Answer-key & Solution

AE (Mechanical)
MOCK -(13)
Date 10/ 9/ 2017

1. B	16. D	31. A	46. B	61. A	76. B	91. C	106. A
2. A	17. C	32. A	47. B	62. B	77. D	92. B	107. D
3. C	18. B	33. D	48. C	63. D	78. C	93. C	108. B
4. D	19. C	34. C	49. B	64. A	79. A	94. D	109. A
5. B	20. D	35. C	50. C	65. C	80. C	95. B	110. C
6. C	21. B	36. B	51. C	66. B	81. B	96. B	111. B
7. A	22. C	37. B	52. D	67. C	82. D	97. C	112. C
8. D	23. D	38. A	53. A	68. D	83. A	98. C	113. B
9. B	24. A	39. C	54. C	69. A	84. D	99. B	114. B
10. C	25. B	40. B	55. D	70. A	85. A	100. C	115. A
11. C	26. B	41. B	56. C	71. D	86. A	101. A	116. D
12. C	27. A	42. B	57. D	72. A	87. A	102. B	117. C
13. D	28. A	43. B	58. D	73. D	88. C	103. A	118. C
14. B	29. A	44. A	59. C	74. A	89. C	104. C	119. D
15. C	30. D	45. B	60. C	75. C	90. C	105. A	120. C

Note : *If your opinion differ regarding any answer, please message the mock test and Question number to 9560620353*

Note : *If you face any problem regarding result or marks scored, please contact : 9313111777*

SOLUTION (AE Mechanical) MOCK TEST no. 13

1. B Let the two numbers be A and B.

$A + B = 18$

$A^2 + B^2 = 256$

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

$\Rightarrow (18)^2 = 256 + 2AB$

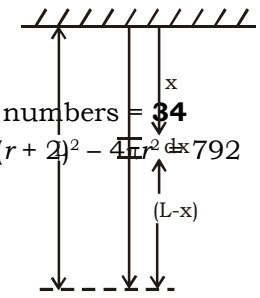
$\Rightarrow 324 = 256 + 2AB$

$\Rightarrow 2AB = 68$

$\Rightarrow AB = 34$

$\therefore$ The product of two numbers = **34**

2. A Let r be the radius $4\pi (r + 2)^2 - 4\pi r^2 = 792$



$\Rightarrow (r + 2)^2 - r^2 = \frac{792}{4\pi}$

$\Rightarrow r^2 + 4r + 4 - r^2$

$= \frac{792 \times 7}{4 \times 22} = 63$

$\Rightarrow 4r = 63 - 4 = 59$

$\Rightarrow r = 14.75$ m

$\therefore$ Required radius = **14.75 m**

3. C $\sin 3A = \cos (A - 56°)$

$\Rightarrow \cos (90° - 3A) = \cos(A - 56°)$

$\Rightarrow 90° - 3A = A - 56°$

$\Rightarrow 90° + 56° = 3A + A$

$\Rightarrow 4A = 146°$

$\Rightarrow A = \frac{146}{4} =$ **36.5°**

4. D

Ist person → 6		4
IInd person → 8	24	3
I + II + Boy → 3		8

$\therefore$ Share of Boy = $\frac{1}{8} \times 5000 =$ ₹ **625**

5. B Let the sum be P.

$\therefore 1015 = P\left[\left(1+\frac{3}{100}\right)^2 - 1\right]$

$\left[\because C.I. = P\left[\left(1+\frac{r}{100}\right)^n - 1\right]\right]$

$\Rightarrow 1015 = P\left[\left(\frac{103}{100}\right)^2 - 1\right]$

$\Rightarrow 1015 = P\left(\frac{10609 - 10000}{10000}\right)$

$\Rightarrow P =$ ₹ $\frac{1015 \times 10000}{609}$

$=$ ₹ $\frac{10150000}{609}$

$\therefore$ S.I. = $\frac{10150000 \times 2 \times 3}{609 \times 100}$ = ₹ **1000**

6. C We know that,

$l = a + (n - 1)d$ → common Diff.

last term, first term, no. of terms

Here,

$l = 7875$ (The number nearer to 8000 which is divisible by 225)

