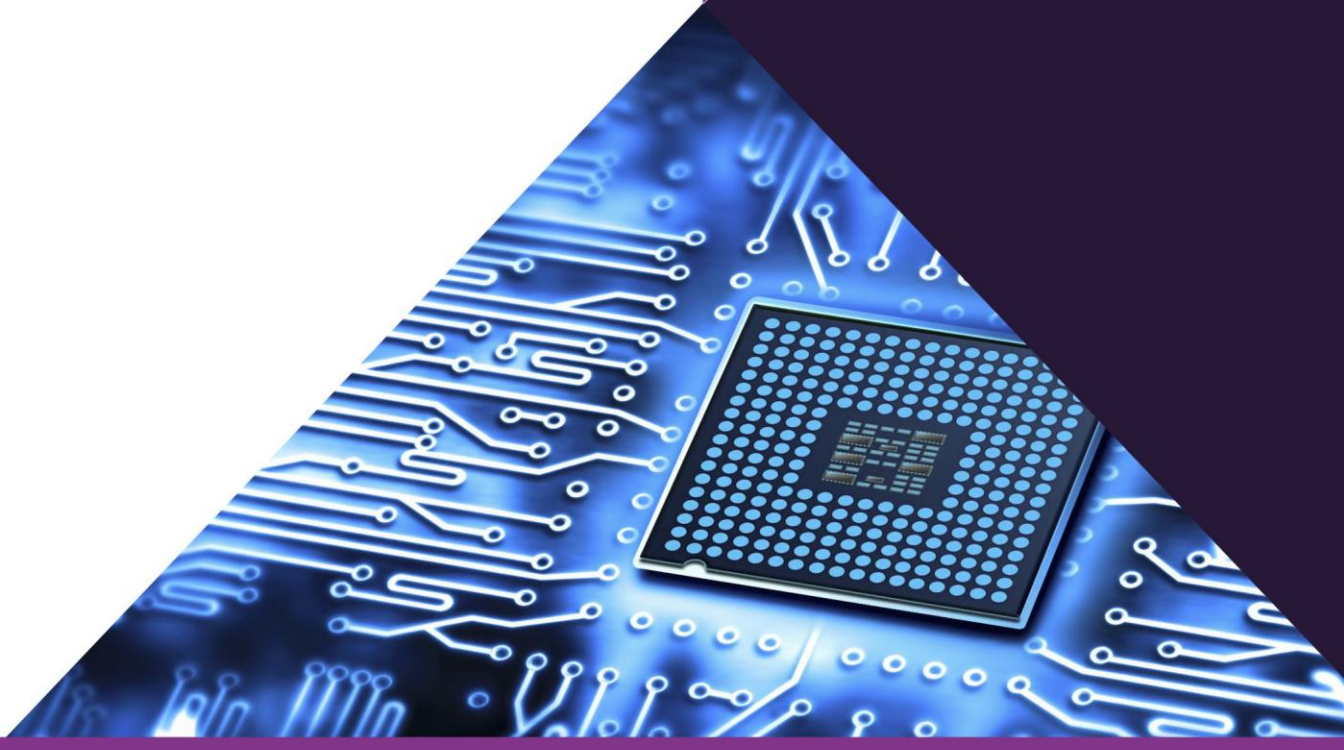
BYJU'S EXAM PREP

HAL 2022

Electronics Engineering Course

Sample Question Paper

Questions & Answer Key



1. **Select the correctly spelt word.**

A. intrepid
B. actuetion
C. inoeculete
D. ominoeus

Ans. A

1. In the following question, select the related letters from the given alternatives.

EHGI : LONP : : ? : ORQS

A. GJIK
B. GIHJ
C. HKJL
D. HJIK

Ans. C

Sol. E+7 = L ,
H+7 = O,
G+7 = N,
I+7 = P
Similarly,
O-7 = H ,
R-7 = K,
Q-7 = J,
S-7 = L
Hence, option C is the right answer.

2. How many meaningful English words can be made with the letters RTOU using each letter only once in each word?

A. None
B. One
C. Two
D. Three
E. More than three

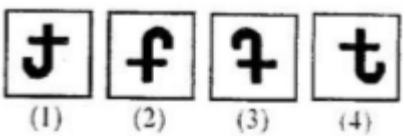
Ans. C

Sol. With the word 'RTOR' the following meaning words of English can be formed:
1. TOUR (travel around)
2. ROUT (over through)

3. Select the correct option that will be the mirror reflection of the problem figure.

Problem figure:

Answer figures:

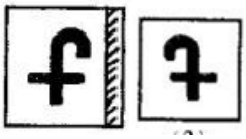


A. Fig.(1) B. Fig.(2)

C. Fig.(3) D. Fig.(4)

Ans. C

Sol. A mirror image (in a plane mirror) is a reflected duplication of an object that appears almost identical but is reversed in the direction perpendicular to the mirror surface. As an optical effect, it results from reflection off of substances such as a mirror or water.



Hence, option C is correct.

4. A series is given with one term missing. Choose the correct alternative from the given ones that will complete the series.

Inch, Decameter, Foot, ?

A. Decimeter B. Millimeter

C. Centimeter D. Meter

Ans. D

Sol. The series given is an ordinal series of measurement and the unit which comes after Foot in the

pattern is Meter.

Hence, the correct option is D.

5. Each letter of the alphabet from Z to A has been given a value from 1 to 26 serially. What is the total value of the word **CONSEQUENCE**?

A. 137 B. 154

C. 196 D. 176

Ans. D

Sol. Clearly, the letters have been assigned numerical value as shown below:

Z Y W V U T S R Q P O N M L K J I H G F E D C B A

So, CONSEQUENCE = C + O+ N + S+ E+ Q+ U+ E+ N + C + E

= 24 + 12+13 + 8 + 22 + 10 + 6 + 22 + 13 + 24 + 22 = 176.

6. If A stands for 'addition', M for 'multiplication', D for 'division', G for 'greater than' and L for 'Lesser than' then which of the following will be logically correct?

A. 20A 4D 4L 4A 6D2 B. 20D 5G 8D 4A 6M3

C. 20D 4A 4L 4A 2M3 D. 20A 2G 10M 3A 12D2

Ans. C

Sol. 20 + 4/4 < 4 +6/2 Ã 21 < 7 NOT CORRECT

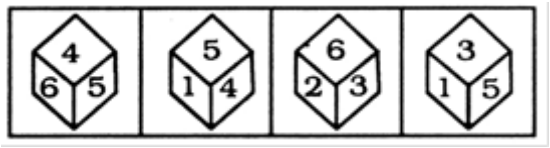
20/5 > 8/4 + 6 ×3 Ã 4 > 22 NOT CORRECT

20/4 + 4 < 4 + 2× 3 Ã 9 < 10 CORRECT

20 + 2 > 10 × 3 + 12/2 Ã 22 > 36 NOT CORRECT

Hence option C is correct

7. Four positions of a dice are given below Identify the number of the bottom when the number on the top is 2.



A. 3 B. 5

C. 4 D. 6

Ans. B

Sol. The number 6 is adjacent to 2,3,4 and 6. So the number opposite to 6 is 1.

Now the number 5 is adjacent to 4, 6, 3. So the number opposite to 5 is 2.

Hence, option B is the correct answer.

8. In a row, there are 12 professors between Akash and Bhumi and Akash being the first professor in the row. There are 6 professors between Bhumi and Charu. If there are 15 professors after Charu, then how many minimum professors are there in the row?

A. 21 B. 24

C. 20 D. 22

Ans. D

Sol.

1st	2nd	3rd	4th	5th	6th	7th	8th	9th	10th	11th	12th	13th	14th	+ 8 more
Akash						Charu							Bhumi	

Therefore, there are minimum **22.**

Hence, the correct option is **D.**

9. Nikhil is 8 yr younger than his brother Rohan. How old will Rohan be when he is twice as old as Nikhil ?

A. 4 yr B. 6 yr

C. 8 yr D. 16 yr

Ans. D

Sol. Let, the present age of Rohan be R yr.

And, the present age of Nikhil be N yr.

Now, R – 8 = N

R = 2N

So, 2N – 8 = N

N = 8

R – 8 = 8

R = 16 yr

Hence, age of Rohan be 16 yr.

10. The age of Ram is double as that of Shyam and half as that of Suresh. If the sum of their ages is 70, what is the age of Ram?

A. 20 B. 30

C. 40 D. 10

Ans. A

Sol. Let Ram's age be 'X'

Then Shyam's age will be 'X/2'

And, Suresh's age will be '2X'.

Sum of their ages = 70

X + X/2 + 2X = 70

⇒ 7X/2 = 70

⇒ X = 20

⇒ Ram's age = X = 20 years

Hence, option A is the correct response.

11. In the following question, select the related word from the given alternatives.

Spiritual : Belief :: Orchestral : ?

A. Theatre B. Situation

C. Music D. Direction

Ans. C

Sol. Spiritual and Belief are synonyms of each other. Similarly, Orchestral and music are synonyms of each other.

Hence, option C is the correct response.

12. Seven people D, E, F, G, H, I and J are sitting in a row.

1) J is third to the left of H

2) D is immediate right of G

3) F sits at one of ends which is immediate left of J.

4) E is next to the right of H and I is fifth to the right of J.

Who sits at the extreme right end?

A. D B. F

C. I D. H

Ans. C

Sol. Using (1), the order is

J - - H

Using (1) and (3), the order is

FJ - - H

Using (1), (3) and (4), the order is

FJ - - HEI

Using (1) and (2) the order is

FJGDHEI

so, the final order is FJGDHEI.

Clearly, I sits at the extreme right end.

Hence, option C is the correct answer.

13. **Select the option figure which contains figure X embedded in it as its part. (Rotation is not allowed)**

A. 

B. 

C. 

D. 

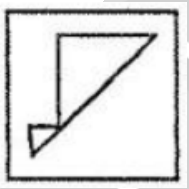
Ans. B

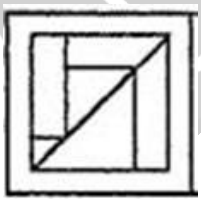
Sol. After carefully observing the figures given in the question, it is very clear that the answer figure(b) is embedded in question figure. It is shown as given below:

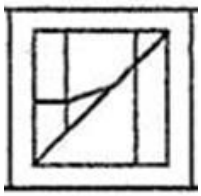
Hence, option B is the correct answer.

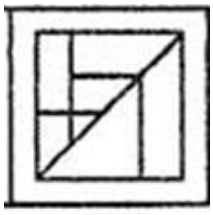
14. From the given answer figures, select the one in which the question figure is hidden/embedded.

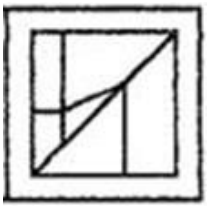
Question Figure :



A. 

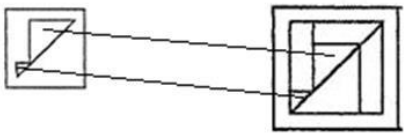
B. 

C. 

D. 

Ans. A

Sol. The part of the question figure is embedded in the answer figure (A).



Hence, option A is the correct answer.

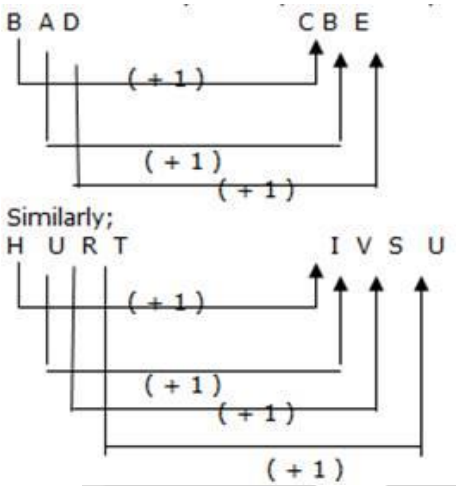
15. **Direction**: Select the related word/letters/ number from the given alternatives.

BAD : CBE : : ? : IVSU

A. GOOD
B. HSPR
C. HALT
D. HURT

Ans. D

Sol. The relation depicted by the above question is as follows:



Hence, Option D is the correct response.

16. A car travels 20 miles in the same time as another car, travelling 20 MPH faster, covers 30 miles. How long does the journey take?

A. 31 minutes
B. 29 minutes
C. 30 minutes
D. 28 minutes

Ans. C

Sol. Let the speed of 1st car be 'X' MPH.

Therefore, the speed of 2nd car will be 'X + 20' MPH.

Now,

Time required to cover 20 miles by 1st car= 20/X minutes,

Similarly, time required to cover 30 miles by second car

= 30/ (X+20)

20/X = 30/(X+20)

⇒ X=40 MPH

Therefore, the journey will take 20 miles/40 MPH= 0.5 hours i.e. 30 minutes.

17. Common **In the following question one statement is given followed by two assumptions I and II. You have to consider the statement to be true even if it**

seems to be at variance from commonly known facts. You have to decide which of the given assumptions, if any, follow from the given statement. End

Statement: Politicians become rich by the votes of the people.

Assumptions:

I. People vote to make politicians rich.

II. Politicians become rich by their virtue.

A. Only I is implicit
B. Only II is implicit
C. Both I and II are implicit
D. Both I and II are not implicit

Ans. D

Sol. Both the given assumptions do not follow the given statement.

Hence, option D is the correct answer.

18. A series is given with one term missing. Choose the correct alternative from the given ones that will complete the series.

HI, MN, RS, ?

A. XY
B. WX
C. WY
D. WE

Ans. B

Sol. There are 26 alphabets in English and if we assign numbers to each and every alphabet starting from 'A', 'B', 'C etc., it will appear to be:

A=1, B=2, C=3, D=4……. likewise, till Z=26

If we observe the difference between first alphabet of any pair and last alphabet of its immediate next pair:

I + 4 = M

N + 4 = R

Therefore, S + 4 = W and the missing term is 'WX'.

Hence, the correct option is B.

19. In a certain code language, "BRING" is written as "25698" and "JAIL" is written as "4367". How is "BRINJAL" written in that code language?

A. 2566437
B. 2569437
C. 2569347
D. 2659437

Ans. B

Sol. Coding of alphabet is as follow,

Alphabet	B	R	I	N	G	J	A	L
Coding	2	5	6	9	8	4	3	7

Therefore, 'BRINJAL' will be: 2569437

Hence, the correct option is B.

20. In a certain code language, "CONDITION" is written as "@#^$*!*#^". How is "NOTION" written in that code language?

A. ^#!*^#
B. ^!#*#^
C. ^#*!#^
D. ^#!*#^

Ans. D

Sol. The following letters code for the symbols as shown below:

C = @

O = #

N = ^

D = $

I = *

T = !

Using the above codes we get,

The code of 'NOTION' is ^#!*#^

Hence, option D is correct.

21. Common

In the sentence identify the segment which contains the grammatical error. If the sentence has no error, then select 'No error'.

End

The law should specifically provide a clause to protect animals from poachers.

A. The law should specifically
B. provide a clause
C. to protect animals from
D. No Error

Ans. D

Sol. The sentence is grammatically and contextually correct.

Hence, option D is the correct answer.

22. Common **Select the most appropriate option to fill in the blank.** End

I _____ to the movies with some friends last night.

A. have gone
B. went
C. am gone
D. am going

Ans. B

Sol. The use of "last night" here indicates that the sentence talks about some recent past event. So, the tense must be simple past.

For example:

We watched the complete tv series last night.

Only option B has the verb which belongs to simple past.

Hence, option B is the correct answer.

23. Common

Choose the most appropriate option to change the voice (active/passive) form of the given sentence.

End

Why did he punish you?

A. Why I was punished by him?
B. Were you punished by him?
C. Why were you punished by him?
D. I was punished by him.

Ans. C

Sol. Basic rules to be followed for Active/Passive conversions are:

1. The object of the active verb becomes the subject of the passive verb.
2. The finite form of the verb is changed (to be+ past participle).
3. The subject of the active sentence becomes the object of the passive sentence (or is dropped).
4. Preposition "by" is used before object.

