

    (3) The system is stable, controllable and observable

    (4) The system is stable and observable, but not controllable

67. If u(t) denotes the unit step function, which of the following is an example of a bounded signal ?

    (1) $e^{2t}u(t)$

    (2) $e^{-2t}u(t)$

    (3) $e^{t}\sin(t)u(t)$

    (4) $tu(t)$

68. If the Nyquist plot of the open loop transfer function G(s)H(s) of a system passes through the $-1 + j0$ point, then the phase margin of this system is likely to be

    (1) 180 degrees

    (2) 0 degree

    (3) 90 degrees

    (4) 45 degrees

16

69. For the open loop transfer function of a system is given as $G(s)H(s) = \dfrac{\pi e^{-0.25s}}{s}$, the gain crossover frequency in rad/sec is
(1) π
(2) $\pi/2$
(3) $\pi/4$
(4) 2π

70. The transfer function given as $G(s) = \dfrac{s+\alpha}{s+\beta}$ could represent that of a lead compensator, if
(1) $\alpha = 1$, $\beta = 2$
(2) $\alpha = 3$, $\beta = 2$
(3) $\alpha = -3$, $\beta = -1$
(4) $\alpha = 3$, $\beta = 1$

71. The impedance of a three phase transmission line in ohms is given as $Z_{line} = 5 + j10$. If the line delivers 100 MVA of power at 400 kV, what would be the transmission power loss in the line ?
(1) 621 kW
(2) 210 kW
(3) 356 kW
(4) 104 kW

72. Two synchronous generators G1 and G2 rated 200 MW and 400 MW respectively are operated in parallel to supply a total load of 300 MW. If the governors in both the machines are set to a droop of 4%, what would be the individual power supplied by each generator ?
(1) G1 = 200 MW, G2 = 100 MW
(2) G1 = 150 MW, G2 = 150 MW
(3) G1 = 100 MW, G2 = 200 MW
(4) G1 = 50 MW, G2 = 250 MW

73. In a salient pole synchronous generator with X_d and X_q denoting the reactance in the d and q axes, what is likely to be the relation between X_d and X_q ?
(1) $X_d < X_q$
(2) $X_d = X_q$
(3) $X_d > X_q$
(4) $X_d = -X_q$

74. A three-phase induction motor rated at 15 hp, 440 V has an efficiency of 85% and operates at a power factor of 0.9 (lag), while delivering rated output power. What would be the reactive power drawn by the motor under this condition ?
(1) 7.42 kVAr
(2) 6.38 kVAr
(3) 8.21 kVAr
(4) 5.11 kVAr

75. The surge impedance of a 300 km long overhead line is 180 ohms. For a 150 km length of the same line, the surge impedance in ohms would be
(1) 180 Ohms
(2) 360 Ohms
(3) 90 Ohms
(4) 270 Ohms

76. In a long transmission line operating under lightly loaded conditions, the receiving end voltage is found to be higher than the sending end voltage. Which effect accounts for this phenomenon ?

(1) Corona effect

(2) Ferranti effect

(3) Proximity effect

(4) Skin effect

77. Which of the following machines is most suitable for installation as a generator in a coal-fired thermal power plant ?

(1) Salient pole synchronous generator

(2) Cylindrical rotor synchronous generator

(3) Squirrel cage induction generator

(4) Wound rotor induction generator

78. Which of these is responsible for developing the pressure in the working fluid cycle in a thermal power plant ?

(1) Steam Turbine

(2) Condenser

(3) Feed Water pump

(4) Superheater

79. An electric machine wherein the self-inductances of both stator and rotor windings are independent of the rotor position will NOT develop any

(1) Starting torque

(2) Reluctance torque

(3) Hysteresis torque

(4) Synchronizing torque

80. Consider the following lists regarding compensation techniques in power systems :

A. Reduce the Ferranti effect — 1. Series capacitor

B. Improve power factor — 2. Shunt reactor

C. Increase power flow capability of line — 3. Shunt capacitor

D. Reduce current ripple — 4. Series reactor

Choose the option in which all the items are correctly matched.

