



UPPSC AE 2020 PAPER-1

Civil Engineering

Mega Mock Challenge

(November 6- November 7 2020)

Questions &
Solutions

1. निम्न में से कौन-सा महाप्राण वर्ण है?

- | | |
|------|------|
| A. आ | B. क |
| C. थ | D. च |

Ans. C

Sol. जिन व्यंजनों के उच्चारण में वायु का उपयोग अधिक श्रम पूर्वक करना पड़ता है, वे महाप्राण व्यंजन कहलाते हैं।

महाप्राण - ऐसे व्यंजन जिनको बोलने में अधिक प्रत्यन करना पड़ता है और बोलते समय मुख से अधिक वायु निकलती है। उन्हें महाप्राण व्यंजन कहते हैं। इनकी संख्या 15 होती है।

महाप्राण वर्ण -

क वर्ण का दूसरा, चौथा अक्षर - ख घ

च वर्ण का दूसरा, चौथा अक्षर - छ झ

ट वर्ण का दूसरा, चौथा अक्षर - ठ ढ

त वर्ण का दूसरा, चौथा अक्षर - थ ध

प वर्ण का दूसरा, चौथा अक्षर - फ भ

चारों उष्म व्यंजन - श ष स ह

एक उच्छिप्त व्यंजन - ढ

नियम - वर्ग का 2, 4 अक्षर, उष्म व्यंजन

2. जिसका पति जीवित हो इस वाक्य के लिए सार्थक शब्द है -

- | | |
|----------|------------|
| A. विधवा | B. विधुर |
| C. सधवा | D. स्त्रैण |

Ans. C

Sol. जिसका पति जीवित हो - सधवा

जिसका पति मर गया हो - विधवा

जिसकी पत्नी मर गई हो - विधुर

3. जातिवाचक एवं व्यक्तिवाचक संज्ञाओं का कौन सा युग्म गलत है?

- | | |
|------------------|------------------|
| A. कुत्ता-पिल्ला | B. नगर-जयपुर |
| C. पर्वत-हिमालय | D. स्त्री-श्वेता |

Ans. A

Sol. कृत्ता और पिल्ला दोनों ही जातिवाचक संख्या है। जिस संज्ञा शब्द से उसकी संपूर्ण जाति का बोध हो उसे जातिवाचक संज्ञा कहते हैं। जैसे - मनुष्य, । जिस संज्ञा शब्द से किसी विशेष, व्यक्ति, प्राणी, वस्तु अथवा स्थान का बोध हो उसे व्यक्तिवाचक संज्ञा कहते हैं। जैसे - कुतुबमीनार, हिमालय आदि।

4. निम्न में से किस शब्द में "नि" उपसर्ग का प्रयोग किया गया है?

- | | |
|------------|------------|
| A. निर्वास | B. निपात |
| C. निर्भय | D. निर्दोष |

Ans. B

Sol. उपसर्ग = उप (समीप) + सर्ग (सृष्टि करना) का अर्थ है- किसी शब्द के समीप आ कर नया शब्द बनाना।
उपसर्ग कहलाते हैं।

यहाँ केवल निपात शब्द में 'नि' उपसर्ग है, अन्य शब्दों में 'निर्' उपसर्ग का प्रयोग किया गया है।

निपात = नि + पात

निर्वास = निर् + वास

निर्भय = निर् + भय

निर्दोष = निर् + दोष

5. "राजवीर रोज चार लीटर दूध पीता है" वाक्य में विशेषण है।

- | | |
|----------------------|----------------------|
| A. गुणवाचक विशेषण | B. परिणामवाचक विशेषण |
| C. संख्यावाचक विशेषण | D. सार्वनामिक विशेषण |

Ans. B

Sol. विशेषण - संज्ञा या सर्वनाम की विशेषता बताने वाले शब्द को विशेषण कहते हैं।

परिणाम वाचक विशेषण - ऐसे शब्द जो हमें किसी संज्ञा या सर्वनाम के नाप-तौल या मात्रा का बोध कराएं, वे शब्द परिमाणवाचक विशेषण कहलाते हैं।

चार लीटर दूध का माप है इस वास्तु को गिना नहीं जा सकता ,केवल मापा जा सकता है, इसलिए ये परिणाम वाचक विशेषण है।

6. "उर्दू, तलाश, बेगम" किस भाषा के शब्द है ?

- | | |
|-----------|--------------|
| A. फ़ारसी | B. पुर्तगाली |
| C. तुर्की | D. अरबी |

Ans. C

Sol. विदेशज शब्द - विदेशी भाषाओं से हिंदी में आये शब्दों को विदेशी शब्द कहा जाता है। इन विदेशी भाषाओं में मुख्यतः अरबी, फारसी, तुर्की, अंग्रेजी व पुर्तगाली शामिल है।

उर्दू, तलाश, बेगम शब्द तुर्की भाषा से हिंदी भाषा में लिए गए शब्द हैं।

तुर्की भाषा के शब्द - उर्दू, मुगल, आका, काबू, कालीन, कैंची, कुली, कुर्की, चेचक, चमचा, तोप, तमगा, तलाश, बेगम

7. निम्नलिखित में से शुद्ध वर्तनी वाले शब्द का चयन कीजिए।

A. कालीदास

B. बलीदान

C. वाल्मीकि

D. बहुव्रीही

Ans. C

Sol. वर्तनी - भाषा की वर्तनी का अर्थ उस भाषा में शब्दों को वर्णों से अभिव्यक्त करने की क्रिया को कहते हैं।

दिए गए विकल्पों में बाल्मीकि शब्द की वर्तनी शुद्ध है अन्य विकल्पों की वर्तनी में अशुद्धि है।

अशुद्ध शब्दों की शुद्ध वर्तनी -

अशुद्ध शब्द - शुद्ध शब्द

कालीदास - कालिदास

बहुव्रीही - बहुव्रीहि

बलीदान - बलिदान

8. निम्न में से तत्सम और तद्भव शब्दों का युग्म सही है।

A. रक्षण - रक्षा

B. श्याल - श्याम

C. सौभाग्य - भाग्य

D. स्फुटन - फूटना

Ans. D

Sol. तत्सम - तत्सम दो शब्दों से मिलकर बना है - तत् + सम, जिसका अर्थ होता है ज्यों का त्यों। जिन शब्दों को संस्कृत से बिना किसी परिवर्तन के ले लिया जाता है उन्हें तत्सम शब्द कहते हैं। इनमें ध्वनि परिवर्तन नहीं होता है।

तद्भव - समय और परिस्थिति की वजह से तत्सम शब्दों में जो परिवर्तन हुए हैं उन्हें तद्भव शब्द कहते हैं।

स्फुटन - फूटना शब्दों का तत्सम और तद्भव युग्म सही है अन्य शब्द का युग्म अशुद्ध है

शब्दों का सही युग्म -

रक्षण - रखना

श्याल - साला

सौभाग्य - सुहाना

स्फुटन - फूटना

9. "करकमल" शब्द में निम्न में से कौन-सा समास है?