This is an interrogative (past) sentence which starts with Wh-Question word**.** To make its passive voice, we follow the below structure of passive voice of question sentences:

Active: Wh-question word + did + Subject + verb (Ist form)...?

Passive: Wh-question + was/were + object + verb (IIIrd form) + by + subject....?

So, the passive voice of the given sentence would be: Why were you punished by him?

Hence, option C is the correct answer.

24. Common In this section, direct speech sentences are given and you are required to find the correct indirect speech sentence of the same. Choose the correct response (a), (b), (c) or (d) and indicate on the Answer Sheet accordingly. End

She said, "Good bye Ramesh".

A. She bade Ramesh good bye.
B. She bade to Ramesh good bye.
C. She bids Ramesh good bye.
D. She had bade Ramesh good bye.

Ans. A

Sol. This is a sentence of optative direct speech. The reporting verb "said" will change to "bade" as per the sense of the sentence. We will use the object (Ramesh) after the verb 'bade'. (We do not use 'to' after 'bade'). Hence, option A is the correct answer

25. Common

Direction: In the following question, the first and the last parts of the passage/sentence are numbered (1) and (6). The rest of the passage/sentence is split into four parts and named P, Q, R and S. These four parts are not given in their proper order. Read the sentences and find out which of the four combinations is correct and mark the respective option.

End

1. As whalers reduced catches of the larger whales, they switched to smaller species.

P. By 1985, the situation had reversed and the number of minke whales killed was far higher than that of sei whales.

Q. By 1975 catches of the two species were equal.

R. We can clearly see this when we compare figures for the Antarctic catch of the larger sei whales with those for small minke whales.

S. In 1970, ten times as many sei whales as minke whales were caught.

6. The graph shows that while the sei catch was reduced by 90% between 1970 and 1985, over the same period the minke whale catch was ten times greater.

A. SQPR
B. PQRS
C. RSQP
D. SRQP

Ans. C

Sol. The word "this" in sentence R refers to the fact presented in sentence 1. So, R should be the first sentence after 1. There is only one sequence given in options which starts with R which is RSQP. When we read the sentences in this order, we find that they make a correct and coherent paragraph. So, the correct sequence is RSQP.

26. Common

Identify the best way to improve the underlined part of the given sentence. If there is no improvement required, select 'no Improvement'.

End

The policeman captured first car that approached and ordered the driver to take the injured child to the hospital.

A. commandeered the first car that
B. interrupted the first car who
C. captured the first car whom
D. No improvement

Ans. A

Sol. The underlined part is grammatically incorrect. The sentence implies that the policeman stopped the first car he saw and asked the driver of the car to take the injured child to the hospital. The word 'captured' (meaning to take control of something) imparts a negative meaning here. The word 'commandeered' (which means to take control or possession of something for military or police use) will be a suitable word here. Also, the ordinal numbers like 'first, second, etc' take the article 'the' before them.

Hence, option A is the correct answer.

27. Common

Direction: Select the most appropriate meaning of the given idiom.

End

Make both ends meet

A. to lead a lavish life
B. to live by begging
C. earn just enough money to live on
D. to lead an active life

Ans. C

Sol. The idiom "make both ends meet" is the phrase that is used in order to describe the action of earning just enough to manage the expenses.

Hence, option C is the correct answer.

28. In this section, a word is spelled in four different ways. You are to identify the one which is correct. Choose the correct response (a), (b), (c) or (d) and indicate on the Answer Sheet accordingly.

A. Quaint
B. Qauint
C. Quiant
D. Quaaint

Ans. A

Sol. Option A has the correctly spelt word. "Quaint" means attractively unusual or old-fashioned.

29. Common

Direction: Select the most appropriate antonym of the given word.

End

DEVIOUS

A. straight
B. obvious
C. simple
D. superficial

Ans. A

Sol. Let's first learn the meanings of the words:

Devious = (of a route or journey) longer and less direct than the most straightforward way.

Obvious = easily perceived or understood; clear, self-evident, or apparent.

Superficial = existing or occurring at or on the surface.

Straight = erect in posture.

Hence, option A is the correct answer.

30. Common

Select the word which means the same as the group of words given.

End

A person who insists on adherence to formal rules or literary meaning

A. scholar
B. pedant
C. pedagogue
D. literalist

Ans. B

Sol. Scholar: A specialist in a particular branch of study

Pedant: A person who is excessively concerned with minor details and rules or with displaying academic learning

Pedagogue: A teacher, especially a strict or pedantic one

Literalist: Adherence to the explicit sense of a given text or doctrine

Hence, option B is the correct answer.

31. Common **In the sentence, identify the segment which contains the grammatical error. If the sentence has no error, then select 'No error'.** |||End|||

While he was walking along the road a speeding car knocked down to him.

A. While he was walking along the road

B. a speeding car

C. knocked down to him

D. No error

Ans. C

Sol. The sentence is grammatically incorrect and the error lies in option C. The phrase ‘knock somebody down’ means "to hit someone with a vehicle and injure or kill them".

For example:

The old beggar was knocked down by a bus.

Thus, "to" is redundant here. Replace ‘knocked down to him’ with ‘knocked him down’ to make the sentence grammatically sound.

32. Common **Select the most appropriate option to fill in the blank.** End

I can _____ him without qualifications.

A. recommend B. commend

C. praise D. disregard

Ans. A

Sol. Recommend = to put forward (someone or something) with approval as being suitable for a particular purpose or role

Commend = praise formally or officially.

Praise = express warm approval or admiration of.

Disregard = the action or state of paying no attention to something.

The person has approved the other person for something. Only 'recommend' fits in the blank contextually.

Hence, option A is the correct answer.

33. Common **Choose the most appropriate option to change the voice (active/passive) form of the given sentence.** End

People thronged the grounds.

A. The grounds will be thronged with people.

B. The grounds were thronged by people.

C. The grounds were thronged with people.

D. The grounds will be thronged by people.

Ans. C

Sol. The given sentence is in active form of **simple past tense**. The structures for active/passive voices are:

Active: Subject + verb (IInd form) + object...

Passive: Object + was/were + verb (IIIrd form) + by + subject...

Note: **The verb "throng" is followed by the preposition "with". So, we will use "with" instead of "by" in the passive voice.**

So, with the help of the above structures, we can convert the given sentence into passive voice: **The grounds were thronged with people.**

Hence, option C is the correct answer.

34. Common

Choose the most appropriate option to change the narration (direct/indirect) of the given sentence.

End

My little brother said, "I wish it rains hard, so I don't have to go to school."

A. My little brother earnestly wished that it should rain so hard that he did not have to go to school.

B. My little brother earnestly wished that it should rain so hard that he would not have to go to school.

C. MY little brother earnestly wished that it will rain so hard that he would not have to go

to school.

D. My little brother earnestly wished that it could rain so hard that he would not have to went school.

Ans. B

Sol.

Rules for changing the direct speech into indirect speech are given below:

- The inverted commas (" ") used in Direct Narration is removed in Indirect Narration and "that" conjunction is used.
- Says to/said to changes to tells/told in indirect speech if they are followed by an object. If not, they would remain same in indirect speech.

How to changes the tense in indirect speech

- If the reporting verb is in present or future tense, no changes are made to the verb/tense of the reported speech.
- If the reporting verb is in past tense, we make changes to the reported verb as per the below rule:
- Simple present tense changes to simple past tense.
- Present continuous tense changes to past continuous tense.
- Present perfect tense changes to past perfect tense.
- Present Perfect continuous tense changes to past perfect continuous tense.
- Simple past tense changes to past perfect tense.
- Past continuous tense changes to past perfect continuous tense.
- No changes are made to past perfect and past perfect continuous tense.
- Can, shall, will, may, must changes to could, should, would, might and must respectively.
- If there are any universal truth, habitual fact in the reporting speech, no changes are made to the reported verb's tense.

How some words change in indirect speech

- Words like "this, these, tomorrow, yesterday change to that, those, the next day, the previous day" respectively.

Below are the rules for changing the pronouns correctly:

- First person pronoun changes according to the subject of reporting speech.
- Second person pronoun changes according to the object of reporting speech.
- Third person pronoun does not change in indirect speech.

Hence, option B is the correct answer.

35. Common

Direction: In the following question, the first and the last parts of the passage/sentence are numbered (1) and (6). The rest of the passage/sentence is split into four parts and named P, Q, R and S. These four parts are not given in their proper order. Read the sentences and find out which of the four combinations is correct and mark the respective option.

End

1. Research was carried out recently to measure noise pollution.

P. The local hospital had also reported large number of patients suffered from headache.

Q. It was found that the noise level during peak traffic hours reached 130 decibels.

R. This has lead to many health problems.

S. The incidence of deafness has been 4.6 times higher than the normal as reported by the local hospital.

6. During night loud music has caused sleeplessness among people.

A. RPSQ
B. QRSP
C. PSRQ
D. SRPQ

Ans. B

Sol.

Sentence 1 talks about the research conducted to measure noise pollution. Sentence Q elaborates the findings of the research, so, it should be the first sentence after 1. There is only one sequence which starts with Q which is QRSP. When we read the sentences in this sequence, we find that they make a correct passage, so, it is the correct sequence.

36. Common

Select the alternative that will improve the underlined part of the sentence; if no improvement is

required, select "No improvement".

End

A citizen is expected to give allegiance to his country of origin.

A. homage
B. loyalty
C. obedience
D. No improvement

Ans. D

Sol. Let's understand the meaning of the given words:-

Homage= An artistic work imitating another in a flattering style.

Unprecedent= Having no precedent; novel.

Obedience= The trait of being willing to obey.

Allegiance = The quality of being loyal.

In the context of the sentence, allegiance is the most suitable response, as one should be loyal to one's country. So, no improvement is needed here.

Hence, option D is the correct answer.

37. Common

Select the most appropriate meaning of the given idiom.

End

A gerrymandering way

A. in a legal and constitutional manner

B. in a judicial and fair way

C. in a manipulative and unfair way

D. in a dictative manner like the Germans

Ans. C

Sol. The idiom 'gerrymandering way' means to manipulate or adapt to one's advantage.

e.g. The Prime Minister tried to gerrymander the recent elections in two ways.

Hence, option C is the correct answer.

38. In this section, a word is spelled in four different ways. You are to identify the one which is correct. Choose the correct response (a), (b), (c) or (d) and indicate on the Answer Sheet accordingly.

A. Recommand

B. Recommend

C. Recommend

D. Recomend

Ans. B

Sol. Option B has the correctly spelt word. 'Recommend' means to put forward (someone or something) with approval as being suitable for a particular purpose or role.

39. Common

Direction: Select the most appropriate synonym of the given word.

End

PERQUISITE

A. incentive

B. privilege

C. treat

D. award

Ans. B

Sol. Let us understand the meaning of the given words :-

Perquisite = prerogative, perk, a special right; a benefit which one enjoys, or is entitled to on account of one's job or position.

E.g. :- Suffrage was the perquisite of white adult males.

Privilege = a special right, advantage, or immunity granted or available only to a particular person or group.

E.g. :- There is no handing on of privilege or pre-eminence to perpetual generations.

Incentive = a thing that motivates or encourages someone to do something.

Treat = interact in a certain way.

Award = a tangible symbol signifying approval or distinction.

Hence, option B is the correct answer.

40. Common

Select the word which means the same as the group of words given.

End

all the arts, beliefs and social institutions etc. characteristic of a race

A. culture

B. native

C. infrastructure

D. ritual

Ans. A

Sol. Let us understand the meaning of the given words :-

Culture = the attitudes and behavior that are characteristic of a particular social group or

organization.

Native = a person born in a particular place or country.

Infrastructure = the basic structure or features of a system or organization.

Ritual = the prescribed procedure for conducting religious ceremonies

Hence, option A is the correct answer.

41. In which of the following towns is "Moti Masjid" situated?

A. Agra
B. Jaipur
C. Lahore
D. Ahemdabad

Ans. A

Sol.

- The **Moti Masjid** in Agra was built by Shah Jahan.
- During the rule of Shah Jahan the Mughal emperor, numerous architectural wonders were built. Most famous of them being the Taj Mahal.
- Moti Masjid earned the epithet Pearl Mosque for it shined like a pearl. It is held that this mosque was constructed by Shah Jahan for his members of the royal court.

42. Which of the following prominent leaders wrote the book 'Citizen Delhi: My Life, My Times?

A. Arun Jaitley
B. Sheila Dikshit
C. Harsh Vardhan
D. Arvind Kejriwal

Ans. B

Sol.

- Sheila Dikshit wrote the book '**Citizen Delhi: My Life, My Times'**.
- Sheila Dikshit was the **longest** serving Chief Minister of Delhi from 1998.
- Sheila Dikshit awarded from **Best Chief Minister of India in 2008** by Journalist Association of India.
- She also awarded from **Dara Shikoh award** by Indo-Iran Society in 2010

43. In which state is 'Tarnetar' fair celebrated annually?

A. Gujarat
B. Telangana
C. Madhya Pradesh
D. Manipur

Ans. A

Sol.

The 'Tarnetar' fair is celebrated annually in **Gujrat State.**

- The fair is held for three days every year during the Hindu calendar dates of Bhadarva Sud – 4 to 6th. This year Tarnetar fair held from 1st September to 4th September 2019.
- The Tarnetar fair is held 8 km from the town of Thangadh, in Surendranagar District.

44. JP Nadda was elected as the President of the Bharatiya Janata Party (BJP) on 20 January 2020. He is the _____ president of the BJP.

A. twelfth
B. tenth
C. eleventh
D. ninth

Ans. C

Sol.

• Currently, Jagat Prakash Nadda is serving as the 11th president of the Bharatiya Janata Party since 20 January 2020.
• He was the BJP's working president from June 2019 to January 2020.
• He has replaced Amit Shah.
• As of 2019, the Bharatiya Janata Party (BJP) is the country's largest political party in terms of representation in the national parliament and state assemblies.
• It is the world's largest party in terms of primary membership.
• It was formed on April 6, 1980 by Atal Bihari Vajpayee and Lalkrishna Advani.

45. Which state has bagged the top position under the Pradhan Mantri Surakshit Matritav Abhiyan (PMSMA)?

A. Odisha
B. West Bengal
C. Himachal Pradesh
D. Assam
E. Gujarat

Ans. C

Sol. Himachal Pradesh has been adjudged first among states for its performance under the Pradhan Mantri Surakshit Matritav Abhiyan (PMSMA) in the country.
The Union government has conferred the award upon Himachal Pradesh for bringing a maximum number of women for an ante-natal check-up to the PMSMA clinics.
Himachal Pradesh government had launched PMSMA in August 2016 and established around 495 clinics in which ante-natal check-ups were conducted by the doctors. Under PMSMA pregnant women are supposed to get antenatal check up on 9th of every month by a doctor.

46. _____ is the oldest hockey tournament in India.

A. Beighton Cup
B. Bombay Gold Cup
C. Obaidullah Khan Gold Cupe
D. MCC Murugappa Gold Cup

Ans. A

Sol.

• **Beighton Cup** is the oldest **hockey** tournament in India. It was instituted in **1895**. It was initially organised by the **Indian Football Association** until the **Bengal Hockey Association** took over in **1905**.
• **Indian Oil Corporation Ltd.** won their **fifth** All India Beighton Cup title by edging past **Bharat Petroleum Corporation Limited** in **2019**.

47. International Astronomical Union (IAU) named minor planet 2006 VP32 (number - 300128) in September 2019 after a famous Indian. Who is this Indian?

A. Pandit Jasraj
B. APJ Abdul Kalam
C. Viswanathan Anand
D. Hamsa Padmanabhan

Ans. A

Sol.

* International Astronomical Union (IAU) named minor planet 2006 VP32 (number - 300128) in September 2019 after a famous Indian Pandit Jasraj.

* He is the first Indian to receive this honour.
* Pandit Jasraj was an Indian classical vocalist, belonging to the Mewati gharana.
* He awarded from
* Padma Shri in 1975 and
* Padma Bhushan in 1990.
* Padma Vibhushan in 2000
* Swathi Sangeetha Puraskaram in 2008
* Sangeet Natak Akademi Fellowship in2010
* Pu La Deshpande lifetime achievement award in 2012.
* He created a unique form of jugalbandi called Jasrangi.