$a = 1125$ (The number nearer to 1000 which is divisible by 225)

$d = 225$

ATQ,

$7875 = 1125 + (n - 1)225$

$\Rightarrow (7875 - 1125) = (n - 1)225$

$\Rightarrow (n - 1) = \frac{6750}{225}$

$\Rightarrow (n - 1) = 30$

$\Rightarrow n = 30 + 1 = 31$

$\therefore$ Required answer = **31**

7. A Let x be the maximum marks

then, pass marks = 24% of x + 12 = 30% of x + 6 $\Rightarrow$ 6% of x = 6 $\Rightarrow x$ = 100

Maximum marks x = **100**

Pass marks = $\frac{30}{100} \times 100 + 6 =$ **36.**

8. D Here, 12 – 2 = 10, 16 – 6 = 10, 24 – 14 = 10

Now, LCM of 12, 16 and 24 = 48

$\therefore$ The lowest 4-digit number exactly divisible by 48 = 1008

$\therefore$ Required number = 1008 – 10 + 48 = **1046**

9. B $\frac{\sqrt{24}+\sqrt{600}}{\sqrt{216}} = \frac{2\sqrt{6}+10\sqrt{6}}{6\sqrt{6}}$

$= \frac{12\sqrt{6}}{6\sqrt{6}} =$ **2**

10. C Let the required number of extra days =D – 4.

ATQ,

$300 \times 31 = 27 \times 300 + 120 \times D$

$4 \times 300 = 120 \times D$
$\Rightarrow D = 10$ days
$\therefore$ Extra number of days = $(10 - 4) =$ **6 days**

11. CDownstream speed (u) = $\frac{D}{T} = \frac{8}{40} \times 60$
= 12 km/h

Upstream speed (v) = $\frac{D}{T} = \frac{3}{30} \times 60$
= 6 km/h

Speed of boat in still water = $\frac{1}{2}(u + v)$

$= \frac{1}{2}(12 + 6) =$ **9 km/h**

Speed of stream = $\frac{1}{2}(u - v) = \frac{1}{2}(12 - 6)$
= **3 km/h**

12. C Let the original number of students in two classes be $2x$ and $3x$ respectively.
ATQ,

$$\frac{2x + 20}{3x + 20} = \frac{4}{5}$$

$\Rightarrow 10x + 100 = 12x + 80$
$\Rightarrow 12x - 10x = 100 - 80$
$\Rightarrow 2x = 20$

$$\Rightarrow x = \frac{20}{2} = 10$$

$\therefore$ Total number of students originally
$= 2x + 3x = 5x$ (put $x = 10$)
$= 5 \times 10 =$ **50**

13. D $4\sin^2\theta + 5\cos^2\theta$
$= 4\sin^2\theta + 4\cos^2\theta + 5\cos^2\theta$
$= 4(\sin^2\theta + \cos^2\theta) + 5\cos^2\theta$
$= 4 + \cos^2\theta$ $[\because \sin^2\theta + \cos^2\theta = 1]$
$\because$ Minimum value of $\cos\theta = -1$
But $\cos^2\theta \geq 0$, when $\theta = 90°$
$[\because \cos 0° = 1, \cos 90° = 0]$
$\therefore$ Required minimum value = $4 + 0 =$ **4**

14. B $x = 3 + 2\sqrt{2}$

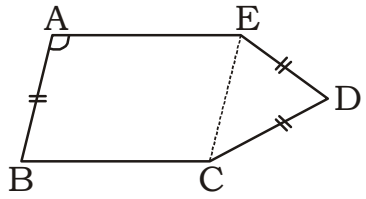
$$\therefore \frac{1}{x} = 3 \times 2\sqrt{2}$$

$$\therefore \left(\sqrt{x} - \frac{1}{\sqrt{x}}\right)^2 = x + \frac{1}{x} - 2$$

$$\Rightarrow \left(\sqrt{x} - \frac{1}{\sqrt{x}}\right)^2 = 3 + 2\sqrt{2} + 3 - 2\sqrt{2} - 2 = 4$$