(1) A – 2, B – 1, C – 3, D – 4

(2) A – 1, B – 3, C – 2, D – 4

(3) A – 4, B – 2, C – 1, D – 3

(4) A – 2, B – 3, C – 1, D – 4

81. If the value of complex power flow in a certain transmission line is assumed to be fixed and if V denotes the sending end voltage of the line, then the real power loss in the line would be proportional to

(1) V

(2) V^2

(3) V^{-1}

(4) V^{-2}

82. Which of the following relays used for transmission line distance protection has the property of being inherently directional ?

(1) MHO relay

(2) OHM relay

(3) Impedance relay

(4) Reactance relay

83. Gauss-Siedel technique is commonly used in power systems for which of the following ?
    (1) Load flow Analysis
    (2) Fault Analysis
    (3) Unit Commitment
    (4) Stability Analysis

84. A bucholz relay is commonly used for the protection of which of the following ?
    (1) Transformers
    (2) Transmission lines
    (3) Busbars
    (4) Generators

85. An ideal diode connected in series with a pure inductance is supplied from an ideal AC voltage source. Then for what duration in radians will the diode conduct, with respect to the AC voltage waveform ?
    (1) 2π
    (2) π
    (3) $\pi/2$
    (4) $\pi/4$

86. A three-phase 33 kV, oil-circuit breaker is rated 1500 A, 2000 MVA, 2 s. The symmetrical breaking current for this breaker would be
    (1) 25 kA
    (2) 35 kA
    (3) 50 kA
    (4) 40 kA

87. Which of the following is the purpose of using harmonic restraint function in power transformers ?
    (1) To reduce the harmonic content in the transformer voltage
    (2) To reduce the harmonic content in transformer current
    (3) To prevent false tripping due to magnetising inrush current
    (4) To reduce the harmonic power loss in the transformer

88. Consider the following statements made about the sequence impedances of power system components.
    A. A fully transposed transmission line has equal positive and negative sequence impedances.
    B. The negative sequence impedance of a synchronous generator is usually smaller than the positive sequence impedance.
    C. The negative sequence impedance of a transformer is generally much higher than the positive sequence impedance.

    Which of the above statements is/are true ?
    (1) A and B only
    (2) B and C only
    (3) A and C only
    (4) A only

89. In a three-phase bridge inverter operating in the square wave mode, the output voltage waveform contains
    (1) Only triplen order harmonics
    (2) Only odd order harmonics
    (3) Only even order harmonics
    (4) Both even and odd order harmonics, but no triplen harmonics

90. A dc shunt motor supplied from a 220 V DC input supply runs at 1200 rpm. Neglecting all losses and saturation, what would be the speed when the same motor is supplied from a 175 V DC input ?

    (1) 750 rpm

    (2) 950 rpm

    (3) 1200 rpm

    (4) 1100 rpm

91. In an alternator, a field current of 20 A results in an armature current of 400 A when the terminals are short-circuited. The same field current also creates a terminal voltage of 2000 V in open circuit. What would be the magnitude of the internal voltage drop within the machine at a load current of 200 A ?

    (1) 1 V

    (2) 10 V

    (3) 100 V

    (4) 1000 V

92. Which of the following could be the effect of using high-speed circuit breakers in a power system ?

    (1) Improved system stability

    (2) Reduced short circuit current

    (3) Increased short circuit current

    (4) Reduced system reliability

93. A single-phase diode bridge rectifier is used to supply a highly inductive load. If the load current is assumed to be ripple free, then the input current at the ac side of the rectifier will be

    (1) Purely sinusoidal

    (2) Pure DC

    (3) Triangular wave

    (4) Square wave

94. Which of the following can be the result of introducing an integral action in the forward path of a unity feedback system ?

