MEGA MOCK CHALLENGE

BYJU'S EXAM PREP

UPPSC

Mechanical Engineering

AE Paper-1 Mega Mock

(January 16th - January 17th 2022)

Questions & Solutions

1. बोरौ सवै रघुवंश कुठार की धार में बारन बाजि सरत्थहि।
बान की वायु उड़ाइ कै लच्छन लक्ष्य करौ अरिहा समरत्थहिं।
रामहिं बाम समेत पठै बन कोप के भार में भूजौ भरत्थहिं।
जो धनु हाथ धरै रघुनाथ तो आजु अनाथ करौ दसरत्थहि'।
इस पद्य में कौन-सा रस है?

A. शान्त रस
B. वीर रस
C. रौद्र रस
D. करुण रस

Ans. C

Sol. उपर्युक्त पद्य में परशुराम ने वचन कहे है।

राम, लक्ष्मण - विभाव

धनुष का टूटना अनिष्ट कार्य है, - जो उद्दीपन विभाव है।

अधर्म, गर्व, उग्रता - व्यभिचारी भाव

गर्वदीस कठोर भाषण, जिसमें राम, लक्षमण इत्यादि को ललकारा गया है - अनुभाव

इन अवयवों द्वारा 'क्रोध' स्थायी भाव जागृत होता है, अतएव यहाँ रौद्र रस है।

2. 'चरण कमल बंदौ रघुराई' में कौन सा अलंकार है?

A. श्लेष अलंकार
B. रूपक अलंकार
C. अनुप्रास अलंकार
D. यमक अलंकार

Ans. B

Sol. अलंकार - अलंकार का शाब्दिक अर्थ होता है 'आभूषण'। काव्य की शोभा बढ़ाने वाले शब्दों को अलंकार कहते है।

'चरण कमल बंदौ रघुराई' पंक्ति में रूपक अलंकार है। जहाँ उपमेय को उपमान के रूप में कर दिया जाए वहाँ रूपक अलंकार होता है।

रूपक अलंकार - जब गुण की अत्यंत समानता के कारण उपमेय को ही उपमान बता दिया जाए यानी उपमेय ओर उपमान में अभिन्नता दर्शायी जाए तब वह रूपक अलंकार कहलाता है।

3. **शोकग्रस्त** में समास है।

A. कर्मधारय तत्पुरुष समास
B. संप्रदान तत्पुरुष समास
C. संबंध तत्पुरुष समास
D. करण तत्पुरुष समास

Ans. D

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।

शोकग्रस्त = शोक से ग्रस्त (करण तत्पुरुष समास)

'तत्पुरुष समास - जिस समास का उत्तरपद प्रधान हो और पूर्वपद गौण हो उसे तत्पुरुष समास कहते हैं।

करण तत्पुरुष समास - जहाँ पर पहले पद में करण कारक का बोध होता है। इसमें दो पदों के बीच करण कारक छिपा होता है। करण कारक की विभक्ति **'के द्वारा' और 'से'** होती है। उसे करण तत्पुरुष समास कहते हैं।

समास और विभक्ति चिन्ह-

कर्मधारय तत्पुरुष समास – **'को'**

संप्रदान तत्पुरुष समास - **'के लिए'**

संबंध तत्पुरुष समास - **'का', 'के', 'की'**

4. निम्नलिखित पर्यायवाची शब्दों में से 'मछली' का पर्यायवाची नही है, उसे चयनित कीजिये-

A. मीन
B. सफरी
C. निलय
D. झष

Ans. C

Sol. मछली के पर्यायवाची मत्स्य, मीन, सफरी, झष, जलजीवन इत्यादि होते है। निलय, गृह का पर्यायवाची शब्द है। अतः विकल्प C सही उत्तर है।

5. 'परिसीमन' का विलोम है।

A. ससीम
B. निरसीमन
C. असीम
D. ससीमन

Ans. B

Sol. विलोम - ऐसे शब्द जिनका अर्थ विपरीत या उल्टा हों, उन शब्दों को विलोम शब्द कहते हैं।

दिए गए शब्दों में "परिसीमन" का विलोम शब्द "निरसीमन" है परिसीमन का अर्थ सीमा निर्धारित करना से सम्बंधित होता है जबकि निरसीमन शब्द का अर्थ सीमाओं के अधीन से सम्बंधित होता है।

6. 'कर्पट' का तदभव रूप कौनसा है?

A. कपट
B. कारपोट
C. कपूर
D. कपड़ा

Ans. D

Sol. कर्पट (तत्सम) का तदभव रूप कपड़ा है|

7. क्षणिक एवं तीव्र आनंद। वाक्य के लिए एक शब्द होगा-

A. आनंद
B. आह्लाद
C. उल्लास
D. प्रसन्नता

Ans. B

Sol. आनंद- खुशी का स्थायी और गंभीर भाव।

आह्लाद- क्षणिक एवं तीव्र आनंद।

उल्लास- सुख-प्राप्ति की अल्पकालिक क्रिया, उमंग।

प्रसन्नता-साधारण आनंद का भाव।

8. 'आये थे हरि भजन को ओटन लगे कपास' – मुहावरे का अर्थ क्या है?

A. उद्देश्य की प्राप्ति में असफल होना
B. ईश्वर भक्ति को छोड़कर व्यापार में लग जाना
C. हरि भक्ति का मार्ग कठिन होता है
D. किसी कार्य विशेष की उपेक्षा कर दूसरे कार्य को करना

Ans. D

Sol. विशेष अर्थ को प्रकट करने वाले वाक्यांश को मुहावरा कहते हैं। अत: आए थे हरि भजन को ओटन लगे कपास एक प्रचलित हिन्दी मुहावरा है। अर्थ - उच्च लक्ष्य लेकर चलना पर कोई घटिया सा काम करने लगना।

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

A. प्रसंशा
B. जिव्हा
C. जुखाम
D. यथेष्ट

Ans. D

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

दिए गये विकल्पो में यथेष्ट की वर्तनी शुद्ध है अन्य सभी वर्तनी अशुद्ध है।

विकल्पों की शुद्ध वर्तनी –

प्रसंशा – प्रशंसा

जिव्हा – जिह्वा

जुखाम – जुकाम

10. अशुद्ध वाक्य का चयन करें-

A. माता-पिता का आदर करना चाहिए।
B. घी बहुत अच्छा नहीं है।
C. वह कक्षा का सर्वश्रेष्ठ छात्र है।
D. पाप बढ़ती है तो वर्षा नहीं होता।

Ans. D

Sol. वाक्य में लिंग और क्रिया सम्बंधी त्रुटि है। अतः बढ़ती के स्थान पर बढ़ता तथा होता के स्थान पर होती का प्रयोग करना उचित है।

अशुद्ध वाक्य - शुद्ध वाक्य

पाप बढ़ती है तो वर्षा नहीं होता। - पाप बढ़ता है तो वर्षा नहीं होती।

11. निम्न में से ''भ्वादि'' शब्द मे संधि है?

A. स्वर संधि
B. व्यंजन संधि
C. विसर्ग संधि
D. यण संधि

Ans. D

Sol. दिए गए विकल्पों में से सही विकल्प D है।

संधि (सम् + धि) शब्द का अर्थ है 'मेल'। दो निकटवर्ती वर्णों के परस्पर मेल से जो विकार (परिवर्तन) होता है वह संधि कहलाता है।

भ्वादि = भू + आदि (यण संधि)

नियम - ऊ + आ = वा

यण संधि - जब संधि करते समय इ, ई के साथ कोई अन्य स्वर हो तो ' य ' बन जाता है, जब उ, ऊ के साथ कोई अन्य स्वर हो तो ' व् ' बन जाता है , जब ऋ के साथ कोई अन्य स्वर हो तो ' र ' बन जाता है।

12. निम्न में स्त्रीलिंग शब्द है –

A. पानी
B. रवि
C. कवि
D. तिथि

Ans. D

Sol. आज की तिथि क्या है |

इकारांत शब्द प्राय: स्त्रीलिंग होते है |

13. निम्न में से कौन-सा वचन का जोड़ा सही है -

A. डिबिया – डिबियें
B. सुधि - सुधिजन
C. पाठक – पाठकजन
D. कली - कलियों

Ans. B

Sol. वचन - शब्द के जिस रूप से एक या एक से अधिक का बोध होता है, उसे 'वचन' कहते है।

बहुवचन - शब्द के जिस रूप से एक से अधिक व्यक्ति या वस्तु होने का ज्ञान हो, उसे बहुवचन कहते है।

एकवचन - संज्ञा के जिस रूप से एक वस्तु होने का ज्ञान हो, उसे एकवचन कहते है।

सुधि का बहुवचन सुधिजन होता है अन्य विकपों का युग्म सही नहीं है।

विकल्पों का सही युग्म -

एकवचन - बहुवचन

कली - कलियाँ

डिबिया - डिबियाँ

पाठक - पाठकगण

14. **'पेड़ से बन्दर कूदा'** वाक्य में कौन-सा कारक है?