- | | |
|-------------------|------------------|
| A. अव्ययीभाव समास | B. तत्पुरुष समास |
| C. कर्मधारय समास | D. द्विगु समास |

Ans. C

Sol. समास - समास का तात्पर्य है "संक्षिप्तीकरण" दो या दो से अधिक शब्दों से मिलकर बने हुए एक नवीन एवं सार्थक शब्द को समास कहते हैं।

करकमल शब्द का समास विग्रह - कमल के समान कर (हाथ) (कर्मधारय समास)

कर्मधारय समास - जिस समास में उत्तर पद प्रधान हो तथा पूर्व पद व उत्तर पद में उपमान-उपमेय अथवा विशेषण-विशेष्य सम्बन्ध हो, वह 'कर्मधारय समास' कहलाता है।

10. "नए उपग्रह खोजे जा रहे हैं।" वाक्य में काल है-

- | | |
|------------------------|-------------------------|
| A. पूर्ण वर्तमान काल | B. तत्कालिक वर्तमान काल |
| C. संदिग्ध वर्तमान काल | D. सामान्य वर्तमान काल |

Ans. B

Sol. वर्तमान काल:- क्रिया के जिस रूप से वर्तमान में चल रहे समय का बोध होता है, उसे वर्तमान काल कहते हैं।

तत्कालिक वर्तमानकाल- क्रिया के जिस रूप से यह पता चलता है कि कार्य वर्तमानकाल में हो रहा है उसे तात्कालिक वर्तमानकाल कहते हैं।

नए उपग्रह खोजे जा रहे हैं। वाक्य यह पता चलता है कि कार्य वर्तमानकाल में हो रहा है, नए उपग्रह खोजे नहीं हैं कार्य चल रहा है यदि उपग्रह खोजे जा चुके होते तो पूर्ण वर्तमान काल होता परन्तु कार्य वर्तमान में चल रहा है पूर्ण नहीं हुआ है अतः तत्कालिक वर्तमानकाल होगा ।

11. निम्न में से असंगत है -

- | | |
|--------------------------|------------------------|
| A. अत्र + आभाव= अत्राभाव | B. कोण + अर्क= कोणार्क |
| C. शिव + आलय= शिवालय | D. भोजन + आलय= भोजनालय |

Ans. A

Sol. संधि - दो वर्णों के मेल को संधि कहते हैं।

दी गये विकल्पों में अत्र + आभाव= अत्राभाव संधि अशुद्ध है अन्य विकल्प की संधि शुद्ध है।

अत्राभाव का संधि विच्छेद = अत्र + अभाव

12. निम्नलिखित में से कौन-सा शब्द युग्म सही है।

- | | |
|---------------------------|----------------------------|
| A. अवधि - काल, अवधी - समय | B. ऋत - असत्य ऋतु- मौसम |
| C. आली - सखी, अलि - भौरा | D. तरणि - नाव तरणी - पत्नी |

Ans. C

Sol. हिंदी के अनेक शब्द ऐसे हैं, जिनका उच्चारण प्रायः समान होता है। किंतु, उनके अर्थ भिन्न होते हैं। इन्हें 'युग्म शब्द' कहते हैं।

आली - सखी, अलि - भौरा शब्दों का युग्म सही है अन्य शब्दों का सही युग्म -

तरणि - सूर्य, तरणी - नाव

ऋत - सत्य, ऋतु - मौसम

अवधि - काल, अवधी - अवध देश की भाषा

13. निम्न में से किस विकल्प का विलोम युग्म सही है?

- | | |
|------------------|----------------------|
| A. भय - डर | B. लिप्त - निर्लिप्त |
| C. आशा - अभिलाषा | D. गुण - सगुण |

Ans. B

Sol. विलोम - किसी शब्द का विपरीत या उल्टा अर्थ देने वाले शब्दों को विलोम शब्द कहते हैं।

दिए गए विकल्प में लिप्त का विलोम निर्लिप्त है और अन्य शब्द एक दूसरे के समानार्थी शब्द हैं।

लिप्त का अर्थ - सांसारिक माया-मोह में लीन रहनेवाला।

निर्लिप्त का अर्थ - सांसारिक माया-मोह से दूर रहनेवाला।

शब्दों के विलोम -

गुण - अवगुण

आशा - निराशा

भय - निर्भय

14. "श्याम मजदूरों से हल चलवाता है।" इस वाक्य में कौन-सी क्रिया है?

- | | |
|---------------|-----------------------|
| A. पूर्वकालिक | B. प्रेरणार्थक |
| C. संयुक्त | D. इनमें से कोई नहीं। |

Ans. B

Sol. दिए गए वाक्य "श्याम मजदूरों से हल चलवाता है", में प्रेरणार्थक क्रिया है। जिस क्रिया से ज्ञान हो कि कर्ता स्वयं कार्य को न करके किसी अन्य को उस कार्य को करने की प्रेरणा देता है ऐसी क्रिया प्रेरणार्थक क्रिया कहलाती है। प्रेरणार्थक क्रिया के दो कर्ता होते हैं: 1.प्रेरक कर्ता - प्रेरणा प्रदान करने वाला 2.प्रेरित कर्ता - प्रेरणा लेने वाला कर्ता यहाँ **काम मजदूर कर रहे हैं**, इसलिए वे प्रेरित कर्ता हैं जबकि श्याम प्रेरणा देने वाला कर्ता है, क्योंकि वह मजदूरों को कार्य करने की प्रेरणा दे रहा है।

15. निम्न में से "**मिश्र वाक्य**" कौन-सा है?

- A. मेने नया फ़ोन खरीदा है।
- B. राम स्कूल जाता और बापस आता है।
- C. श्याम मेहनत करता है ताकि वह सफल हो सके।
- D. दो दोस्त फिल्म देखने गए।

Ans. C

Sol. **मिश्र वाक्य** - इस वाक्य में एक प्रधान उपवाक्य और दूसरा आश्रित उपवाक्य होता है। यह आपस में व्यधिकरण समुच्चबोधकों (क्योंकि, यदि, तो, यद्यपि, तथापि, ताकि, जिससे, मानो) शब्दों से जुड़ा होता है।

वाक्य - श्याम मेहनत करता है **ताकि** वह सफल हो सके।

ताकि शब्द मिश्र वाक्य को जोड़ता है।

16. निम्नलिखित में योगरूढ़ शब्द चुनिए-

- | | |
|------------|-------------|
| A. पीला | B. चक्रपाणि |
| C. दूधवाला | D. नैन |

Ans. B

Sol. चक्रपाणि (चक्र है हाथ में जिसके वह अर्थात् विष्णु) योगरूढ़ शब्द है। वे शब्द, जो यौगिक तो हैं, किन्तु सामान्य अर्थ को न प्रकट कर किसी विशेष अर्थ को प्रकट करते हैं, योगरूढ़ कहलाते हैं। जैसे-पंकज, दशानन आदि।

दूधवाला यौगिक शब्द है यह सामान्य अर्थ बताता है कोई विशेष शब्द कि ओर संकेत नहीं करता है

17. "**का**" प्रत्यय का प्रयोग किस शब्द में हुआ है ?

- | | |
|----------|----------|
| A. दुकाल | B. कपूत |
| C. अधपका | D. छिलका |

Ans. D

Sol.

प्रत्यय - वे शब्दांश जो किसी शब्द के अन्त में जुड़कर उसका अर्थ परिवर्तित करने में सक्षम होते हैं वे प्रत्यय कहलाते हैं।

छिलका शब्द - छिल + का (छिलका शब्द में का प्रत्यय का प्रयोग है)

अन्य शब्द -

दुकाल - दु + काल

कपूत - क + पूत

अधपका - अध + पका

18. "वह" निम्न में से किस प्रकार का सर्वनाम है?