    (1) Elimination of steady state error

    (2) Increased stability margins

    (3) Faster system response

    (4) Reduced noise immunity

95. A balanced three-phase supply feeds power to a balanced three-phase R-L load. Under this condition, the total instantaneous power supplied to the load would be

    (1) Constant

    (2) Pulsating with zero average

    (3) Pulsating with non-zero average

    (4) Zero

96. DC voltage of 54.6 V is applied across an electric bulb which draws 3.76 A current. What is the power consumed by the bulb ?

    (1) 205.296 W

    (2) 792.86 W

    (3) 771.91 W

    (4) 502.296 W

97. 4 μA current flows through a conductor for 4 s. Find the number of electrons passed through the conductor.

(1) $16e^{-6}$

(2) 16

(3) $1e^{14}$

(4) $16e^{14}$

98. A dynamometer type wattmeter is used to measure power of a room heater. Which option is correct ?

(1) Current in the fixed coil is same as the current in the moving coil

(2) Current in the fixed coil is more than the current in the moving coil

(3) Current in the fixed coil is lower than the current in the moving coil

(4) Cannot comment on the relative currents in the moving and fixed coil

99. Two channels of a CRO are fed with two signals. In the X-Y mode, an ellipse with major axis aligned along the Y axis is observed. The following inference can be made from this

(1) Two signals are periodic with same frequency and amplitude but different phase

(2) Two signals are periodic with same frequency and phase but different amplitude

(3) Two signals are periodic with same amplitude but different frequency

(4) Two signals are periodic with same frequency but different phase and amplitude

100. The octal representation of 111100010001 is

(1) 7421

(2) 7241

(3) 6512

(4) 6541

101. In the circuit below, find the terminals of X and Y, for the circuit to be in negative feedback.
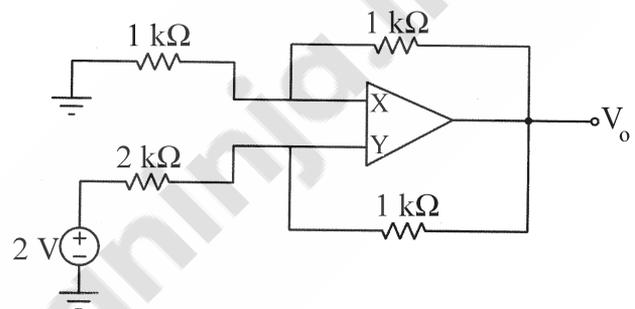
(1) X negative and Y positive

(2) X positive and Y negative

(3) Any of the terminals can be negative or positive
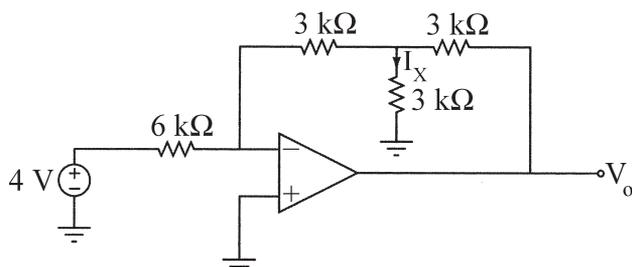
(4) Circuit will never be in negative feedback

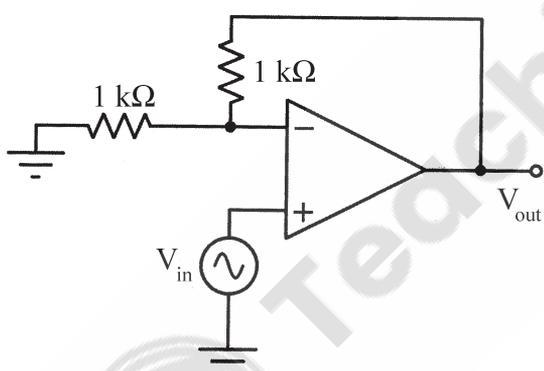102. In the circuit below, find the V_o for negative feedback operation.
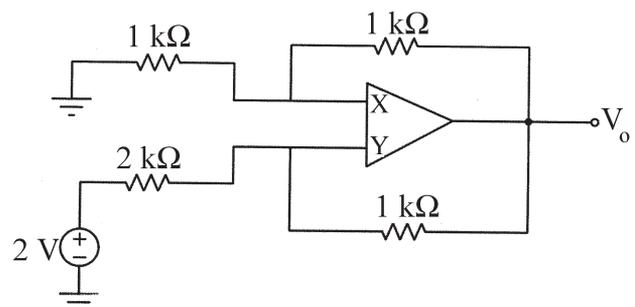
(1) 1 V