A. अपादान कारक
B. कर्म कारक
C. सम्प्रदान कारक
D. करण कारक

Ans. A

Sol. पेड से बन्दर कूदा। इस वाक्य में 'से' अलग होने के भाव को दर्शाता है जो अपादान कारक का उदाहरण हैं।

अपादान कारक - अपादान कारक का भी विभक्ति चिन्ह से होता है। से चिन्ह करण कारक का भी होता है लेकिन वहां इसका मतलब साधन से होता है।

15. **पुष्कर का अनेकार्थी शब्द है।**

A. मेवा
B. नतीजा
C. कमल
D. पेड़ का फल
E. तलवार

Ans. C

Sol. **पुष्कर-** तालाब, कमल, आकाश, तलवार

फल- लाभ, मेवा, नतीजा, पेड़ का फल, तलवार, भाले की नोक

16. निम्न में से ''मतैक्य'' शब्द मे संधि है?

A. यण संधि
B. अयादि संधि
C. गुण संधि
D. वृद्धि संधि

Ans. D

Sol. दिए गए विकल्पों में से सही विकल्प D है।

संधि (सम् + धि) शब्द का अर्थ है 'मेल'। दो निकटवर्ती वर्णों के परस्पर मेल से जो विकार (परिवर्तन) होता है वह संधि कहलाता है।

मतैक्य = मत + ऐक्य (वृद्धि संधि)

नियम – अ + ऐ = ऐ

वृद्धि संधि - जब संधि करते समय जब अ , आ के साथ ए , ऐ हो तो ' ऐ ' बनता है और जब अ , आ के साथ ओ , औ हो तो ' औ ' बनता है। उसे वृधि संधि कहते हैं।

17. जन रंजन मंजन दनुज मनुज रूप सुर भूप।
विश्व बदर इव धृत उदर जोवत सोवत सूप।।
इस पद में कौनसा अलंकार है?

A. यमक
B. श्लेष
C. अनुप्रास
D. इनमें से क़ोई नहीं|

Ans. C

Sol. अनुप्रास शब्द 'अनु' तथा 'प्रास' शब्दों से मिलकर बना है। 'अनु' शब्द का अर्थ है- बार- बार तथा 'प्रास' शब्द का अर्थ है- वर्ण।
अनुप्रास अलंकार में वर्णों की बार -बार आवृत्ति होती है।

दिए गए वाक्य में **स एवं द** वर्ण की आव्रति एक से अधिक बार हो रही है इसीलिये दिए गए पद में अनुप्रास अलंकार है। एक और अन्य उदाहरण के माध्यम से हम इसे समझा सकते हैं-

रीझि रीझि रहसि रहसि हँसि हँसि उठै,
साँसैं भरि आँसू भरि कहत दई दई।

18. 'दोराहा' में कौन-सा समास है?

A. द्वंद्व
B. अव्ययीभाव
C. द्विगु
D. तत्पुरुष

Ans. C

Sol. दो या दो से अधिक शब्दों के मेल से बने हुए नवीन एवं सार्थक शब्द को समास कहते है दोराहा - दो राहों का समाहार। 'दोराह' में द्विगु समास है।
द्विगु समास में पहला पद संख्यावाचक होता है विग्रह करने पर समूह का बोध होता है।

19. 'धूसर' शब्द का पर्याय है।

A. अश्व
B. मेघ
C. गर्दभ
D. अजा

Ans. C

Sol. पर्यायवाची का संधि विच्छेद पर्याय+वाची जहा 'पर्याय' का अर्थ है- 'समान' तथा 'वाची' का अर्थ है- 'बोले जाने वाले' अर्थात जिन शब्दों का अर्थ एक जैसा होता है, उन्हें 'पर्यायवाची शब्द' कहते हैं।
धूसर शब्द का पर्याय गर्दभ है अन्य विकल्प धूसर के पर्याय नहीं है।

धूसर के पर्याय - शीतलावाहन, चक्रीवान, गधा, गर्दभ, खर

20. दिए गए शब्द का विलोम चुनें।

नूतन

A. निर्माण

B. पुरातन

C. दूर

D. धीर

Ans. B

Sol. दिए गए विकल्पों में से सही विकल्प B है 'नूतन' का विलोम 'पुरातन' होता है।

विलोम का अर्थ - उल्टा या विपरीत अर्थ बताने वाले शब्द को विलोम शब्द कहते हैं।

अन्य विकल्प –

निरक्षर - साक्षर

निर्माण - विनाश

निकट - दूर

धीर – अधीर

21. निम्न मे से तत्सम और तद्भव शब्दों का कौन-सा मेल गलत है?

A. भ्रमर – भौंरा

B. भ्रात – भाई

C. भिक्षा – भीख

D. वारिद – पानी

Ans. D

Sol. दिए गये विकल्पों में सही रूप बादल (तदभव) – वारिद (तत्सम) , पानी के स्थान पर बादल आयेगा।

वारिद – बादल

तत्सम - तत्सम (तत् + सम = उसके समान) आधुनिक भारतीय भाषाओं में प्रयुक्त ऐसे शब्द जिनको संस्कृत से बिना कोई रूप बदले ले लिया गया है।

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

22. **निर्देश:** नीचे कुछ वाक्यांश या शब्द दिए गये हैं और उसके बाद चार शब्द दिए गये हैं जो एक ही शब्द में इस वाक्यांश या शब्द-समूह का अर्थ प्रकट करता है। आपको यह पता लगाना है कि वह शब्द कौन सा है जो वाक्यांश या शब्द समूह का सही अर्थ प्रकट करता है। उस विकल्प का क्रमांक ही आपका उत्तर है। यदि कोई शब्द अर्थ नहीं प्रकट करता है तो उत्तर (5) अर्थात् इनमें से कोई उत्तर नहीं है।

जिसका जन्म कन्या के गर्भ से हुआ हो

A.कन्यापुत्र

B.अवैधपूर्ण

C. कानीन

D. कुमारीपुत्र

E. इनमें से कोई नहीं

Ans. C

Sol. "जिसका जन्म कन्या के गर्भ से हुआ हो" वाक्यांश के लिए एक शब्द "कानीन" उचित है।

अन्य विकल्प -

कन्यापुत्र का अर्थ - कन्या का पुत्र

अवैधपूर्ण का अर्थ - जिसमें कोई वैधता न हो

कुमारीपुत्र का अर्थ - कुमारी का बेटा

कानीन का अर्थ - जिसका जन्म कन्या के गर्भ से हुआ हो'

23. 'आँख का अंधा नाम नयनसुख' – लोकोक्ति का क्या अर्थ है?

A. आँख की रोशनी जाना
B. नामकरण करना
C. गुण के विरुद्ध नाम का होना
D. संतुष्ट होना

Ans. C

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

'आँख का अंधा नाम नयनसुख' एक प्रचलित लोकोक्ति है।

लोकोक्ति का अर्थ- नाम के अनुसार गुण न होना।

प्रयोग- उसका नाम तो करोड़ीमल है परन्तु वह पैसे-पैसे के लिए मारा-मारा फिरता है। इसे कहते है- आँखों के अन्धे नाम नयनसुख।

24. निर्देश: वर्तनी के अनुसार शुद्ध शब्द का चयन कीजिए:

A. अलोकित
B. अलौकिक
C. अलोकिक
D. आलौकिक

Ans. B

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

उपरोक्त शब्दों में 'अलौकिक' वर्तनी के अनुसार शुद्ध रूप है बाकी सभी शब्द वर्तनी के अनुसार गलत शब्द है। अलौकिक शब्द का अर्थ अद्भुत या अपूर्व।

25. **निर्देश:-** दिए गए वाक्य का वह भाग ज्ञात करें जिसमें कोई त्रुटि है।

शिक्षक से व्यक्ति के भविष्य को बनाया जाता है।

A. व्यक्ति के
B. बनाया जाता है
C. शिक्षक से
D. भविष्य को

Ans. C

Sol. शिक्षक से व्यक्ति के भविष्य को बनाया जाता है।" वाक्य में करक का अशुद्ध प्रयोग किया गया है। क्योकि 'से' करक के स्थान पर 'के द्वारा' सही है अत:

विकल्प C में अशुद्धि है।

शुद्ध पूर्ण वाक्य - शिक्षक **के द्वारा** व्यक्ति के भविष्य को बनाया जाता है।

कारक -

कर्त्ता - ने

कर्म - को

करण - से, के द्वारा

सम्प्रदान - को, के लिए

अपादान - से (अलग होने के अर्थ में)

संबंध - का, के, की

अधिकरण - में, पर

सम्बोधन - हे!, ओ!, अरे!

26. A single degree of freedom vibrating system has the following data associated with it.

Mass = 5kg

Stiffness = 500N/m

Damping Coefficient = 100 N-s/m

Which of the following must be done to make the system critically damped?

A. No change in any parameter is required

B. Stiffness to be doubled

C. Damping coefficient to be halved

D. Increase in mass by 4 times.

Ans. A

Sol. Given data,

m = 5kg, k = 500N/m, c = 100N-s/m

For critical damping

$$c_c = 2\sqrt{mk} = 2\sqrt{5\ X\ 500} = 100N - s/m$$

As given damping coefficient is same as critical damping coefficient no change in any of the system parameters is required.