A. उत्तमपुरुष सर्वनाम

B. मध्यपुरुष सर्वनाम

C. अन्यपुरुष सर्वनाम

D. इनमें से कोई नहीं

Ans. C

Sol. सर्वनाम - जिन शब्दों का प्रयोग संज्ञा के स्थान पर किया जाता है, उन्हें सर्वनाम कहते हैं।

वह शब्द अन्यपुरुष सर्वनाम है।

अन्य पुरुषवाचक - जिन सर्वनाम शब्दों का प्रयोग किसी अन्य व्यक्ति के लिए किया जाता है, उन्हें अन्य पुरुषवाचक कहते हैं।

जैसे- वे, यह, वह, इनका, इन्हें, उसे, उन्होंने, इनसे, उनसे आदि।

19. 'बिल्ली चटाई के ऊपर बैठी है' वाक्य में कौन सा क्रिया विशेषण है ।

A. रीति वाचक

B. स्थान वाचक

C. परिमाण वाचक

D. इनमें से कोई नहीं

Ans. B

Sol. बिल्ली चटाई के ऊपर बैठी है, वाक्य में स्थान वाचक क्रिया-विशेषण है । क्योंकि बिल्ली चटाई के ऊपर बैठी है। वाक्य में ऊपर शब्द स्थान को बताते हुए क्रिया की विशेषता प्रकट करते हैं । अतः ये शब्द स्थान वाचक क्रिया-विशेषण है।

20. सही मुहावरे को मिलायें।

A) अपना उल्लू सीधा करना - 1. कंगाल होना

B) उन्नीस बीस का अंतर होना - 2. जबरदस्त बदला लेना

C) ईंट का जबाब पत्थर से देना - 3. बहुत कम अंतर होना

D) फूटी कौड़ी न होना - 4. मतलब निकालना

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

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

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

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

Ans. C

Sol. मुहावरों का अर्थ - मुहावरे का शाब्दिक अर्थ होता है - अभ्यास। विशेष अर्थ को प्रकट करने वाले वाक्यांश को मुहावरा कहते हैं।

अपना उल्लू सीधा करना - मतलब निकालना

उन्नीस बीस का अंतर होना - बहुत कम अंतर होना

ईंट का जबाब पत्थर से देना - जबरदस्त बदला लेना

फूटी कौड़ी न होना - कंगाल होना

21. निम्नलिखित में से कौन-सा शब्द बहुवचन है?

A. पुस्तक

B. लड़का

C. पौधा

D. प्राण

Ans. D

Sol. वचन - शब्द के जिस रूप से उसके एक अथवा अनेक होने का बोध हो उसे वचन कहते हैं।

बहुवचन - शब्द के जिस रूप से अनेकता का बोध हो उसे बहुवचन कहते हैं। जैसे- रोटियाँ, बेटे आदि।

प्राण, दर्शन और हस्ताक्षर हिंदी में वे गिने-चुने शब्द हैं जो हमेशा बहुवचन रूप में उपयोग किए जाते हैं। **उदाहरण:** प्राण सभी को प्यारे होते हैं।

लड़का - लड़के

पौधा - पौधे

पुस्तक - पुस्तकें

22. "परिश्रम के बाद विश्राम आवश्यक है" वाक्य के लिए उपयुक्त लोकोक्ति है।

A. दाँतो तले ऊँगली दबाना

B. थका ऊँट सराय ताकता है

C. आज काज महाकाज

D. बाँह गहे की लाज

Ans. B

Sol. लोकोक्ति - किसी विशेष स्थान पर प्रसिद्ध हो जाने वाले कथन को 'लोकोक्ति' कहते हैं।

"थका ऊँट सराय ताकता है" - परिश्रम के बाद विश्राम आवश्यक है

अन्य लोकोक्तियाँ -

दाँतो तले ऊँगली दबाना - आश्चर्यचकित रह जाना

आज काज महाकाज - स्वंय करने पर ही कार्य ठीक होता है

बाँह गहे की लाज - शरणागत की रक्षा करना

23. 'मुझसे उठा नहीं गया' वाक्य में वाच्य है।

A. कृत्रवाच्य

B. कर्मवाच्य

C. भाववाच्य

D. उपर्युक्त में से कोई नहीं

Ans. C

Sol. **भाववाच्य** - क्रिया के उस रूपान्तर को भाववाच्य कहते हैं, जिससे वाक्य में क्रिया अथवा भाव की प्रधानता का बोध हो। क्रिया के लिंग वचन कर्म के लिंग एवं वचन के अनुसार होते हैं।

जैसे- मोहन से टहला भी नहीं जाता।

वाच्य का अर्थ: क्रिया के उस परिवर्तन को वाच्य कहते हैं, जिसके द्वारा इस बात का बोध होता है कि वाक्य के अन्तर्गत कर्ता, कर्म या भाव में से किसकी प्रधानता है।

24. 'हतभागी' का स्त्रीलिंग शब्द है।

A. हतभागनी

B. हतभाग्यवती

C. हतभाग्या

D. हतभागु

Ans. C

Sol. लिंग - "संज्ञा के जिस रूप से व्यक्ति या वस्तु की नर या मादा जाति का बोध हो, उसे व्याकरण में 'लिंग' कहते हैं।

स्त्रीलिंग - जिस संज्ञा शब्द से स्त्री जाति का बोध होता है, उसे स्त्रीलिंग कहते हैं।

हतभागी शब्द पुल्लिंग है जिसका स्त्रीलिंग शब्द हतभाग्या होता है।

हतभागी शब्द का अर्थ - अभागा, बदकिस्मत, भाग्यहीन

25. इस वाक्य में किस प्रकार के चिन्हों का प्रयोग हुआ है? |||End|||

"आह! बहुत दर्द हो रहा है।"

A. कोष्ठक चिन्ह+विराम

B. विराम चिन्ह+अर्द्ध विराम

C. अर्द्ध विराम+प्रश्नवाचक

D. विस्मयादिबोधक+पूर्ण विराम

Ans. D

Sol. दिए गए वाक्य में सबसे पहले आह के बाद विस्मयादि बोधक चिन्ह का प्रयोग हुआ है। इस चिन्ह का प्रयोग विस्मय, शोक, घृणा, प्रेम आदि की स्थिति में किया जाता है जबकि वाक्य के अंत में पूर्ण विराम के चिन्ह का उपयोग हुआ है।

26. Calculate the quantity of the sand required for 8 cubic meter brick work with cement mortar (1 : 3).

A. 1.38

B. 1.5

C. 1.8

D. 2.4

Ans. C

Sol. No of bricks for 8 m^3 brick work = 4000

Volume of one brick = $19 \times 9 \times 9 \text{ cm}^3$

= $.001539 \text{ m}^3$

Volume of 4000 brick = $4000 \times .001539$

= 6.156 m^3

Volume of mortar = $8 - 6.156 = 1.844 \text{ m}^3$

Volume of dry mortar = 1.33×1.844

= 2.45 m^3

So quantity of sand = $(3/4) \times 2.45$

= 1.82 m^3

27. Which of the Bouges compound influence the ultimate strength of cement?

A. Tri-calcium silicate

B. Di-calcium silicate

C. Tri-calcium aluminate

D. Tetra-Calcium alumina-ferrite

Ans. B

Sol. Dicalcium silicate hydrates and hardens slowly and takes long time to add to the strength which varies from one year or more. This is also responsible for ultimate strength of concrete.

28. PVC is widely used to make pipes because:

A. Cost effective

B. Does not react to chemicals

C. Easily available

D. Easy to transport

Ans. B

Sol. PVC is resistant to attack by kerosene oil, acid and chemicals. It is water proof too. Hence it is widely used for pipe manufacture for carrying sewage and rain water.

29. The most commonly used admixture which prolongs the setting time is:

A. Calcium chloride

B. Gypsum

C. Sodium Silicate

D. All of these

Ans. B

Sol. Gypsum is a retarder and delays the setting of concrete.

Calcium chloride is an accelerator and increases the setting of concrete.

30. According to IS Code what will be the target compressive strength for the M30 concrete if the standard deviation is 5 N/mm^2 .