48. What was the tenure of 6th Prime Minister of India 'Rajiv Gandhi'?

A. 1984-1988 B. 1983-1990
C. 1984-1989 D. 1983-1988

Ans. C

Sol. **Rajiv Ratna Gandhi** was the **6th Prime Minister of India** from **1984 to 1989**. He took office after the **1984 assassination** of his mother, Prime Minister **Indira Gandhi**, to become the **youngest Indian Prime Minister** at the age of **40**.

49. Which one of the following is an Audio Tool?

A. Avidemus B. Ardour
C. Dscaler D. Blender

Ans. B

Sol.

• **Ardour** is a hard disk recorder and digital audio workstation application. It runs on Linux, macOS, FreeBSD and Microsoft Windows.
• Its primary author is **Paul Davis**.
• It was released on 23 September 2005.

50. Bengali is the official language of _____.

A. Uttarakhand B. Tripura
C. Kerala D. Chhattisgarh

Ans. B

Sol. Bengali is the official language of Tripura. This is the one of 22 official state language of India. Other than Tripura this is the official language of west Bengal.

51. What are the basic, functions of Public Accounts Committee (PAC)?

A. to examine the statement of accounts showing the income and expenditure of state corporations, trading and manufacturing schemes and projects.
B. to examine the accounts of stores and stocks.
C. to examine the statement of accounts of autonomous bodies
D. All of the above

Ans. A

Sol. The Public Accounts Committee (PAC) is a committee of selected members of Parliament, constituted by the Parliament of India, for the auditing of the expenditure of the Government of India.

The PAC is formed every year with a strength of not more than 22 members of which 15 are from Lok Sabha, the lower house of the Parliament, and 7 from Rajya Sabha, the upper house of the Parliament. The term of office of the members is one year. The Chairman is appointed by the Speaker of Lok Sabha. Since 1967, the chairman of the committee is selected from the opposition. Earlier, it was headed by a member of the ruling party. Its chief function is to examine the audit report of the Comptroller and Auditor General (CAG) after it is laid in the Parliament. CAG assists the committee during the course of the investigation. None of the 22 members shall be a minister in the government.

52. Transistors belong to which of the following generation of computers?

A. Fourth
B. Third
C. First
D. Second

Ans. D

Sol.

• **Transistors** belong to the **second** generation of computers. In this generation, assembly language and high-level programming languages like **FORTRAN**, **COBOL** were used. The computers used **batch processing** and **multiprogramming** operating system.

Generation	Main Component	Period
First Generation	Vacuum tubes	1940-1956
Second Generation	Transistors	1956-1963
Third Generation	Integrated Circuits	1964-1971
Fourth Generation	Microprocessors	1972-2010
Fifth Generation	Artificial Intelligence	2010-Present

53. The Parliament and the constitution are the instruments of

A. Legal Justice
B. Political Justice
C. Economic Justice
D. All of these

Ans. D

Sol. The answer is D, all of the above.

Both are the instruments of Social Justice too as: Social rights include the rights to an adequate standard of living, affordable housing, food, education, and equitable health system, and social security based on respect, not sanctions. Our parliament has provided it in Article 21 of the constitution along with Directive Principles of State Policy for the state.

Both are the instruments of Economic Justice too as: The concept of economic justice has not been defined in the Constitution, but the ideals of economic justice have been. Article 39 (b) (c) and (d) signify those ideals. Economic justice simply means the absence of distribution between man and man. As mentioned in the Preamble, the Indian constitution has strived for justice: social, economic and political.

Both are also an instrument of Legal Justice as Article 226 states that Power of High Courts to issue any person or authority, including inappropriate case any government, directions, orders or writs, for the enforcement of any of the rights conferred by part III and for "any other purpose." This any other purpose denotes the enforcement of legal rights other than Fundamental Rights enshrined in Part III of the constitution.

54. Indian Constitution is:

A. Federal
B. Quasi Federal
C. Unitary
D. Presidential
E. none of these

Ans. B

Sol. Indian constitution contains both features of a federal constitution and unitary constitution.
In a federal set up there is a two-tier of Government with well-assigned powers and functions.
The Central and the State governments work in coordination and at the same time act independently.

55. Sulphur Dioxide pollution is indicated by an excessive growth of which of the following?

A. Algal Blooms
B. Lichens
C. Bryophytes
D. Protozoa

Ans. B

Sol.

- Sulphur Dioxide pollution is indicated by an excessive growth of Lichens.
- Lichens are plants that grow in exposed places such as rocks or tree bark. They need to be very good at absorbing water and nutrients to grow there. This makes lichens natural indicators of air pollution.

56. Which of the following islands is located in the Arabian Sea?

A. Andaman Islands
B. Nicobar Islands
C. Lakshadweep Islands
D. All of the above

Ans. C

Sol. The largest islands in the Arabian Sea include Socotra (Yemen), Masirah Island (Oman), Lakshadweep (India) and Astola Island (Pakistan).

57. On 10 April 2017, Lok Sabha passed Constitution (123rd Amendment) Bill, 2017. The Bill seeks to give Constitutional Status to _____.

A. National Human Rights Commission
B. National Commission on Backward Classes
C. National Finance Commission
D. National Commission for Women

Ans. B

Sol. • Lok Sabha has passed Constitution **123rd Amendment Bill, 2017** which seeks to give constitutional status to National Commission for Backward Classes.

• The bill was passed by the house with 360 MPs voting in favor and 2 against the bill.The Constitution 123rd Amendment Bill seeks to make the following changes:

Insert a new article 342-A which empowers the president to notify the list of socially and educationally backward classes of that state / union territory. In case of a state, president will make such notification after consultation with the Governor. Under the same article, it is proposed that parliament by making a law can include or exclude the classes from the central list of backward classes.

58. Which company manufactured the first microprocessor 4004?

A. NVIDIA Corporation
B. PLX Devices
C. INTEL Corporation
D. ENOcean Private Company

Ans. C

Sol.

• INTEL Corporation manufactured the first microprocessor 4004.
• Microprocessor 4004 is a 4-bit central processing unit.
• It was released on November 15, 1971.

59. The centre of a cyclone is a calm area is called the _____ of the storm.

A. point
B. needle
C. eye
D. limit

Ans. C

Sol.

• The **eye** is a region of mostly calm weather at the center of strong tropical cyclones.
• The eye of a storm is a roughly circular area, typically 30–65 km (20–40 miles) in diameter. It is surrounded by the eyewall, a ring of towering thunderstorms where the most severe weather and highest winds occur.
• The **cyclone's lowest barometric pressure occurs in the eye** and can be as much as 15 per cent lower than the pressure outside the storm.

60. Who has been appointed as the Press Attache of India's Olympic contingent at the Tokyo Olympic Games 2021?

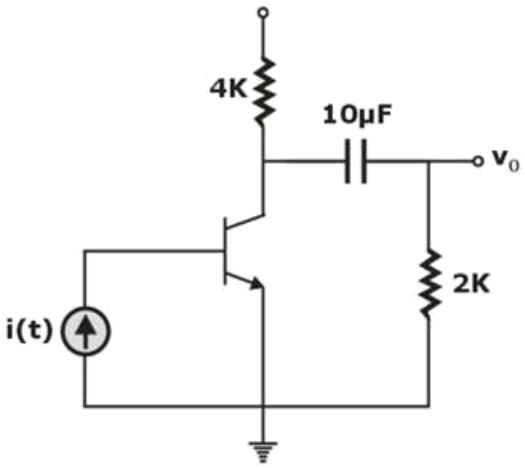
A. Narinder Batra
B. B K Sinha
C. Rajeev Mehta
D. Anirban Lahiri
E. Anurag Thakur

Ans. B

Sol.

* B K Sinha has been appointed as the Press and Security Attache of India's Olympic contingent at the Tokyo Games
* He is a former Haryana DGP and also a recipient of the President's Police Medal.

61. The transistor used has $\beta_0=100$, r_π =1kΩ and $r_0=\infty$.



Determine the value of f_L

A. 2.65 Hz
B. 26.5 Hz
C. 2.65 kHz
D. 2.65 MHz

Ans. A

Sol. Given R_C=4k, R_L=2k, C_C=10 μ F,

β =100, r π =1k Ω

$$f_L = \frac{1}{2\pi(R_C + R_L)C_C}$$

$$= \frac{1}{2\pi(4+2)\times10^3\times10\times10^{-6}}$$

f_L=2.65Hz.

62. Find the value of x in the following equation $(21)_x = \log_2(11202)_x$

A. 4
B. 3
C. 6
D. 5

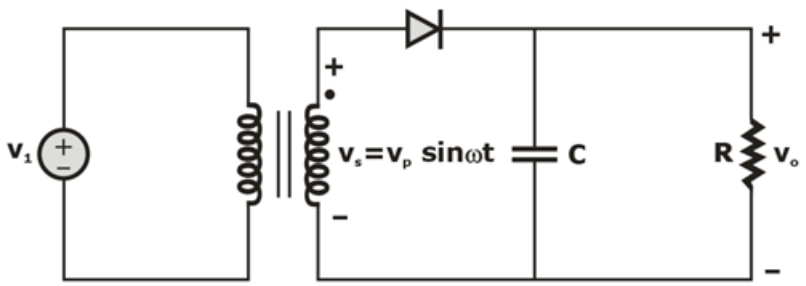
Ans. B

Sol. $2x+1=\log_2(x^4+x^3+2x^2+2)$

$x^4+x^3+2x^2+2=(2)^{2x+1}$

x=3 satisfies the above relation

63. Given that a half-wave rectifier circuit driven from a transformer having a secondary voltage of 12.6 V_{rms}, f = 60 Hz with R = 15 Ω and C = 25 mF. Assume the diode on voltage V_{on} = 1 V.



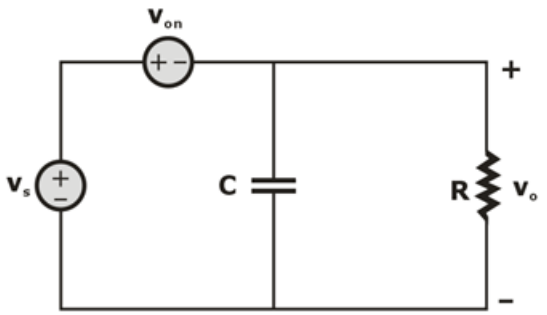
The value of the DC output voltage ($V_{o,\,dc}$) and value of ripple voltage is in volts is

A. 16.82, 0.147 B. 16.82, 0.747

C. 14.82, 0.147 D. 14.82, 0.747

Ans. B

Sol. For the diode operating in ON stage, simplified circuit is



The ideal dc output voltage in the absence of the ripple is given by

$$(V_{de})_{output} = (V_{dc})_{input} - V_{on}$$

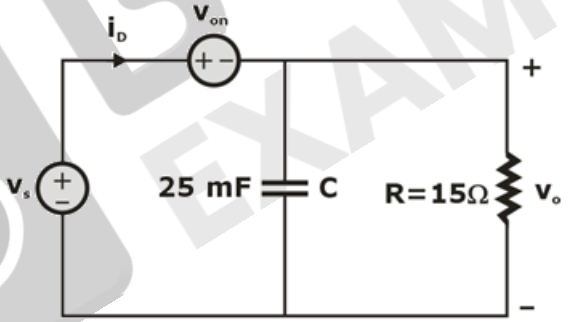
Since, $(V_{de})_{input} = (V_{rms})_{input} \times \sqrt{2}$

$$= 12.6 \times \sqrt{2} = 17.82 \text{ V}$$

So, $(V_{de})_{output} = 17.82 - 1 = 16.82 \text{ V}$

Again, for the diode operating in ON state, we have the simplified circuit as

For Diode ON



From the circuit, the ripple voltage is

$$V_{rip} \approx \frac{V_m - V_o}{R}\frac{T}{C}$$

$$= I_{dc}\frac{T}{C}$$

Given that f = 60 Hz. So,

$$\left[\because I_{dc} = \frac{V_m - V_o}{R}\right]$$

$$T = \frac{1}{f} = \frac{1}{60}\text{sec}$$

Therefore, $V_{rip} = \frac{16.8}{15} \times \frac{1/60}{25 \times 10^{-3}}$

=0.747 V

64. The point charges Q_1=1nc, Q_2 = −2nC, Q_3 = 3nC are located at (0, 0, 0), (1, 0, 0) and (0, 0, −1) respectively. The energy in the system is _____nJ.

A. −29.18 nJ
B. 10 nJ
C. 22 nJ
D. 50 nJ

Ans. A

Sol.
$$W = \frac{1}{2}(Q_1V_1 + Q_2V_2 + Q_3V_3)$$

$$= \frac{Q_1}{2}\left[\frac{Q_2}{4\pi\varepsilon_0(1)} + \frac{Q_3}{4\pi\varepsilon_0(1)}\right] + \frac{Q_2}{2}\left[\frac{Q_1}{4\pi\varepsilon_0(1)} + \frac{Q_3}{4\pi\varepsilon_0(\sqrt{2})}\right] + \frac{Q_3}{2}\left[\frac{Q_1}{4\pi\varepsilon_0(1)} + \frac{Q_2}{4\pi\varepsilon_0(\sqrt{2})}\right]$$

$$= \frac{1}{4\pi\varepsilon_0}\left[Q_1Q_2 + Q_1Q_3 + \frac{Q_2Q_3}{\sqrt{2}}\right]$$

$$= 9\times10^9\times10^{-18}\left[-2+3+\frac{(-6)}{\sqrt{2}}\right]$$

$$= 9\times10^{-9}\left[1-\frac{6}{\sqrt{2}}\right] = -29.18 \text{ nJ}$$

65. An AM broadcast receiver has an IF of 465 kHz and is tuned to 500 kHz with a 'Q' of 30 at that frequency. The image rejection ratio is

A. 42
B. 75.31
C. 62
D. 72

Ans. B

Sol. IF = 456 kHz

f_s=500 kHz

$f_{si}=f_s+2IF$

=500+2×465

f_{si}=1430 kHz

$$\rho = \frac{f_{si}}{f_s} - \frac{f_s}{f_{si}}$$

$$\rho = 2.5103$$

$$IRR = \sqrt{1+\rho^2Q^2}$$

$$= \sqrt{1+(2.5103)^2(30)^2} = 75.31$$

66. Which of the following statements is true?

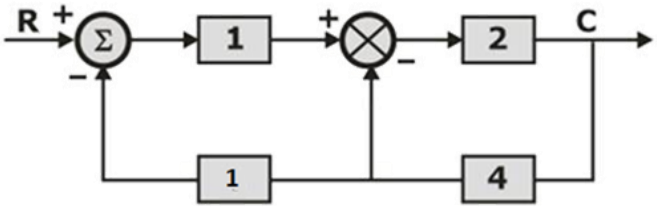
A. Both refrigerators and thermocouples can be made using the Peltier effect.
B. Both refrigerators and thermocouples can be made using the Seeback effect.
C. Refrigerators can be made using the Peltier effect and thermocouples can be made using the Seeback effect.

D. Refrigerators can be made using the Seeback effect and thermocouples can be made using the Peltier effect.

Ans. C

Sol. Note: Reversion of the seeback effect is Peltier effect.

