



HALDT

Mechanical Engineering

Mega Mock Challenge

(August 8th - August 9th 2021)

Questions &
Solutions

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:

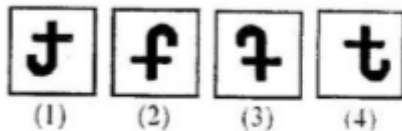
- 1. TOUR (travel around)
- 2. ROUT (over through)

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

Vision 2022
A Course for ESE & GATE
Mechanical Aspirants

START FREE TRIAL

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. $20 + 4/4 < 4 + 6/2 \checkmark 21 < 7$ NOT CORRECT

$20/5 > 8/4 + 6 \times 3 \checkmark 4 > 22$ NOT CORRECT

$20/4 + 4 < 4 + 2 \times 3 \checkmark 9 < 10$ CORRECT

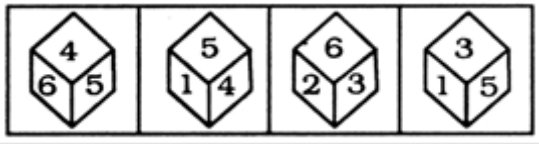
$20 + 2 > 10 \times 3 + 12/2 \checkmark 22 > 36$ NOT CORRECT

Hence option C is correct

Vision 2022
A Course for ESE & GATE
Mechanical Aspirants

START FREE TRIAL

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.

1 st	2 nd	3 rd	4 th	5 th	6 th	7 th	8 th	9 th	10 th	11 th	12 th	13 th	14 th	+ 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.



Vision 2022
A Course for ESE & GATE
Mechanical Aspirants

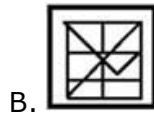
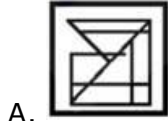
START FREE TRIAL

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)**

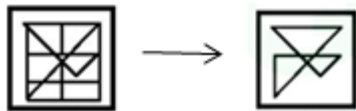


Figure-X



Ans. B

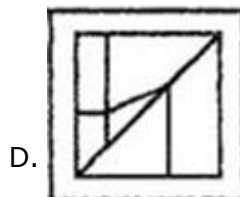
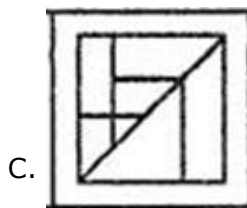
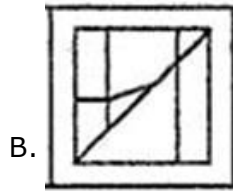
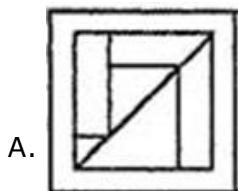
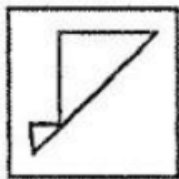
Sol. After carefully observing the figures given in the question, it is very clear that the answer figure(b) is embedded in question figure. It is shown as given below:



Hence, option B is the correct answer.

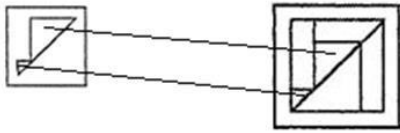
14. From the given answer figures, select the one in which the question figure is hidden/embedded.

Question Figure :



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

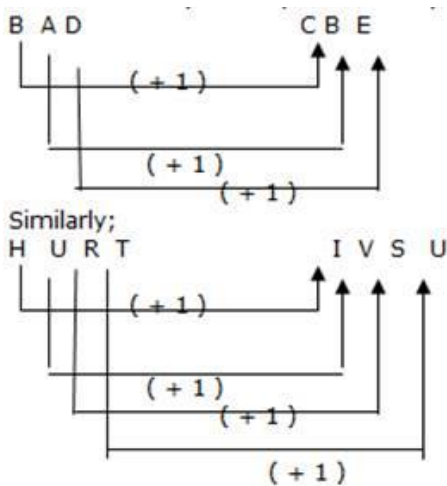
B. HSPR

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

$$= 30 / (X+20)$$

$$20/X = 30/(X+20)$$



Vision 2022
A Course for ESE & GATE
Mechanical Aspirants

START FREE TRIAL

$\Rightarrow X=40$ MPH

Therefore, the journey will take $20 \text{ miles}/40 \text{ MPH} = 0.5$ 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:

$A=1, B=2, C=3, D=4, \dots$ 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



Vision 2022
A Course for ESE & GATE
Mechanical Aspirants

START FREE TRIAL

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



Vision 2022
A Course for ESE & GATE
Mechanical Aspirants

START FREE TRIAL

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.



Vision 2022
A Course for ESE & GATE
Mechanical Aspirants

START FREE TRIAL

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



Vision 2022
A Course for ESE & GATE
Mechanical Aspirants

START FREE TRIAL

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.



Vision 2022
A Course for ESE & GATE
Mechanical Aspirants

START FREE TRIAL

- 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.



Vision 2022
A Course for ESE & GATE
Mechanical Aspirants

START FREE TRIAL

- 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



Vision 2022
A Course for ESE & GATE
Mechanical Aspirants

START FREE TRIAL

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.

Unprecedented= 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.



Vision 2022
A Course for ESE & GATE
Mechanical Aspirants

START FREE TRIAL

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.



Vision 2022
A Course for ESE & GATE
Mechanical Aspirants

START FREE TRIAL

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. Ahmedabad

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



Vision 2022
A Course for ESE & GATE
Mechanical Aspirants

START FREE TRIAL

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 Lal Krishna 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.



Vision 2022
A Course for ESE & GATE
Mechanical Aspirants

START FREE TRIAL

- * 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 in 2010
 - * 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



Vision 2022
A Course for ESE & GATE
Mechanical Aspirants

START FREE TRIAL

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



Vision 2022
A Course for ESE & GATE
Mechanical Aspirants

START FREE TRIAL

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 |



Vision 2022
A Course for ESE & GATE
Mechanical Aspirants

START FREE TRIAL

- A. $n/2$
- B. n
- C. $(n-1)/2$
- D. $n(n-1)/2$

Ans. D

Sol.

Number of instantaneous centers for a mechanism consisting of 'n' links is

$$N = n(n-1)/2$$

62. A lead – screw with half nuts in a lathe, free to rotate in both directions has
- A. V- threads
 - B. Whitworth threads
 - C. Buttress threads
 - D. ACME threads

Ans. D

Sol. A lead – screw with half nuts in a lathe, free to rotate in both directions has ACME threads.

63. The ratio of ω/ω_n for which the transmitted force is equal to the exciting force under no damping conditions ____?
- A. $1/\sqrt{2}$
 - B. $\sqrt{2}$
 - C. 2
 - D. $1/2$

Ans. B

Sol. we know that,

$$Transmissibility (\epsilon) = \frac{\sqrt{1 + \left(2\zeta \frac{\omega}{\omega_n}\right)^2}}{\sqrt{\left(1 - \left(\frac{\omega}{\omega_n}\right)^2\right)^2 + \left(2\zeta \frac{\omega}{\omega_n}\right)^2}}$$

$$\epsilon = 1 \text{ when } \frac{\omega}{\omega_n} = \sqrt{2} \text{ or } 0$$

under no damping $\zeta = 0$

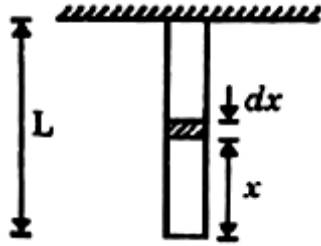
The transmitted force is equal to the exciting force when $\frac{\omega}{\omega_n} = \sqrt{2}$

So, the correct option is (b).

64. A straight bar having a constant cross sectional area A, length L and weight W, is hanging vertically. If E is the young's modulus of the material of the bar, total increase in length of the bar due to its own weight only will be
- A. $\frac{WL}{2AE}$
 - B. $\frac{WL}{AE}$
 - C. $\frac{2WL}{AE}$
 - D. $\frac{4WL}{AE}$

Ans. A

Sol.