A. 33.25

B. 38.25

C. 43.25

D. 45.55

Ans. B

Sol. Target strength = $1.65 s + f_{ck}$

= $1.65 \times 5 + 30$

= 38.25 N/mm^2

31. Match List-I (Grade of cement and Age) with List-II (Compressive strength in N/mm²) and select the correct answer using the codes given below the lists

List-I

- A) Grade 33 (7 days)
- B) Grade 43 (28 days)
- C) Grade 53 (3 days)
- D) Grade 43 (7 days)

List-II

- 1) 27
- 2) 43
- 3) 22
- 4) 33

Codes :

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

Ans. B

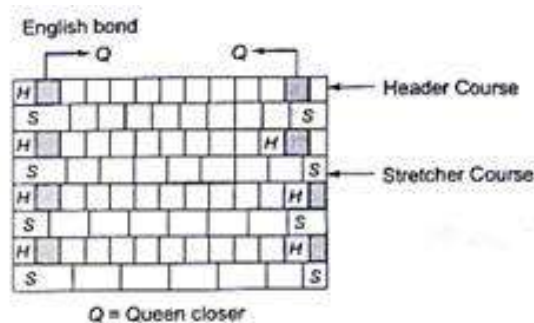
Sol.

	3 days	7 days	28 days
Grade 33	16	22	33
Grade 43	23	33	43
Grade 53	27	37	53

32. A type of bond in a brick masonry Consisting of alternate course of headers and stretchers, is called
- A. English bond
 - B. Flemish bond
 - C. Stretching bond
 - D. Heading bond

Ans. A

Sol.



33. The acceptable value for wear in good building stone should not exceed

- A. 1% B. 3%
- C. 5% D. 10%

Ans. B

Sol. The percentage wear as determined in attrition test of less than 3% is desirable.

34. Oleic acid may be used in the manufacture of

- A. White cement
B. Hydrophobic cement
C. Anti-bacterial cement
D. Portland pozzolana cement

Ans. B

Sol. Oleic acid acts as an air-entraining agent hence used to manufacture hydrophobic cement which can be stored for a greater period of time.

35. Purpose of linseed oil is to be used as

- A. Base
B. Thinner
C. Carrier
D. Pigment

Ans. C

Sol. Linseed oil is a common carrier used in oil paint. It can also be used as a painting medium, making oil paints more fluid, transparent and glossy. It is available in varieties such as cold-pressed, alkali-refined, sun-bleached, sun-thickened, and polymerised.

36. Consider the following statement

- 1) Addition of a small quantity of slaked lime to Portland cement in cement mortar increase the plasticity of the mortar
- 2) Light weight mortar is prepared by mixing cement and finely crushed fire bricks with water
- 3) Fire resistant mortar is prepared by mixing cement and finely ground China clay wares with water

Which of these statements are correct

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

Ans. D

Sol. Lime improves the plasticity of the cement. The finely crushed fire bricks are used for light weight mortar and China clay wares are fire resistant hence used in the preparation of fire resistant mortar.

37. The most important purpose of frog in a brick is to :

- A. Reduce the weight of brick
- B. Emboss manufactures name
- C. Form keyed joint between brick and mortar
- D. Improve insulation by providing 'hollows'

Ans. C

Sol. Although frog in a brick carries manufacturer's name, the most important purpose of providing frog is form a key for holding the mortar.

38. For the marine structure suitable cement is

- | | |
|-----------------------------|------------------------------|
| A. Low heat Portland cement | B. Rapid hardening cement |
| C. Ordinary Portland cement | D. Blast furnace slag cement |

Ans. D

Sol. Slag cement is a hydraulic cement formed when granulated blast furnace slag (GGBFS) is ground to suitable fineness and is used to replace a portion of portland cement. Used in the places susceptible to chloride and sulphate attacks such as sub-structure, bored piles, pre-case piles and marine structures.

39. Which of the following are the properties of Cast Iron?

- a) It is hard and brittle with specific gravity of 4.5
b) It has low melting point (1200°C)
c) It cannot be magnetized and not suitable for forging.
- | | |
|------------|---------------|
| A. only a | B. a and b |
| C. b and c | D. a, b and c |

Ans. C

Sol. Cast iron is hard and brittle with specific gravity of 7.5

40. For M40 grade of concrete the assumed value of standard deviation in N/mm^2 according to IS 456 is

- | | |
|--------|------|
| A. 3.5 | B. 4 |
| C. 5 | D. 6 |

Ans. C

Sol. The value of standard deviation according to IS: 456-2000 for M40 is 5 N/mm^2 .

For M10 and M15 – 3.5 N/mm^2

For M20 and M25 – 4 N/mm^2

For M30 to M55 – 5 N/mm^2 .

41. In tensile strength test of concrete, if the maximum nominal size of aggregate is less than 20 mm, the size of concrete specimen used is

- | | |
|--------------------------|--------------------------|
| A. 15 cm x 15 cm x 70 cm | B. 15 cm x 15 cm x 15 cm |
| C. 10 cm x 10 cm x 50 cm | D. 10 cm x 10 cm x 70 cm |

Ans. C

Sol. Tensile strength of the concrete is tested indirectly, by noting its modules of rupture that is determined by preparing a block of

– Size 15 cm x 15cm x 70 cm if the maximum nominal size of aggregate is greater than 20 mm.

– Size 10cm x10cm x 50cm if the maximum nominal size of aggregate is less than 20 mm.

42. Which of the following is water based varnishes?

- A. Urethane
- B. Wax
- C. Polyurethane
- D. Urea

Ans. A

Sol. Urethane and Acrylic are water based resins. Polyurethane is oil based varnish.

43. Sand stone is:

- A. Sedimentary rock
- B. Metamorphic rock
- C. Igneous rock
- D. Volcanic rock

Ans. A

Sol. Sandstone is a type of sedimentary rock.

44. A machine has an operating cost of 1500 Rupees per hour having a idle time of 5 %. Then find out the down time cost of the machine if the machine operates for 5 hours per day.

- A. Rs 75 per day
- B. Rs 375 per day
- C. Rs. 350 per day
- D. Rs. 1875 per day

Ans. B

Sol. Down time cost per hour = 5% of 1500 = Rs. 75.

Down time for 5 hours in a day = 75×5 = Rs. 375

45. A recurring deposit of Rs. 5000 per month for 12 installments will grow to _____ at the end of 12 months for the given nominal interest rate of 12 percent, but compounded monthly (consider deposit being done on the last day of the month and also accrual of interest being calculated on the last day of the month).

- A. Rs. 60000
- B. Rs. 62834
- C. Rs. 63413
- D. Rs. 64047

Ans. C

Sol. Monthly Interest rate = $\frac{12\%}{12} = 1\%$

$$P = 12 \times 5000 = 60000$$

$$\begin{aligned} \text{To find } F, \frac{F}{A} &= \frac{(1+i)^n - 1}{i} \\ &= \frac{(1+0.01)^{12} - 1}{0.01} = 12.68 \\ F &= 12.68 \times 5000 \\ &= \text{Rs. } 63413 \end{aligned}$$

46. Decrease or reduction in the value of an equipment or asset is called as:

- A. Saturation
- B. Depreciation
- C. Negotiation
- D. Valuation

Ans. B

Sol. Depreciation: a decrease in an asset's value, may be caused by a number of other factors as well such as unfavorable market conditions, etc. Machinery, equipment, currency are some examples of assets that are likely to depreciate over a specific period of time. Opposite of depreciation is appreciation which is increase in the value of an asset over a period of time.

Saturation: is the process or state that occurs when a place or thing is filled completely with people or things, so that no more can be added

Negotiation are formal discussions between people who have different aims or intentions, especially in business or politics, during which they try to reach an agreement.

Valutaion - A professional judgement about how much money something is worth

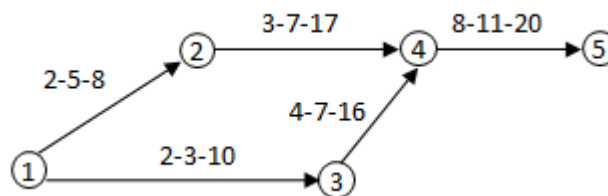
47. One of the main disadvantages of the bar chart for construction management is:

- A. The time schedule is not shown properly
- B. Progress of the work cannot be monitored
- C. The financial aspect is not shown
- D. Does not show the interdependencies of the activity

Ans. D

Sol. A bar chart shows the progress of activities with time but fails to depict interdependencies between varies activities.