67. Consider the block diagram representation of a system shown in the following figure



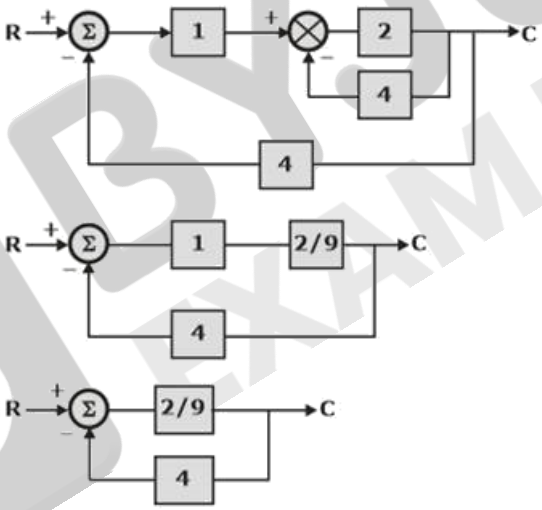
The value of $\frac{C}{R}$ is _____

A. 0.243 B. 0.117

C. 0.171 D. 0.711

Ans. B

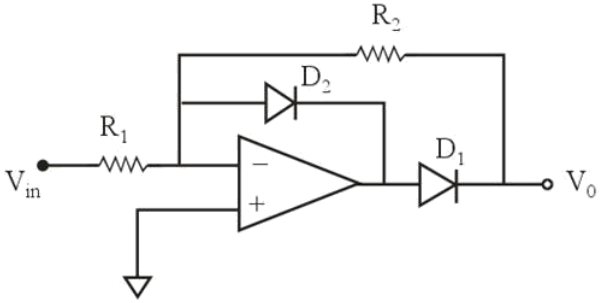
Sol.

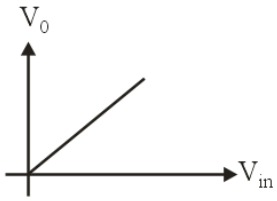


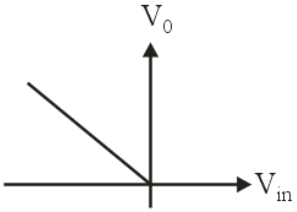
$$\frac{C}{R} = \frac{2/9}{1+4\times\frac{2}{9}} = \frac{2/9}{1+\frac{8}{9}} = \frac{2}{17}$$

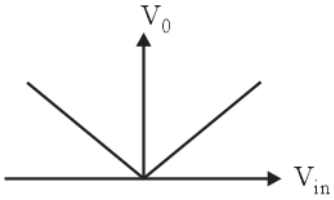
$$\frac{C}{R} = 0.117$$

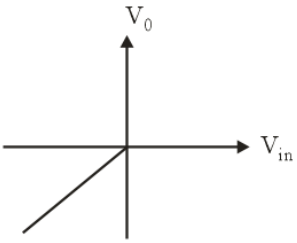
68. For the given circuit the transfer characteristics are



A. 

B. 

C. 

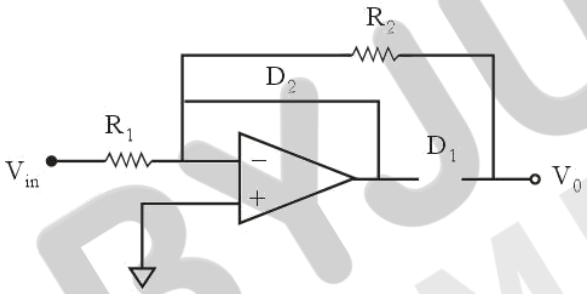
D. 

Ans. B

Sol. The above op-amp work as half wave rectifier

When $V_{in} > 0$

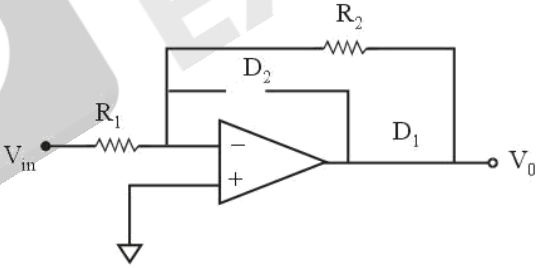
So D_2 is ON and D_1 is OFF



Hence $V_0 = 0$

When $V_{in} < 0$

So D_2 is OFF and D_1 is ON



Hence $V_0 = -\frac{R_2}{R_1}V_{in}$

69. The irredundant minimised logic expression corresponding to the K – map shown below is

WX \ YZ				
			1	
	1	1	1	
		1	1	1
		1		

A. XZ

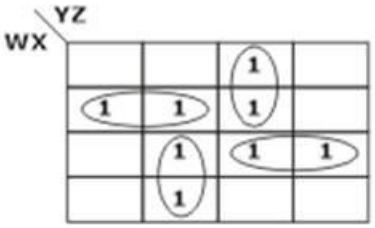
B. $\bar{w}x\bar{y} + \bar{w}yz + w\bar{y}z + wxy$

C. $\bar{w}x\bar{y} + \bar{w}yz + w\bar{y}z + wx\bar{y}$

D. $xz + \bar{w}yz + wx\bar{y} + w\bar{y}z + wxy$

Ans. B

Sol.



$Z = \bar{w}x\bar{y} + wxy + \bar{w}yz + w\bar{y}z$

70. Magnetic cores required for RF applications have

A. High hysteresis and eddy current losses

B. High hysteresis and low eddy current losses

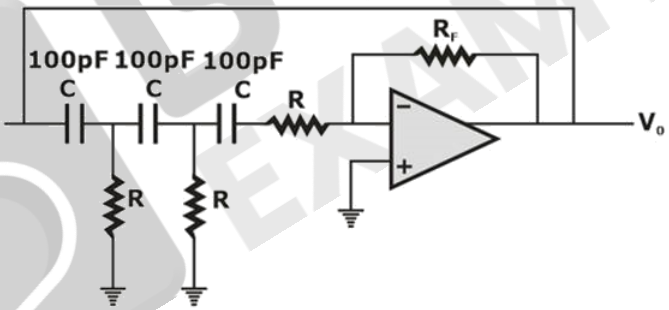
C. Low hysteresis and high eddy current losses

D. Low hysteresis and eddy current losses

Ans. D

Sol. Magnetic cores should have low hysteresis and eddy current losses.

71. Consider the phase shift oscillator as shown the figure below



If the frequency of oscillations of the circuit is 100 KHz, then the value of the resistance R will be _____

A. 2.4 kΩ

B. 6.5 kΩ

C. 1.9 kΩ

D. 4.7 kΩ

Ans. B

Sol. $f = \frac{1}{2\pi RC\sqrt{6}} = \frac{1}{2\pi\sqrt{6}RC}$

$R = \frac{1}{2\pi\sqrt{6}\ 100 \times 10^{-12} \times 100 \times 10^{3}}$

$= \frac{1}{2\pi\sqrt{6}} \times 10^{2} \times 10^{3}$ = 6.5 kΩ

72. A fibre has refractive indices n_{core} = 1.47 and n_{Clad} = 1.46. The minimum angle at which the ray will strike the core-clading interface to be guided in the core is _____ degrees

A. 83.3° B. 78.2°

C. 43.5° D. 53.2°

Ans. A

Sol. $$Q_c = \sin^{-1}\left(\frac{n_{clad}}{n_{core}}\right) = \sin^{-1}\left(\frac{1.46}{1.47}\right)$$

= 83.3°

73. A 10 MHz uniform plane wave propagates through a lossy medium, so that its amplitude is reduced by 20% every meter travelled. The skin depth of the material is_____m.

A. 3.12 B. 4.48

C. 2.47 D. 1.73

Ans. B

Sol. $$(1 - 0.2)E = Ee^{-\alpha z}\Big|_{z=1}$$

$$0.8E = Ee^{-\alpha z}\Big|_{z=1}$$

$$0.8 = e^{-\alpha}$$

$$e^{\alpha} = \frac{1}{0.8} = 1.25$$

$\alpha = \ln(1.25)$ N/m

$$S = \frac{1}{\alpha} = \frac{1}{\ln(1.25)}\ m = 4.48\ m$$

74. If $(211)_x = (152)_8$ then the value of x is___

A. 16 B. 2

C. 9 D. 7

Ans. D

Sol. Converting to decimal equivalent

$(211)_x = (2x^2 + x + 1)_{10}$

$(152)_8 = (64 + 40 + 2)_{10} = (106)_{10}$

$2x^2 + x + 1 = 106$

$2x^2 + x - 105 = 0$

$\boxed{x = 7}$

75. 10 mV input to an amplifier gives 10 V output without feedback with negative feedback 200 mV input is required to get the same output. The feedback factor (β) is_____%

A. 1.9 B. 1

C. 2.3 D. 4.3

Ans. A

Sol. Open loop gain

$$= A = \frac{10}{10 \times 10^{-3}} = 1000$$

$$A_{CL} = \frac{10}{200} \times 10^3 = \frac{1000}{200} = 50$$

$$A_{CL} = \frac{A}{1 + A\beta}$$

$$1 + A\beta = \frac{A}{A_{CL}} = \frac{1000}{50} = 20$$

$$A^{\beta} = 19$$

$$\beta = \frac{19}{1000}$$

$$\%\beta = \frac{19}{1000} \times 100 = 1.9\%$$

76. A lossless transmission line having characteristic impedance of 100Ω is terminated by a load resistance R_L if the voltage standing wave ratio on the line is 2, then the value of R_L will be

A. 50 Ω
B. 200 Ω
C. Either 50 Ω or 200 Ω
D. $\frac{100}{3}$ Ω

Ans. C

Sol. For $R_L > R_0$,

$$\text{VSWR} = \frac{R_L}{R_0} = R_L = 2 \times 100\ \Omega = 200\ \Omega$$

$\Rightarrow$ For $R_L < R_0$

$$\text{VSWR} = \frac{R_0}{R_L} = R_L = \frac{100}{2}\Omega = 50\Omega$$

77. The resolution of a DAC depends on which of the following?

A. The number of bits
B. Monotonicity
C. Reference
D. The values of resistance

Ans. A

Sol. The resolution of a DAC is an indication of the number of increments in output voltage that it can produce and it is directly related to the number of bits.

78. The dominant poles of a control system are located at S = (−1 ± 2j). The damping ratio of the system is

A. 0.447
B. 0.5
C. 0.707
D. 1

Ans. A

Sol. $\omega_n = \sqrt{(-1)^2 + (2)^2} = \sqrt{5}$

$\xi\omega_n = 1$

$\xi = \frac{1}{\omega_n} = \frac{1}{\sqrt{5}} = 0.447$

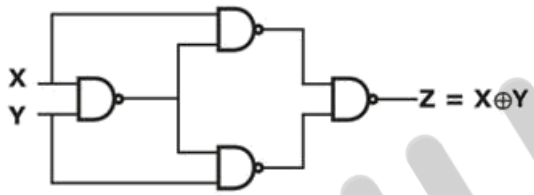
79. If X and Y logic inputs are available and their respective complements $\bar{X}$ and $\bar{Y}$ are not available, then the minimum number of two input NAND gate required to implement $X \oplus Y$ is _____

A. 7 B. 5

C. 4 D. 3

Ans. C

Sol.



80. A lossless medium has $\varepsilon_r = 4, \mu_r = 4.$ The intrinsic impedance of this medium is _____Ω

A. 377Ω B. 326Ω

C. 412Ω D. 271Ω

Ans. A

Sol. $\eta = \sqrt{\frac{\mu}{\varepsilon}} = 120\pi\sqrt{\frac{\mu_r}{\varepsilon_r}} = 120\pi\sqrt{\frac{4}{4}}$

$= 377\Omega$

81. If the signal $x_1(n) = e^{j5\pi n/7}$ and $x_2(n) = e^{j2\pi n}$, and a signal made by $x_1(n)$ and $x_2(n)$. this is $x(n) = x_1(n) + x_2[3n/4]$ so fundamental time period of the signal x(n) is

A. 56 B. 7

C. 28 D. 14

Ans. C

Sol. Given $x_1(n) = e^{j5\pi n/7}$

$x_2(n) = e^{j2\pi n}$

and $x(n) = x_1(n) + x_2(3n/4)$

$x(n) = e^{j5\pi n/7} + e\frac{j6\pi n}{4}$

$\omega_1 = 5\pi/7 \qquad \omega_2 = \frac{3\pi}{2}$

$\frac{N_1}{m_1} = \frac{2\pi}{\frac{5\pi}{7}} = \frac{14}{5}$

$$\frac{N_2}{m_2} = \frac{2\pi}{\frac{3\pi}{2}} = \frac{4}{3}$$

Fundamental time period is = LCM (N, N_2)

= LCM [14, 4]

= 28

Option (C) is correct.

82. Consider the following statements relating to the cavity resonator:

1). The cavity resonator does not possess as many modes as the corresponding waveguide does.

2). The resonant frequencies of cavities are very closely spaced.

3). The resonant frequency of a cavity resonator can be changed by altering its dimensions.

Which of these statements is/are correct?

A. 2 and 3 only
B. 2 only
C. 3 only
D. none of these

Ans. C

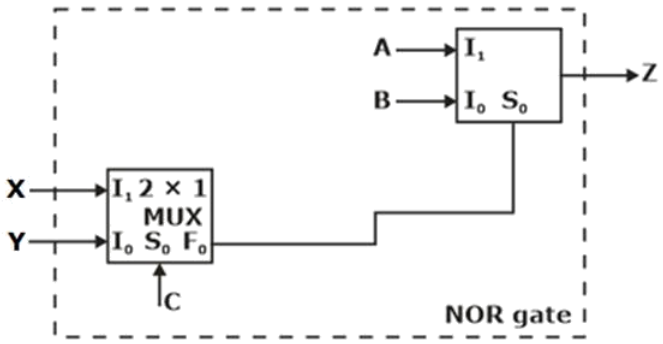
Sol. Resonant frequency for a rectangular resonator is given by

$$f_c = \frac{v_0}{2\pi}\sqrt{\left(\frac{m\pi}{a}\right)^2 + \left(\frac{n\pi}{a}\right)^2 + \left(\frac{p\pi}{d}\right)^2}$$

$$\ldots for \begin{cases} TE_{mnp} \\ TM_{nmp} \end{cases}$$

From above relation it is clear that resonant frequency can be altered by changing its dimensions. Also it is clear that the cavity resonator possess as many modes as the corresponding waveguides does and the resonant frequencies of cavities are not very closely spaced.

83. The circuit shown below implements a two input NOR gate by using two 2 × 1 Multiplexer. The values of A, B and C are respectively.



A. 0, $\bar{x}$, 0
B. 1, $\bar{x}$, 1
C. 0, 0, $\bar{x}$
D. 1, 1, x

Ans. A

Sol. $F_0 = XC + Y\bar{C}$

$Z = F_1 = B\bar{F}_0 + AF_0$

For NOR gate,

$Z = \overline{X + Y} = \bar{X}\bar{Y} = \bar{F}_0B + F_0A$

for A = 0

$F_0B = \bar{X}\bar{Y}$

Let us take,

$B = \bar{X}$ (as only X and $\bar{X}$ are used in the options)

then, $\bar{F}_0 = \bar{Y} \Rightarrow F_0 = Y$

$F_0 = \bar{C}Y + CX = Y \Rightarrow$ it is posible for C = 0

So correct combination is $A = 0, B = \bar{X}, C = 0$

84. A second order-system described by the differential equation.

$$J\frac{d^2\theta_0}{dt^2} + F\frac{d\theta_0}{dt} + K\theta_0 = K\theta_i$$

(where θ_i and θ_0 are the input and output shaft angles respectively). The natural frequency of this system is given by

A. $\sqrt{\frac{K}{J}}$ rad/ sec

B. $\sqrt{\frac{J}{K}}$ rad/ sec

C. $\sqrt{K}$ rad/ sec

D. $\sqrt{K - J}$ rad/ sec

Ans. A

Sol. Taking Laplace transform, we get

$Js^2\theta_0(s) + Fs\,\theta_0(s) + K\theta_0(s) = K\,\theta_i(s)$

$$\frac{\theta_0(s)}{\theta_i(s)} = \frac{K}{Js^2 + Fs + K}$$

$$\frac{\theta_0(s)}{\theta_i(s)} = \frac{K/J}{s^2 + \frac{F}{J}s + \frac{K}{J}}$$

Comparing the above equation with standard transfer function $\frac{\omega_n^2}{s^2 + 2\xi\omega_n s + \omega_n^2}$

We get,

$$\omega_n^2 = \frac{K}{J}$$

$$\omega_n = \sqrt{\frac{K}{J}}$$

85. An open loop transfer function with unity feedback system is

$$G(s) = \frac{K}{S^3 + 4s^2 + 5s}$$

The value of K at one of the break-away or break-in points of the root locus for the above system.