ρ = unit weight of material.

$$= \frac{\text{weight}}{\text{volume}}$$

$$w_x = \rho \cdot A \cdot x$$

Deflection of elemental length

$$dx = \frac{W_x \cdot dx}{AE}$$

$$\text{Total deflection} = \int_0^L \frac{W_x \cdot dx}{AE} = \int_0^L \frac{\rho \cdot Ax \cdot dx}{AE}$$

$$\Delta = \frac{\rho L^2}{2E}$$

$$\Delta = \frac{WL}{2AE}$$

65. Which of the following statement is correct regarding Clausius statement of second law of thermodynamics _____.
- A. Heat can't be transferred from low temperature body to high temperature body
 - B. Heat can be transferred from low temperature body to high temperature body by using refrigeration cycle
 - C. Heat can't be transferred from low temperature body to high temperature body without the consuming any other form of energy
 - D. Heat can be transferred from low temperature body to high temperature body if COP of the process is more than unity

Ans. C

Sol. **Clausius statement of second law of thermodynamics:**

- o It is impossible to construct a device which operates in a cycle and transfer heat from low temperature body to high temperature body without the consuming any other form of energy.

66. The crippling load for both ends fixed long column is given by_____.

- A. $\frac{\pi^2 EI}{l^2}$
- B. $\frac{\pi^2 EI}{4l^2}$
- C. $\frac{4\pi^2 EI}{l^2}$
- D. $\frac{2\pi^2 EI}{l^2}$

Vision 2022
A Course for ESE & GATE
Mechanical Aspirants

START FREE TRIAL

Ans. C

Sol. The Crippling load for long column is given by,

$$P_{cr} = \frac{\pi^2 EI}{L_e^2}$$

when the column is fixed at both end is,

$$L_e = \frac{L}{2}$$

$$P_{cr} = \frac{4\pi^2 EI}{L^2}$$

67. What is the specific name of the equation governing three- dimensional steady state heat conduction with self-heat generation _____?

- A. Fourier equation
- B. Laplace equation
- C. Poisson equation
- D. Diffusion equation

Ans. C

Sol.

- o Poisson's equation is 3dimensional steady state heat generation self-heat generation equation.

It's mathematical form is given by:

$$\nabla^2 T + \frac{q_g}{K} = 0$$

- o Laplace equation is without heat generation equation. Fourier equation us one dimensional steady state conduction equation.

$$\nabla^2 T = 0$$

68. The deaerator in thermal power plants is used mainly to?

- A. Reduce steam pressure
- B. Remove air from condenser
- C. Remove dissolved gases from feed water
- D. Increase fire water temperature

Ans. C

Sol. In deaerator the feed water is heated by direct mixing with steam bled from turbine, it is used to remove dissolved gases in feed water.

69. Using the Buckingham Pi (n) theorem, the relevant parameters are density, viscosity, bulk modulus, rotational speed. The number of independent non-dimensional groups are_____?

- A. 1
- B. 2
- C. 3
- D. 4

Ans. A



Vision 2022
A Course for ESE & GATE
Mechanical Aspirants

START FREE TRIAL

Sol. Given,

Here, number of variables,

1. Density,
2. Viscosity,
3. Bulk modulus,
4. Rotational speed,

number of variables (n) = 4

No. of fundamental dimensions m = 3 , (we have only M,L,T)

∴ No. of π terms = n - m = 4 - 3 = 1

70. Hydrodynamic entrance length for laminar flow is

- A. Less than the turbulent length
- B. Greater than the turbulent flow
- C. Equal to turbulent flow
- D. No such relation

Ans. B

Sol. Hydrodynamic length for laminar flow > turbulent flow.

In laminar flow, velocity gradient is high thus the flow to be fully developed length required is more as compare to the turbulent flow.

71. Two shafts X and Y are made of steel. The diameter of the second shaft is half as that of the first shaft. The ratio of the power of X to Y for the same shear stress is _____.

- | | |
|------|-------|
| A. 2 | B. 4 |
| C. 8 | D. 16 |

Ans. C

Sol.

$$p = \frac{2\pi NT}{60}, \quad \tau = \frac{16T}{\pi d^3}$$

Since both shafts are made of steel and carries same shear stress. Thus:

$$P \propto T \propto d^3$$

$$\frac{P_X}{P_Y} = \left(\frac{2d}{d}\right)^3 = 8$$

The ratio of the power of X to Y is 8.

72. Joule-Thomson coefficient is the ratio of _____.

- A. pressure change to temperature change occurring when a gas undergoes the process of adiabatic throttling
- B. temperature change to pressure change occurring when a gas undergoes the process of adiabatic throttling
- C. temperature change to pressure change occurring when a gas undergoes the process



Vision 2022
A Course for ESE & GATE
Mechanical Aspirants

START FREE TRIAL

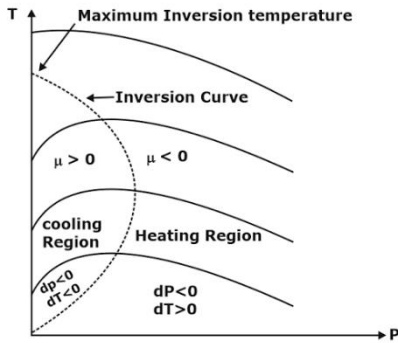
of adiabatic compression

D. pressure change to temperature change occurring when a gas undergoes the process of adiabatic compression

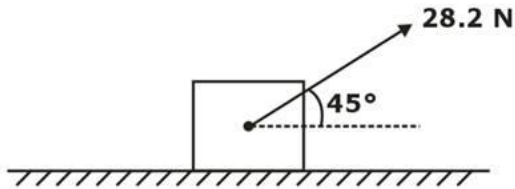
Ans. B

Sol.

- Joule-Thomson coefficient is given by $\mu_J = \left(\frac{dT}{dP}\right)_h$.
- Thus it is ratio of temperature change to pressure change occurring when a gas undergoes the process of adiabatic throttling.



73. A body of weight 50 N placed on a horizontal surface is just moved by a force of 28.2 N. The frictional force and normal reaction are :-



A. 2N, 3N

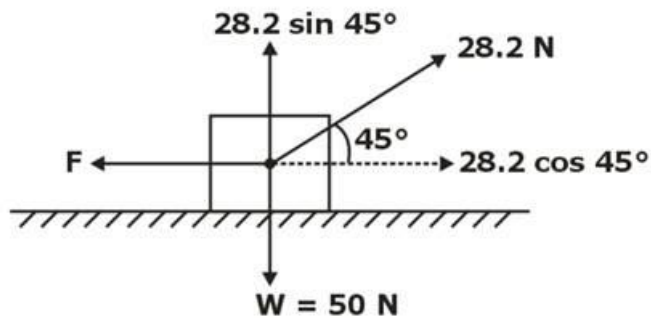
B. 5N, 6N

C. 10N, 15N

D. 20N, 30N

Ans. D

Sol.



\therefore Normal Reaction = $50 - 28.2 \sin 45^\circ = 30 \text{ N}$

Friction force, $F = 28.2 \cos 45^\circ = 20 \text{ N}$



Vision 2022
A Course for ESE & GATE
Mechanical Aspirants

START FREE TRIAL

74. Which one of the following statement is not correct ?
- A. Assignment model is a special case of a linear programming problem
 - B. In queueing models, Poisson arrivals and exponential services are assumed
 - C. In transportation problem, the non-square matrix is made square by adding a dummy row or dummy column
 - D. None of these

Ans. D

Sol.

Assignment model is a special case of a linear programming problem.

In queueing models, Poisson arrivals and exponential services are assumed

In transportation problem, the non-square matrix is made square by adding a dummy row or dummy column.