48. For the given network the critical path is 1-2-4-5, then the value of standard deviation for the given network is



- A. 2.33
- B. 3.22
- C. 1.22
- D. 4.33

Ans. B

Sol.

Activity	t_0	t_m	t_p	t_e	σ
1-2	2	5	8	5	1
2-4	3	7	17	8	2.33
4-5	8	11	20	12	2

$$s \text{ for critical path} = \sqrt{1^2 + 2.33^2 + 2^2} = 3.229$$

49. The probability distribution taken to represent the completion time in PERT analysis is

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- A. Gamma distribution
C. Beta distribution
B. Normal distribution
D. Log normal distribution

Ans. C

Sol. PERT uses Beta distribution. It can be either left or right skewed.

50. A well graded soil has a coefficient of curvature between

- A. 10 to 12
C. 4 to 6
B. 7 to 9
D. 1 to 3

Ans. D

Sol. Both C_u and C_c will be 1 for a single-sized soil.

$C_u > 5$ indicates a **well-graded soil**, i.e. a soil which has a distribution of particles over a wide size range.

C_c **between 1 and 3** also indicates a well-graded soil.

51. If the value of uniformity coefficient of a soil sample is nearly equal to one. This sample will be designated as:-

- A. Well graded soil
C. Poorly graded soil
B. Uniformly graded soil
D. None of the above

Ans. B

Sol. Both C_u and C_c will be 1 for a single- sized soil.

$C_u > 5$ indicates a well-graded soil, i.e. a soil which has a distribution of particles over a wide size range.

C_c between 1 and 3 also indicate a well-graded soil.

$C_u < 3$ indicates a uniform soil, i.e. a soil which has a very narrow particle size range.

52. Density index of medium dense sand is

- A. 20
C. 50
B. 30
D. 80

Ans. C

Sol. Density index is given below

* 0-15 : very loose

* 15-35 : loose

* 35-65 : medium dense

* 65-85 : dense

* 85-100 : very dense

53. Plasticity index of the clay is

- A. 0
C. 12
B. 10
D. 20

Ans. D

Sol. * Sand 0

- * Silt 10-15
- * Clay 15-100

54. A granular soil deposit 8 m deep is resting over impervious layer. GWT is 4 m above the ground level. If GWT rises 5 m due to heavy rainfall, then what will be the change in effective stress at 4 m below ground level.

Given : $e = 0.6$, $G = 2.65$

- A. 39.24 kN/m^3
- B. 4 g/cc
- C. 19.94 kN/m^3
- D. no change

Ans. D

Sol. When GWT is above GL, then no change occurs in effective stress due to rise in GWT.

55. The grain size of the medium grained sand lies between

- A. $4.75 \text{ mm} - 2 \text{ mm}$
- B. $2 \text{ mm} - 0.425 \text{ mm}$
- C. $0.425 \text{ mm} - 75 \mu$
- D. $75 \mu - 2 \mu$

Ans. B

Sol. * $4.75 \text{ mm} - 2 \text{ mm}$ - coarse sand
 * $2 \text{ mm} - 0.425 \text{ mm}$ - medium sand
 * $0.425 \text{ mm} - 75 \mu$ - fine sand
 * $75 \mu - 2 \mu$ - silt

56. If natural void ratio of soil sample is 0.4 and if its void ratio in the densest state is 0.2. Then, find the value of Relative compaction for the soil sample.

- A. 0.8
- B. 0.86
- C. 1.16
- D. 1

Ans. B

Sol. $R_c = \frac{1+e_{min}}{1+e} = \frac{1+0.2}{1+0.4} = 0.86$

57. A layer of clayey soil is underlain by rock and overlain by sandy soil. The depth of the layer is 3 m. If the coefficient of consolidation of the clay was $0.02 \text{ cm}^2 / \text{min}$. Then the time when the settlement in the clay is the half of the final settlement is (T_v for 50% consolidation is 0.22)

- A. 1650 hours
- B. 95000 min
- C. 658 days
- D. 688 days

Ans. D

Sol. For 50% consolidation $T_v = 0.22$

$$T_v = \frac{C_v t}{d^2}$$

$$0.22 = \frac{0.02 t}{300^2}$$

$t = 990000 \text{ min.} = 16500 \text{ hours} = 687.5 \text{ days}$

58. The maximum dry density of soil is 15 kN/m^3 at OMC 23%. Find air void (%) of the soil. If specific gravity of soil is 2.6

- A. 10
C. 6
B. 2
D. 12

Ans. C

Sol. $Y_d = \frac{G \gamma_w}{1+e}$

$$15 = \frac{2.6 \times 9.81}{1+e}$$

$$e = 0.7$$

$$n = \frac{e}{1+e} = 0.41$$

$$S = \frac{G w}{e} = 0.85$$

$$\text{Air content } (a_c) = 1 - S = 0.15$$

$$\text{air void } (n_a) = a_c \times n = 0.06 = 6\%$$

59. Major principal stress at failure of a soil sample is 100kN/m² in confined compression test which make 50° angle with horizontal. Find shear parameter c and ϕ
- A. 0 °, 50 kN/m²
B. 0 °, 42 kN/m²
C. 10 °, 50 kN/m²
D. 10 °, 42 kN/m²

Ans. D

Sol. $50 = (45 + \phi/2)$

$$\phi = 10^\circ$$

$$100 = 0 + 2C \tan (50)$$

$$C = 42\text{kN/m}^2$$

60. Soil having volume of 1m³ and void ratio of 0.8 is compacted in lab such that the final void ratio is 0.4. Calculate the final volume after compaction.
- A. 0.6
B. 0.78
C. 0.9
D. 1

Ans. B

Sol. $\frac{V_1}{1+e_1} = \frac{V_2}{1+e_2}$

$$\frac{1}{1+0.8} = \frac{V_2}{1+0.4}$$

$$V_2 = 0.778 \text{ m}^3$$

61. A layer of clay is situated between two layers of sand. The settlement properties of the layer is to be found by application and removal of the loads. The soil has water content of 18%, plasticity index of 14% and plastic limit of 11%. The recompression ratio of the soil is 1/5 of the coefficient of compression. Then determine the value of recompression ratio
- A. 0.135
B. 0.027
C. 0.036
D. 0.125

Ans. B

Sol. $I_P = w_L - w_P$

$$w_L = I_P + w_P$$

$$w_L = 14 + 11 = 25$$

$$C_c = 0.009(w_L - 10) = 0.009(25 - 10) = 0.135$$

$$C_R = \frac{1}{5} \times C_c = \frac{0.135}{5} = 0.027$$

62. Find approximate value of ϕ of the granular soil sample having effective major principle stress at failure was 400kN/m² and minor principle stress was 400kN/m².

A. 30

B. 20

C. 40

D. 36

Ans. D

Sol. $400 = 100 \tan^2(45 + \phi/2) + 0$

$$\phi = 36^\circ$$

63. A fill have volume of 1500m³ is to be constructed at a void ratio of 0.6. The borrow pit soil has void ratio of 1.2. The volume of soil required to be excavated from the borrow pit will be

A. 10

B. 27

C. 30

D. 40

Ans. B

Sol. **For void ratio 1.2**

$$e = \frac{V_{v1}}{V_s} \text{ (Volume Of solid remains constant)}$$

$$V_{v1} = V_s \times 1.2$$

$$\text{Total volume} = 2.2V_s$$

For void ratio 0.6

$$e = \frac{V_{v2}}{V_s}$$

$$V_{v2} = V_s \times 0.6$$

$$\text{Total volume} = 1.6V_s$$

$$\text{Change in volume} = \frac{2.2 - 1.6}{2.2} = 27\%$$

64. Which of the following statement is correct for Triaxial test?

- A. UU test can be conducted in few minutes
- B. CU test is suitable for investigate of stability analysis of earthen dam due to sudden drawdown
- C. CD test is also known as slow test
- D. All of the above

Ans. D

Sol. * UU test can be conducted in few minutes

* CU test is suitable for investigate of stability analysis of earthen dam due to sudden drawdown

* CD test is also known as slow test

65. For a sample of sand void ratio at densest stage = 0.49

Void ratio at loosest stage = 1.29

What is the relative density of a sample prepared with a void ratio of 0.99?