A. 1.667 B. 0.5

C. 1 D. 1.852

Ans. D

Sol. Characteristic equation is

$s^3 + 4s^2 + 5s + k = 0$

$K = -(s^3 + 4s^2 + 5s)$

$$\frac{dK}{dS} = -(3s^2 + 8s + 5) = 0$$

$(3s^2 + 8s + 5) = (s + 1)(s + 1.667)$

s= -1, -1.667

At s = −1, k=2 and s = −1.667, K = 1.852

86. An air-filled rectangular waveguide has dimension a = 2 cm and b = 1.5cm. If waveguide is operating at 15 GHz with TE_{01} mode, then the corresponding phase velocity will be

A. 4×10^8 m/sec B. 5×10^8 m/sec

C. 3×10^8 m/sec D. 2.24×10^8 m/sec

Ans. A

Sol.

$$V_p = \frac{C}{\sqrt{1 - \left(\frac{f_c}{f}\right)^2}}$$

$$f_c = \frac{c}{2b} = \frac{3 \times 10^{10}}{2 \times 1.5} = 10 \text{ GHz}$$

$$V_p = \frac{3 \times 10^8}{\sqrt{1 - \left(\frac{10}{15}\right)^2}} = 4.025 \times 10^8 \text{ m/sec}$$

87. The resolution of a 10-bit analog to digital convertor is _____%.

A. 0.071 B. 0.012

C. 0.121 D. 0.097

Ans. D

Sol. % Resolution $= \frac{100}{2^n - 1} = \frac{100}{2^{10} - 1} = \frac{100}{1023} = 0.097\%$

88. An antenna has a diameter of 1m is operating at 1 GHz. The minimum distance beyond which the inductive and electrostatic contribution to the radiated fields can be neglected is _____m.

A. 5.32 m
B. 6.67 m
C. 4.37 m
D. 1.82 m

Ans. B

Sol. For far field approximation,

$$d_{min} = \frac{2d^2}{\lambda}$$

$$= \frac{2 \times (1)^2}{c/f} = \frac{2f}{c}$$

$$= \frac{2 \times 10^9}{3 \times 10^8} = \frac{20}{3} m = 6.67 \text{ m}$$

89. Which of the following statements are true for a type-II system having unity negative feedback?

(i) Positional error constant K_p is equal to zero.

(ii) Acceleration error constant K_a is equal to infinite.

(iii) Steady state error to a unit step displacement input is equal to one.

A. (i) and (iii)
B. (ii) and (iii)
C. (i), (ii) and (iii)
D. None of these

Ans. D

Sol. For type-II system

Acceleration constant, $K_a = \lim_{s \to 0} s^2 G(s)H(s)$

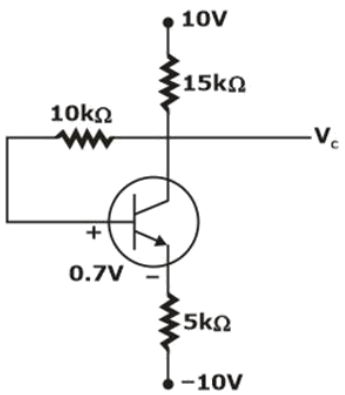
K_a = constant

Positional error constant $K_p = \lim_{s \to 0} G(s)H(s) = \infty$

The steady state error for unit step displacement is zero

$$e_{ss} = \frac{A}{1 + K_p} = \frac{A}{1 + \infty} = 0$$

90. Consider the circuit shown in the figure below:



Assume the β of the transistor to be very large, the value of the collector valtage V_c is equal to

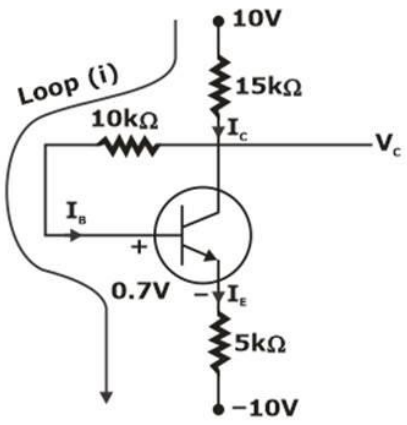
A. 6.1 B. 2.43

C. –4.475 D. –2.21

Ans. C

Sol. Since β of the transistor is very large, thus

$I_B = 0$ and $I_C = I_E$



Applying KVL across loop (i), we get

$-10 + I_C \times 15 \times 10^3 + 0.7 + 5 \times 10^3 I_E - 10 = 0$

($\because I_C = I_E$ and $I_B = 0$)

$$I_C = \frac{20 - 0.7}{20} \times 10^{-3} = 0.965 \times 10^{-3}$$

$$10 - 15 \times 10^3 \times 0.965 \times 10^{-3} = V_c$$

V_c= –4.475 V

91. In 8085, if the clock frequency is 5 MHz, the time required to execute an instruction of 18 T-states is

A. 3.0μs B. 3.6μs

C. 4.0μs D. 6.0μs

Ans. B

Sol. Clock frequency, f = 5 MHz

Time required to execute 1 T-state,

$$t = \frac{1}{f}$$

Time required to execute 18 T-states,

$$T = 18t$$

$$= \frac{18}{f} = \frac{18}{5 \times 10^6} = 3.6\,\mu s$$

92. A TE_{10} rectangular waveguide is to be designed for operation over 25-35 GHz and the band centre is 1.5 times the cutoff frequency. What should be the dimension of the broad side?

A. 15 mm
B. 10 mm
C. 9 mm
D. 7.5 mm

Ans. D

Sol. Given band is 25-35 GHz

Center frequency = 30 GHz

Given centre frequency =1.5 f_c

$$f_c = \frac{\text{centre frequency}}{1.5}$$

$$f_c = \frac{30\times10^9}{1.5}$$

$f_c=20\times10^9$ Hz

For TE_{10} mode : $f_c = \frac{c}{2a} = 20\times10^9$

$$\Rightarrow a = \frac{c}{2\times20\times10^9}$$

$$= \frac{3\times10^8}{40\times10^9}$$

A = 7.5 mm

93. The z - transform of a signal is given by $C(z) = \frac{1}{4}\frac{z^{-1}(1-z^{-4})}{(1-z^{-1})^2}$. Its final value is

A. $\frac{1}{4}$
B. Zero
C. 1
D. Infinity

Ans. C

Sol. $C(z) = \frac{1}{4}\frac{z^{-1}(1-z^{-4})}{(1-z^{-1})^2}$

$$C(z) = \frac{1}{4}\frac{z^{-1}(1+z^{-2})(1-z^{-2})}{(1-z^{-1})^2}$$

$$= \frac{1}{4}\frac{z^{-1}(1+z^{-2})(1+z^{-1})(1-z^{-1})}{(1-z^{-1})^2}$$

$$= \frac{1}{4}\frac{z^{-1}(1+z^{-2})(1+z^{-1})}{(1-z^{-1})}$$

final value, $c(\infty) = \lim_{z\to1}(1-z^{-1})C(z)$

$$= \lim_{z\to1}(1-z^{-1})\frac{1}{4}\frac{z^{-1}(1+z^{-2})(1+z^{-1})}{(1-z^{-1})}$$

$$= \frac{1}{4}(1)(1+1)(1+1) = 1$$

94. The relation between the magnetic vector potential $\bar{A}$ and the magnetic field intensity $\bar{H}$ can be given by

A. $\bar{H} = \frac{1}{\mu}(\nabla \times \bar{A})$

B. $\bar{H} = \mu(\nabla \times \bar{A})$

C. $\bar{A} = \mu(\nabla \times \bar{H})$

D. $\bar{A} = \frac{1}{\mu}(\nabla \times \bar{H})$

Ans. A

Sol. $\nabla \times \bar{A} = \bar{B}$

$\nabla \times \bar{A} = \mu\bar{H}$

$\Rightarrow \bar{H} = \frac{1}{\mu}(\nabla \times \bar{A})$

95. Which logic gate is used to detect overflow in 2's complement arithmetic?

A. OR gate

B. AND gate

C. NAND gate

D. XOR gate

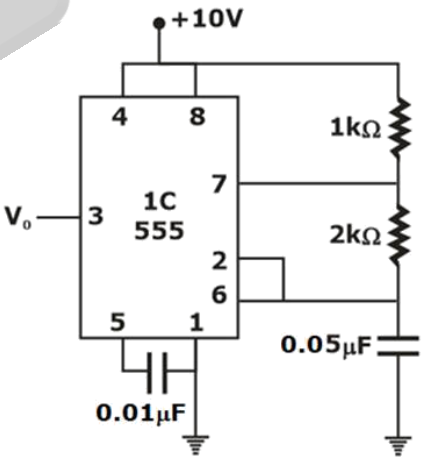
E. Logic gate

Ans. D

Sol. The following are characteristics of XOR GATE-:

If the sum of two positive numbers yields a negative result, the sum has overflowed. If the sum of two negative numbers yields a positive result, the sum has overflowed. Otherwise, the sum has not overflowed.

96. Consider the square generator shown in figure.



The frequency of oscillation is

A. 5.2

B. 5.7

C. 4.3

D. 3.5

Ans. B

Sol. $$f = \frac{1}{0.693(R_A + 2R_B)C}$$

$$= \frac{1}{0.693 \times 5 \times 10^3 \times 5 \times 10^{-6} \times 10^{-2}}$$

= 5.77 kHz

97. At I_C = 1 mA and V_{CE} = 10 V, the high frequency parameters at cut off frequency f_T = 500 MHz was measured at C_μ = 10 pF. Then the value of capacitance C_π will be equal to _____

(Assume V_T = 25 mV)

A. 1.6 pF
B. 2.1 pF
C. 2.7 pF
D. 3.4 pF

Ans. C

Sol. $$f_T = \frac{g_m}{2\pi(C\mu + C\pi)}$$

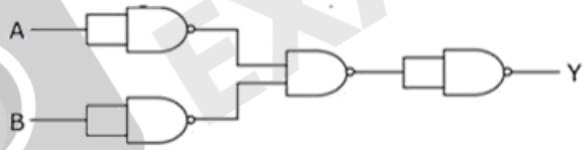
$f_T = 500 \times 10^6$ Hz

$$g_m = \frac{I_C}{V_T} = \frac{1 \times 10^{-3}}{25 \times 10^{-3}} = 40 \text{ ms}$$

$$\therefore \quad C_u + C_\pi = \frac{40 \times 10^{-3}}{2\pi \times 500 \times 10^6} = 12.7 \text{ pF}$$

C_π =(12.7 −10)pF = 2.7 pF

98. The following logic gate is equivalent to:



A. NOR Gate
B. AND Gate
C. OR Gate
D. NAND Gate

Ans. A

Sol. $Y = \overline{\overline{A}\overline{B}} = \overline{A}\overline{B}$

So, given logic gates circuit is a NOR gate

99. A micro-strip line of 50 ohm is terminated in Z_L = 40 + j30Ω what is the VSWR of the load?

A. 2.0
B. 1.8
C. 1.5
D. 1.3

Ans. A

Sol. Reflection coefficient, $\rho = |\Gamma|$

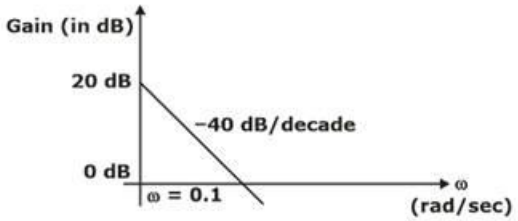
$$\rho = \left[\frac{Z_L - Z_0}{Z_L + Z_0}\right] = \left|\frac{40 + j30 - 50}{40 + j30 + 50}\right|$$

$$= \left|\frac{-10 + j30}{90 + j30}\right| = \frac{\sqrt{(-10)^2 + (30)^2}}{\sqrt{(90)^2 + (30)^2}}$$

$$= \frac{\sqrt{1000}}{\sqrt{9000}} = \frac{1}{3}$$

$$VSWR = \frac{1+\rho}{1-\rho} = \frac{1+\frac{1}{3}}{1-\frac{1}{3}} = \frac{4}{2} = 2$$

100. The asymptotic bode magnitude plot for open loop transfer function of a unity negative feedback system is shown in figure. If the input is $\frac{t^2}{2}u(t)$, then the steady state error will be _____

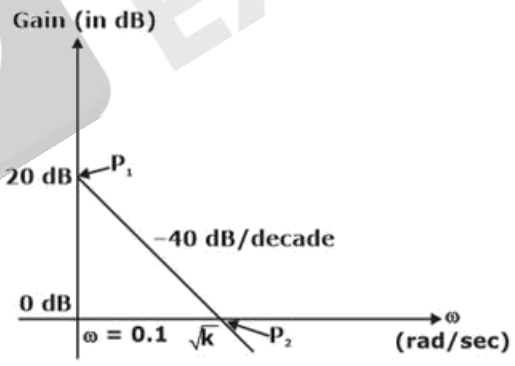


A. 10 B. 12

C. 9.3 D. 8

Ans. A

Sol.



Here, $P_1(20\text{ dB}, 0.1)$ and $P_2(0\text{ dB}, \omega_1)$

$$-40 = \frac{y_2 - y_1}{x_2 - x_1} = \frac{20 - 0}{\log_{10} 0.1 - \log_{10} \omega_1}$$

$$\log_{10}(0.1) - \log_{10}(\omega_1) = -\frac{1}{2}$$

$$-1 + \log_{10}\left(\frac{1}{\omega_1}\right) = -\frac{1}{2}$$

$$\log_{10}\left(\frac{1}{\omega_1}\right)=\frac{1}{2}$$

$$\frac{1}{\omega_1}=10^{\frac{1}{2}}$$

$$\Rightarrow \quad \omega_1=\frac{1}{\sqrt{10}}=\sqrt{k}$$

$$\Rightarrow \quad K=\frac{1}{10}$$

$$G(s)=\frac{K}{S^2}=\frac{1}{10.S^2}$$

$$e_{ss}=\frac{1}{k_a}$$

$$K_a=\lim_{s\to 0}S^2G(s)=\frac{1}{10}$$

$$\boxed{e_{ss}=10}$$

101. The Depletion region formed in the P-N junction shows:

A. Presence of electric field due to diffusion of carriers

B. Presence of diffusion current

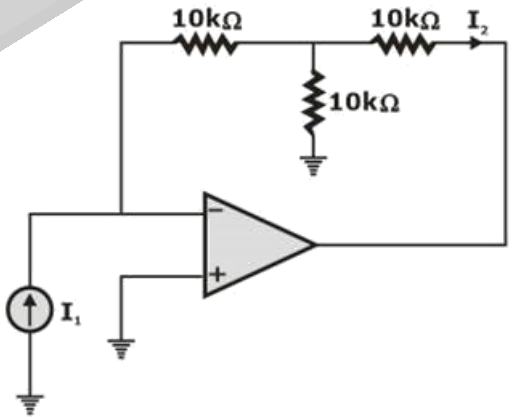
C. Separation of PN region

D. All of above

Ans. D

Sol. The result of depletion region formed in P-N junction will cause an electric field due to diffusion of carriers which finally shows drift current.

102. For the circuit shown below the value of $\frac{I_2}{I_1}$ is



A. −1

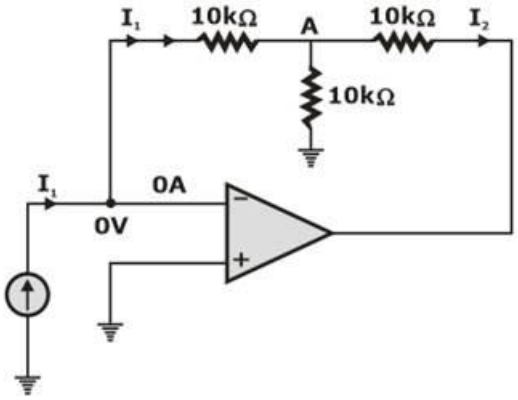
B. −2

C. +1

D. +2

Ans. D

Sol. Using virtual ground concept



KCL at node A

$$\frac{V-0}{10k}+\frac{V-0}{10k}+I_2=0 \quad \text{...(i)}$$

$$-I_1=\frac{V}{10k} \quad \text{...(ii)}$$

Substituting (ii) in (i)

$-2I_1 + I_2 = 0$

$I_2 = 2I_1$

$$\frac{I_2}{I_1}=2$$

103. An antenna radiates a total power of 20 kW and has a directive gain of 15 dB. The electric field at a distance of 10 km away from the antenna is _____ mV/m.