27. The magnitude of two forces, which when acting at right angle produce resultant force of $\sqrt{10}$ and when acting at 60° produces resultant of $\sqrt{13}$. Then the forces are

A. 2 and 5

B. 3 and 1

C. 2 and $\sqrt{6}$

D. $\sqrt{5}$ and $\sqrt{5}$

Ans. B

Sol. $R = \sqrt{(A^2 + B^2 + 2AB\cos\emptyset)}$

When φ = 90

$10 = A^2 + B^2 \longrightarrow 1$

When φ = 60

$13 = A^2 + B^2 + 2AB\cos 60$

$13 = A^2 + B^2 + 2ABx\frac{1}{2}$

From 1 ($A^2 + B^2 = 10$)

13=10 +AB

AB=3

thus ,

$(A-B)^2 = A^2 + B^2 - 2AB$

$(A-B)^2 = 10 - 2\times 3$

A-B = 2

$(A+B)^2 = A^2 + B^2 + 2AB$

$(A+B)^2 = 10 + 2\times3$

A+B =4

so A = 3, B = 1

From above option B is correct

28. While cooling, a cubical casting of side 50 mm undergoes 1%, 2% and 3% volume shrinkage during the liquid state, phase transition and solid state, respectively. The volume of metal compensated from the riser is _____.

A. 2% B. 3%

C. 5% D. 6%

Ans. B

Sol. As Risers are used to compensate shrinkage before solidification i.e. liquid shrinkage and shrinkage during phase change.

Therefore, the volume of the metal compensated from the riser = 1+2 = 3%.

29. Machinability is judged by the factor

A. Tool life B. Surface finish

C. Power Consumption D. All of the above

Ans. D

Sol. Machinability is a term indicating how the work material responds to the cutting process. In the most general case good machinability means that material is cut with good surface finish, long tool life, low force and power requirements, and low cost.

30. Find the speed of the gear if the worm is a three start worm rotating at 500 rpm. The gear has 20 teeth.

A. 125 rpm B. 100 rpm

C. 75 rpm D. 50 rpm

Ans. C

Sol. $N_1/N_2 = T_2/T_1$

$500/N_2 = 20/3$

N_2 = 75 rpm

Thus, the gear rotates at a speed of 75 rpm.

31. A Screw will be self-locking, if _____.

A. Friction angle is less than helix angle

B. Friction angle is more than helix angle

C. Friction angle is equal to helix angle

D. none of these

Ans. B

Sol.

- If Screw has friction angle more than helix angle, it is said to be self locking, else it is known as over-hauling screw.

32. Which of the following manufacturing processes is mainly considered for producing the components of very high strength?

A. Casting
B. Forging
C. Extrusion
D. Rolling

Ans. B

Sol. Forging is a deformation process in which the material is compressed between the dies by using the impact load or hydraulic load. This process includes large forces which gradually or instantly deformed the material resulting in production of variety of high strength components like connecting rods, gears, jet engine turbine parts, aircraft parts etc.

33. Miss Strike is a_____.

A. Casting Defect
B. Welding Defect
C. Extrusion Defect
D. Deep Drawing Defect

Ans. D

Sol.

- Miss Strike is a deep drawing defect. While drawing a rolled stock, ears or lobes tend to occur because of the anisotropy induced by the rolling operation. Due to these misplacements of the stock, unsymmetrical flanges may result. This is called Miss Strike.

34. In whitworth quick return mechanism, if length of extension link on which tool is pivoted is 150 mm, then what is the length of stroke?

A. 75 mm
B. 150 mm
C. 300 mm
D. 600 mm

Ans. C

Sol. In whitwoth quick return mechanism, length of stroke = 2×(length of extension link)
= 2×150
length of stroke = 300 mm

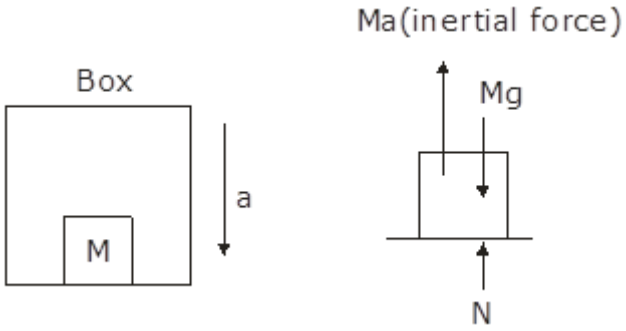
35. For a material with the Poisson's ratio μ, the modulus of elasticity (E) and the bulk modulus of elasticity (K) are same. Which of the following is correct?

A. The material has μ = 0
B. The material has μ = 1/2
C. The material has μ = 1/3
D. The material has μ= 3/4

Ans. C

Sol. Given condition is E = K.
so we know that,
E = 3K (1 – 2μ),
1 = 3 (1 – 2μ)
It means poisons ratio will be 1/3.

36. With what acceleration should the box shown in the figure below descend so that the block of mass M exerts a force $\frac{Mg}{4}$ on the floor of the box?



A. g/2
B. g
C. 5g/4
D. 3g/4

Ans. D

Sol. ∑Fy=0

⇒ Mg-N=Ma

⇒ Mg- $\frac{Mg}{4}$ =Ma

⇒ a= $\frac{3g}{4}$

37. Cotter joint is used to transmit _____.

A. Axial tensile load only
B. Axial compressive load only
C. Combined axial and twisting load only
D. Axial tensile or compressive load

Ans. D

Sol.

- Cotter joint mainly used to connect rigidly two rods which transmit motion in the axial direction, without rotation.
- These joints may be subjected to tensile or compressive forces along the axes of the rods.

38. If the undeformed chip thickness is 2 mm and shear angle to $30°$. Then what is the length of the shear plane?

A. 1 mm
B. 2 mm
C. 4 mm
D. 8 mm

Ans. C

Sol. Length of shear plane $= \frac{t_1}{\sin\phi} = \frac{2}{\sin 30} = 4\,mm$

39. The cross-section of a bar is subjected to an uniaxial tensile stress 'P'. The tangential stress on a plane inclined at θ to the cross-section the bar would be.

A. $\frac{P\sin 2\theta}{2}$
B. $P\sin 2\theta$
C. $\frac{P\cos 2\theta}{2}$
D. $P\cos 2\theta$

Ans. A

Sol.

$$Normal\ stress = P\cos^2\theta$$

$$\text{Tan } gential\ stress = P\sin\theta\cos\theta$$

$$= \frac{P\sin 2\theta}{2}$$

40. If the arrivals at a service facility are distributed as per the Poisson distribution with a mean rate of 10 per hour and the services are exponentially distributed with a mean service time of 4 minutes, what is the probability that a customer may have to wait to be served?

A. 0.40 B. 0.50

C. 0.67 D. 1.00

Ans. C

Sol. Arrivals at a rate of 10/hour

$\lambda = 10$

Service is at the rate of 4 minutes interval

$\mu = 15$

$$\rho = \frac{\lambda}{\mu} = \frac{10}{15} = 0.67$$

41. The dimension of couple in MLT system is_____.

A. MLT B. ML^2T^{-1}

C. MLT^{-1} D. ML^2T^{-2}

Ans. D

Sol.

- Couple is the moment produced so it's unit is Nm and dimensional system is ML^2T^{-2}.

42. Maximum shear stress theory was postulated by _____.

A. ST Venant B. Mohr

C. Rankine D. Tresca

Ans. D

Sol.

- Maximum shear stress theory was postulated by Tresca.
- Tresca yield criterion: It states that when the maximum shear stress within an element is equal to or greater than a critical value, yielding will begin.

43. In an 8085 microprocessor, the shift registers which store the result of an addition and the overflew bit are, respectively _____.

A. B and F B. A and C

C. A and F D. H and F

Ans. C

Sol.

- In an 8085 microprocessor, after performing the addition, result is stored in accumulator (A) and if any carry (overflow bit) is generated it updates flags.
- Microprocessor consists 6 general purpose registers of 8-bit each named as B, C, D, E, H and L. Generally, theses registers are not used for storing the data permanently.

44. When an IC engine, having crank & connecting rod of lengths, 250 mm & 1250 mm respectively, is running at 625 rpm, the maximum magnitude of the primary forces is observed to be 625N. The magnitude of maximum secondary forces would be (in N):

A. 625 N B. 256 N

C. 37.5 N D. 125 N

Ans. D

Sol. By definition, the maximum value of Primary forces will be:

$$F_P = mr\omega^2 = 625N$$

Similarly, the maximum value of secondary forces will be:

$$F_s = \frac{mr\omega^2}{n}$$

$$where, n = \frac{L}{r} = \frac{1250}{250} = 5$$

$$\therefore F_s = \frac{625}{5}$$

$$\therefore F_s = 125N$$

45. A 500 mmx 20 mm flat surface of a plate is to be machined on a shaping machine. The plate is fixed with 500mm side along the tool travel direction. The over-travel of tool at each end of plate is 15 mm. The average cutting speed is 8 m/min, feed rate is 0.5 mm/stroke and the quick return ratio is 0.5. The machining time is:

A. 5 min B. 4 min

C. 6 min D. 7 min

Ans. B

Sol. Given,

L= 500mm

Over-travel (OT) = 15 mm.