75. A pitot tube is used to measure the velocity of water in a pipe. The stagnation pressure head is 10 m and the static pressure head is 5 m. The velocity of flow is closest to
- A. 8 m/s
 - B. 10 m/s
 - C. 12 m/s
 - D. 15 m/s

Ans. B

Sol.

given,

$$P_{\text{stagnation}} = 10\text{m}, P_{\text{static}} = 5\text{m}$$

$$\frac{P_{\text{stagnation}}}{\rho g} = \frac{P_{\text{static}}}{\rho g} + \frac{v^2}{2g}$$

$$10 = 5 + \frac{v^2}{2g}$$

$$v = 10\text{m/s}$$

76. The force requirement in a blanking operation of low carbon steel is 5 kN. The thickness of sheet is t and diameter of blanked part is d . For the same work material, if diameter of the blanked part is increased $1.5d$ and thickness is reduced to $0.8t$, the new blanking force (in kN) is _____.
- A. 6
 - B. 4.5
 - C. 290.7
 - D. 8

Ans. A

Sol. In Blanking shear force (F) is given by:

$$F = \pi dt\tau$$

Where: d = diameter of the blank

t = thickness of blank

Thus, for a material:



Vision 2022
A Course for ESE & GATE
Mechanical Aspirants

START FREE TRIAL

$$F \propto dt$$

$$\frac{F'}{5} = \frac{1.5d \times 0.8t}{dt} \Rightarrow F' = 6 \text{ kN}$$

77. Match the following List 1 and List 2:

List 1:

- A. M05
- B. G01
- C. G04
- D. G90

List 2:

- 1. Absolute coordinate system
- 2. Dwell
- 3. Spindle stop
- 4. Linear interpolation

- A. A-2,B-3,C-4,D-1
- C. A-3,B-4,C-2,D-1

- B. A-3,B-4,C-1,D-2
- D. A-4,B-3,C-2,D-1

Ans. C

Sol. Important G and M codes:

G-code	Description	M-Code	Description
G00	Rapid traverse	M00	Program Stop
G01	Linear Interpolation	M01	Optional Program stop
G02	Circular Interpolation (CW)	M02	End of Program
G03	Circular Interpolation (CCW)	M03	Spindle starts forward CW
G04	Dwell	M04	Spindle starts reverse CCW
G40	Tool cutter compensation off	M05	Spindle stop
G41	Tool cutter compensation left	M06	Too change
G42	Tool cutter compensation right	M07	Coolant ON – Mist coolant
G90	Absolute programming of XYZ	M08	Coolant ON – Flood coolant
G91	Incremental programming of XYZ	M09	Coolant OFF

78. During a psychometric process, the latent heat added is 20 kJ/s and the sensible heat added is 30 kJ/s. Determine the Sensible heat factor:

- A. 0.3
- B. 0.6
- C. 0.6777
- D. 1.5

Ans. B

Sol.

By definition, Sensible heat factor = $\frac{\text{Sensible Heat}}{\text{Total Heat}}$



Vision 2022
A Course for ESE & GATE
Mechanical Aspirants

START FREE TRIAL

Therefore, S.H.F = $\frac{S.H.}{S.H.+L.H.} = \frac{30}{20+30} = \frac{30}{50} = 0.6$

79. What is the ratio of the maximum shear stress to average shear stress for a beam with rectangular cross section?

- A. 2/3
- B. 3/2
- C. 4/3
- D. 9/8

Ans. B

Sol. Shear stress developed for a beam with rectangular cross section is given by:

$$\tau = \frac{P}{2I} \left[\left(\frac{d}{2} \right)^2 - y^2 \right]$$

$$= \frac{6P}{bd^3} \left[\left(\frac{d}{2} \right)^2 - y^2 \right] \text{ where, } I = \left(\frac{bd^3}{12} \right)$$

for τ_{max} , y should be 0

$$\tau_{max} = \frac{3P}{2bd} = \frac{3}{2} \tau_{avg}$$

$$\frac{\tau_{max}}{\tau_{avg}} = \frac{3}{2}$$

So, the correct option is (b).

80. The demand and forecast in a Manufacturing plant for November are 17000 and 15500 orders respectively. By using simple exponential smoothing method, forecast for the month of December will be? Use smoothing coefficient= 0.26

- A. 16890
- B. 1589
- C. 15890
- D. 15690

Ans. C

Sol. Forecasting using exponential smoothing method is given by:

$$F_{Dec} = F_{Nov} + \alpha(D_{Nov} - F_{Nov})$$

$$F_{Dec} = 15500 + 0.26 \times (17000 - 15500)$$

$$F_{Dec} = 15890$$

81. The maximum efficiency of self locking screw is :

- A. 35 %
- B. 45 %
- C. 50 %
- D. 75 %

Ans. C

Sol. Efficiency of screw is given by:

$$\eta = \frac{\tan \alpha}{\tan(\phi + \alpha)} \dots \dots \dots (i)$$

Where,

α = Helix angle

ϕ = Friction angle

For a self locking screw,

$$\phi \geq \alpha$$

Substituting the limiting value ($\phi = \alpha$) in equation (i)

$$\eta \leq \frac{\tan \alpha}{\tan(2\phi)}$$

$$\eta \leq \frac{\tan \phi (1 - \tan^2 \phi)}{2 \tan(\phi)}$$

$$\eta \leq \frac{1}{2} - \frac{\tan^2 \phi}{2}$$

So maximum efficiency of a self locking screw is 50 %

So, the correct option is (c).

82. The polar section modulus of a circular section about an axis through its centre of gravity is _____.

A. $\frac{\pi d^3}{16}$

B. $\frac{\pi d^3}{32}$

C. $\frac{rd^3}{64}$

D. $\frac{rd^2}{32}$

Ans. A

Sol. polar section modulus of a circular section,

$$Z_P = \frac{I_{zz}}{Y_{max}} = \frac{\pi \times d^4}{32 \times \frac{d}{2}} = \frac{\pi d^3}{16}$$

83. Work ratio obtained in a Brayton cycle is 0.64. What is the back work ratio for this cycle?

A. 0.64

B. 0.36

C. 0.6

D. 1

Ans. B

Sol.

$$\text{Work ratio} + \text{Back work ratio} = 1$$

$$\text{Work ratio} = \text{net work/Positive work}$$

$$\text{Back work ratio} = \text{negative work/Positive work}$$

$$\text{Back work ratio} = 1 - \text{Work ratio}$$

$$= 1 - 0.64$$

$$= 0.36$$

Vision 2022
A Course for ESE & GATE
Mechanical Aspirants

START FREE TRIAL

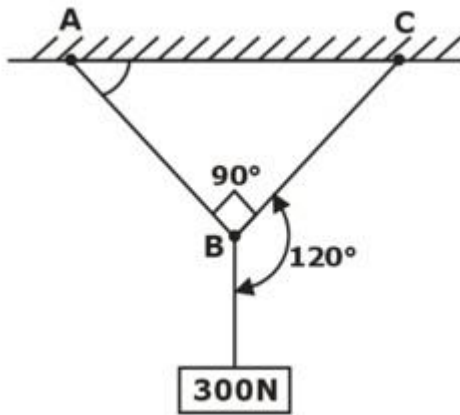
84. In a Vapour compression refrigeration, the desired condensing temperature for higher COP while making ice must be :
- A. Much below the critical temperature of the refrigerant
 - B. Near the critical temperature of the refrigerant
 - C. Above the critical temperature of the refrigerant
 - D. Can of any value, as it does not affects the COP

Ans. A

Sol.

The desired condensing temperature in a VCRS for higher COP must be much below the critical temperature of the refrigerant so that the most of the heat rejection takes place from phase change of refrigerant.

85. A body of weight 300 N is being hanged by the support of two ropes as shown below :

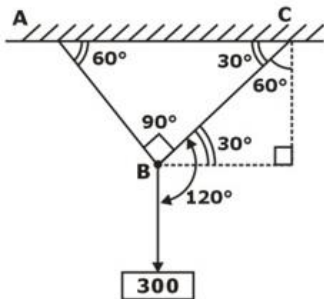


What will be the Tensions in ropes AB and BC respectively (in N)?