A. 530 mV/m
B. 616 mV/m
C. 430 mV/m
D. 600 mV/m

Ans. B

Sol. P_{rad} = 20 kW

G = 15 dB = 31.6

t = 10 km = 1000 m

$\eta = 377\Omega$

$$P_{avg}=\frac{P_{rad}\times G}{4\pi r^2}=\frac{|E|^2}{2\eta}$$

$$E^2=\frac{P_{rad}\times G\times 2\pi}{4\pi r^2}=\frac{20\times 10^3\times 31.6\times 2\times 377}{4\pi\times(0.10\times 10^3)^2}$$

= 0.38

E = 0.616 V/m = 616 mV/m

104. The underlying principle of working of a cavity wave meter, used to measure frequency of microwaves in a system, is

A. selective absorption of microwave energy in solids
B. selective scattering of microwave energy by a cavity

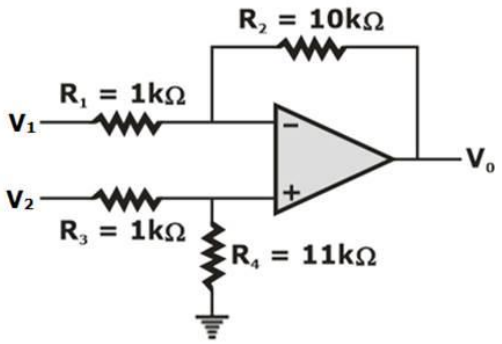
C. selective diffraction of microwaves around a cavity

D. resonance of a cavity with incoming microwave energy

Ans. A

Sol. Absorption cavities attenuate the signal frequency to which they are tuned.

105. Consider the difference amplifier as shown in the figure below. Assuming the op-amp to be ideal the CMRR of the circuit is equal to



A. 35.1 dB

B. 41.6 dB

C. 74.4 dB

D. 89.2 dB

Ans. B

Sol. Applying superposition at the output, we have

$$V_0 = \frac{-R_2}{R_1}V_1 + \left(\frac{R_4}{R_3+R_4}\right)\cdot\left(1+\frac{R_2}{R_1}\right)\cdot V_2$$

$= -10V_1 + 10.0833V_2$

Now, the differential input voltage is given as,

$V_d = V_2 - V_1$

$$V_1 = V_c - \frac{V_d}{2}$$

$$V_2 = V_c + \frac{V_d}{2}$$

$$V_0 = (10.0833)\left[V_c + \frac{V_d}{2}\right] - 10\left[V_c - \frac{V_d}{2}\right]$$

$V_0 = 10.042V_d + 0.0833\ V_c$

Comparing the equation from the standard result

$V_0 = A_d\ V_d + A_c\ V_c$

$A_d = 10.042$

$A_c = 0.0833$

$$\therefore \quad (CMRR)_{dB} = 20\log_{10}\left[\frac{10.042}{0.0833}\right] = 41.63\ dB$$

106. The following is generally true. RC snubber is used to protect the SCR

A. against device overvoltage
B. against device overcurrent
C. against forward dV/dt
D. against dI/dt

Ans. C

Sol. RC snubber is used to protect the SCR against forward dV/dt

107. For a n-channel MOSFET biased in the saturation region, the parameter $\frac{\mu_n C_{ox} W}{2L} = 0.5\ mA/V^2$, V_{TN} = 0.8 V and $\lambda = 0.01\ V^{-1}$, if the value of the drain current flowing inside the MOS transistor is I_D = 0.75 mA, then the value of intrinsic gain, $A_0 = g_m r_0$ of the MOSFET is equal to

A. 201.21
B. 115.46
C. 143.34
D. 163.3

Ans. D

Sol. $g_m = \sqrt{\frac{2\mu_n C_{ox} W}{L} I_D} = \sqrt{4 \times 0.5 \times 0.75 \times 10^{-6}}$

$= 1.225\ m\mho$

$r_0 = \frac{1}{\lambda I_0} = \frac{100}{0.75} \times 10^3$ = 133.33 kΩ

$A_0 = g_m r_0 = 163.3$

108. The carrier c(t) = A cos $2\pi 10^6 t$ is angle modulated (PM or FM) by the sinusoidal signal m(t)=2 cos 2000πt. The deviation constants are k_p =1.5 rad/V and k_f = 3000 Hz/V. If β_f and β_p denote the modulation indices of FM and PM systems respectively, then the values of are β_f and β_p respectively are?

A. 6, 3
B. 3, 6
C. 3, 3
D. 6, 6

Ans. A

Sol. $\beta_p = k_p \max\left[|m(t)|\right] = 1.5 \times 2 = 3$

$\beta_f = \frac{k_f \max\left[|m(t)|\right]}{f_m} = \frac{3000 \times 2}{1000} = 6$

109. The dead time of an instrument refers to

A. Large change of input quantity for which there is no output.
B. Retardation or delay in the opposite of an instrument to a change in the input signal.
C. The time encountered when the instrument has to laid for some reactions to take place
D. The time before the instrument begins to response after the quantity has altered

Ans. D

Sol. Dead time is defined as the time required by a measurement system to begin to respond to a change in the measurand.

110. The minimum number of 2 input NAND gate required to implement the Boolean function $F = (\bar{X} + \bar{Y})(Z + W)$ is_____

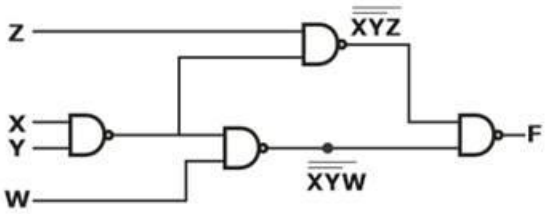
A. 6
B. 3
C. 5
D. 4

Ans. D

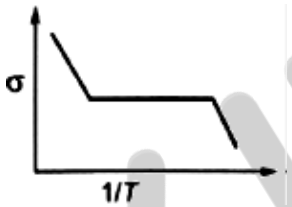
Sol. $F = (\overline{x} + \overline{y})(z + W)$

$F = \overline{xy} \cdot z + \overline{xy}\, W = \overline{\overline{xyz} + \overline{xyW}}$

$= \overline{(\overline{xyz})(\overline{xyW})}$



111. The conductivity σ as a function of 1/T, where T is the temperature, for a semiconducting material varies as shown in the figure. Using this information, state whether a resistance made from intrinsic semiconductor will have

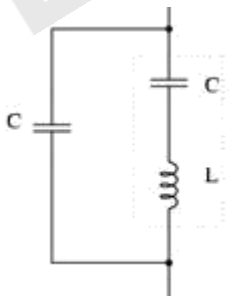


A. Positive temperature coefficient of resistance
B. Negative temperature coefficient of resistance
C. Zero temperature coefficient of resistance
D. Initially positive and later negative temperature coefficient of resistance

Ans. B

Sol. Intrinsic semiconductor has negative temperature coefficient of resistance.

112. In a quartz crystal circuit as shown, resonant frequency variation over time with the crystal is:



A. High
B. Low
C. Very very low
D. Very high

Ans. C

Sol. The quartz crystal circuit contains a capacitance and inductance in series which does not exist as discrete components inside the crystal. Here the capacitance is parallel across dielectric quartz having an effect on resonant. In this, the crystals as resonant elements have much higher Q values as compared to tank circuits because of relative absence of stray resistance that keeps resonant frequencies very definite and precise which depends

on physical properties with resonant frequency variation over time being very, very low in order to see quartz movement with high accuracy.

113. To double the drain current of an N-channel enhancement mode MOSFET biased in saturation

A. Channel length should be doubled

B. Channel width should be halved

C. Channel length should be halved

D. Oxide thickness should be doubled

Ans. C

Sol. Since Drain current is inversely proportional to channel length in Saturation mode.

114. A certain 8-bit successive approximation type analog to digital converter has full scale voltage of 2.65 V, if the conversion time for V_A = 1.5 V is 75 μs, then the conversion time for V_A = 2.5 V is.

A. 75 μsec

B. 25 μsec

C. 225 μsec

D. 150 μsec

Ans. A

Sol. For successive approximation type of converter, the conversion time is independent of V_A. Here, option (A) is correct

115. The main purpose of inserting a microwave isolator in a microwave circuit is for

A. offering minimum forward impedance

B. offering maximum power output from the source.

C. maintaining frequency stability of the source

D. maintaining amplitude stability of output power

Ans. C

Sol. Main purpose of isolator is to maintain frequency stability of source because it eliminate the reflected wave which disturb the source.

116. 24 MHz clock frequency is applied to a cascaded counter of MOD-3, MOD-4 and MOD-5 counters. The lowest output frequency and the overall MOD value of the cascaded counter are

A. 600 KHz, 60

B. 400 KHz, 60

C. 400 KHz, 160

D. 600 KHz, 120

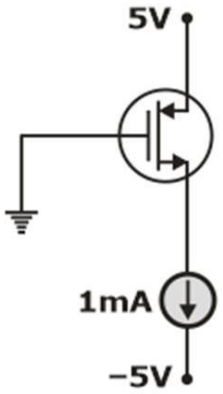
Ans. B

Sol. Overall MOD = 3 × 4 × 5 = 60

Lowest frequency is output frequency

$$f_{out} = \frac{24 \times 10^6}{60} = 400\ KHz$$

117. Consider an N-MOS transistor shown in the circuit below:



The N-MOS transistor is so constructed that it has $\frac{\mu_n C_{ox} W}{2L} = 0.5\ mA/V^2$, the threshold voltage $V_T = 1.2$ V and $\lambda = 0$, then the value of voltage V_{DS} is equal to

A. 7.614 V
B. 4.212 V
C. 3.212 V
D. 8.624 V

Ans. A

Sol. To calculate the value of V_{DS}, we require the voltage of both drain and source terminal. Now, assuming the transistor to be in saturation region, the value of V_{GS} can be calculated as

$$I_D = \frac{\mu_n C_{ox} W}{2L}(V_{GS} - V_T)^2$$

$1 \times 10^{-3} = 0.5 \times 10^{-3} \times (V_{GS} - V_T)^2$

On solving

Now, $V_{GS} = V_G - V_S$

$V_G = 0$

$V_S = -2.614$ V

$V_D = 5$ V

$V_{DS} = V_D - V_S = 5 - (-2.614)$

$= 7.614$ V

118. In a n-type gallium arsenide semiconductor at a temperature T = 300 k, the electron concentration varies linearly from 10^{16} to 10^{17} cm^{-3} over a distance of 0.5cm. If the electron diffusion coefficient is $D_n = 1250$ cm^2/s then the electron diffusion current density will be

A. 36 A/cm^2
B. 360 A/cm^2
C. 72 A/cm^2
D. 720 A/cm^2

Ans. A

Sol. Diffusion Coefficient , $D_n = 1250$ cm^2/s

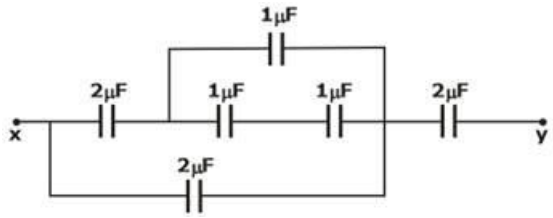
Diffusion current density , $J_v = q.D_n \frac{dn}{dx}$

$$\frac{dn}{dx}=\frac{10^{17}-10^{16}}{0.5}=\frac{9\times10^{16}}{0.5}=1.8\times10^{17}$$

$$J_\eta=1.6\times10^{-19}\times1.8\times10^{17}\times1250$$

$$=36\ A/cm^2$$

119. The equivalent capacitance seen across the terminals x and y if the circuit shown below is ____μF.

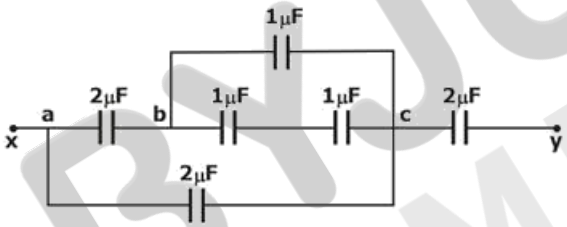


A. 1.176 B. 2.176

C. 0.766 D. 4.886

Ans. A

Sol. By redrawing the circuits



The equivalent capacitance seen across the terminals 'b' and 'c' is

$$C_{bc}=\frac{1\times1}{1+1}\mu F+1\mu F=1.5\mu F$$

Similarly, the equivalent capacitance seen across the terminals 'a' and 'c' are

$$C_{ac}=\frac{2\times1.5}{1+1.5}\mu F+2\mu F=2.857\mu F$$

∴ The total capacitance between the terminals x and y is

C_{xy} = (2857||2)μF = 1.176 μF

120. Optical communication system uses:

A. PIN photodiode.

B. Avalanche photodiode.

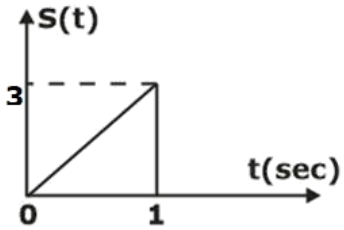
C. Both (A) and (B) in combination.

D. Neither (A) nor (B)

Ans. B

Sol. Since power handling capacity of Avalanche photodiode is much higher than PIN diode, so, Avalanche photodiode is much preferred.

121. Consider the signal S(t) shown in the figure below.



This signal is applied to its matched filter after contaminated with an AWGN noise. If the two sided PSD of the noise is $\frac{N_0}{2}$, then the maximum signal to noise ratio possible at the output of the filter will be?

A. $\frac{3}{N_0}$

B. $\frac{6}{N_0}$

C. $\frac{9}{N_0}$

D. $\frac{12}{N_0}$

Ans. B

Sol. Maximum SNR possible at the output of a matched filter is

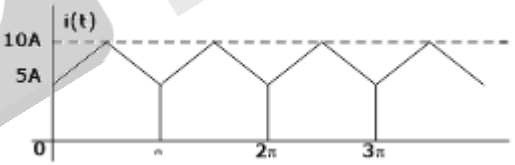
$$(SNR)_{max} = \frac{2E_S}{N_0}$$

E_S = Energy of the signal S(t)

$$F_S = \int_{-\infty}^{\infty} |S(t)|^2 \, dt = \int_0^1 (3t)^2 dt = \left[\frac{9t^3}{3}\right]_0^1 = 3$$

So, $(SNR)_{max} = \frac{6}{N_0}$

122. The average value of the current waveform shown in fig.,



A. 2.5 A

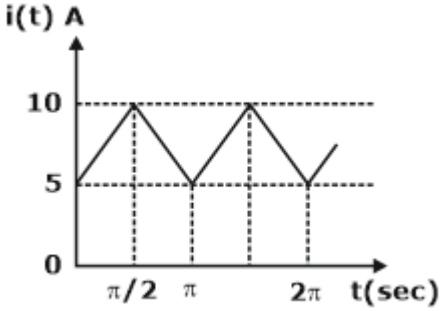
B. 5.1 A

C. 7.5 A

D. 10.0 A

Ans. C

Sol.



i(t) is periodic a period in t of π sec.

$$i(t) = \begin{cases} \left(\frac{10t}{\pi} + 5\right) & 0 \le t \le \frac{\pi}{2} \\ \left(-\frac{10t}{\pi} + 15\right) & \frac{\pi}{2} \le t \le \pi \end{cases}$$

$$I_{ave} = \frac{1}{\pi}\int_{t=0}^{t=\frac{\pi}{2}}\left(\frac{10t}{\pi} + 5\right)dt + \int_{t=\frac{\pi}{2}}^{t=\pi}\left(-\frac{10t}{\pi} + 15\right)dt$$

$$= \frac{1}{\pi}\left[\frac{5t^2}{\pi} + 5t\right]_{t=0}^{t=\frac{\pi}{2}} + \left[\frac{-5t^2}{\pi} + 15t\right]_{t=\frac{\pi}{2}}^{t=\pi} = 7.5\,A$$

123. A single mode fibre does not suffer from which type of dispersion?

A. Waveguide dispersion
B. Material dispersion
C. Intermodal dispersion
D. Polarization mode dispersion

Ans. C

Sol. Intermodal dispersion arises in a multimode fibre.