Average cutting speed (V_c) =8 m/min, f= 0.5 mm/stroke,

Quick return ratio (m) =0.5

Total number of double strokes:

$$N = \frac{width}{feed\ per\ stroke} = \frac{20}{0.5} = 40$$

width w=20 mm

Since quick return ratio: $m = \frac{V_c}{V_r}$

Where: V_r = average return speed

$$0.5 = \frac{8}{V_r} \Rightarrow V_r = 16\ m/min$$

Total length of cut (L_c) =L+2OT =500+2x15 =530 mm = 0.530 m

Time of one double stroke:

$$t = \frac{L_c}{V_c} + \frac{L_c}{V_r} = \frac{0.530}{8} + \frac{0.530}{16} = 0.099375\ min$$

Total machining time (T_m)=Nxt= 40x0.099375 = 3.975 min

46. For long column of length L, what will be the ratio of $\left(\frac{P_1}{P_2}\right)$. Where, P_1 = Euler's buckling load, when both ends are hinged and P_2 = Euler's buckling load, when both ends are fixed.

A. $\frac{1}{4}$ B. $\frac{1}{2}$

C. 1 D. 4

Ans. A

Sol. Buckling load is given by Euler's formula:

$$P = \frac{\pi^2 EI}{l_e^2}$$

Where,

l_e = effective length of the column.

When both ends are hinged: $l_e = L$

$$P_1 = \frac{\pi^2 EI}{L^2}$$

$$P_2 = \frac{\pi^2 EI}{l_e^2};\ l_e = \frac{L}{2}\ (\text{for both ends fixed})$$

$$\therefore P_2 = \frac{\pi^2 EI}{\left(\frac{L}{2}\right)^2} = \frac{4\pi^2 EI}{L^2} = 4(P_1)$$

Hence, $\frac{P_1}{P_2} = \frac{1}{4}$

47. In smoothing method of forecasting, the weight to demand data assigned

A. In an exponentially increasing order from most recent data to last data.

B. In an exponentially decreasing order from most recent data to last data.

C. Equally weight to all past data.

D. None of the above

Ans. B

Sol. In smoothing method of forecasting, the weight to demand data assigned in an exponentially decreasing order from most recent data to last data.

48. The permissible shear stress in a fillet used is 100 MPa. The fillet weld has equal leg length of 15 mm each. The allowable shear load on element per mm is

A. 2.25 kN

B. 1.5 kN

C. 1.06 kN

D. 0.15 kN

Ans. C

Sol. $\tau = \frac{F}{A} = \frac{F}{t \times L}$

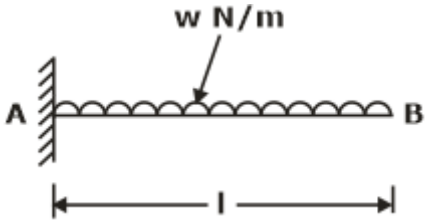
$\tau = \frac{F}{0.707 \times S \times L}$

$100 = \frac{F}{0.707 \times 15 \times 1}$

F = 1060.5 N

F = 1.06 kN

49. For the cantilever beam as shown below:



The slope At end 'B' will be:

A. $\frac{wL^3}{5EI}$

B. $\frac{5}{384}\frac{wL^3}{EI}$

C. $\frac{wL^3}{48EI}$

D. $\frac{wL^3}{6EI}$

Ans. D

Sol. Given:

For uniformly loaded cantilever beam,

Load = w N/m

Length of the beam = l

For this loading condition:

$\text{Slope at B} = \theta_B = \frac{wL^3}{6EI}$

50. In a manufacturing assembly, Break even point can be reduced by _____.

A. by decreasing the sales value

B. by increasing the fixed cost

C. by decreasing the variable cost

D. by increasing the total cost

Ans. C

Sol. Break even point is the point at which there is no profit and no loss.

At this point total cost (sum of fixed cost and variable cost) equals to the sales value.

$x_{BEP} = \frac{F}{s - v}$

Thus, BEP can be reduced by:

(i). by increasing unit sales value

(ii). by decreasing Fixed cost

(iii). by decreasing unit variable cost

51. In a rolling operation using rolls of diameter 800mm , the thickness of a plate reduces from 20mm to 8mm in 4 passes with equal reduction in each pass. The coefficient of friction between the plate and the roll is _____.

A. 0.7 B. 0.07

C. 0.8 D. 0.08

Ans. D

Sol. Maximum reduction per pass:

$$\Delta t = \mu^2 R$$

Reduction in 4 passes = 4 × Δt

$20 - 8 = 4 \times \mu^2 \times 400$

$12/1600 = \mu^2$

$\mu = 0.086$

52. Which of the following is not a technique for plant layout?

A. Process charts B. Travel charts

C. Man-machine charts D. Relationship charts

Ans. C

Sol. Man machine chart is not a plant layout technique it is a work study technique. While Process chart, travel chart and relationship chart are methods for plant layout.

53. The SDE analysis is done based on

A. purchase value B. purchase quantity

C. purchasing problems D. purchase rate

Ans. C

Sol. The SDE analysis is done based on purchasing problems, such as long lead time, scarcity and hardly availability, geographically scattered sources, uncertainty in supply.

54. At the point of contraflexure _____.

A. shear force changes its behaviour

B. bending moment changes its behaviour

C. shear force is maximum

D. shear force is minimum

Ans. B

Sol.

- Contraflexture is a location where bending moment is zero or changes its sign.

55. For a power transmission shaft that transmits power P kW at N rpm, then the diameter of the shaft is proportional to (keeping τ constant)-

A. $\left(\frac{P}{N}\right)^{1/3}$ B. $\left(\frac{P}{N}\right)^{1/2}$

C. $\left(\frac{P}{N}\right)^{2/3}$ D. $\frac{P}{N}$

Ans. A

Sol. Power $= \frac{2\pi NT}{60}$

$\therefore \frac{T}{J} = \frac{T}{r}$

$T = \frac{\pi}{16} d^3 \tau$

$P = \frac{2\pi N}{60} \times \frac{\pi}{16} d^3 \tau$

d is proportional to $\left(\frac{P}{N}\right)^{1/3}$

56. A body that undergoes deformation when acted upon by loads is called as?

A. Streamlined body B. Bluff body

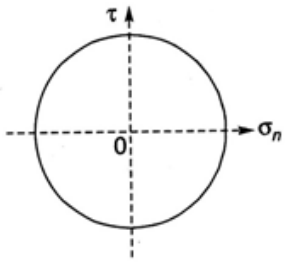
C. Real body D. Gray body

Ans. C

Sol.

- A real body is one that undergoes deformation when acted upon by external loads or forces.
- In practice, every real body can also be represented by an equivalent spring.

57. Consider the Mohr's circle show below:



What is the state of stress represented by this circle?

A. $\sigma_x = \sigma_y \neq 0, \tau_{xy} = 0$

B. $\sigma_x = \sigma_y = 0, \tau_{xy} \neq 0$

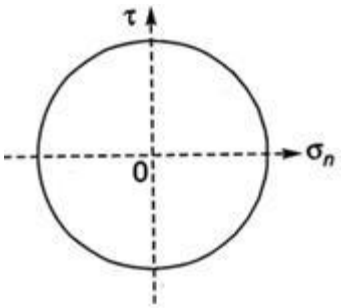
C. $\sigma_x = 0, \sigma_y = \tau_{xy} \neq 0$

D. $\sigma_x \neq 0, \sigma_y = \tau_{xy} = 0$

Ans. B

Sol.

- The state of stress represented by $\sigma_x = \sigma_y = 0, \tau_{xy} \neq 0$.



- Another possible case: $|\sigma_x| = |\sigma_y| = \tau_{xy}$ i.e. here $\sigma_x = \sigma_y$ are of same magnitude but have different signs.
- When $\sigma_x = \sigma_y \neq 0$ then centre will be of zero radius.

58. Reason of flank wear is _____.

A. Abrasion B. Diffusion

C. Adhesion D. None of these

Ans. A

Sol.

- Flank wear occurs at the tool flanks (side of tools) as a result of the abrasion (caused by hard constituents in the workpiece material).
- The flank wear region is known as wear land and is measured by the width of the wear land.

59. In beam of rectangular cross-section, the ratio of the maximum transverse shear stress to average shear stress at a section is_____.

A. 2:1 B. 3:1

C. 3:2 D. 4:3

Ans. C

Sol. For rectangular cross section,

The resistance offered by the internal stress to shear is known as shearing stress.

Shearing stress is zero at extreme fibres of the beam. The bending stresses are maximum at extreme fibres of the beam cross section. Maximum shear stress is 1.5 times that of average shear stress.

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

60. Which of the following is the most preferred bearing material?

A. Babbitt metal B. Silver

C. Aluminum D. Cast iron

Ans. A

Sol. Babbitt metal is the most preferred bearing material for bearings. It is also called white metal.