(2) 2 V

(3) 3 V

(4) −4 V

103. For the circuit below, find the value of current I_x.

(1) 0.33 mA
(2) 0.67 mA
(3) −0.67 mA
(4) −0.33 mA

104. Find the type of feedback in the below circuit.

(1) Series - series feedback
(2) Series - shunt feedback
(3) Shunt - series feedback
(4) Shunt - shunt feedback

105. The following gates are designated as Universal Gates
(1) XOR, OR and AND
(2) XNOR, NOR and NAND
(3) NOR and NAND
(4) NOT, OR and AND

106. An average-reading multimeter reads 5 V when fed with a square wave symmetric about the time-axis. For the same input an rms-reading meter will read
(1) $5/\sqrt{2}$ V
(2) $5/\sqrt{3}$ V
(3) 5 V
(4) 10 V

107. Two 10-bit ADCs, one of successive approximation type and other of single slope integrating type, take Ta and Tb time respectively to convert 3V analog input signal to digital output. If the input analog signal is increased to 6V, the approximate time taken by the two ADCs will respectively be
(1) Ta, Tb
(2) Ta, 2Tb
(3) 2Ta, Tb
(4) 2Ta, 2Tb

108. Q1 and Q2 are perfectly matched BJTs. Assuming beta to be infinite and forward bias voltage drop in diode to be 0.7V, find the current I_{out}.
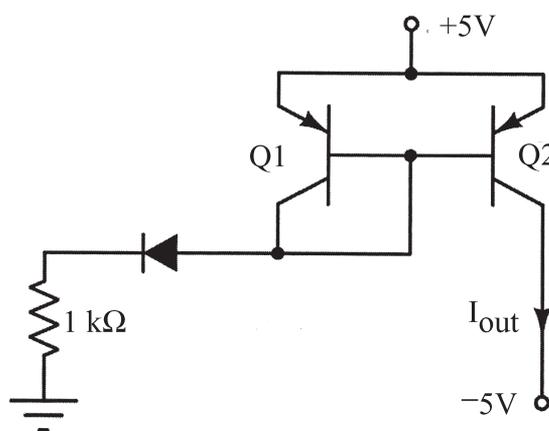
(1) 0 mA
(2) 3.6 mA
(3) 4.3 mA
(4) 5.7 mA

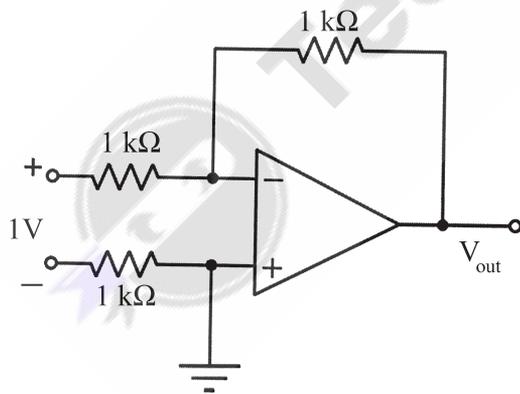109. Find the minimum sum-of-products representation for the Boolean expression.