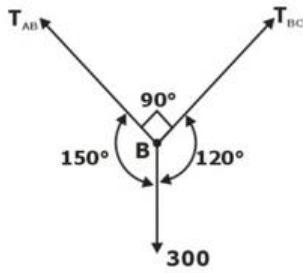
- A. $T_{AB} = 260, T_{BC} = 150$
- B. $T_{AB} = 150, T_{BC} = 260$
- C. $T_{AB} = 290, T_{BC} = 130$
- D. $T_{AB} = 130, T_{BC} = 290$

Ans. A

Sol. By applying Lami's Theorem at B:



FBD is,



$$\frac{T_{AB}}{\sin 120^\circ} = \frac{T_{BC}}{\sin 150^\circ} = \frac{300}{\sin 90^\circ}$$

$$T_{AB} = 259.81 \text{ N}$$

$$T_{BC} = 150 \text{ N}$$

86. Which of the following quantities is not the property of the system_____?

- A. Pressure
- B. Temperature
- C. Density
- D. Heat

Ans. D

Sol.

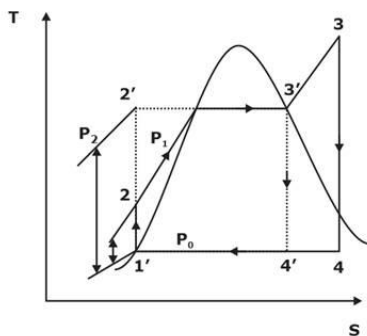
- Every system has certain characteristics by which its physical condition may be described. Such characteristics are called properties of the system.
- Since heat transfer is the path function hence it is not the property of the system.

87. Which of the following statement are correct regarding Rankine cycle?

- A. Efficiency of Rankine cycle is greater than Carnot cycle.
- B. Pump work is more in Rankine cycle than Carnot cycle.
- C. Net-work output is more in Rankine cycle than Carnot cycle.
- D. Pressure rise in pump will be same for both cycles.

Ans. C

Sol.



1 - 2 - 3 - 4 ⇒ Rankine cycle

1 - 2' - 3' - 4' ⇒ Carnot cycle



Vision 2022

A Course for ESE & GATE

Mechanical Aspirants

START FREE TRIAL

Carnot cycle is an ideal cycle thus efficiency of Carnot is higher than Rankine cycle

Pressure rise in Rankine cycle is $(P_1 - P_2)$

Pressure rise in Carnot cycle $(P_2 - P_2')$

Here

$$(P_1 - P_2') > (P_1 - P_2)$$

When pressure rise is more then, pump work will also be more.

W_{Net} is the area under the curve thus W_{Net} is more Rankine cycle.

88. The casting method best suited for ornament toys of nonferrous alloys is

- A. Die casting
- B. Investment casting
- C. Slush casting
- D. Shell mould casting

Ans. C

Sol. *Permanent mould casting- pistons, stators, gear boxes, connecting rods, aircraft fittings, cylinder blocks.

*Slush casting- Toys and ornaments especially to produce hollow castings.

*Die casting- carburettors, crank cases, magnetos, handle-bar housings, zip fasteners, head lamp bezels and other decorative items on automobiles.

*Centrifugal casting- axisymmetric objects like pipes.

89. In a grinding wheel specification "51 A 36 L 5 V 23", 'V' stands for

- A. Abrasive type
- B. Grade
- C. Bond type
- D. manufacturer's symbol

Ans. C

Sol. 51: manufacturer's symbol indicating exact kind of abrasive

A: Abrasive type (A – aluminium oxide and C – silicon carbide)

36: grain size

L: grade

5: Structure (open or dense)

V: bond type (V – Vitrified bond)

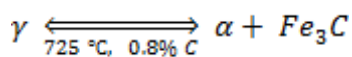
23: manufacturer's private marking to identify wheel

90. Which one of the following is true about eutectoid reaction?

- A. Austenite converts to ferrite and cementite
- B. Ferrite converts to cementite and martensite
- C. Cementite converts to austenite and ferrite
- D. Martensite converts to ferrite and cementite

Ans. A

Sol. Eutectoid reaction



Where,



Vision 2022
A Course for ESE & GATE
Mechanical Aspirants

START FREE TRIAL

γ is austenite

α is ferrite and,

Fe_3C is cementite

So, the correct option is (a).

91. A dummy activity _____.
- A. is artificially introduced
 - B. is represented by a dotted line
 - C. does not consume time
 - D. all the above.

Ans. D

Sol. **Dummy Activity:**

- A dummy activity is used to indicate the precedence relationship via a dashed arc. It is introduced artificially.
- A dummy activity has no duration and uses no resources.
- All of the above are correct.

92. Electrochemical machining is a process widely used as a non conventional machining operation. What is the mechanism of material removal for electrochemical machining process _____?
- A. Erosion
 - B. shear
 - C. ionic dissolution
 - D. fusion and vaporisation

Ans. C

Sol.

- ECM is process which works on the electrolysis principle and the mode of material removal is ionic dissolution.

93. The distance between corresponding points on adjacent teeth measured along the direction of the axis is called _____
- A. joint line
 - B. normal link
 - C. axial pitch
 - D. lead

Ans. C

Sol. Axial pitch is the distance between corresponding points on adjacent teeth measured along the direction of the axis. The axial pitch of the worm gear is the same thing as the circular pitch of the helical gear.

94. Case hardening is the only method suitable for hardening:
- A. High alloy steel
 - B. High carbon steel
 - C. Low carbon steel
 - D. High speed steel

Ans. C



Vision 2022
A Course for ESE & GATE
Mechanical Aspirants

START FREE TRIAL

Sol. Case hardening is the only method suitable for hardening low-carbon steel.

95. The iron-carbon diagram and the TTT curves are determined under

- A. equilibrium and non-equilibrium conditions, respectively
- B. non-equilibrium and equilibrium conditions, respectively
- C. equilibrium conditions for both
- D. non-equilibrium conditions for both

Ans. A

Sol. Phase diagrams such as iron-carbon, are under equilibrium, whereas the diagrams of phase transformation, such as TTT curves, are determined under non-equilibrium conditions.

96. What is the condition involved in Grashof's law?

(where s and l are the links of shortest and longest links of the 4 bar chain respectively and p and q are the lengths of the other links)

- A. $s+l \geq p+q$
- B. $s-l \geq p-q$
- C. $s+l \leq p+q$
- D. $s-l \leq p-q$

Ans. C

Sol. According to Grashof's law, in a four bar mechanism, the sum of the lengths of the shortest and the longest link should be less than or equal to the sum of the lengths of two remaining links for continuous relative motion between them.

Therefore, $s+l \leq p+q$.

97. In an Otto cycle, air is compressed from 2.66 litre to 0.26 litre from an initial pressure of 1.2 kg/cm^2 . The net output per cycle is 46.8 kJ. What is mean effective pressure of cycle _____?

- A. 225 bar
- B. 207 bar
- C. 195 bar
- D. 185 bar

Ans. C

Sol.

Given:

Initial volume: $V_1 = 2.66 \text{ litre}$

Final volume: $V_2 = 0.26 \text{ litre}$

Initial pressure: $P_i = 1.2 \text{ kg/cm}^2$

Net output: $W_{\text{net}} = 46.8 \text{ kJ}$

Work done (W) is given as:

$$W = P_m \times V_s$$

$$46.8 = P_m \times \frac{(2.66 - 0.26)}{1000}$$

$$\Rightarrow P_m = 195 \text{ bar}$$



Vision 2022
A Course for ESE & GATE
Mechanical Aspirants

START FREE TRIAL

Ans. D

Sol.

Given,

Modulus of casting B = m,

modulus of casting A = n,

We know, from chovirnov's rule;

$$t_{\text{solidification}} \propto \left(\frac{V}{A}\right)^2$$

$$\Rightarrow t \propto M^2$$

Where M is the modulus;

Now,

$$\frac{t_A}{t_B} = \left(\frac{M_A}{M_B}\right)^2 = \left(\frac{n}{m}\right)^2$$

102. A large clearance volume in reciprocating compressor results in:

- A. Reduced volume flow rate
- B. Increased volume flow rate
- C. Lower suction pressure
- D. Lower delivery pressure

Ans. A

Sol. The clearance volume reduces the capacity of the compressor and volume flow rate. as the clearance volume increases, swept volume decrease so the capacity of the compressor decreases.

103. Peclet Number is _____.

- A. $Re \times Pr$
- B. $Nu \times Pr$
- C. Pr/Re
- D. $Nu \times Re$

Ans. A

Sol.