Babbitt metal is most commonly used as a thin surface layer in a complex, multi-metal structure, but its original use was as a cast-in-place. bulk bearing material. Babbitt metal is characterized by its resistance to galling. Babbitt metal is soft and easily damaged, which

suggests that it might be unsuitable for a bearing surface. However, its structure is made up of small hard crystals dispersed in a softer metal, which makes it a metal matrix composite. As the bearing wears, the softer metal erodes somewhat, creating paths for lubricant between the hard high spots that provide the actual bearing surface. When tin is used as the softer metal, the friction causes the tin to melt and function as a lubricant, protecting the bearing from wear when other lubricants are absent.

61. A close-coiled helical spring of stiffness 50 N/mm is arranged in series with another such spring of stiffness 100 N/mm. The stiffness of composite unit is

A. 150 N/mm
B. 200 N/mm
C. 33.33 N/mm
D. 75 N/mm

Ans. C

Sol. Stiffness of composite unit when spring is in series connection can be calculated as follows:

$$\frac{1}{k}=\frac{1}{k_1}+\frac{1}{k_2}$$

$$\frac{1}{k}=\frac{1}{50}+\frac{1}{100}$$

$$\frac{1}{k}=\frac{2+1}{100}=\frac{3}{100}$$

$$k=\frac{100}{3}=33.33\ N/mm$$

62. Use of multiple notches in a V shaped flat plate will_____.

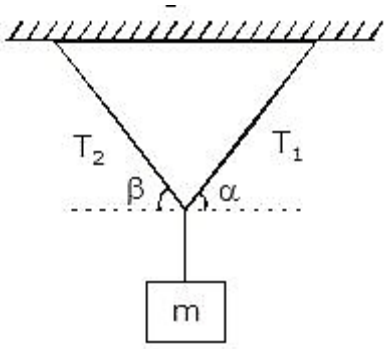
A. Reduce the stress concentration
B. Increase the stress concentration
C. No effect
D. Cannot be determined

Ans. A

Sol.

- The sharp bending of a force flow line is reduced due to multiple notches in a flat plate and hence effect of stress concentration will be very less.

63. A body of mass m is suspended by two strings making angles α and β with horizontal. The tension T_2 in the string is



A. $\frac{mg\cos\alpha}{\sin(\alpha+\beta)}$

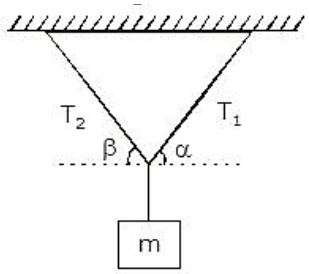
B. $\frac{mg\sin\alpha}{\cos(\alpha+\beta)}$

C. $\frac{mg\cos\alpha}{\cos\beta}$

D. $\frac{mg\sin\alpha}{\sin\beta}$

Ans. A

Sol.



Applying Lami's Theorem,

$$\frac{mg}{\sin(180-(\alpha+\beta))}=\frac{T_2}{\sin(90+\alpha)}$$

$$\Rightarrow \frac{mg}{-\sin(\alpha+\beta)}=\frac{T_2}{-\cos(\alpha)}$$

$$\Rightarrow T_2=\frac{mg\cos(\alpha)}{\sin(\alpha+\beta)}$$

64. The resolution of an encoder with 10 tracks will be nearly

A. 0.15°

B. 0.25°

C. 0.35°

D. 0.45°

Ans. C

Sol. The resolution of an encoder with 10 tracks $=\frac{360^\circ}{(2^{10}-1)}=\frac{360^\circ}{1023}$

$= 0.35^\circ$

65. The specific machining energy during the orthogonal turning of MS rod is 2.0 J/mm^3. The depth of cut, feed, cutting velocity 2mm, 0.2mm/rev, and 120m/min respectively. The main cutting force in N is:

A. 40

B. 400

C. 800

D. None of the above

Ans. C

Sol. Given,

Specific machining energy = 2.0 J/mm^3,

depth of cut = 2 mm,

feed = 0.20 mm/rev.

cutting velocity = 120 m/min

The energy consumption per unit volume of material removal, commonly known as

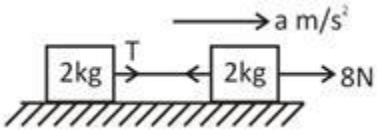
specific energy.

$$e = \frac{Power\ (W)}{MRR\ (mm^3/s)} = \frac{F_c \times V}{1000 f dV}$$

$$2.0 = \frac{F_c}{1000 \times 2 \times 0.2}$$

F_c = 800 N

66. Find tension T on the string as shown in figure (take g = 10 m/s^2) (frictionless)



A. 8N B. 4N

C. 2N D. 1N

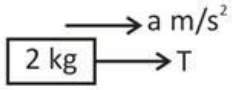
Ans. B

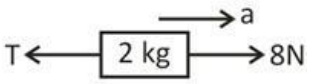
Sol. T = 2a …..(1)

8-T= 2a ….(2)

From (1) and (2)

8 = 4a ⇒ a = 2m/s^2





∴T = 2 × 2 ⇒ T = 4N

67. In the TTT diagram of heat treatment for carbon steel _____.

A. vertical axis represents temperature on linear scale and horizontal axis represents time on logarithmic scale

B. horizontal axis represents temperature on linear scale and vertical axis represents time on logarithmic scale

C. vertical axis represents temperature on logarithmic scale and horizontal axis represents time on linear scale

D. vertical axis represents temperature on linear scale and horizontal axis represents time also on linear scale

Ans. A

Sol.

- In the TTT diagram of heat treatment for carbon steel vertical axis represents temperature on linear scale and horizontal axis represents time on logarithmic scale.
- TTT diagrams are equilibrium diagrams while Fe-Fe_3C is non-equilibrium diagram.

68. A machine part of mass 2 kg vibrates in viscous medium, angular frequency at resonance condition is found to be 10π rad/s. If a harmonic exciting force of 25 N produces 1.25 cm. Find the stiffness of the system (in N/m).

A. 2566 B. 1973

C. 2363 D. 2236

Ans. B

Sol. Given,

mass(m) = 2 kg

angular frequency at resonance condition (ω_n) = 10π rad/s

At resonance condition the resonance frequency is the natural frequency.

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

$$10\pi = \sqrt{\frac{k}{2}}$$

$$\therefore k = 1973\ N/m$$

69. Small amounts of which one of the following elements/pairs of elements is added to steel to increase its machinability?

A. Nickel B. Sulphur and phosphorus

C. Silicon D. Manganese and copper

Ans. B

Sol.

- Sulphur is added up to 0.33% in free cutting steels to increase machinability.
- Similarly, phosphorus is added up to 0.12% for free cutting steel.

70. Volumetric strain for a thin cylindrical pressure vessel is given by

A. $\frac{pd}{5tE}(5-4\mu)$ B. $\frac{pd}{4tE}(5-4\mu)$

C. $\frac{pd}{4E}(5t-4\mu)$ D. $\frac{pd}{4t}(5E-4\mu)$

Ans. B

Sol. where,

$p = pressure$

d = diameter

t = thickness

E = modulus of elasticity

$\mu = poisson's\ ratio$

Volumetric strain for thin pressure vessel, $\epsilon_V = \frac{pd}{4tE}(5-4\mu)$

71. For a damped vibration system, the frequency(ω_d) of the system is given by Where, ω is natural frequency.

A. $\omega\sqrt{\zeta^2-1}$ B. $\omega\sqrt{1-\zeta^2}$

C. $\omega\sqrt{1-\zeta}$ D. $\omega\sqrt{1-2\zeta}$

Ans. B

Sol. The frequency of the damped system is given by,

$\omega_d = \omega\sqrt{1-\zeta^2}$

ω_d = damped vibration frequency of the system

So, the correct option is (b)

72. The crystal systems are specified by

A. edge lengths
B. inter axial angles
C. both of above
D. none of above

Ans. C

Sol.

- Both edge lengths and inter axial angles are necessary for specifying crystal systems.
- Depending on them crystal systems are divided in seven types.

73. In M/M/I system, service is at the rate of 6 per hour, and arrival rate is 4 per hour. The fraction for which the system would remain idle is

A. 2/3
B. 1/3
C. 1/2
D. 1/6

Ans. B

Sol. Given:

Arrival rate, $\lambda = 4$,

service rate, $\mu = 6$.

The probability that the system is idle is

$P_0 = 1-\rho = 1-\lambda/\mu = 1-4/6 = 1/3$

74. Theoretical stress concentration factor and fatigue stress concentration factor are related by (q= notch sensitivity)

A. $q=\frac{K_f-1}{K_t-1}$
B. $q=\frac{K_t-1}{K_f-1}$
C. $q=\frac{K_t}{K_f}$
D. $q=\frac{K_f}{K_t+1}$

Ans. A

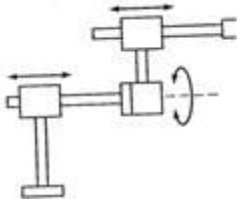
Sol.