$$Z = \overline{X}Y + X\overline{Y} + XY$$

(1) XY

(2) X + Y

(3) $\overline{X} + \overline{Y}$

(4) $\overline{XY}$

110. What is the hexadecimal conversion of this binary number 1111 ?

(1) 4

(2) 8

(3) A

(4) F

111. Find V_{out} in the below circuit. Assume opamp to be ideal.

(1) 0 V

(2) 1V

(3) −1V

(4) −2V

112. Find the type of filter shown below.
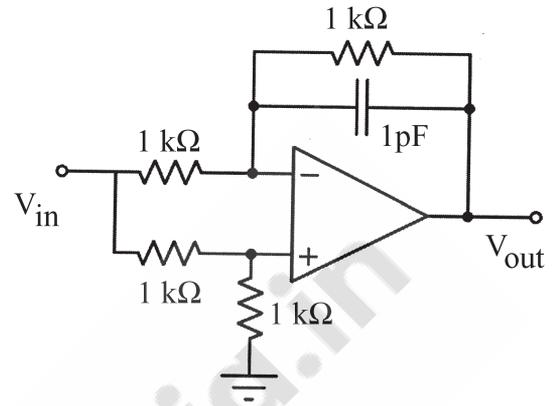
(1) Low-pass filter

(2) High-pass filter

(3) Band-pass filter

(4) Band-stop filter

113. The decimal equivalent of the HEX number EF.A is

(1) 239.15

(2) 239.6

(3) 239.625

(4) 239.16

114. What is the SNR of an ideal 10 bit ADC ?

(1) 51.96 dB

(2) 61.96 dB

(3) 71.96 dB

(4) 81.96 dB

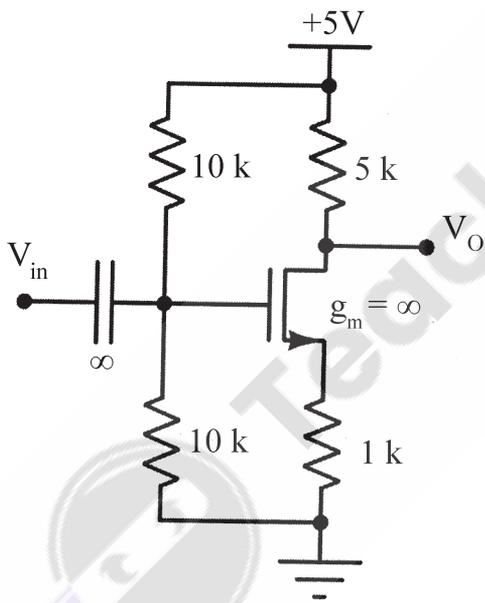115. An ammeter has a range of $0 - 10$ A with an internal resistance of 0.1 Ω. In order to increase its range to $0 - 30$ A, we need to add a resistance of

   (1) 0.05 Ω in series with the meter

   (2) 0.1 Ω in series with the meter

   (3) 0.05 Ω in shunt with the meter

   (4) 0.1 Ω in shunt with the meter

116. What is the small-signal gain of below circuit ?

   +5V

   10 k   5 k

   V_{in} V_O

   $g_m = \infty$

   ∞

   10 k   1 k

   (1) 4

   (2) 5

   (3) -4

   (4) -5

117. Which bridge can be used for measuring relative permeability ?

   (1) Wheatstone

   (2) Kelvin

   (3) Schering

   (4) Anderson

118. Which bridge is used to measure frequency ?

   (1) Maxwell's bridge

   (2) Schering bridge

   (3) Wien's bridge

   (4) Anderson bridge

119. For the two circuits to be equivalent, R should be equal to

   G   D
   V_{gs} $g_m V_{gs}$ $\equiv$ G $g_m V_{gs}$ D
   S V_{gs} R   S
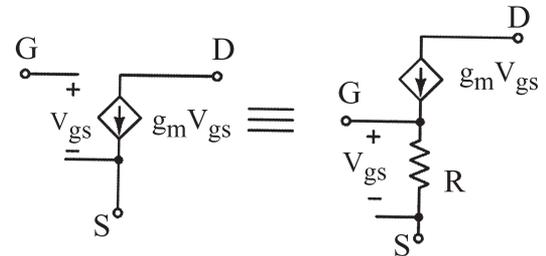
   (1) 0

   (2) infinity

   (3) $\dfrac{1}{g_m}$

   (4) $\dfrac{1}{(2\,g_m)}$

120. Choose the correct statement.

    (1) Moore and Mealy machine outputs depend on input

    (2) Moore and Mealy machine outputs depend on current state

    (3) Moore and Mealy machine outputs depend on both the input and the current state