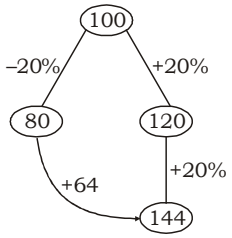
$$\Rightarrow \sqrt{x} - \frac{1}{\sqrt{x}} = 2 \Rightarrow 3\left(\sqrt{x} - \frac{1}{\sqrt{x}}\right) = 3 \times 2 =$$ **6**

15. C



$\angle BCE = 94°$, AB = CD = ED (given)
$\therefore$ CD = ED = CE $[\because$ AB = CE$]$
ΔECD is an equilateral triangle.
$\therefore \angle ECD = 60°$
$\angle BCD = 94° + 60°$
= **154°**

16. D Let the cost price of an article = ₹ 100
ATQ,



Original Profit = 20%

New Profit = $\frac{64}{80} \times 100 = 80\%$
$\therefore$ Change in profit percent
$= \frac{(80 - 20)}{20} \times 100$
= **300%**

17. C $\tan^2\alpha = 1 + 2\tan^2\beta$
$\Rightarrow \sec^2\alpha - 1 = 1 + 2(\sec^2\beta - 1)$
$\Rightarrow \sec^2\alpha - 1 = 2\sec^2\beta - 1$

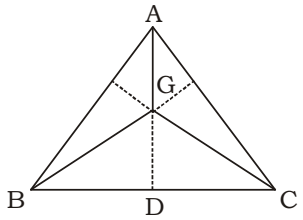
$$\Rightarrow \frac{1}{\cos^2\alpha} = \frac{1}{2\cos^2\beta}$$

$\Rightarrow \sqrt{2}\cos\alpha = \cos\beta$

$\therefore \sqrt{2}\cos\alpha - \cos\beta =$ **0**

18. B $x = 7$
$\therefore x^5 - 8x^4 + 8x^3 - 8x^2 + 8x - 2$
$= x^5 - (7 + 1)x^4 + (7 + 1)x^3 - (7 + 1)x^2 + (7 + 1)x - 2$
$= x^5 - 7x^4 - x^4 + 7x^3 + x^3 - 7x^2 - x^2 + 7x + x - 2$
When $x = 7$,
$= 7^5 - 7^5 - 7^4 + 7^4 + 7^3 - 7^3 - 7^2 + 7^2 + 7 - 2 =$ **5**

19. C



Area of ΔABC = 6 × ar(ΔBGD)
= 6 × 9 = **54 cm²**

20. D By componendo and dividendo,

$$\frac{\left(x^3+3x\right)+\left(3x^2+1\right)}{\left(x^3+3x\right)-\left(3x^2+1\right)} = \frac{234+109}{234-109}$$

$$\Rightarrow \frac{(x+1)^3}{(x-1)^3} = \frac{343}{125}$$

$$\Rightarrow \left(\frac{x+1}{x-1}\right)^3 = \left(\frac{7}{5}\right)^3$$

$$\Rightarrow \frac{x+1}{x-1} = \left(\frac{7}{5}\right) \Rightarrow 5x+5 = 7x-7 \Rightarrow x = \mathbf{6}$$

21. B Let the original volume of cylinder be 100
⇒ Volume after change

$$= 100 \times \frac{150}{100} \times \frac{150}{100} \times \frac{40}{100} = 90$$

Hence, percent decrease = 100 – 90 = **10%**

22. C $1 \times 3 \times 5 \times 7 \times \ldots\ldots\ldots \times 99 \times 2^8$.
For calculating number of zeros we have to find the combination of 2 and 5. Here no. of 2's is 8. So the max possible number of zeros is **8.**

23. D Percentage of students failed in 2016

$$= \frac{35}{200} \times 100 = \mathbf{17.5\%}$$

24. A Total passed students,
= 140 + 150 + 165 = 455
Total students
= 170 + 195 + 200 = 565
∴ Required percentage

$$= \frac{455}{565} \times 100 = \frac{9100}{113} = \mathbf{80\frac{60}{113}\%}$$

25. B Required percentage

$$= \frac{20}{170} \times 100 = \frac{200}{17} = \mathbf{11\frac{13}{17}\%}$$

26. B Change 'stem' into 'stems', as the subject of the sentence 'need' is singular.

27. A Change 'adopt' into 'adapt', which means 'to make oneself suitable to a new environment'. 'Adopt' means 'to accept'.