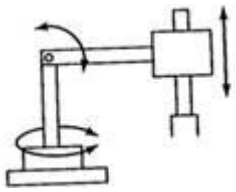
Notch sensitivity, $q=\frac{K_f-1}{K_t-1}$;

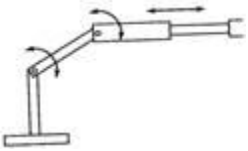
K_f = Fatigue stress concentration factor
K_t = theoretical stress concentration factor

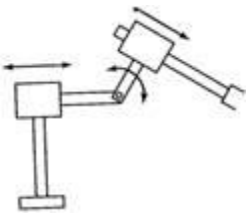
75. Match the following Robot model with its configuration?

Robot Model

1) 

2) 

3) 

4) 

Configuration

A) LRL robot

B) RRL robot

C) TRL robot

D) LVL robot

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

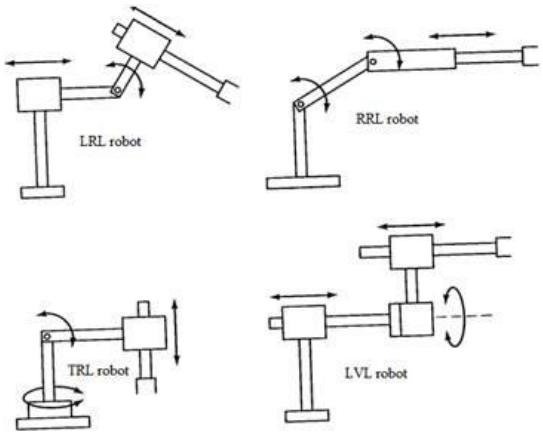
B. 1-D, 2-A, 3-B, 4-C

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

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

Ans. A

Sol.



76. Parting tool and broaching tool are respectively

A. Single point cutting tool and multi point cutting tool

B. Multi point cutting tool and single point cutting tool

C. Both are double point cutting tool

D. None of these

Ans. A

Sol. Parting tool has single edge for cutting while broaching tool has many teeth for cutting purpose.

77. Which of the following defects occur due to scattering of metal around the vicinity of weld?

A. Under cut
B. Spatter
C. Cracking in weld metal
D. Cold cracking

Ans. B

Sol. Spatter defects occur due to scattering of metal around the vicinity of a weld. It causes poor surface finish

78. Out of the following alternatives, which one is not the approximate line generating mechanism using lower pairs?

A. Peaucellier Mechanism
B. Grasshopper mechanism
C. Watt's mechanism
D. Robert's mechanism

Ans. A

Sol. Peaucellier's Mechanism is an exact straight line mechanism using lower pairs.

79. The problem of hunting of a centrifugal governor becomes very acute when the governor becomes.

A. Less sensitive
B. Highly sensitive
C. High stable
D. Less stable

Ans. B

Sol. Sensitiveness of a governor is a desirable quality. However, if a governor is too sensitive, it may fluctuate continuously above and below the mean position it is called hunting of governor which is undesirable.

80. In blanking operation, find the shear to be provided on the die such that the force required for blanking operation is 2/3 of maximum force when percentage penetration is 50%.

A. t/3
B. t/2
C. t/4
D. t

Ans. C

Sol. $F(kt + I) = F_{max}\, kt$

$$\frac{2F_{max}}{3}(kt + I) = F_{max}\, kt$$

$$\frac{2}{3}(0.5t + I) = 0.5t$$

$$\Rightarrow \quad I = \frac{t}{4}$$

81. A spur gear is used for power transmission between two parallel shafts having module of 2.5 mm. Find the circular pitch of the spur gear under consideration in mm

A. 6.25
B. 7.85
C. 2.65
D. 25

Ans. B

Sol. Given:

$$m = 2.5\ mm$$

$$circular\ pitch\ P_c = \pi m$$

$$= \pi \times 2.5$$

$$= 7.85\ mm$$

82. A 100 mm × 50 mm × 50 mm steel bar free to expand is heated from 15 °C to 40 °C. What kind of stress shall be developed?

A. Tensile stress
B. Compressive stress
C. Shear stress
D. No stress

Ans. D

Sol.

- There is no stress developed in a bar if bar is free to expand.
- Only strain is Developed in body on heating.
- Stress is only developed due to resistance force.

In our case there is no resistance in the expansion of bar.

83. The Maximum Magnitude of the unbalanced force along the line perpendicular to the line of stroke is called_____.

A. Hammer blow
B. Swaying cycle
C. Variation interactive effort
D. None of these

Ans. A

Sol. **Hammer Blow:** The maximum magnitude of unbalanced force along the line perpendicular to the line of stroke is called hammer blow.

84. According to Denavit-Hartenberg's notations, joint angle can have-

A. Positive value only
B. Negative value only
C. Zero only
D. Either positive or negative or zero value

Ans. D

Sol. According to Denavit-Hartenberg's notations, joint angle can have either positive or negative or zero value.

85. The following type of gauge has gauging sections combined on one end _____.

A. progressive gauge
B. fixed gauge
C. limit gauge
D. combination gauge

Ans. A

Sol.

- In a progressive gauge both the GO and NO GO diameters are stepped on a single gauge member.

86. A long cylindrical bar subjected to a tensile load of 50 kN, undergoes a percentage elongation of 25 % in length. The area of cross section of the bar is 1000 mm^2. The value of true stress (in MPa) is:

A. 50 B. 62.5

C. 12.5 D. 37.5

Ans. B

Sol. Given,

Tensile load = 50 kN

Area of cross-section of bar = 1000 mm^2

$$engineering\ strain = \frac{l_2 - l_1}{l_1} = \frac{1.25l - l}{l} = 0.25$$

$$engineering\ stress = \frac{50000}{1000 \times 10^{-6}} = 50\ MPa$$

Also, $True\ stress = engg.stress \times (1 + engg.strain)$

$$\sigma_t = \sigma_0 \times (1 + e)$$

True stress = 50 x (1 + 0.25) = 62.5 MPa

87. In machine shop, pins of 15mm diameter are produced at a rate of 1000 per month and the same is consumed at a rate of 500 per month. The production and consumption continue simultaneously till the maximum inventory is reached. Then inventory is allowed to reduce to zero due to consumption. The lot size of the production is 1000. If backing is not allowed, the maximum inventory level is

A. 400 Units B. 500 Units

C. 600 Units D. 700 Units

Ans. B

Sol. Given,

Production rate = 1000 Unit/month

consumed at a rate = 500 Unit/month

lot size of the production = Q*=1000 unit

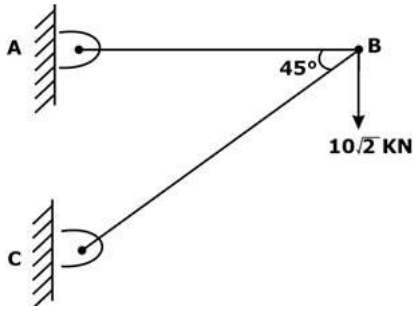
Maximum Inventory level (Q_m)

$$Q_m = \frac{Q^*(P-d)}{P}$$

$$Q_m = \frac{1000(1000-500)}{1000}$$

$$Q_m = 500\ units$$

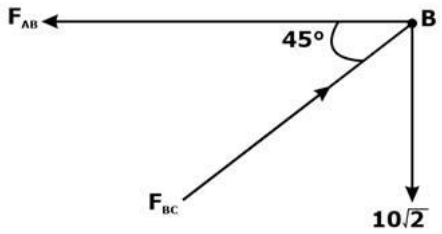
88. A truss ABC is supporting a load of $10\sqrt{2}$ kN as shown in the figure below. The axial force in the member BC is



A. 20 kN Compressive
B. 20 kN Tensile
C. 14.14 kN Tensile
D. 14.14 kN Compressive

Ans. A

Sol. F.B.D of joint B is shown below



$\Sigma F_v = 0$

$F_{BC} \sin 45° = 10\sqrt{2}$

$F_{BC} \frac{1}{\sqrt{2}} = 10\sqrt{2}$

$F_{BC} = 20\,KN$

Since force is toward the joint it is compressive nature.