- Peclet number (Pe) is a dimensionless group representing the ratio of heat transfer by motion of a fluid to heat transfer by thermal conduction.
- It is given by: $Pe = Re \times Pr$
Where Re is Reynolds number, Pr is Prandtl number.

104. Kaplan turbine is

- A. An axial flow turbine
- B. Tangential flow turbine
- C. Radial flow turbine
- D. Mixed flow turbine

Ans. A

Sol. In Kaplan turbine, the flow of water through the runner is wholly and mainly along the direction parallel to axis of rotation of runner.

105. Which of following process is used granular flux to cover the joint?

- A. Submerged metal arc welding (SMAW)
- B. Plasma Arc Welding (PAW)



Vision 2022
A Course for ESE & GATE
Mechanical Aspirants

START FREE TRIAL

- C. Submerged arc welding (SAW)
- D. Electroslag welding

Ans. C

Sol.

- Submerged arc welding electrode is in the form of spool of copper coated wire and granular flux is used.
- Copper is coated to increase the conductivity of wire.
- Powdered flux is initially poured into the welding area and arc is maintained within the pool of flux. This minimizes the Spatter of liquid metal and suppresses the intense ultraviolet radiation Flux is fed on weld zone by gravity through flow nozzle, a long continuous weld can be performed.

106. The body will be in equilibrium if the two forces are_____.

- A. Collinear and equal
- B. Collinear and opposite
- C. Collinear, equal and opposite
- D. None of these

Ans. C

Sol. When a body is subjected to two forces, the body will be in equilibrium if the two forces are collinear, equal and opposite. If the forces are not collinear, the a couple will act and equilibrium will not be achieved.

107. Which of the following is correct safe boundary for given theories

- A. Rankine's : hexagon
- B. Guest & Tresca's : square
- C. Von-Mise's : ellipse
- D. None of these

Ans. C

Sol. Von-Mise's theory has safe boundary of ellipse

having semi major axis- $\sqrt{2}S_{yt}$

semi minor axis: $\sqrt{\frac{2}{3}}S_{yt}$

108. An air washer can work as a

- A. Filter only
- B. Humidifier only
- C. Dehumidifier only
- D. All of the above

Ans. D

Sol. An air washer is a hybrid appliance, a combination of an air purifier and a humidifier. Like conventional humidifiers, air washers add therapeutic moisture to the air And like a conventional air purifier, an air washer removes symptom-triggering allergens from the air.

109. Two composite bars of copper and steel, heated up to a certain temperature, then thermal stress developed in Copper and Steel bar respectively is?

- A. Compressive and tensile
- B. Tensile and compressive
- C. Both compressive
- D. Both tensile



Vision 2022
A Course for ESE & GATE
Mechanical Aspirants

START FREE TRIAL

Ans. A

Sol. Thermal expansion coefficient of Copper bar is more than steel bar, thus on heating, Copper bar will try to expand more compared to the steel bar. Since both are joined rigidly, expansion in both must be the same. Hence, the actual expansion in copper will be somewhat lesser than its free expansion. So compressive thermal stresses will be developed in Copper and tensile thermal stress will be developed in Steel bar.

110. The Independent variables in orthotropic materials are _____.

- A. 2
- B. 21
- C. 9
- D. 3

Ans. C

Sol.

Material	Isotropic	Anisotropic	Orthotropic
No. of Independent Elastic constants	2	21	9

111. For a small scale industry, the fixed cost per month is Rs. 5000/-. The variable cost per product is Rs. 20/- and sales price is Rs. 30/- per piece. The break-even production per month will be _____.

- A. 300
- B. 460
- C. 500
- D. 10000

Ans. C

Sol. Fixed cost: $F = \text{Rs } 5000$

Variable cost per product: $v = \text{Rs } 20$

Sales price per product: $s = \text{Rs } 30$

Let x be the breakeven production per month.

$$F + vx = sx$$

$$5000 + 20x = 30x$$

$$x = 500$$

112. Which of the ideal cycle have two-isothermal and two-isobaric processes?

- A. Atkinson cycle
- B. Stirling cycle
- C. Ericsson cycle
- D. Brayton cycle

Ans. C

Sol.

Ericsson cycle consists of four totally reversible processes:

- (a). An isothermal heat addition process from an external source.
- (b). There is a constant pressure, heat regeneration.
- (c). an isothermal heat rejection through a compression process
- (d). Finally a constant pressure regeneration process again.

113. For a governor running at constant speed, what is the value of the force acting on the sleeve.
- A. Zero
 - B. Variable depending upon the load
 - C. Maximum
 - D. Minimum

Ans. A

Sol. When governor is running at constant speed, then the net force acting on sleeve is zero.

114. For an ideal gas, the slope of the constant volume line in the T-S diagram is.
- A. higher than the slope of the constant pressure line
 - B. lower than the slope of the constant pressure line
 - C. Equal to the slope of the constant pressure line
 - D. Equal to the slope of the constant temperature line

Ans. A

Sol.

$$\left(\frac{dT}{dS}\right)_V = \frac{T}{C_V}$$

$$\left(\frac{dT}{dS}\right)_P = \frac{T}{C_P}$$

Since $C_P > C_V$

$$\left(\frac{dT}{dS}\right)_V > \left(\frac{dT}{dS}\right)_P$$

115. In Vickers hardness test method, the shape of indenter is
- A. Square
 - B. Diamond
 - C. Hemisphere
 - D. Any of the above three

Ans. B

Sol. In Vickers hardness test loads using a diamond shape indenter to make an indentation in the form of a right pyramid with a square base and an angle of 136 degrees between opposite faces.

116. Coefficient of discharge (C_d) for venturi meter is
- A. 0.95 – 0.99
 - B. 0.61 – 0.65
 - C. 0.91 – 0.95
 - D. 0.8 – 0.9

Ans. A

Sol. Coefficient of discharge (C_d) for venturi meter is 0.95 to 0.99.

117. The code 'M 07' in NC machining process denotes _____.
- A. Spindle start (CCW)
 - B. Coolant ON
 - C. Coolant OFF
 - D. Spindle start (CW)



Vision 2022
A Course for ESE & GATE
Mechanical Aspirants

START FREE TRIAL

Ans. B

Sol. Different M-codes and description is given below:

Code	Description
M03	Spindle start forward CW
M04	Spindle start reverse CCW
M05	Spindle stop
M06	Tool change
M07	Coolant ON – Mist coolant
M08	Coolant ON – Flood coolant
M09	Coolant OFF

118. Which of the following material has highest thermal conductivity?

- A. Wood
- B. Silver
- C. Mercury
- D. Oxygen gas

Ans. B

Sol. $K_{\text{gas}} < K_{\text{liquid}} < K_{\text{solid}}$

Therefore oxygen gas has lowest thermal conductivity

119. In ultrasonic machining, the material removal rate changes with abrasive size as

- A. First increases then decreases
- B. Increases
- C. Decreases
- D. Constant

Ans. A

Sol. By increasing the size of the abrasive grains, the material removal rate increases. But when the size increases beyond a certain value due to mutual drag between abrasive grains the material removal rate decreases.

120. Which one of the following is not true about the orthogonal cutting?

- A. Cutting edge of the tool is perpendicular to the direction of cutting velocity.
- B. The cutting edge is smaller than the workpiece width.
- C. The cutting forces act along two directions only
- D. None of these

Ans. B

Sol.

- In orthogonal cutting, the cutting edge is wider than the workpiece width and extends beyond the workpiece on either side. Also the width of the workpiece is much greater than the depth of cut.

So, the option (B) is not true about orthogonal cutting.