28. A Change 'is' into 'are', as 'people' takes plural verb.

29. A Change 'you' into 'your'. 'Gerund' is preceded by a possessive adjective.

39. C 'Information' takes no plural form.

55.(D) $\delta x = \int \frac{\gamma . A(L-x)}{AE} dx$

$$= -\frac{\gamma}{E}\int (L-x) \quad d(L-x)$$

$$\delta x = -\frac{\gamma}{E}\frac{(L-x)^2}{2} + C$$

At fixed end δ = 0
So δ(x = 0) = 0
δ(x = 0) = c = 0

so $\delta x = -\frac{\gamma}{2E}(L-x)^2$

$$\delta(x=20) = -\frac{\gamma}{2E}(L-20)^2$$

$$\delta(x=10) = -\frac{\gamma}{2E}(L-10)^2$$

$$\frac{\delta(x=10)}{\delta(x=20)} = \frac{(L-10)^2}{(L=20)^2}$$

$$= \left(\frac{40-10}{40-20}\right)^2$$

$$= \left(\frac{3}{2}\right)^2$$

$$\frac{\delta(x=10)}{\delta(x=20)} = \frac{9}{4}$$

56.(C) Since the system is composite
So, $\varepsilon_{Brass} = \varepsilon_{Steel}$

$$\frac{\delta_{Brass}}{L} = \frac{\delta_{Steel}}{L}$$

$$\delta_{steel} = \delta_{Brass} = 0.1mm$$

58.(D) τ_{max} = 140 mPa
In pure shear case
$\tau_{max} = (\sigma_n)_{max}$
$(\sigma_n)_{max}$ = 140 mPa

59.(C) $\sigma_{min} = \left(\frac{\sigma_x+\sigma_y}{2}\right) - \sqrt{\left(\frac{\sigma_x-\sigma_y}{2}\right)^2 + \tau_{xy}^2} = 0$

$$\left(\frac{\sigma_x+\sigma_y}{2}\right)=\sqrt{\left(\frac{\sigma_x-\sigma_y}{2}\right)^2+\tau_{xy}^2}$$

$$\left(\frac{\sigma_x+\sigma_y}{2}\right)^2-\left(\frac{\sigma_x-\sigma_y}{2}\right)^2=\tau_{xy}^2$$

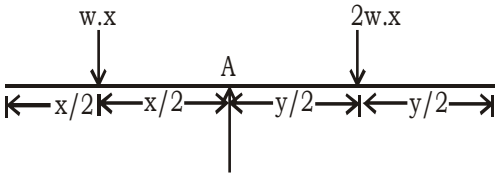
$$\left(\frac{\sigma_x}{2}\right)^2+\left(\frac{\sigma_y}{2}\right)^2+\frac{2\sigma_x\sigma_y}{4}-\left(\frac{\sigma_x}{2}\right)^2-\left(\frac{\sigma_y}{2}\right)^2$$

$$+\frac{2\sigma_x\sigma_y}{4}=\tau_{xy}^2$$

$$\frac{4\sigma_x\sigma_y}{4}=\tau_{xy}^2$$

$$\tau_{xy}=\sqrt{\sigma_x\sigma_y}$$

60.(C)



Taking moment about 'A'

$\Sigma M_A = 0$

W.x. x/2 – 2.w.y.y/2 = 0

$$\frac{x^2}{2}-y^2=0$$

$x^2 = 2y^2$

63.(D) $h=\frac{4\sigma\cos\theta}{\rho.g.D}$

$$h\propto\frac{1}{D}$$

$$\frac{h_2}{h_1}=\frac{D_1}{D_2}$$

$$h_2=h_1\frac{D_1}{D_2}$$

$$\text{or } h_2=h_1\frac{R_1}{R_2}$$

$$=15\frac{10}{5}$$

h_2 = 30 mm

65.(C) $W_p = (F_B)_P$

$$\rho_P Vg=\rho_w\frac{V}{2}g$$

$$\rho_P=\frac{\rho_w}{2} \qquad \ldots(i)$$

$W_Q = (F_B)_Q$

$$\rho_Q Vg=\rho_w\frac{2V}{3}g$$

$$\rho_Q=\frac{2\rho_w}{3} \qquad \ldots(ii)$$

from equation (i) and (ii)