   (4) Moore and Mealy machine outputs does not depend on input

121. A bipolar junction transistor is

    (1) a voltage-controlled device

    (2) a current-controlled device

    (3) a charge-controlled device

    (4) a field-controlled device

122. A MOSFET biased in common-drain configuration is best suited for designing a

    (1) current buffer

    (2) voltage buffer

    (3) transresistance amplifier

    (4) transconductance amplifier

123. Find the polarity of opamp input for negative feedback operation.
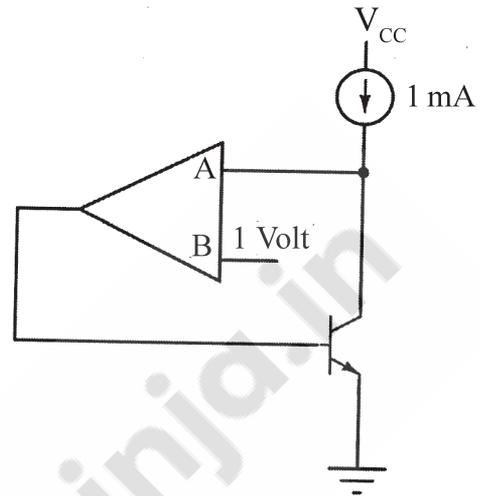
    (1) A is positive and B is negative
    (2) A is negative and B is positive
    (3) The circuit will never operate in negative feedback
    (4) The circuit will always operate in negative feedback irrespective of the opamp input polarity

124. What kind of filter is realized by the below circuit ?
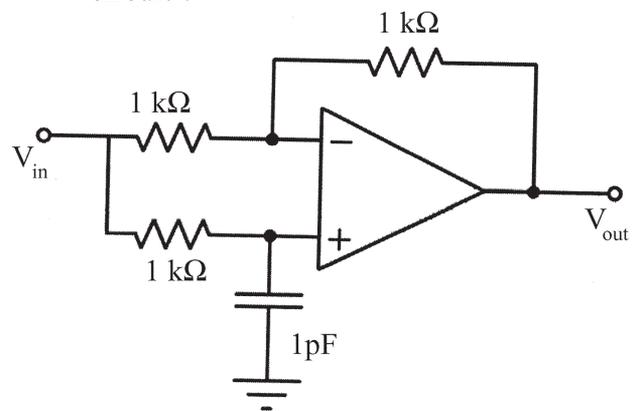
    (1) Low-pass filter
    (2) High-pass filter
    (3) Band-pass filter
    (4) All-pass filter

125. What is the time period of oscillation of V_{out} ?

(1) $2R_3 C \ln\left(1 + \dfrac{2R_1}{R_2}\right)$
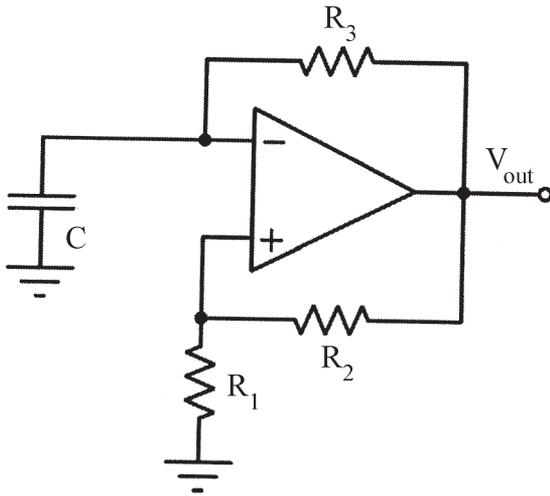
(2) $2\dfrac{R_2}{R_1} R_3 C \ln\left(1 + \dfrac{2R_1}{R_2}\right)$

(3) $2\dfrac{R_1}{R_2} R_3 C \ln\left(1 + \dfrac{2R_1}{R_2}\right)$

(4) $2\dfrac{R_2}{R_1} R_3 C \ln\left(1 + \dfrac{2R_2}{R_1}\right)$

126. What is the effect of AC side source inductance in SCR based phase-controlled rectifier operating with firing angle less than $\pi/2$ radians during R-L type loading condition, compared to that in zero source impedance condition ?