121. The critical temperature for water is

- A. 374.2°C
- B. 221.2°C
- C. 100°C
- D. 0°C

Ans. A



Vision 2022
A Course for ESE & GATE
Mechanical Aspirants

START FREE TRIAL

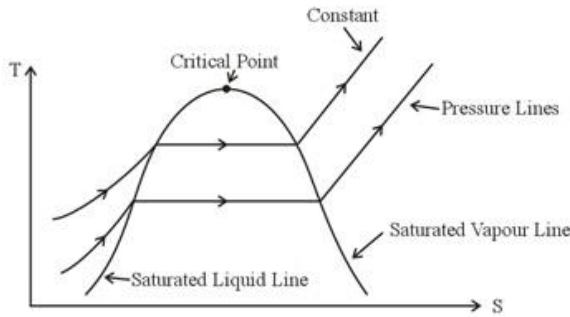
Sol. The point, where saturated liquid and saturated vapour line meets in the T-S diagram of water is called critical point and the temperature, pressure and specific volume corresponding to this point is called critical temperature(T_c), critical pressure(P_c) and critical specific volume (v_c).

For water,

$$T_c = 374.2^\circ\text{C}$$

$$P_c = 221.2 \text{ bar}$$

$$v_c = 0.00317 \text{ m}^3/\text{kg}$$



122. Which of the following equation is known as the inequality of Clausius _____.

A. $\oint \frac{dQ}{T} \leq 0$

B. $\oint \frac{dQ}{T} \geq 0$

C. $\oint \frac{dQ}{T} = 0$

D. $\oint \frac{dQ}{T} > 0$

Ans. A

Sol. $\oint \frac{dQ}{T} \leq 0$ is known as the inequality of Clausius.

So, the correct option is (a).

123. How draught can be produced in locomotive boilers _____?

A. mechanical fan

B. chimney

C. a steam jet

D. all of the above

Ans. C

Sol. As Locomotive boiler is a moving boiler, therefore, its chimney is completely eliminated. For expelling the burnt gases (draught) the exhaust steam coming out from steam engine is being used. Thus, it is an artificial draught used in these boilers for expelling burnt gases.

124. A jet working under air as the fuel for its thermodynamic cycle, is flying at an altitude where the air density is one - third of normally the density of air at ground level. Find the ratio of A/F at this altitude with respect to the ground.

A. $\sqrt[3]{2}$

B. 3

C. $\sqrt{\frac{1}{3}}$

D. 9



Vision 2022
A Course for ESE & GATE
Mechanical Aspirants

START FREE TRIAL

Ans. C

Sol. By definition:

$$A/F \text{ ratio} = \frac{m_{air}}{m_{fuel}}$$

Thus,

$$\frac{(\text{Air fuel ratio})_{altitude}}{(\text{Air fuel ratio})_{ground}} = \sqrt{\frac{(\rho_{air})_{altitude}}{(\rho_{air})_{ground}}}$$
$$= \sqrt{\frac{(\rho_{air})_{ground}}{3(\rho_{air})_{ground}}} = \sqrt{\frac{1}{3}} = 0.5773$$

125. In a frame, the number of joint is 5, number of members=3, the frame is

- A. Perfect
- B. Redundant
- C. Deficient
- D. can't say

Ans. C

Sol. We know that

if

$2j-3=m$, for a perfect frame

$2j-3>m$, for deficient frame

$2j-3<m$, for redundant frame

where , j = number of joints, m = number of members

here $j = 5$, $m = 3$

$2j - 3 = 2 \times 5 - 3 = 7 > 5(m)$

thus it is a deficient frame

126. A body of mass 0.1 kg moving with a velocity of 10 ms^{-1} hits a spring (fixed at the other end) of force constant 1000 Nm^{-1} and comes to rest after compressing the spring. The compression of the spring is

- A. 0.01 m
- B. 0.1 m
- C. 0.2 m
- D. 0.5 m

Ans. B

Sol. Decrease in kinetic energy = increase in elastic potential energy

$$\therefore \frac{1}{2}mv^2 = \frac{1}{2}kx^2$$

$$\text{or } x = \sqrt{\frac{m}{k}} \cdot v = \sqrt{\frac{0.1}{1000}} \times 10 = 0.1 \text{ m}$$



Vision 2022
A Course for ESE & GATE
Mechanical Aspirants

START FREE TRIAL

127. Pitch point in cam and follower mechanism is _____.
- A. A point on pitch curve of having minimum pressure angle
 - B. A point on pitch curve of having maximum pressure angle
 - C. A reference point on follower and is used to generate pitch curve
 - D. A reference point on follower and is used to generate prime circle

Ans. B

Sol. Pitch point in cam and follower mechanism is a point on pitch curve of having maximum pressure angle.

128. Which of the following is an example of positive clutch?
- A. Plate Clutch
 - B. Cone Clutch
 - C. Centrifugal Clutch
 - D. Jaw Clutch

Ans. D

Sol.

- The positive clutches are used when positive (no slip) drives are required.
- These clutches transmit power from the drive shaft to the driven shaft by the interlocking of jaws or teeth.
- They are rarely used as compared to friction clutch. E.g. jaw clutch, claw clutch, toothed clutch.

129. Determine the type of friction acting on the block having mass 20kg and the force applied in it 5N, if the coefficient of friction between the block and the surface is 0.3. Take $g = 10\text{m/s}^2$
- A. Static Friction
 - B. Dynamic Friction
 - C. Limiting Friction
 - D. Cannot be determined

Ans. A

Sol. First we calculate the force of friction 'f'

$$f = \mu mg$$

$$f = 0.3 \times 20 \times 10 = 6\text{N}$$

Since, $f > F$.

The block will not move and the type of friction acting will be static friction.

130. A vessel of 10 mm diameter and 20 mm height with corner radius 0.1 mm is to be produced by cup drawing. The required blank diameter in mm is
- A. 30
 - B. 20
 - C. 10
 - D. 25

Ans. A

Sol.

Given,

$$d = 10\text{mm}, h = 20\text{mm}$$



Vision 2022
A Course for ESE & GATE
Mechanical Aspirants

START FREE TRIAL

by the conservation of mass

$$D^2 = d^2 + 4dh$$

$$D^2 = 10^2 + 4 \times 10 \times 20 = 900$$

Therefore, $D = 30$ mm

131. Flow of fluid through a pipe is turbulent when_____.

- A. Reynolds number is greater than 2000
- B. Reynolds number is greater than 4000
- C. Reynolds number is less than 2000
- D. None of the above.

Ans. B

Sol.

- For pipe flow,
Re < 2000: Laminar flow
2000 < Re < 4000: Transition flow
Re > 4000: Turbulent flow

132. The efficiency of the Otto cycle for the same compression ratio will be maximum when working fluid is

- A. Air
- B. Helium
- C. Carbon Dioxide
- D. Oxygen

Ans. B

Sol.

The efficiency of the Otto cycle is function of the specific heat ratio

$$\eta = 1 - \frac{1}{r^{\gamma - 1}}$$

with increase in the specific heat ratio efficiency of the otto cycle increases.

The highest specific heat ratio is of Helium i.e. 1.66 thus it will give highest efficiency.

133. Temperature profile in case of heat transfer through hollow sphere.

- A. Parabolic
- B. Exponential
- C. Hyperbolic
- D. Logarithmic

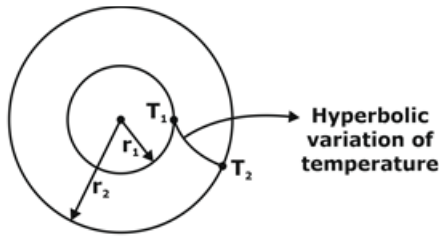
Ans. C

Sol.

Expression for heat transfer through hollow sphere.

$$Q = \frac{4\pi K r_1 r_2 (T_1 - T_2)}{(r_2 - r_1)} \quad (T_1 > T_2)$$





134. The temperature to which air must be cooled at constant pressure in order to become saturated is the
- A. minimum temperature
 - B. dew point temperature
 - C. wet-bulb temperature
 - D. freezing point

View Answer

Ans. B

Sol. The dew point is the temperature at which the water vapour in air at constant barometric pressure condenses into liquid water at the same rate at which it evaporates.