- A. 62.5%
- B. 37.5%
- C. 45%
- D. 55%

Ans. B

Sol. Relative density = $\frac{e_{\max} - e}{e_{\max} - e_{\min}} \times 100$

$$= \frac{1.29 - 0.99}{1.29 - 0.49} \times 100$$

$$= \frac{0.3}{0.8} \times 100$$

$$= 37.5\%$$

66. The head falls from h_1 to h_2 in T time in a falling head permeability test. The test was repeated with same quantity of water. This time head fall from h_1 to h_3 in 0.5T time. Which of the following equations give relation between h_1 , h_2 , h_3 ?

- A. $h_3 = h_1 h_2$
- B. $h_3 = \sqrt{h_1 h_2}$
- C. $h_3 = \sqrt{h_2 / h_1}$
- D. $h_3 = \sqrt{h_1 / h_2}$

Ans. B

Sol. For falling head permeability test

$$Q = \frac{al \ln \frac{h_1}{h_2}}{AT}$$

Similarly,

$$Q = \frac{al \ln \frac{h_1}{h_3}}{0.5AT}$$

$$\frac{\ln \frac{h_1}{h_2}}{1} = \frac{\ln \frac{h_1}{h_3}}{0.5}$$

$$\sqrt{\frac{h_1}{h_2}} = \frac{h_1}{h_3}$$

$$h_3 = \sqrt{h_1 h_2}$$

67. Following are the results of pycnometers test :

Mass of Empty pycnometers, (M_1) = 945 gm

Mass of pycnometer and dry sample, (M_2) = 1145 gm of soil

Mass of pycnometer filled with dry sample and water, M_3 = 2071 gm

Mass of pycnometer filled with water, M_4 = 1945 gm

The specific gravity of soil is

- | | |
|---------|---------|
| A. 2.69 | B. 2.70 |
| C. 2.71 | D. 2.67 |

Ans. B

Sol. $G_s = \frac{(w_2 - w_1)}{(w_2 - w_1) - (w_3 - w_4)} = \frac{1145 - 945}{(1145 - 945) - (2071 - 1945)}$
 $= 2.70$

68. The combined footing can be _____ if the columns carry unequal loads

- | | |
|----------------|----------------------|
| A. Rectangular | B. Trapezoidal |
| C. Square | D. Any of the above. |

Ans. B

Sol. The combined footing can be trapezoidal, if the columns carry unequal loads

Note:

Combined footing

A combined footing supports two or more columns in a row. The combined footing can be rectangular if both the columns carry equal loads or can be trapezoidal if there are space limitations and carry unequal loads. Generally, they are constructed of reinforced concrete.

69. Pile foundation is generally used when the soil is

- | | |
|-----------------|----------------------------|
| A. Water logged | B. Compressible |
| C. Made-up type | D. All options are correct |

Ans. D

Sol. Pile foundation is generally used when the soil is compressible, water logged, and made-up type

Note:

The pile foundation is a construction for the foundation supported on piles. A pile is an element of construction composed of timber, concrete or steel or a combination of them.

Pile foundation may be defined as a column support type of foundation, which may be cast in situ or precast.

70. Any slope of great extent with uniform soil conditions at any given depth below the surface is termed as

- | | |
|-------------------|----------------------|
| A. Infinite slope | B. Finite slope |
| C. General slope | D. None of the above |

Ans. A

Sol. * Any slope of great extent with uniform soil conditions at any given depth below the surface is termed as infinite slope.

* Any slope of finite extent, i.e., with limited height, is termed as finite slope.

* All-natural slopes are infinite slopes: slopes of embankments, dams, cuts, canals, etc., are finite slopes.

71. Match List-I (Field test) with List-II (Useful for) and select the correct answer using the codes given below the lists:

List-I

- a. Vane shear test
- b. Standard penetration test
- c. Static cone penetration test
- d. Pressure meter test

List-II

- 1. End bearing and skin friction resistance
- 2. In-situ stress strain characteristics
- 3. Soft clay
- 4. Sandy deposits

Codes

- | | |
|--------------------|--------------------|
| A. a-4 b-2 c-1 d-3 | B. a-3 b-4 c-1 d-2 |
| C. a-4 b-3 c-2 d-1 | D. a-3 b-4 c-2 d-1 |

Ans. B

Sol. i) Vane shear test is useful method for measuring shear strength of clays

ii) SPT is an in-situ dynamic test used to provide an indication of relative density of granular deposits such as sands and gravels from which it is impossible to obtain undisturbed samples.

iii) Pressure meter test can be used to determine shear modulus (G), undrained shear strength, angle of shearing resistance and other engineering properties.

Sol. On differentiating the equation of motion twice with respect to time

$$\text{i.e. } \frac{ds}{dt} = 12t^2 - 14t$$

$$\frac{d^2s}{dt^2} = 24t - 14$$

at $t = 2$ sec

$$\text{Acceleration, } a = \frac{d^2s}{dt^2} = 24 \times 2 - 14 = 34 \text{ m/s}^2$$

76. In case of principal axes of a section _____.

- A. sum of moment of inertia is zero
- B. difference of moment of inertia is zero
- C. product moment of inertia is zero
- D. None of these

Ans. C

Sol. In case of principal axes of a section $I_{xy} = 0$

77. A bullet of weight 1.4g enters a wooden partition block at a velocity of 955 m/s and 0.003s after entering the block. Determine the length penetration of bullet.

- A. 0.71 m
- B. 1.56 m
- C. 1.43 m
- D. None of these

Ans. C

Sol. $F \cdot t = m(0 - v)$

$$F \times 0.003 = \frac{1.4}{1000} \times (0 - 955) = -1.337$$

$$F = -\frac{1.337}{0.003} = -445.667 \text{ N}$$

Using Work-Energy principle:

$$F \cdot S = \frac{1}{2} m(0^2 - v^2)$$

$$-445.667 \times S = \frac{1}{2} \times \frac{1.4}{1000} (0^2 - 955^2)$$

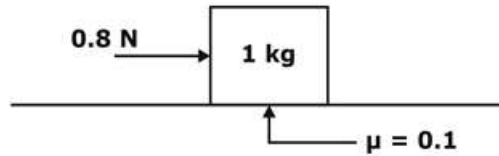
$$S = 1.4325 \text{ m}$$

78. The ratio of moment of inertia of circular disc of diameter 7 m to the square of side 7 m about centroidal axis is

- A. $\frac{3\pi}{32}$
- B. $\frac{3\pi}{64}$
- C. $\frac{9\pi}{32}$
- D. $\frac{3\pi}{16}$

Ans. D

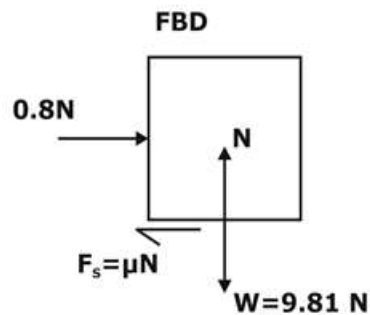
81. A 1 kg block is resting on a surface with coefficient of friction $\mu = 0.1$. A force of 0.8 N is applied to the block as shown in figure. The friction force is:



- A. Zero
B. 0.8 N
C. 0.89 N
D. 1.2 N

Ans. B

Sol.