89. Two 1.5 mm thick sheets are spot welded by using a current of 5000A. The current time is 0.5s and each electrode tip has a diameter of 10 mm. The effective resistance in the welding operation is 200 μΩ. The heat generated in the spot welding is

A. 2.5kJ
B. 2500kJ
C. 5000J
D. 5kJ

Ans. A

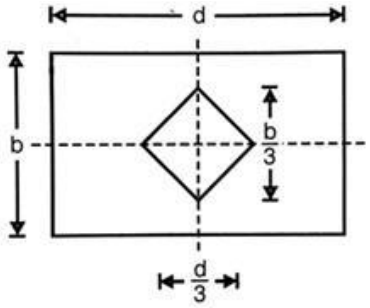
Sol. Given,

I = 5000A , R = 200 X 10^{-6} ohm , t = 0.5s

Heat generated = $I^2Rt = 5000^2\ X\ 200\ X\ 10^{-6}\ X\ 0.5$

Heat = 2500J = 2.5kJ [Ans]

90. The ratio of the core of a rectangular section to the area of the rectangular section when as a short column is



A. 1/9

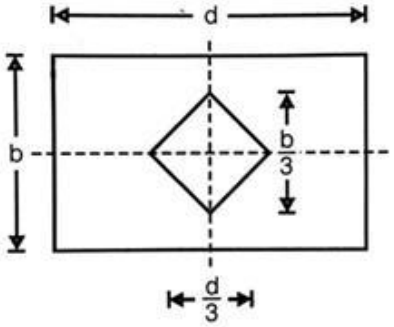
B. 1/36

C. 1/18

D. 1/24

Ans. C

Sol.



$$area\,of\,core = 4\left[\frac{1}{2}\times\frac{b}{6}\times\frac{d}{6}\right] = \frac{bd}{18}$$

$$area\,of\,rectangular\,column = bd$$

$$\frac{area\,of\,core}{area\,of\,rectangular\,column} = \frac{\frac{bd}{18}}{bd} = \frac{1}{18}$$

91. The face of the tooth is the _____.

A. Surface of the top of the tooth

B. Surface of the tooth above the pitch surface

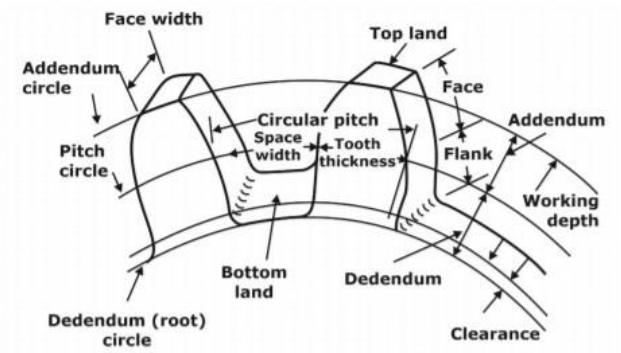
C. Surface of the tooth below the pitch surface

D. width of the tooth measured along the pitch circle.

Ans. B

Sol.

- Surface of the tooth above the pitch surface is the face of the tooth.



92. A bar of copper and brass form a composite system which is heated through a temperature of 50°C. The stress induced in the copper bar is _____.

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

Ans. A

Sol. The thermal expansion coefficient of copper is less than brass.

$$\alpha_{Brass} > \alpha_{copper}$$

Thus, free expansion of brass will be more than copper.

But for a bimetallic strip actual expansion for both is same. Therefore, copper will experience tensile stress and brass will experience compressive stress.

93. A prismatic cantilever beam with circular cross section has polar moment of inertia = 900 mm^4. The beam is subjected to a transverse load of intensity 30N acting at free end. If Young's modulus of the material is 180GPa, then calculate the radius of curvature of beam at 15mm from the free end _____.

A. 120mm
B. 180mm
C. 180m
D. 240m

Ans. C

Sol. Bending formula:

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

M = 30 × 15 = 450 N-mm

E = 180 GPa

$I = I_p/2 = 900/2 = 450\ mm^4$

Substituting the values:

$$R = \frac{180 \times 10^9 \times 450 \times 10^{-12}}{450 \times 10^{-3}} = 180m$$

94. In the basic EOQ Model, if the lead time increases from 10 to 20 days. The EOQ

A. Will remain same
B. Will double
C. Will increase √2 times
D. Insufficient data

Ans. A

Sol. Economic Order Quantity,

$$EOQ = \sqrt{\frac{2DC_O}{C_H}}$$

D=Demand per unit time

C_O = Ordering cost per item

C_H = Holding cost per unit per time

EOQ is independent of lead time.

95. Which of the following statement is correct regarding the pitch point in the cam?

A. It is the point on the base circle at which the pressure angle is maximum.

B. It is the point on the pitch circle at which the pressure angle is maximum.

C. It is the point on the pitch curve at which the pressure angle is minimum.

D. It is the point on the pitch curve at which the pressure angle is maximum.

Ans. D

Sol. According to the terminology of the cam profile, the pitch point is the point on the pitch curve at which the pressure angle is maximum.

96. Two alternatives can produce a product. First has a fixed cost of Rs. 2000 and a variable cost of Rs. 20 per piece. The second method has a fixed cost of Rs. 1500 and a variable cost of Rs.30. The break even quantity between the two alternatives is

A. 25 units

B. 50 units

C. 75 units

D. 100 units

Ans. B

Sol. If x is the break even quantity, then

$2000 + 20x = 1500 + 30x$

or, $x = 50$.

97. Bearing Characteristic Number consists of which parameters _____.

A. Diameter, pressure, viscosity

B. Speed, diameter, viscosity

C. Speed, diameter, pressure

D. Viscosity, pressure, speed

Ans. D

Sol. Bearing characteristic number is given by:

$$Bearing\ characteristic\ number = \frac{\mu n_s}{p}$$

where μ: denotes viscosity

n_s angular speed (in rps)

p for pressure

98. The larger side cutting edge angle causes _____.

A. Decrease in nose radius

B. Decrease in thrust force

C. Chattering

D. Chips break

Ans. C

Sol. Larger side cutting edge angle Causes:

- An increase in nose radius.
- Increase Thrust force. now this thrust force will try to separate the tool from the work piece which results in chattering.

99. Which of the following is not a high energy rate forming process?

A. Explosive forming

B. Automatic hot forging

C. Electro hydraulic Forming

D. Electro-magnetic Forming

Ans. B

Sol.

- In high energy rate forming (HERF), a ductile material is deformed by working on it at a very faster speed and against a die of the shape required, the material can be shaped under the pressure of this applied energy.
- **Examples of HERF:** Electro-hydraulic Forming, Electromagnetic Forming and Explosive forming.
- **Automatic hot forging:** The automatic hot forging process involves feeding mill-length steel bars into one end of the machine at room temperature and hot forged products emerge from the other end.

100. Which alloy is not suitable for hot chamber die casting?

A. Tin
B. Zinc
C. Aluminium
D. Lead

Ans. C

Sol.

- Aluminium has high melting point rest all have low melting points, so its alloy is not suitable for hot chamber die casting.

101. The angular velocity of the pinion is 40 rad/s and that of the gear is 12 rad/s. The path of recess is equal to 16 mm. Find the velocity of sliding at the end of the contact.

A. 832 mm/s
B. 213 mm/s
C. 1029 mm/s
D. 720 mm/s

Ans. A

Sol. ω_p= 40 rad/s and ω_g= 12 rad/s. Path of recess = 16 mm.

Velocity of sliding = $(\omega_p + \omega_g)$ x Path of recess = (40 + 12) x 16 = 832 mm/s.

102. The predicted ratio of shear stress to direct stress at yield condition for steel specimen under maximum energy of distortion theory is

A. 1.0
B. 0.77
C. 0.62
D. 0.577

Ans. D

Sol.

Theory of failure	$\frac{S_{ys}}{S_{yt}}$
Maximum shear stress theory	0.5
Maximum distortion energy theory	0.577
Maximum principal stress theory	1.0
Maximum principal strain theory	0.77

103. Milling cutters are mounted on _____.

A. bracket
B. shaft
C. arbor
D. tang

Ans. C

Sol.

- Milling is an interrupted cutting operation and cutting tools are called milling cutters which are mounted on the Arbor.
- Arbors are supplied with one of three tapers to fit the milling machine spindle: the Standard Milling Machine taper, the Brown and Sharpe taper, and the Brown and Sharpe taper with tang.

104. An OR logic control in pneumatic systems is possible with the help of

A. sequence valve
B. shuttle valve
C. dual pressure valve
D. delay valve

Ans. B

Sol. A) Sequence valve is a pilot control valve.
B) shuttle valve is an OR logic control valve.
C) dual pressure valve is as AND logic control valve.
D) Delay valve use to delay the vacuum signal.

105. In case of a ball-bearing, rating load is 110 kN. What will be the approximate rating life (in million revolutions) of the bearing at a load of 9.8 kN?

A. 1200
B. 1400
C. 1600
D. 1800

Ans. B

Sol. Given,

Dynamic load capacity C = 110 kN

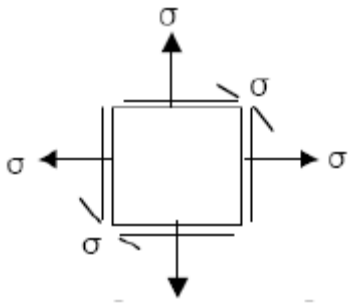
bearing load P = 9.8 kN

$\therefore$ Rating life, $L_{90} = \left(\frac{C}{P}\right)^3 \times 10^6 = \left(\frac{110}{9.8}\right)^3 10^6$

$= 1414.16 \times 10^6$ Revolutions

$\cong$ 1400 million Revolutions

106. The maximum principal stress for the state of the stress as shown in the figure is



A. σ
B. 2σ
C. 3σ
D. 1.5σ

Ans. B

Sol. The principal stress is given by

$$\sigma_{1,2} = \frac{1}{2}[(\sigma_x + \sigma_y) \pm \sqrt{(\sigma_x - \sigma_y)^2 + 4(\tau_{xy})^2}]$$

$$\sigma_{1,2} = \frac{1}{2}\left[(\sigma + \sigma) \pm \sqrt{(\sigma - \sigma)^2 + 4(\sigma)^2}\right] = \frac{1}{2}[2\sigma \pm 2\sigma] = 0 \text{ or } 2\sigma$$

107. Find the ratio of volumetric strains in cylindrical and spherical shell when they are subjected to same internal pressure and both have same d/t ratio, where d is the internal diameter of the vessel and t is the thickness of the vessel. It is given that poisson ratio is 0.3. Neglect the stress in radial direction.