$$\frac{\rho_P}{\rho_Q}=\frac{\rho_w/2}{2\rho_w/3}$$

$$\frac{\rho_P}{\rho_Q}=\frac{3}{4}$$

69.(A) $\frac{dx}{u}=\frac{dy}{v}$

$$\frac{dx}{x^2t}=\frac{dy}{-2xyt}$$

$$2\int\frac{dx}{x}=-\int\frac{dy}{y}$$

$2\ell nx = -\ell ny + \ell nc$

$\ell nx^2 + \ell ny = \ell nc$

$x^2y = K$

79.(A) ω_{min} = 190 rpm

ω_{max} = 210 rpm

ΔE = 400Nm

$$\Delta E=\frac{I}{2}\left[\omega_{max}^2-\omega_{min}^2\right]$$

$$400=\frac{I}{2}\left[210^2-190^2\right]$$

$$I=\frac{400}{4000}$$

$I = 0.1 \text{ kg m}^2$

94.(D) T_G = 360K

T_C = 300 K

$T_E = 270K$

$(COP)_{max} = \eta_{carnot}\ (COP)_{carnot}$

$$= \left(1 - \frac{T_C}{T_G}\right)\left(\frac{T_E}{T_C - T_E}\right)$$

$$= \left(1 - \frac{300}{360}\right)\left(\frac{270}{300 - 270}\right)$$

$= (0.166)\ (9)$

$(COP)_{max} = 1.5$

102.(B) $T = 4 - 10x + 20x^2 + 10x^3$

$\alpha = 2 \times 10^{-3} m^2/hr$

$L = 1m$

$$\Delta^2 T = \frac{1}{\alpha}\frac{\partial T}{\partial \tau}$$

In 1-D

$$\frac{\partial^2 T}{\partial x^2} = \frac{1}{\alpha}\frac{\partial T}{\partial \tau}$$

$$\frac{\partial^2 T}{\partial x^2} = \frac{\partial}{\partial x}\left[\frac{\partial}{\partial x}(4 - 10x + 20x^2 + 10x^3)\right]$$

$$= \frac{\partial}{\partial x}[-10 + 40x + 30x^2]$$

$$= \frac{\partial^2 T}{\partial x^2} = [40 + 60x]$$

$$[40 + 60x] = \frac{1}{\alpha}\frac{\partial T}{\partial \tau}$$

$$\left[\frac{\partial T}{\partial \tau}\right]_{x=1} = \alpha[40 + 60x]_{x=1}$$

$$= 2 \times 10^{-3}[40 + 60 \times 1]$$

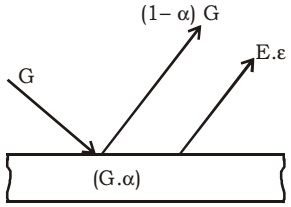
$$\frac{\partial T}{\partial \tau} = 0.2\ ^\circ c / hr$$

104.(C) $G = 20w/m^2$

$J = 12w/m^2$

$E = 10w/m^2$

$J = \varepsilon.E + (1 - \alpha)\ G$



for opaque body, $\tau = 0$

from krichhof's law ($\alpha = \varepsilon$)

$J = \varepsilon.E + (1 - \varepsilon)\ G$

$J = \varepsilon.\ (E - G) + G$

$12 = \varepsilon.(10 - 20) + 20$

$-8 = -10\ \varepsilon$

$\varepsilon = 0.8$

108.(B) $$t_e = \frac{t_o + 4t_m + t_p}{6}$$

$$= \frac{8 + 4 \times 10 + 14}{6}$$

$$= \frac{62}{6}$$

$t_e = 10.33$ min

110.(C) $$\sigma = \sqrt{\sigma_1^2 + \sigma_2^2 + \sigma_3^2 + \sigma_4^2}$$

$$= \sqrt{4 + 16 + 4 + 1}$$

$$= \sqrt{125}$$

$$\sigma = 5$$