Normal reaction on the block, $N = mg$

$$N = 1 \times 9.81 = 9.81$$

Force of friction on the block, $F_s = \mu N$

$$F_s = 0.1 \times 9.81 = 0.981 \text{ N}$$

Since $F_s > 0.8 \text{ N}$

Hence friction generated is same as applied force.

82. The natural frequency of a system increases with
- A. an increase in the stiffness of the system
B. a decrease in the mass of the system
C. both increase in the stiffness of the system and decrease in the mass of the system
D. neither increase in the stiffness of the system nor decrease in the mass of the system

Ans. C

Sol. $\omega = 2\pi f = 2\pi \sqrt{\frac{K}{M}}$

$$f \propto \sqrt{K} \text{ and } f \propto \frac{1}{\sqrt{M}}$$

As $K \uparrow$, $f \uparrow$ and as $M \downarrow$, $f \uparrow$

83. The body is sometimes acted by two or three force members and we need to find the moment of inertia for the same. The difference between the two and the three force members is:

- A. The former is collinear and the latter is parallel
- B. The former is parallel and the latter is perpendicular
- C. The former is perpendicular and the latter is collinear
- D. The former is acting on two points in the body while the latter is on three points

Ans. D

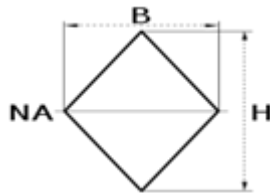
Sol. The definition of the two force member only defines that the forces are being acted on the two points on the body. So does the definition of the three forces members i.e. the points of action of the forces are three.

84. A bar of square section of area a^2 is held such that one of its diagonal is vertical. The maximum shear stress will develop at a depth h where h is

- A. $(2\sqrt{3})/4$
- B. $(3\sqrt{2})/4$
- C. $2/\sqrt{3}$
- D. $\sqrt{3}/4$

Ans. B

Sol. Side of square = a , $H = a\sqrt{2}$, In case of the diamond section $\tau_{max} = \frac{9}{8}\tau_{avg}$



85. S1- If U_1 is strain energy at Point 1, U_2 is strain energy at Point 2. If total strain energy is U then relation between strain energy can be defined as

$$U_1 + U_2 = U$$

S2- As per superimposed theorem resultant energy can be algebraic sum of energy at different points (provided they have linear variation)

- A. S1 is correct, S2 is incorrect
- B. S1 is incorrect, S2 is correct
- C. Both are corrected
- D. Both are incorrect

Ans. B

Sol. As per superimposed theorem if linear variation exist only then resultant is algebraic sum of all forces/stress

$$U = \frac{1}{2} \frac{\sigma^2}{E} \text{ hence } U_1 + U_2 \neq U$$

86. The point on the stress-strain curve up to which if the load is removed, the original volume and shape of the body are regained is called as:

- A. Elastic limit
- B. Material limit
- C. Ultimate point
- D. upper yield point

Ans. A

Sol. The elastic limit is that limit up to which any material behaves like an elastic material. Any material which is loaded up to the elastic limit returns back to its original volume and shape on unloading.

87. "Poisson's ratio" is defined as:

- A. ratio of lateral strain to linear strain
- B. ratio of linear strain to lateral strain
- C. ratio of lateral stress to linear stress
- D. ratio of linear stress to lateral stress

Ans. A

Sol. Poisson's ratio is the ratio of transverse contraction strain to longitudinal extension strain in the direction of stretching force.

So poisson's ratio, $\mu = \text{lateral strain} / \text{linear or longitudinal strain}$

88. Among the following identify the dimensionless quantity.

- A. Shear force
- B. Stress
- C. Strain
- D. Modulus of elasticity

Ans. C

Sol. The ratio of extension to original length is called strain it has no units as it is a ratio of two lengths and since both the lengths are considered, it becomes a dimensionless quantity.

89. For an isotropic, homogeneous and elastic material obeying Hook's law, number of independent elastic constants is

- A. 2
- B. 1
- C. 9
- D. None of these

Ans. A

Sol. There are 2 independent constants : Young's modulus, and Poisson's Ratio.

90. A circular column of length 2m has crushing load of 1.5kN and buckling load of 1.6kN. Find the Rankine failure load in kN

- A. 2.2
- B. 1.29
- C. 3.1
- D. 1.6

Ans. B

Sol. Rankine failure load = P

Crushing load = $P_c = 1.5\text{kN}$

Buckling load = $P_b = 1.6\text{kN}$

$$\frac{1}{P} = \frac{1}{P_b} + \frac{1}{P_c}$$

$$P = 1.29 \text{ kN}$$

91. The one that has least carbon content is:

- A. Wrought iron
- B. Cast iron
- C. Mild steel
- D. Pig steel

Ans. A

Sol. Cast iron (Pig iron) → It contains 2-5% of carbon.

Wrought iron → It is purest form of iron and contains carbon to the extent of .25%.

Steel → It contains .5 to 1.5% of carbon along with varying amount of other elements.

92. A uniform steel rod 1 m long and 20 mm diameter is at 27 °C. The coefficient of thermal expansion is $12 \times 10^{-6}/^{\circ}\text{C}$. Modulus of elasticity is 200 GPa. The increase in temperature of rod is increased to 87 °C. The temperature stress produced (in N/mm^2) if expansion is prevented is

- A. 288
- B. 144
- C. 1440
- D. 2880

Ans. B

Sol. Given, coefficient of thermal expansion, $\alpha = 12 \times 10^{-6}/^{\circ}\text{C}$

Modulus of elasticity, $E = 200 \text{ GPa} = 2 \times 10^5 \text{ N/mm}^2$

Change in temperature $\Delta T = 87 - 27 = 60^{\circ}\text{C}$

Temperature stress, $\sigma_T = \alpha E \Delta T = 12 \times 10^{-6} \times 2 \times 10^5 \times 60 = 144 \text{ N/mm}^2$

93. Of the several prismatic beams of equal lengths and of same material, the beam that can carry maximum load in flexure is the one having maximum

- A. Depth of section
- B. Area of cross-section
- C. Section modulus
- D. Moment of inertia

Ans. C

Sol.

As we know

$$\frac{M}{I} = \frac{\sigma}{y}$$

$$\Rightarrow M = \sigma \times \frac{I}{y} = \sigma \times Z$$

where Z = section modulus

94. The ratio of shear stress to shear strain within elastic limit is called

- A. Modulus of rigidity
- B. Modulus of elasticity
- C. Bulk modulus
- D. Poison's ratio

Ans. A

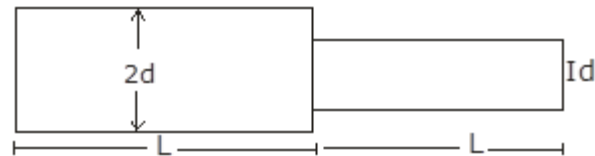
Sol. Modulus of rigidity = shear stress/shear strain

Modulus of elasticity = normal stress/ normal strain

Bulk modulus = normal stress/ volumetric strain

Poison's ratio = - lateral strain/ longitudinal strain

Sol.