135. Match the following

TABLE-1	TABLE-2
P: Probability of 'n' arrivals in system during period T	$\frac{(\lambda T)^n e^{-\lambda T}}{n!}$
Q: Probability of serve a customer in more than T time	$e^{-\mu T}$
R: Probability that waiting time in queue is more than T	$\rho e^{-T/W_s}$
S: Probability that waiting time in system is more than T	e^{-T/W_s}

- A. P – 2 Q – 1 R – 3 S – 4
- B. P – 1 Q – 2 R – 4 S – 3
- C. P – 1 Q – 2 R – 3 S – 4
- D. P – 2 Q – 1 R – 4 S – 3

Ans. C

Sol. Probability of 'n' arrivals in system during period T = $\frac{(\lambda T)^n e^{-\lambda T}}{n!}$
 Probability of serve a customer in more than T time = $e^{-\mu T}$
 Probability that waiting time in queue is more than T = $\rho e^{-T/W_s}$
 Probability that waiting time in system is more than T = e^{-T/W_s}

136. A Carnot engine operates between 37°C and 347°C. If the engine produces 620 kJ of work, the entropy change (in kJ/K) of working fluid during heat addition is _____.
- A. 1
 - B. 2
 - C. 4
 - D. 0

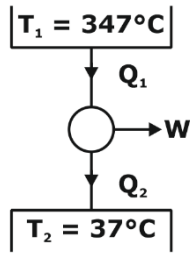
Ans. B

Sol.



Vision 2022
 A Course for ESE & GATE
 Mechanical Aspirants

START FREE TRIAL



Source Temperature (T_1) = $347^\circ\text{C} = 347 + 273 = 620\text{ K}$

Sink Temperature (T_2) = $37^\circ\text{C} = 37 + 273 = 310\text{ K}$

Work output (W) = 620 KJ

$$\text{Efficiency of Heat Engine } (\eta) = 1 - \frac{T_2}{T_1} = 1 - \frac{310}{620} = 0.5$$

$$\eta = \frac{\text{Work Output}}{\text{Heat Supplied}} = \frac{W}{Q_1} = \frac{620}{Q_1} = 0.5$$

$$Q_1 = 1240\text{ KJ}$$

$$\text{Entropy change during heat addition of working fluid in heat engine } (\Delta s) = \frac{Q_1}{T_1} = \frac{1240}{620} = 2\text{ KJ/K}$$

137. A right circular cone of base diameter 4 mm and height 8 mm is kept inverted. What is its CG from the top?

- A. 2 mm
- B. 4 mm
- C. 6 mm
- D. None of these

Ans. A

Sol.

The distance of the centre of gravity of solid cone from the vertex is $3h/4$ and from the base is $h/4$.

Given it's an inverted cone. Thus, the CG from top is $(8/4) = 2\text{ mm}$.

138. In a reaction turbine the enthalpy drop in a stage is 45 units, the enthalpy drop in moving blades is 23 units. The degree of reaction is _____?

- A. 0.345
- B. 0.511
- C. 0.682
- D. 1.386

Ans. B

Sol. Given:

$$(\Delta h)_{\text{moving}} = 23\text{ units}$$

$$(\Delta h)_{\text{stage}} = 45\text{ units}$$

Degree of reaction is given by:



$$R = \frac{(\Delta h)_{\text{moving}}}{(\Delta h)_{\text{stage}}}$$

$$R = 23/45 = 0.511$$

139. Which of the following bearing is preferred for oscillating conditions?

- A. Double row ball bearing
- B. Taper roller bearing
- C. Angular contact single row ball bearing
- D. Needle roller bearing

Ans. D

Sol.

- Due to its high (L/D) ratio, Needle roller bearing are preferred for oscillating conditions

140. Collapsible tooth paste tubes are manufactured by _____.

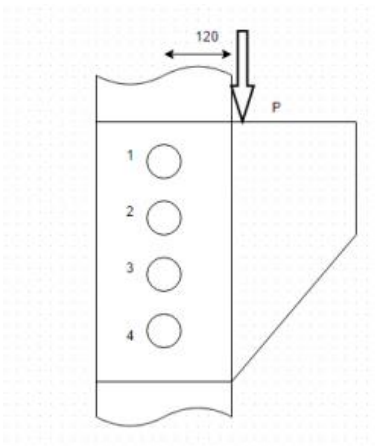
- A. Direct extrusion
- B. Piercing
- C. Impact extrusion
- D. Indirect extrusion

Ans. C

Sol.

- Impact extrusion is used for making the thin walled collapsible tubes such as toothpaste tubes, cans usually using soft materials such as aluminum, lead, tin.
- In impact extrusion, usually a small shot of solid material is placed in the die and is impacted by a ram, which causes cold flow of the material.

141. A bracket is attached to a vertical wall by means of four rivets as shown in figure below. Find the rivet which is under maximum stress.



- A. 1 and 4
- B. 2 and 3
- C. 3 and 1
- D. 4 and 2

Ans. A

Sol. Primary Shear acts vertically upward on all the rivets and its value will be the same for all rivets. Secondary shear is proportional to the distance from CG and rivets 1, 4 are farthest

Vision 2022
A Course for ESE & GATE
Mechanical Aspirants

START FREE TRIAL

from CG of rivets. Hence rivets 1 and 4 will experience the maximum value of secondary shear force. Thus, the resultant shear force/stress on rivets 1,4 will be the highest.

142. In an ideal vapour compression refrigeration cycle, the enthalpy of the refrigerator before and after the evaporator are respectively 200 kJ/kg and 300 kJ/kg. The circulation rate of the refrigerant (in kg/min) for each 200 kJ/min of refrigeration is

- A. 1
- B. 2
- C. 3
- D. 4

Ans. B

Sol. Given,

Ideal vapour compression refrigeration cycle,

Enthalpy of the refrigerator before evaporator $h_4 = 200$ kJ/kg

Enthalpy of the refrigerator after evaporator $h_1 = 300$ kJ/kg

Refrigeration Capacity = 200 kJ/min

Refrigeration Effect, $Q = h_1 - h_4 = 300 - 200 = 100$ kJ/kg

Refrigeration Capacity = mass \times Refrigeration Effect

$$m = \frac{Q}{h_1 - h_4} = \frac{200}{300 - 200} = 2 \text{ kg / min}$$

143. Which of the following correctly defines torsional rigidity?

- A. Product of polar moment of inertia and modulus of rigidity
- B. Torque per unit twist
- C. Torque at which shear stress is maximum
- D. Product of modulus of elasticity and moment of inertia

Ans. A

Sol. Torsional Rigidity is defined as the product of the polar moment of inertia and modulus of rigidity.

Torsional rigidity = GJ

Unit = N-m²

144. In a steady fluid flow, identical ones are_____.

- A. Path line and stream line
- B. Stream line and streak line
- C. Path line and streak line
- D. Path line, stream line and streak line

Ans. D

Sol.

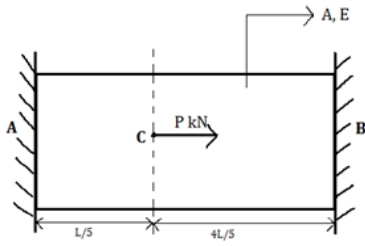
- All the three lines behave likely when the flow is independent of time (steady flow) as the properties such as velocity and acceleration etc. cannot be differentiated when time is not a parameter i.e. during steady flow.



Vision 2022
A Course for ESE & GATE
Mechanical Aspirants

START FREE TRIAL

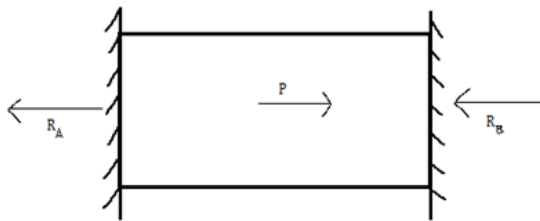
145. The support reactions for the prismatic bar as shown in the figure, which is supported between rigid supports, will be:



- A. $R_A = P/5, R_B = 4P/5$
- B. $R_A = 2P/5, R_B = 3P/5$
- C. $R_A = 4P/5, R_B = P/5$
- D. $R_A = R_B = P$

Ans. C

Sol.