(1) Average output voltage increases

(2) Average output voltage decreases

(3) Average output voltage remain unchanged

(4) Average output voltage may increase or decrease

127. A 200 Volt, 1000 RPM, 100 Amp separately excited dc motor has an armature resistance of 0.1 Ω. The motor is fed from a DC-DC step down chopper. The input dc source has a voltage of 300 Volt to this chopper. What is the duty cycle of the chopper for motoring operation at rated torque and speed of 500 RPM assuming operation with continuous conduction and field flux remains unchanged ?

(1) 0.25

(2) 0.84

(3) 0.50

(4) 0.35

128. A constant V/f controlled induction motor is fed from a variable voltage variable frequency three phase voltage source inverter. The motor is operated within the base speed. Which of the following is true in torque-speed characteristics of this motor ?

(1) Starting torque increases with decrease in frequency and maximum torque remains unchanged.

(2) Starting torque decreases with decrease in frequency and maximum torque remains unchanged.

(3) Starting torque increases with decrease in frequency and maximum torque decreases.

(4) Starting torque decreases with decrease in frequency and maximum torque decreases.

129. A motor-load combination operating in motoring mode (quadrant-I) has the following speed torque characteristics :

T(motor) = 0.1 N – 10 (N-m)

T(load) = 0.25 N – 75 (N-m)

where T(motor) is a motor torque in N-m, T(load) is a load torque in N-m and N is a speed of the motor-load combination in RPM. What is the steady state speed of the system after exciting it ?

(1) 433.3 RPM

(2) 0 RPM

(3) 700 RPM

(4) 666.3 RPM

130. What is the way of imparting braking action of three phase induction motor in plugging scheme ?

(1) By decreasing the stator voltage magnitude

(2) By decreasing synchronous speed

(3) By reversal of the phase sequence of the stator

(4) By increasing the stator voltage magnitude

131. What is the status of machine flux, for the range of frequency above the rated (base) frequency, in the case of a speed regulated V/f controlled induction motor drive ?

(1) Machine flux increases from the rated flux

(2) Machine flux decreases from the rated flux

(3) Machine flux unchanged

(4) Machine flux may increase or decrease based on load

132. What is the condition to achieve regenerative braking of induction motor ?

(1) Synchronous speed should be a little higher than the rotor speed

(2) Synchronous speed should be a little lower than the rotor speed

(3) Synchronous speed should be doubled

(4) Synchronous speed should be increased by a factor of 1.5

133. Which of the following load offers characteristic close to a constant load torque ?

(1) Traction load

(2) Low speed hoist

(3) Fan type of load

(4) Water pumping load

134. A three-phase full controlled converter (with 6 SCRs only) is feeding the armature of a separately excited DC motor. The motor has to also operate in quadrant-III. Which of the following methods is suitable ?

    (1) By adjusting the triggering angle α only

    (2) By adjusting the triggering angle α followed by armature connection reversal

    (3) By operating with triggering angle α > π/2 rad

    (4) By connecting a freewheeling diode across the armature in addition to adjusting the triggering angle α

135. In rotor resistance control of an induction motor, which one of the following is true with increase in rotor resistance ?

    (1) Maximum torque increases, starting torque increases and the slip at which maximum torque occurs decreases

    (2) Maximum torque remains unchanged, starting torque decreases and the slip at which maximum torque occurs increases

    (3) Maximum torque increases, starting torque increases and the slip at which maximum torque occurs increases

    (4) Maximum torque remains unchanged, starting torque increases and the slip at which maximum torque occurs increases

136. In a slip power recovery scheme of 3-phase induction motor drives, what is the operating speed with respect to the synchronous speed of the motor, if the power is injected into the rotor circuit from an external source ?