Given, Ratio = $D_1/D_2 = 2$

$$\theta \propto \frac{1}{J} \propto \frac{1}{D^4} \Rightarrow \frac{\theta_1}{\theta_2} = \left(\frac{D_2}{D_1} \right)^4 = \frac{1}{16}$$

99. If for a given material $E = 2G$ (E is the modulus of elasticity and G is the modulus of rigidity of the material) then the bulk modulus of K will be:

A. $\frac{E}{3}$
C. $\frac{E}{4}$

B. $\frac{E}{2}$
D. E

Ans. A

Sol. The relation between three constants (E , K , and G) is given as

$$E = \frac{9KG}{G+3K}$$

$$E = 2G$$

$$9KG = 2G + 6K$$

$$3K = 2G = E$$

$$K = \frac{E}{3}$$

100. For the linear elastic structural system, minimization of potential energy yields

A. Strain displacement relations

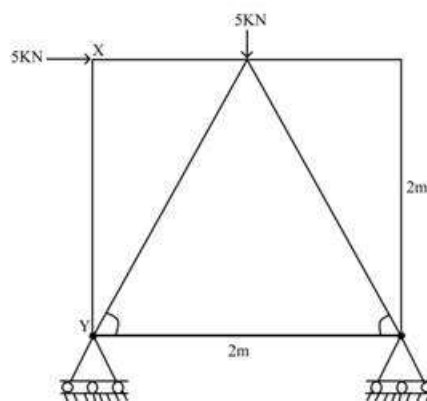
B. Constitutive relations

C. Equilibrium equations

D. Compatibility equation

Ans. D

101. If cross sectional area of each member is ' A ' and the modulus of elasticity of material is ' E '. then strain energy in the member XY of a truss, shown below, is



A. $\frac{25}{AE}$
C. $\frac{50}{3AE}$

B. $\frac{25}{3AE}$
D. Zero

Ans. D

Sol. Since force in member XY is zero, hence strain energy is zero.

the 5 KN force, member XY and the third member, all are meeting at a point, with 5 KN force and the third member as collinear

thus the force in the member XY that is non collinear member is zero

102. In planar system, X parts/members are there with Y no. of forces. If $Y > 3X$, the system is:

A. Statically indeterminate
C. Can't say

B. Statically determinate
D. Depends on other conditions

Ans. A

Sol. Indeterminate structures have more members and/or support reactions than required for static stability, so if a part (or member or support) of such a structure fails, the entire structure will not necessarily collapse, and the loads will be redistributed to the adjacent portions of the structure.

So if X is part of member and Y is no. of forces, then $Y > 3X$ shows the indeterminate structure.

103. A simple mass-spring oscillatory system consists of mass $m = 1$ kg, suspended from a spring of stiffness $k = 9$ N/m. Considering $z = 20$ mm as the displacement of system at time $t = 2$ second, the equation of motion for the free vibration of the system is $m\ddot{z} + kz = 0$. The natural frequency of the system is

A. 0.314 rad/sec
C. 0.11 rad/sec

B. 3 rad/sec
D. 9 rad/sec

Ans. B

Sol. Natural frequency of system = ω

From equation, $m\ddot{z} + kz = 0$

$$\ddot{z} + \frac{k}{m}z = 0$$

Comparing with equation of spring displacement, $a = \omega^2 x$

Where a is acceleration of system and x is displacement

$$\omega^2 = \frac{k}{m}$$

$$\omega = \sqrt{\frac{k}{m}}$$

$$\omega = \sqrt{\frac{9}{1}} = 3 \text{ rad/sec}$$

104. Which of the following is displacement method?

- A. Castigliano's theorem B. Strain energy method
C. Kani's method D. Flexibility matrix method

Ans. C

Sol. Examples of displacement method:

- a) Slope deflection method
b) Moment distribution method
c) Stiffness matrix method
d) Kani's method

105. Given that J is no. of joints. B and R are no. of members and no. of reactions.

If $B = 5$, $R = 4$ and $J = 4$, then the 2-d truss is:-

- A. Statically determinate B. Statically indeterminate
C. Stable D. Unstable

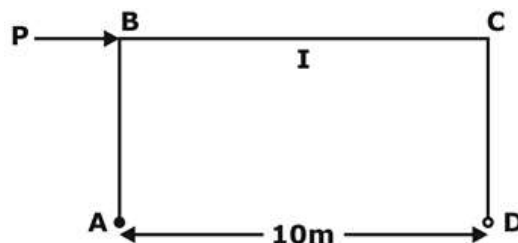
Ans. B

Sol. For truss,

$$B + R - 2J = 5 + 4 - 2 \times 4 = 1$$

So it is statically indeterminate structure.

106. A portal frame is shown in the given figure. If $\theta_B = \theta_C = \frac{400}{EI}$ radian, then the value of moment at B will be:



- A. 120 KNm B. 240 KNm
C. 360 KNm D. 480 KNm

Ans. B

Sol. The deformed shape of structure will have translation at B and C.

$$M_{BC} = 0 + \frac{2EI}{10} (2\theta_B + \theta_C)$$

$$M_{BC} = 0 + \frac{2EI}{10} \times 3 \times \frac{400}{EI} = 240 \text{ KNm}$$

107. Type of tendon used in Gifford-Udall system

- A. Wires and strands B. Wires
C. Bars threaded at ends D. Any of above

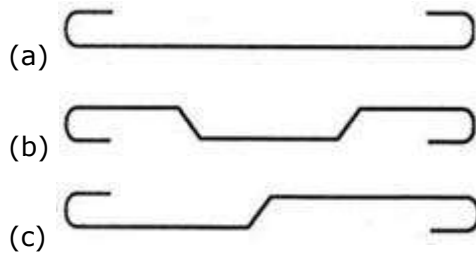
Ans. B

Sol. Freyssinet system = wires and strands

Lee-McCall system = bars threaded at ends

Magnel-Blaton system = wires

108. The properly bent up and hooked bar for resisting diagonal tension in beams is shown in which of the following figures?



- (a) (b) (c)
- A. (a) B. (b)
C. (c) D. None of these

Ans. B

Sol. Option b is the right arrangement of reinforcement to resist the diagonal tension.

109. Minimum spacing between horizontal parallel reinforcement of the same size should not be less than

- A. one diameter B. 2.5 diameters
C. 3 diameters D. 3.5 diameters

Ans. A

Sol. As per IS 456 the minimum horizontal spacing between two parallel main bars shall be diameter of larger bar or maximum size of coarse aggregate plus 5 mm. However, where compaction is done by needle vibrator, the spacing may be further reduced to two-third of the nominal maximum size of the coarse aggregate.

110. Which of the following statements is true?

- A. The self-weight of the footing is not considered for calculating the upward pressure on footing
B. The self-weight of the footing is also considered for calculating the upward pressure on footing
C. The self-weight of the footing is not considered for calculating the area of the footing
D. None of these

Ans. A

Sol. We know that,

Net upward pressure on footing = upward force / area of footings

(This formula is used to design the foundation of the structure)

So upward pressure force depends on upward force and area of footings, and does not depend on the self weight of the footing. This formula is used to design the foundation of the structure.

Sol. Permissible compressive strength of concrete, $\sigma_c = 7 \text{ Mpa}$

Neutral axis to depth ratio, $\frac{n}{d} = 0.25$

Where n is distance of neutral axis

d is depth of the beam

σ_t Is stress in steel

Modular ratio, $m = \frac{280}{3\sigma_c} = \frac{280}{3 \times 7} = 13.33$

$$\frac{n}{d} = \frac{m\sigma_c}{\sigma_t + m\sigma_c}$$

$$0.25 = \frac{13.33 \times 7}{\sigma_t + 13.33 \times 7}$$

$$0.25\sigma_t + 0.25 \times 13.33 \times 7 = 13.33 \times 7$$

$$\sigma_t = 280 \text{ MPa}$$

115. The critical section for shear is at a distance of from the periphery of the column, perpendicular to the plane of the slab where d is the effective depth of the section.

- A. d/3
B. d/2
C. 0.7d
D. 0.6d

Ans. B

Sol. As per Is code 456:2000, clause 31.6.1, the effective depth of the section is d/2

116. W_p and W_f are the weights of a cylinder containing partially compacted and fully compacted concrete. If the compaction factor (W_p/W_f) is 0.95, the workability of concrete is

- A. extremely low
B. very low
C. low
D. high

Ans. D

Sol.

Degree of workability	Slump(mm)	Compaction factor
Very low	0-25	.78
Low	25-50	.85
Medium	50-100	.92
High	100-180	.95

120. The gross diameter of a 16mm nominal diameter rivet is

- A. 17 mm B. 17.5 mm
C. 18 mm D. 18.5 mm

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