A. 1.81 B. 0.81

C. 2.56 D. 1.21

Ans. A

Sol. Volumetric strain in cyindrical shell is given as:

$$\epsilon_V = \frac{pD}{4tE}(5 - 4\mu)$$

And Volumetric strain in spherical shell is given as:

$$\left(\epsilon_V\right)_s = \frac{3pD}{4tE}(1 - \mu)$$

Required ratio:

$$\frac{\epsilon_V}{\left(\epsilon_V\right)_s} = \frac{5 - 4\mu}{3(1 - \mu)}$$

$$\frac{\epsilon_V}{\left(\epsilon_V\right)_s} = \frac{5 - 4 \times 0.3}{3 \times (1 - 0.3)}$$

$$\frac{\epsilon_V}{\left(\epsilon_V\right)_s} = 1.81$$

108. Consider the following regarding their crystal structure

[1]. Alpha iron

[2]. Aluminium

[3]. Nickel

[4]. Zinc

Which of the following has FCC Structure?

A. 1 and 2 only B. 2 and 3 only

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

Ans. B

Sol.

Material	Crystal structure
Alpha Iron	BCC
Aluminium	FCC
Nickel	FCC
Zinc	HCP

109. Resilience of a material becomes important when it is subjected to _____.

A. fatigue
B. thermal stresses
C. shock loading
D. pure static loading

Ans. C

Sol.

- Resilience is defined as the ability of a material to absorb energy when deformed elastically.
- This property is important when the material is subjected to shock loading such as in spring applications.

110. A: A stepper motor is used for rotating the lead screw of a CNC machine tool.
R: Stepper motor can be controlled by signals to stop at the desired position.
A. Both A and R are true and R is the correct explanation of A
B. Both A and R are true, but R is not the correct explanation of A
C. A is true, R is false.
D. A is false, R is true.

Ans. A

Sol. A stepper motor completes a complete revolution in a fixed number of steps. This is used in CNC machines to have a better control over the positioning of the tool even without a feedback system, using a certain number of pre-calculated steps.

111. Coriolis component of acceleration depends on
1) Velocity of slider
2) Angular velocity of the link
3) Acceleration of slider
4) Angular acceleration of link
Which of the following statement is correct?

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

Ans. A

Sol. Coriolis component of acceleration = $2V\omega$
Where V = Velocity of slider
And ω = Angular velocity of the link

112. Match **List-I** with **List-II** and select the correct answer using the code give below the lists:

List-I

[A]. Nickel
[B]. Chromium
[C]. Tungsten

[D]. Vanadium

List-II

[1]. Increase tensile strength in medium carbon steels

[2]. Imparts hot hardness to steel

[3]. Imparts hardness with high strength

[4]. Increases toughness of steel

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

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

Ans. A

Sol. Nickel- Increase toughness

Chromium- Increase Hardenability

Tungsten- Hot hardness

Vanadium- increase tensile strength

113. A car starting from rest, moves with a constant acceleration of 0.7 m/s^2. Determine its velocity in km/h, After it has traveled 50 meters from the point of start.

A. 35 B. 30.11

C. 45.2 D. 20

Ans. B

Sol. Given data:

u=0, a=0.7 m/s^2, s=50 m

we know that:

$v^2 = u^2+2as$

$v^2 = 0^2+ 2 \times 0.7 \times 50 =70$

v=8.36 m/s =30.11 km/h (Ans.)

114. In exponential method of forecasting a stable demand represent which of the following expression to be TRUE _____.(N is number of demand datasets and α is exponential smoothing coefficient)

A. larger value of N and large value of α

B. small value of N and small value of α

C. small value of N and large value of α

D. large value of N and small value of α

Ans. D

Sol. • For the demand to be stable the value of α needs to be small.

• As we know that $\alpha = \frac{2}{N+1}$ so when α is less N is more/large.

115. The dimensions(in mm) of hole and shaft with tolerances is $28^{+0.02}_{-0.00}$ and $28^{-0.04}_{-0.07}$ respectively. What kind of fit will this assembly have?

A. Clearance Fit B. Transiton Fit

C. Interference Fit D. Insufficient data

Ans. A

Sol. Maximum material limit of shaft = 27.96mm

Maximum material limit of hole = 28mm

Therefore, we can see from the dimensions that it is a clearance fit.

116. If the extrusion ratio is 10, the percentage. Reduction in the cross- sectional area of the billet after the extrusion will be

A. 95% B. 90%

C. 10% D. 5%

Ans. B

Sol.

Extrusion ratio $R = \frac{Ai}{Af} = 10$ & $\%\text{reduction} = \frac{Ai - Af}{Ai} = \left(1 - \frac{1}{10}\right)$

$\Rightarrow \%\text{reduction} = \left(1 - \frac{1}{10}\right) \times 100 = 90\%$

117. Consider the following statements:

1) Microprocessors having memory and various input/output arrangements all on the same chip are called microcontrollers.

2) The basic job of a microcontroller is to execute program instructions which are the low-level code that is generated by the compiler in translating a high-level computer program.

3) A microcontroller cannot work without a register file.

Which of the following statements is/are correct?

A. 1 and 2 only B. 1 and 3 Only

C. 1 only D. 1, 2 and 3

Ans. B

Sol.

- Microprocessors having memory and various input/output arrangements all on the same chip are called microcontrollers.
- The basic job of a processor is to execute program instructions which are the low-level code that is generated by the compiler in translating a high-level computer program (such as C code) into machine instructions that are used by that particular processor.
- A microcontroller cannot work without a register file.

118. During monotectic solidification, one liquid _____.

A. combines with one solid to form a second new solid

B. solidified into two different solids

C. forms one solid

D. forms one solid and another liquid of different Composition

Ans. D

Sol.

- In monotectic reaction, a liquid transforms into another liquid of different composition and a solid phase precipitates out on cooling.

- On heating, reversible process takes place.

119. Consider the following statements regarding different types of robots:
1) Cartesian robot arm has three prismatic joints whose axes are coincident with a cartesian co-ordinate. This gives large work volume but has low dexterity.
2) Cylindrical robot has three axes of movement i.e., two linear and one circular (2L/R).
3) Anthropomorphic robot has at least two rotary joints, it needs smaller workplace, and this structure is the most dextrous.
4) SCARA acronym stands for selective complaint articulated robot arm.
Which of the following is/are correct–
A. 1, 2, 4 B. 2, 3, 4
C. 1, 3, 4 D. All

Ans. A

Sol. 1. Cartesian robot arm has three prismatic joints whose axes are coincident with a cartesian co-ordinate. This gives large work volume but has low dexterity.
2. Cylindrical robot has three axes of movement i.e., two linear and one circular (2L/R).
3. Anthropomorphic robot has at least three rotary joints, it needs smaller workplace, and this structure is the most dextrous.
4. SCARA acronym stands for selective complaint articulated robot arm.

120. Which one of the following elements is a ferrite stabilizer?
A. Nickel B. Manganese
C. Copper D. Chromium

Ans. D

Sol.

- The Elements, which stabilize ferrite, are called ferrite stabilizers, for example, Cr, W, Mo, V, Si. Most of the ferrite stabilizers ahve BCC crystal structure.
- The elements which stabilize the austenite, are called the Austenite stabilizers. Example: Ni, Al, etc.

121. A steel column whose slenderness ratio is greater than 150 is known as
A. Short column B. Medium column
C. Long column D. Composite column

Ans. C

Sol. The value of slenderness (S) ratio for different steel columns is following

For short column, $S \leq 30$

For medium column, $30 < S \leq 100$

For long column, $S > 100$

122. Landmines use springs in it to trigger the detonator when a person or vehicle applies pressure on it. The type of spring used is;
A. Helical compression spring B. Conical springs
C. Laminated springs D. Belleville Springs

Ans. D

Sol. Belleville springs or Disc springs are used in landmines, very large loads can be supported with a small installation space and because the spring is annular, force transmission is concentric.

Laminated springs are also called leaf springs.

123. The instantaneous centre of rotation of a sliding block on a horizontal surface is located at

A. The point of contact

B. centre of gravity of sliding block

C. Any point along the line of sliding

D. None of the above

Ans. D

Sol. The instantaneous centre of rotation of a sliding block on a horizontal surface is located at infinite distance from the horizontal surface in vertical direction.

124. Which of the following is used for controlling fluctuations in an engine?

A. Control valve

B. Flywheel

C. Governor

D. Flywheel and Governor both

Ans. D

Sol. flywheel is used to store kinetic energy of engine flywheel tries to reduce fluctuations and governor is used to control the load fluctuation by supplying the fuel according to load.

125. The solution in a transportation model of dimension $m \times n$ is said to be degenerate if it has_____.

A. exactly $(m+n-1)$ allocations

B. fewer than $(m+n-1)$ allocations

C. more than $(m+n-1)$ allocations

D. $m \times n$ allocations

Ans. B

Sol.

- In transportation problem, if the number of allocations is less than $(m+n-1)$ then this is the case of degeneracy.

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