124. A data with a rate of 500 KbPS is to be transmitted using BPSK modulation. If the baseband modelling of the data is done by a raised cosine filter with a roll-off factor of 0.50, then the minimum channel bandwidth required to transmit the BPSK modulated signal will be _____ kHz.

A. 650 kHz
B. 650 kHz
C. 750 kHz
D. 700 kHz

Ans. C

Sol. BW of the baseband modelled data will be

$$(BW)_{Baseband} = \frac{R_b}{2}(1 + \alpha)$$

BW of the BPSK signal will be

$(BW)_{BPSK} = 2(BW)_{Baseband} = R_b(1 + \alpha)$

Given that, R_b = 500 KbPS and α = 0.50

$(BW)_{BPSK} = 500(1 + 0.50) = 750$ kHz

125. A low earth orbit satellite can provide large signal strength at an earth station because

A. Path loss is low
B. These orbits are immune to noise
C. Large solar power can be generated at these orbits
D. Lower microwave frequencies in S-band can be used

Ans. A

Sol.

$$Path\ loss = \left(\frac{4\pi R}{\lambda}\right)^2$$

If R is less then path loss will be low.

126. For a given inductor, the value of the inductance is 'L', the number of turns is 'N', relative permeability (μ_r) is '1', the area of cross-section is 'A' and the length of core is 'l', if the inductor is immersed in a liquid having $\mu_r = 0.25$, then the value of the new inductance will be

A. L
B. L/2
C. L/4
D. L/8

Ans. C

Sol. For any inductance, $L = \frac{N^2 \mu A}{l}$

Now, $\mu' = 0.25\mu = \frac{\mu}{4}$

The new inductance, $L' = \frac{N^2 \times \mu/4 \times A}{l} = \frac{N^2 \mu A}{l} \times \frac{1}{4}$

$$\boxed{L' = \frac{L}{4}}$$

127. A spectrum of (1000 – 1650) kHz is assigned for DSB – SC AM transmission. The spectrum is shared for different users using frequency division multiplexing and quadrature carrier multiplexing and quadrature carrier multiplexing. If each user has a message BW of 5 kHz, then the maximum number of users that can simultaneously use the spectrum will be

A. 65
B. 130
C. 260
D. 650

Ans. B

Sol. BW required for each user = 2 × 5 = 10 kHz

Number of 10 kHz bands possible $= \frac{1650 - 1000}{10} = 65$

We can send two different signals through a single channel of 10 kHz using quadrature carrier multiplexing. So, maximum number of simultaneous users possible = 65 × 2 = 130

128. The output of an information source consists of 128 symbols, 16 of which occur with a probability of 1/32 and the remaining 112 occur with a probability of 1/224. The source emits 1000 symbols/sec. Assuming that the symbols are chosen independently, the average information rate of this source(in kbps) is

A. 6.4
B. 5.4
C. 3.4
D. 7.4

Ans. A

Sol. $$\mathbf{H}(\mathbf{X}) = -\sum_{i=1}^{128} P_i(X_i) \log_2 P_i(X_i)$$

$$= 16 \times \frac{1}{32} \log_2 32 + 112 \times \frac{1}{224} \log_2 224$$

H(X)=6.4036 bits/symbol

R=rH

R=rH

=1000×6.4036

=6403.6 bps

$R \approx 6.4$ kbps

129. The function of a bleeder resistance in an L-section filter rectifier circuit is

A. Increases ripple

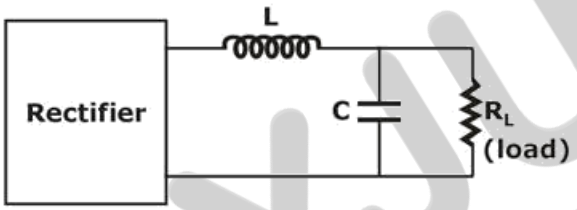
B. Decreases ripple

C. Makes ripple independent of load variations

D. None

Ans. C

Sol.



The figure shown above is a L-section filter.

In general L-section filter has no ripples at all. Some how if rectifier and load are disconnected from the filter circuit, then there is no discharge path for the capacitor to discharge. The voltage it has stored during the charging by rectifier.

This is why we connect a resistance in parallel with capacitor in order to provide a discharge path for capacitor. This is called bleeder resistance.

Even if the load varies also, due to the bleeder resistance, the ripple will be zero in L-section filter.

130. If one of zero of FIR Fitter is $\frac{1}{2+j3}$, then which of the following is also one of the zero of FIR Filters?

A. $\frac{1}{2-j3}$

B. $2+j3$

C. $2-j3$

D. All of the above

Ans. D

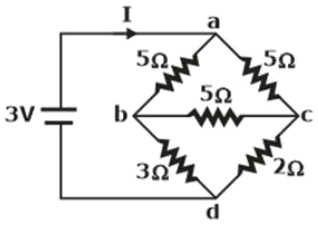
Sol. If one of the zero of FIR Filter is Z, then it also has $Z^{-1}, Z^{x}, (Z^{*})^{-1}$ as zeros. Because the impulse response of FIR filter is

$$h[n] = h(m-n)$$
$$H(z) = \left|H\left(z^{-1}\right)z^{-m}\right|$$
$$o = H\left(z^{-1}\right)z^{-m}$$

$$\therefore\ z^{-1}, z^{*}, \left(z^{*}\right)^{-1}$$

are also zeroes. So, all of the above are also zeroes of given FIR filter.

131. Consider the circuit shown in the figure below:



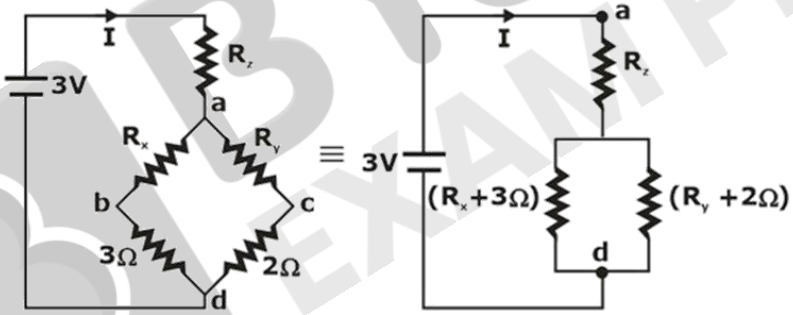
The value of the source current I is _____

A. 0 A
B. 0.54 A
C. 0.80 A
D. 1.6 A

Ans. C

Sol. Let us convert Δ abc to Y xyz

Where, R_x, R_y, R_z are the component resistors



$R_{ad} = [(R_x + 3) \,||\, (R_y + 2\Omega)] + R_z$

where,

$$R_x = R_y = R_z = \frac{5}{3} = 1.667\Omega$$

$$R_{ad} = [(1.667+3)\,||\,(1.667+2)] + 1.667 = 3.721\Omega$$

Source current,

$$I = \frac{3}{3.721} = 0.808\ A$$

132. The message signal m(t) = $\text{sinc}^2(1000t)$ AM modulates a sinusoidal carrier signal. The minimum channel bandwidth required to transmit the modulated signal will be

A. 0.5 kHz
B. 1 kHz
C. 2 kHz
D. 4 kHz

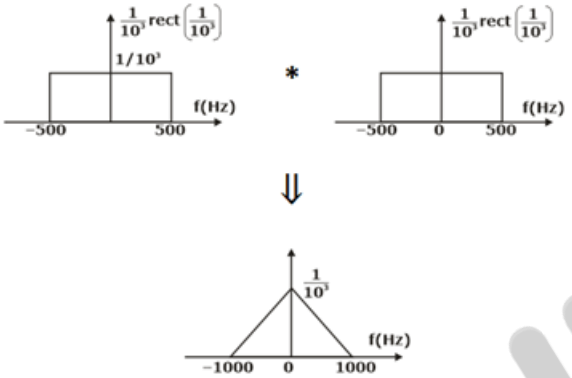
Ans. C

Sol.

$$\sin C(t) \xleftrightarrow{CTFT} rect(t)$$

$$\sin C(100t) \xleftrightarrow{CTFT} \frac{1}{10^3} rect\left(\frac{1}{10^3}\right)$$

$$\sin C^2(1000t) \xleftrightarrow{CTFT} \left[\frac{1}{10^3} rect\left(\frac{1}{10^3}\right)\right] \times \left[\frac{1}{10^3} rect\left(\frac{1}{10^3}\right)\right]$$



So, $f_{m(max)}$ = 100 Hz = 1 kHz

For an AM modulated signal, minimum channel BW required is,

$(BW)_{min} = 2f_{w(max)}$ = 2 kHz

133. Superconductors are becoming popular for their use in

A. Generating very strong magnetic field.

B. Manufacture of bubble memories.

C. Generating electrostatic field.

D. Generating regions free from magnetic field.

Ans. A

Sol. Superconductors are mostly used in powerful superconducting electromagnets used in maglev trains, Magnetic Resonance Imaging (MRI) and Nuclear magnetic resonance (NMR) machines, magnetic confinement fusion reactors (e.g. tokamaks), and the beam-steering and focusing magnets used in particle accelerators and the production of sensitive magnetometers based on SQUIDs.

Hence, the correct option is (A).

134. Energy of the signal $A.\delta[n]$ is given by:

A. $\frac{A^2}{2}$

B. 0

C. $\frac{A^2}{4}$

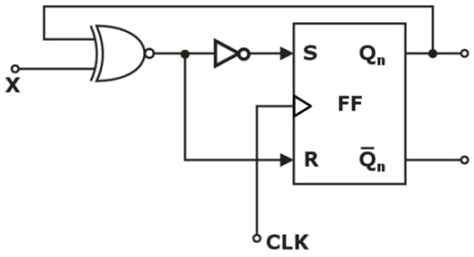
D. A^2

Ans. D

Sol. Energy of a signal $x[n]$ is given by,

$$E_x = \sum_{n=-\infty}^{\infty} |x[n]|^2 = \sum_{n=-\infty}^{\infty} A^2.\delta^2[n] = A^2$$

135. A S –R Flip – Flop is converted into X- Flip – Flop as shown below.



The characteristic equation is

A. $\overline{X \oplus Q_n}$

B. $X + Q_n$

C. $X \oplus Q_n$

D. X Q_n

Ans. C

Sol.

X	Q_n	S	R	Q_{n+1}
0	0	0	1	0
0	1	1	0	1
1	0	1	0	1
1	1	0	1	0

$$Q_{n+1} = \bar{X}Q_n + X\bar{Q}_n$$

$$= X \oplus Q_n.$$

136. In a circuit i(t) has the Laplace transform $I(s) = \frac{3(s+10)}{s(s+12)}$ .The final value of i(t) will be_____

A. 2.5 A

B. 2 A

C. 3.5 A

D. 3 A

Ans. A

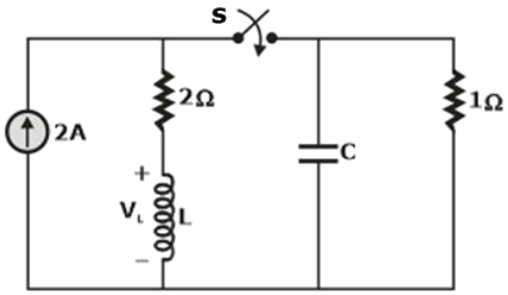
Sol. According to final value theorem

$$f(\infty) = \lim_{s\to 0} sF(s)$$

$$f(\infty) = \lim_{s\to 0} s \times I(s) = \lim_{s\to 0} \frac{s \times 3(s+10)}{s(s+12)}$$

$$= \frac{30}{12} = 2.5 \text{ A}$$

137. Consider the circuit shown in the figure below:



The steady state is reached with switch 's' is open. If 's' is closed at t = 0, the voltage V_L across the inductor L at $t = 0^+$ will be

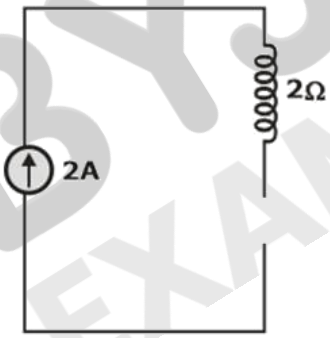
A. Zero
B. 2V
C. 4V
D. –4V

Ans. D

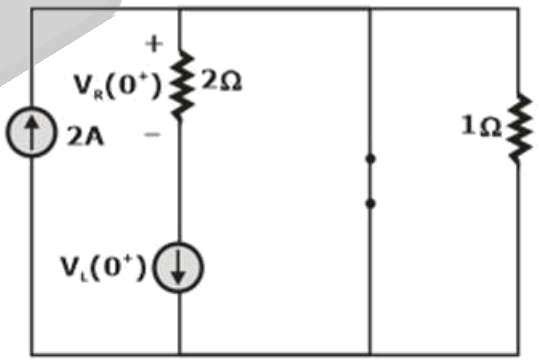
Sol. When the switch was open, the current source drives the current through R – L circuit, thus

$i_L(0^-) = i_L(0^+) = 2$ A

and, $V_C(0^-) = V_C(0^+) = 0$ A



After closing the switch at $t = 0^+$ the capacitor acts as a short circuit



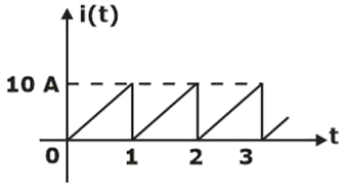
However, the inductor current remains at 2 A

$V_R(0^-) + V_L(0^+) = 0$ A

$V_L(0^+) = -V_R(0^+) = -i_L(0^+) \times R$

$= -2 \times 2 = -4$

138. The below figure shows the periodic current signal flowing through a 30 Ω resistor.



The average power dissipated by the resistor is

A. 0 W
B. 1000 W
C. 3000 W
D. ∞

Ans. B

Sol. The average power dissipated

$$= \frac{\text{Energy of absorbed over one period}}{\text{Total time period}}$$

$$P = \frac{1}{T}\int_0^T i^2 R dt = \frac{1}{1\,\text{sec}}\int_0^1 (10t)^2 30 dt$$

$$= 3000\int_0^1 t^2 dt = 1000\ \text{W}$$

139. In a TDMA/FDD based cellular system, each frame consists of eight time slots and each time slot contains 156.25 bits. If the data is transmitted at a rate of 270.833 Kbps, then the duration of a frame will be

A. 3.92 ms
B. 377 μs
C. 4.615 ms
D. 577 μs

Ans. C

Sol. The time duration of each bit,

$$T_b = \frac{1}{R_b} = \frac{100}{270.833}\ \mu s = 3.692\ \mu s$$

The duration of each slot,

$T_{Slot} = 156.25 \times T_b = 577\ \mu s$

The time duration of each frame,

$T_{frame} = T_{slot} \times 8 = 4.615$ ms

140. In a series R-L circuit, the inductance is 20 mH and the magnitude of total impedance is 17.85Ω. If the angle of lag of the input current from the applied voltage is 63.5°, then the value of angular frequency will be equal to

A. 100.28 rad/sec
B. 398.46 rad/sec
C. 798.78 rad/sec
D. 897.16 rad/sec

Ans. C

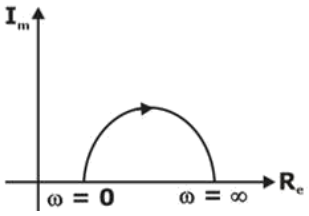
Sol.