Total deflection:

$$\delta_{Total} = \delta_{AC} + \delta_{CB} = 0$$

$$\frac{R_A \times \frac{L}{5}}{AE} - \frac{R_B \times \frac{4L}{5}}{AE} = 0$$

$$R_A = 4R_B \quad \dots\dots\dots (1)$$

$$R_A + R_B = P \quad \dots\dots\dots (2)$$

Solving equation (1) and (2), we get

$$R_A = 4P/5 \text{ and } R_B = P/5$$

146. In thin cylinder the hoop stress is 200 MPa then the maximum shear stress (in plane) is equal to

- A. 100 MPa
- B. 50 MPa
- C. 200 MPa
- D. 400 MPa

Ans. B

Sol.

$$\sigma_H = 200 \text{ MPa}$$

$$\sigma_L = \frac{\sigma_H}{2} = \frac{200}{2} = 100 \text{ MPa}$$

$$\tau(\text{in plane}) = \frac{\sigma_H - \sigma_L}{2} = \frac{200 - 100}{2} = 50 \text{ MPa}$$



- A. Less than 1
- B. lies between 1.03 to 1.06
- C. 1.33
- D. 2

Ans. D

Sol. The kinetic energy correction factor (α) for flow in pipe

$\alpha = 1.03-1.06$ for turbulent flow

$\alpha = 2$ for laminar

151. A Carnot engine rejects 30% of absorbed heat at a sink at 30°C. The temperature of the heat source is _____.

- A. 100°C
- B. 433°C
- C. 737°C
- D. 1010°C

Ans. C

Sol. Given,

$$Q_R = 30\% \text{ of } Q_S$$

$$Q_R = 0.3Q_S$$

$$T_L = 30^\circ\text{C} = 303\text{K}$$

$$Q \propto T$$

$$\frac{Q_S}{Q_R} = \frac{T_H}{T_L} \Rightarrow \frac{1}{0.3} = \frac{T_H}{303}$$

$$T_H = 1010\text{K} = 737^\circ\text{C}$$

152. The helix angle is very small about 2°. The spring is open coiled spring _____.

- A. Yes
- B. It is closed coiled spring
- C. That small angle isn't possible
- D. None of the listed

Ans. B

Sol.

- o When the helix angle is small, the plane containing each coil is almost at right angles and hence it is called closed coiled spring.

153. The heat loss, without the presence of a fin is 3 W. If the efficiency and effectiveness is 0.5 and 4 respectively, what is the heat loss from the fin, keeping the entire surface at base temperature____?

- A. 6 W
- B. 24 W
- C. 12 W
- D. 8 W

Ans. B

Sol.

Given,

efficiency= 0.5

effectiveness = 4

Effectiveness =

$$\frac{Q_{with}}{Q_{w/o}}$$

$$4 = \frac{Q_{with}}{3}$$

$$Q_{with} = 12 W$$

$$\eta = \frac{q_{act}}{q_{max}}$$

$$0.5 = \frac{12}{q_{max}}$$

$$q_{max} = 24 W$$

154. Which one of the following statement is INCORRECT?

- A. In a throttling process enthalpy remains constant.
- B. The degree of freedom for the triple point of water is 0.
- C. Piston-Cylinder with valves is an example of open system.
- D. In an isolated system, the entropy can either increase, decrease or remains constant.

Ans. D

Sol. For an isolated system, the entropy can either increase or remains constant. But it can never decrease.

Therefore, option (d) is an incorrect statement.

155. In an isentropic flow of air (k=1.4) the stagnation temperature is 600 K. If the temperature is 400 K at a section, then the Mach number of the flow will be?

- A. 1.88
- B. 1.58
- C. 2.34
- D. 2.58

Ans. B

Sol. Given,

$$\gamma = 1.4$$

stagnation temperature, $T_0 = 600K, T = 400K$

As we know that

$$\frac{T_0}{T} = 1 + \left(\frac{\gamma - 1}{2}\right)M^2$$

$$\frac{600}{400} = 1 + \left(\frac{1.4 - 1}{2}\right)M^2$$

$$M = 1.58$$

156. An element is subjected to the following strains: $\epsilon_x = 800, \epsilon_y = 400, \gamma_{xy} = 300$, the strains are in multiple of 10^{-6} . What is the maximum shearing strain in the material (in 10^{-6}) _____?

Vision 2022
A Course for ESE & GATE
Mechanical Aspirants

START FREE TRIAL

- A. 250
- B. 750
- C. 500
- D. 1000

Ans. C

Sol.

$$\text{Since: } \frac{\gamma_{max}}{2} = \sqrt{\left(\frac{\epsilon_x - \epsilon_y}{2}\right)^2 + \left(\frac{\gamma_{xy}}{2}\right)^2}$$

$$\text{maximum shear strain, } \gamma_{max} = 2\sqrt{\left(\frac{\epsilon_x - \epsilon_y}{2}\right)^2 + \left(\frac{\gamma_{xy}}{2}\right)^2}$$

$$\text{maximum shear strain, } \gamma_{max} = 2\sqrt{\left(\frac{800 - 400}{2}\right)^2 + \left(\frac{300}{2}\right)^2}$$

$$\gamma_{max} = 2\sqrt{200^2 + 150^2}$$

$$\gamma_{max} = 500$$

157. The natural vibration equation is $5\ddot{x} + 3x = 0$. Find ω_n

- A. $\sqrt{\frac{5}{3}}$
- B. $\sqrt{\frac{3}{5}}$
- C. $\sqrt{3}$
- D. None of these

Ans. B

Sol. Given

natural vibration equation is $5\ddot{x} + 3x = 0$

$$\ddot{x} + \frac{3}{5}x = 0$$

compare with standard natural equation,

$$m\ddot{x} + w_n^2 x = 0$$

$$\omega_n^2 = 3/5$$

$$\omega_n = \sqrt{\frac{3}{5}}$$

158. In ABC analysis of inventories, 'A' items usually constitute: -

- A. 5%
- B. 20%
- C. 30%
- D. 70%

Ans. A

Sol.

'A' items – 20% of the items accounts for 70% of the annual consumption value of the items

'B' items – 30% of the items accounts for 25% of the annual consumption value of the items

'C' items – 50% of the items accounts for 5% of the annual consumption value of the items

159. Which one of the following relationships defines the Helmholtz function F?

A. $F = H + TS$

B. $F = H - TS$

C. $F = U - TS$

D. $F = U + TV$

Ans. C

Sol. By standard result, the Helmholtz function F is $F = U - TS$

160. A solid cylindrical rod having the length $L = 0.15\text{m}$ and diameter $D = 0.05\text{m}$. The top and bottom surfaces of the rod are maintained at constant temperatures of 20°C and 95°C , respectively, while the side surface is perfectly insulated. If it is made of granite with $k = 1.2\text{ W/m}\cdot^\circ\text{C}$, the rate of heat transfer through the rod is

A. 1.05 W

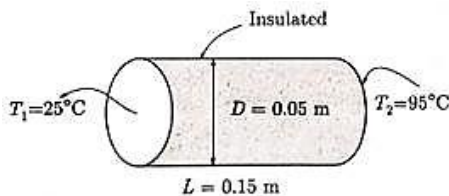
B. 1.35 W

C. 1.50 W

D. 1.18 W

Ans. D

Sol.



Nothing that the heat transfer area (the area normal to the direction of heat transfer) is constant, the rate of heat transfer along the rod is determined from

$$\dot{Q} = -kA \frac{T_1 - T_2}{L}$$

Where $L = 0.15\text{ m}$ and the heat transfer area A is

$$A = \frac{\pi}{4} D^2 = \frac{\pi}{4} (0.05)^2 = 1.964 \times 10^{-3} \text{ m}^2$$

Then the heat transfer rate for granite is as follows:

$$Q = kA \frac{T_2 - T_1}{L} = 1.2 \times 1.964 \times 10^{-3} \times \frac{95 - 20}{0.15} = 1.18 \text{ W}$$



Vision 2022
A Course for ESE & GATE
Mechanical Aspirants

START FREE TRIAL

Vision 2022

A Course for ESE & GATE Mechanical Aspirants

Why take this course?

- Complete Coverage of ESE 2022 Prelims & Mains Syllabus
- Complete Coverage of GATE 2022 Syllabus
- Both Objective & Conventional Approach
- Live Classes, Study Notes, Quizzes & Mock Tests