    (1) Motor speed is above the synchronous speed

    (2) Motor speed is equal to the synchronous speed

    (3) Motor speed is always below the synchronous speed

    (4) Motor speed reduce to zero

137. A 200 Volt, 1200 RPM, 100 Amp DC separately excited motor has an armature resistance of 0.1Ω. It is braked by plugging from initial speed of 1200 RPM. What is the external resistance to be placed in series with the armature circuit to limit the braking current to twice the full load value ?

    (1) 1.5 Ω

    (2) 3.8 Ω

    (3) 10.2 Ω

    (4) 7.33 Ω

138. What is the low order ripple frequency of the output voltage of a three phase fully controlled bridge converter, if the AC input supply frequency is f ?

    (1) f

    (2) 2f

    (3) 3f

    (4) 6f

139. Which of the following statements is correct in the case of multi-loop based close-loop control of DC and AC drives having speed and current feedbacks ?

    (1) Speed control loop is faster than the current control loop.

    (2) Speed control and current control loops have equal bandwidth.

    (3) Current control loop is faster than the speed control loop.

    (4) Output of current control provides the reference speed.

140. Which of the following statements is true in the case of dynamic braking of separately excited DC motor ?

    (1) The armature terminals are reversed and the voltage supply/source is present.

    (2) The voltage supply/source is removed and the armature terminals are shorted.

    (3) The voltage supply/source is removed and the armature terminals are connected to a resistance.

    (4) The voltage supply/source is reversed keeping armature terminal fixed.

141. Which of the following armature voltage control method is employed when the supply is dc ?

    (1) Ward-Leonard schemes

    (2) Transformers with taps and an uncontrolled rectifier bridge

    (3) Chopper control

    (4) Static Ward-Leonard schemes

142. Which of the following is correct regarding Eddy currents in the coil ?

    (1) Eddy currents flow in straight lines, like a wire and complete circuit path without power loss

    (2) Eddy current helps in generating electrical energy

    (3) By making use of a laminated core, Eddy currents are increased

    (4) Eddy currents converts useful energy into heat and waste it

143. Which of the following statements are entirely true regarding Eddy current ?

    (1) Direction of Eddy current can be found by Lenz's law and Eddy current is proportional to the square of the flux frequency.

    (2) Eddy current loss can be minimized by using material which have low hysteresis coefficient and Eddy current is proportional to the flux frequency.

    (3) Eddy current loss can be minimized by thin laminate core and Eddy current is proportional to the flux frequency.

    (4) Eddy current loss can be minimized by using material which have low hysteresis coefficient and Eddy current is proportional to the square of the flux frequency.

144. A lamp takes 10 A at 250 V and emits 16000 Lumens. Determine its Mean Spherical Candle Power (MSCP).

   (1) $2000\,\pi$

   (2) $4000\,\pi$

   (3) $4000/\pi$

   (4) $8000\,\pi$

145. Which type of material is used for filament illumination in the incandescent lamp ?

   (1) Copper

   (2) Aluminum

   (3) Silicon

   (4) Tungsten

146. Which type of transformers is used in AC welding ?

   (1) Ferrite core type

   (2) Step up type

   (3) Step down type

   (4) Equal turns ratio type

147. What is the unit of illumination ?

   (1) Decibel

   (2) Henry

   (3) Coulomb

   (4) Lux

148. Which of the following is used in overhead power supply for AC electric locomotive in India ?

   (1) 110 kV, Single phase

   (2) 330 kV, Single phase

   (3) 415 V, Three phase

   (4) 25 kV, Single phase

149. What happens in coasting mode of an electric traction ?

   (1) The power supply is cut off and the train is allowed to run with its own inertia

   (2) Electric drive accelerates the motor from standstill condition to the rated speed

   (3) Regenerative braking is provided to recover the energy from locomotive

   (4) Continuous power is provided by the electric drive to maintain the locomotive speed

150. What is the effect on co-efficient of adhesion due to following conditions on rails ?

   (1) It is high when the rails are oiled

   (2) It is high when the rails are wet

   (3) It is high when the rails have grease

   (4) It is high when the rails are dry

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