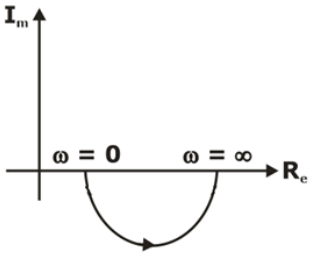
$$\sin\phi = \frac{\omega L}{Z}$$

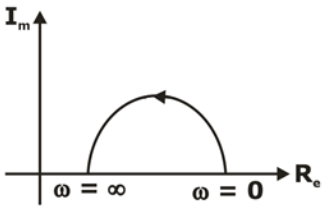
$$\frac{\omega(0.02)}{17.85} = \sin(63.5^\circ)$$

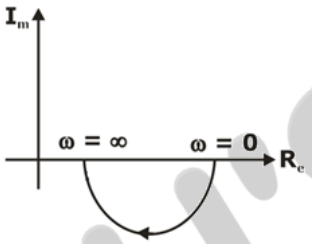
$$\omega = \frac{(0.895)(17.85)}{0.02} = 798.78 \text{ rad/sec}$$

141. Which one of the polar diagram corresponds to a lag network?

A. 

B. 

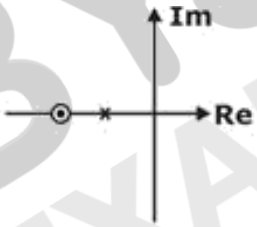
C. 

D. 

Ans. D

Sol. For the lag network, the angle provided by the system are of negative. (a) & (c) are not correct.

For a lag – network, pole is near to origin.



As ω increases the magnitude decreases

142. Which vacuum based device is widely used as a power amplifier in satellite communication systems?

A. Amplitron
B. Klystron
C. Magnetron
D. TWT

Ans. D

Sol. TWT is vacuum based device which is widely used as a power amplifier in satellite communication systems

143. The percentage improvement in stability factor of a collector to base bias circuit over fixed bias circuit when $R_B = 99\ R_C$ for a transistor having $\beta = 100$ is

A. 99%
B. 50%
C. 60%
D. 75%

Ans. B

Sol. Stability factor of fixed bias circuit

$S_1 = 1 + \beta = 101$

Stability factor of collector-to-base bias circuit

$$S_s = \frac{1+\beta}{1+\beta\left(\frac{R_c}{R_c+R_B}\right)}$$

$$S_2 = \frac{1+100}{1+100\left(\frac{R_c}{R_c+99R_c}\right)}$$

$$= \frac{1+100}{1+100\left(\frac{1}{100}\right)}$$

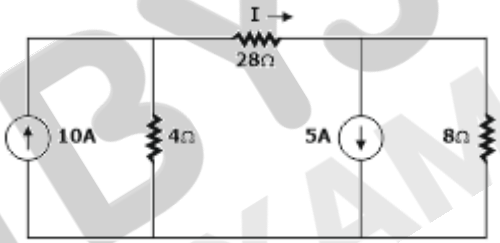
$$S_2 = \frac{101}{2}$$

Percentage improvement $\frac{S_2}{S_1}\times 100\%$

$$= \frac{1}{2}\times 100$$

=50%

144. In the circuit of figure, the current I will be :



A. 1A B. 2A

C. 4A D. 8A

Ans. B

Sol. Superposition theorem is easy to apply here.

I with only 10 A source acting = $10 \times \frac{4}{40}$ = 1 A

I with only 5 A source acting = $5 \times \frac{8}{40} = 1A$

With both source acting, current I = 2A.

145. Why are semiconductor lasers important for communication engineering?

1). They possess large bandwidth

2). They operate at low voltage

3). They are suitable for coupling to fibers at wavelengths, where the attenuation very small.

4). Their integration with other components is easy

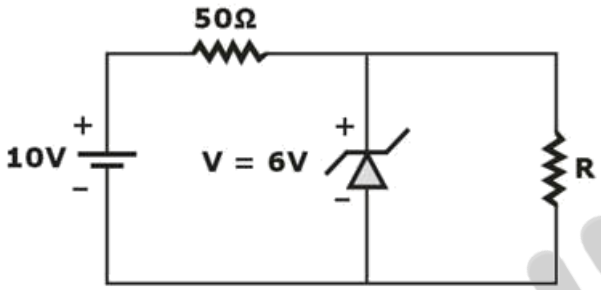
Select the correct answer using the code given below:

A. 1 only
B. 1 and 2 only
C. 2 and 3 only
D. 1, 2, 3 and 4

Ans. D

Sol. All of the above given statement is correct.

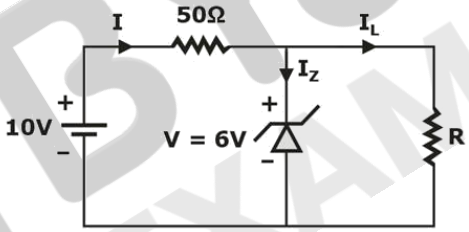
146. Consider the zener diode circuit shown in figure below with V_z = 6 V and zero zener resistance and knee current of 5 mA. The minimum value of 'R' so that the voltage across it does not fall below 6 V is



A. 1.2 kΩ
B. 80 Ω
C. 50 Ω
D. 100 Ω

Ans. B

Sol.



$$R_{min} = \frac{V_Z}{I_{L(max)}} = \frac{6}{I_{L(max)}}$$

$I = I_{Z(knee)} + I_{L(max)}$

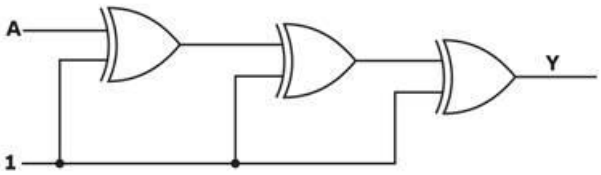
$$\Rightarrow \frac{10-6}{50} = 5m + \frac{6}{R_{(min)}}$$

$$80m = 5m + \frac{6}{R_{min}}$$

$$\Rightarrow 75m = \frac{6}{R_{(min)}}$$

$$\Rightarrow R_{min} = \frac{6}{75m} = 80\Omega$$

147. The initial output of the following circuit is 1. If we apply 010101 at input A (first bit is zero), then what is the bit pattern generated at the output Y.



A. 010101 B. 101010

C. remains at 0 D. remains at '1'

Ans. B

Sol. A $\oplus 1 = \overline{A}$ and $\overline{A} \oplus 1 = A$ then

The final output is $F = \overline{A}$

The input is 0 1 0 1 0 1

Then the output is 1 0 1 0 1 0

148. The output signal from an AM modulator with amplitude modulation sensitivity of K_a= 0.5 volt^{-1} is given by

s(t) = 5 cos (1800 πt)+20 cos (2000 πt)+5 cos (2200πt) Volts

The modulating signal is

A. 2 sin (200t) B. cos(200πt)

C. cos (400 πt) D. 2 sin (400t)

Ans. B

Sol. K_a=0.5

s(t) =5 cos (1800 πt)+20 cos (2000 πt)+5 cos (2200πt) ……..(1)

Standard AM signal is

$= A_c(1 + K_a m(t)) \cos \omega_c t$ ……..(2)

$= A_c \cos \omega_c t + \frac{K_a A_c A_m}{2} \cos(\omega_c - \omega_m)t$

$+ \frac{k_a A_m A_c}{2} \cos(\omega_c + \omega_m)t$

Comparing (1) & (3)

We get

A_c=20

$\omega_c = 2000\pi$

$\omega_m = 200\pi$

$\frac{k_a A_m A_c}{2} = 5$

$\frac{0.5 \times A_m \times 20}{2} = 5$

$$A_m = \frac{5 \times 2}{10} = 1$$

$$\therefore m(t) = A_m \cos \omega_m t$$

$$m(t) = \cos 200\pi t$$

149. What is done to reduce the effect of fringing in a capacitive type transducer?

A. The transducer is shielded and the shield is kept at ground potential.

B. A guard rings provided and is kept at ground potential.

C. The transducer and the shield is kept at the same potential as the moving plate.

D. A guard provided and it is kept at the same potential as the moving plate

Ans. B

Sol. several problem such as fringing effect can cause deviation in the actual capacity of transducer in order to reduce fringing effect one simple remedy has to be used is a guard ring in which the main inner electrode is shielded by ground.

150. Two systems S_1 and S_2 are connected in cascade and S_1 is described as $y(t) = \frac{dx(t)}{dt} + 2x(t)$ and S_2 is an RC HPF with time-constant $\tau = 1$ sec. If the input of S_1 = $x(t) = e^{-2t}\, u(t)$. The output of the cascaded system is:

A. $-e^{-t}\, u(t)$

B. $\delta(t) - e^{-t}\, u(t)$

C. $\delta(t) + e^{-t}\, u(t)$

D. $e^{-t}\, u(t)$

Ans. B

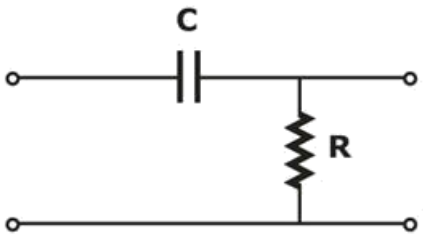
Sol.

S_1: $y(t) = \frac{dx(t)}{dt} + 2x(t)$

$Y(s) = sX(s) + 2X(s)$

$\therefore$ $H(s) = s + 2$

The highpass filter circuit is:



$$\therefore H_2(s) = \frac{sRC}{1 + sRC}$$

$RC = \tau = 1$ sec

$\therefore H_2(s) = \frac{s}{1+s}$

$\therefore H(s) = H_1(s) H_2(s)$

$H(s) = (s+2)\frac{s}{(s+1)} = \frac{s(s+2)}{(s+1)}$

Given $x(t) = e^{-2t} u(t)$

$X(s) = \frac{1}{s+2}$

$\therefore Y(s) = X(s) H(s)$

$\therefore Y(s) = s(s+2).\frac{1}{s+2}$

$\therefore Y(s) = \frac{s}{s+1} = 1 - \frac{1}{s+1}$

$\therefore y(t) = \delta(t) - e^{-t} u(t)$

151. Which of the following is active transducer

A. RTD
B. LVDT
C. Thermistor
D. Piezoelectric crystal

Ans. D

Sol. Active transducer doesn't require external power supply for its operation, e.g., piezoelectric transducer.

152. Which one of the following instruments is useful while measuring the optical power as a function of wavelength?

A. Optical power attenuator
B. Optical power meter
C. Optical spectrum analyzer
D. Optical return loss tester

Ans. C

Sol. Optical spectrum analyzer is useful while measuring the optical power as function of wavelength.

∴ Option C

153. A linear displacement digital transducer uses

A. BCD code
B. Gray code
C. hexadecimal code
D. binary code

Ans. B

Sol. Gray code is used in a linear displacement digital transducer.

154. The optical performance monitoring involves

A. transport layer monitoring. optical signal monitoring and protocol performance monitoring
B. physical layer, network layer and application layer monitoring
C. data-link layer, presentation layer and session layer monitoring
D. transport layer, session layer and application layer monitoring

Ans. A

Sol. Transport layer monitoring, optical signal monitoring and protocol performance monitoring are involved in optical performance monitoring.

∴ Option A

155. A moving coil instrument has a coil resistance of 10 ohms and it can take maximum current of $100\ mA$. What modification is required in the instrument to measure the voltage in the range $(0$ to $500\ V)$?

A. 4.99Ω in parallel with the instrument.

B. 4.99Ω in series with the instrument.

C. $4.99k\Omega$ in series with the instrument.

D. 49.9Ω in series with the instrument.

Ans. C

Sol. V = voltage to be measured = 500 V

$V_m = R_m \times I_m$

$V_m = 10 \times 100 \times 10^{-3}$

$V_m = 1V$

For extending range of voltmeter, a resistance R_S is connected in series with meter.

$R_S = R_m(m - 1)$

where m = multiplying factor $= \frac{V}{V_m} = 500$

$R_S = 10(500 - 1) = 4990\ \Omega$

$R_S = 4.99\ k\ \Omega$

156. LVDT is an/a …….. transducer.

A. magneto-striction

B. inductive

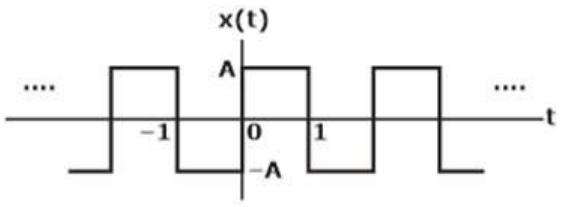
C. resistive

D. eddy current

Ans. D

Sol. LVDT is an eddy current transducer.

157. The Fourier series coefficient for the periodic signal shown below is



A. $\frac{A}{n\pi}[1-(-1)^n]$

B. $\frac{A}{n\pi}[1+(-1)^n]$

C. $\frac{A}{jn\pi}[1-(-1)^n]$

D. $\frac{A}{jn\pi}[1+(-1)^n]$

Ans. C

Sol. We have T = 2 and $\omega_0 = \frac{2\pi}{2} = \pi$,

$$x(t) = \begin{cases} -A, & -1 < t < 0 \\ A, & 0 < t < 1 \end{cases}$$

$$c_n = \frac{1}{T}\int_{-T/2}^{T/2} x(t)e^{-jn\omega_0 t}dt = \frac{1}{2}\int_{-1}^{1} x(t)e^{-jn\pi t}dt$$

$$= \frac{1}{2}\left(\int_{-1}^{0} -Ae^{-jn\pi t}dt + \int_{0}^{1} Ae^{-jn\pi t}dt\right)$$

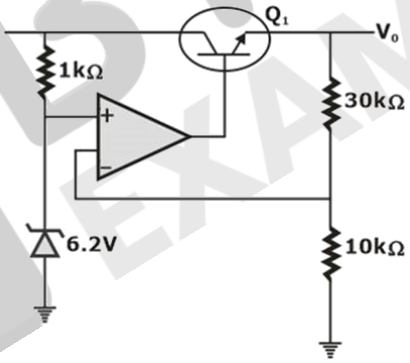
$$= \frac{A}{2}\left(\frac{1-e^{jn\pi}}{jn\pi} + \frac{e^{-jn\pi}-1}{-jn\pi}\right)$$

$$= \frac{A}{2}\left[\frac{1-e^{jn\pi}-e^{-jn\pi}+1}{jn\pi}\right]$$

$$= \frac{A}{j2n\pi}[2-2\cos n\pi]$$

$$= \frac{A}{jn\pi}[1-(-1)^n]$$

158. The regulated output voltage for following circuit will be ……Volts.



A. 25.50 B. 30.1

C. 24.8 D. 19.73

Ans. C

Sol. For op-amp

$V_+ = V_- = 6.2$ V

For non-inverting configuration

$$V_0 = V_+\left(1 + \frac{R_2}{R_1}\right)$$

$$V_0 = 6.2\left(1 + \frac{30\times10^3}{10\times10^3}\right) = 24.8 \text{ V}$$

159. Temperature transducer make use of

A. change in resistivity
B. change in length
C. change in area
D. change in capacitance

Ans. A

Sol. The change in resistivity of the material of a conductor is used to measure the variation in temperature. Temperature is affected due to change in the resistance which is turn varies the resistivity.

160. Which one of the following instrument is not preferred to use at high frequency range for measurement of current?

A. Hot Wire Instrument
B. Thermocouple Instrument
C. Bolometer
D. Electrostatic Instrument

Ans. D

Sol. The Electrothermic Instrument are used for measurement of current at high frequency without any significant error. These are classified as:

Hot Wire Instrument: Utilize the expansion of wire heated by current being measured.

Thermocouple Instrument: Their action depends on the e.m.f developed at the junction heated by an auxiliary circuit carrying current being measured.

Bolometer: The change resistance of a circuit element heated by current being measured is used for their operation.

Electrostatic Instrument are essentially a type of voltmeter, but they may be used to measure current and voltage with the help of external component.

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